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The Interaction of Global Economy Mobility on the Financial Performance of Flagged Airlines

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Abstract

This study examines the impact of global economic mobility and domestic production on revenue and EBITDA, which are income statement performance indicators of flagged carrier's airline companies. The research question is whether the global economic trade mobility and domestic production will lead to an effect in the number of individuals traveling, and thus eventually affect the revenue and profitability performance of airline companies. There are studies in the literature that have selected macroeconomic indicators as affecting travel volume and financials. In this study, trade openness and direct investments represent the global economy's mobility. Short-term interest rates, oil prices and exchange rates are included in the model as a control variable. The results of the panel model indicate that trade openness have a positive effect on firms' revenues. Airline companies should develop their financial forecasts by monitoring the macroeconomic indicators that have shown significant results from empirical analysis.

1. Introduction

The global economy is currently undergoing a period of significant transformation. This is having a notable impact on the airline industry. Factors such as the growth of global mobility and shifts in production are influencing the performance of flag carrier airlines. In particular, the adoption of economic expansion policies by governments and efforts to boost domestic production may lead to an increase in the number of individuals traveling. This, in turn, affects the performance of airline companies.

In the literature, the effects of global economic mobility and domestic production on travel and the airline industry have been examined from various perspectives. Studies such as Adıgüzel (2013) and Şahin (2021) emphasize that trade openness and direct investments play a pivotal role in the process of integration into the global economy. Research on the impact of the components of economic globalization on airline companies shows that trade openness and global investments, such as direct investments, are important. Kulendran and Wilson (2000) argue that trade openness and real income are key components in explaining business travel. There are also studies on the critical role of air transport in economic growth. Eğilmez (2020) emphasizes the long-term relationship between the air travel export volume and economic growth. Choi (2023) analyzes the impact of GDP growth on air traffic volume, finding that GDP growth leads to an increase in passenger and cargo volume. Furthermore, Hazel et al. (2014) indicates that airline revenues in the United States are closely related to nominal GDP. They posit that economic growth increases both business and leisure travel demand.

Earnings before interest, taxes, depreciation, and amortization (EBITDA) is an important income statement element in measuring the performance of firms. EBITDA is a metric that is frequently employed to assess the profitability of a firm's primary operations, as it excludes certain elements that are not directly related to the firm's core facilities. EBITDA is a performance indicator that is used for a variety of purposes, including measuring equity, managing performance, and valuing companies. This metric reflects the profit that a business generates from its core activities, allowing a clearer assessment of its financial position and performance (Bouwens et al., 2019).

The novelty of this study is to examine the effects of the global economy and countries' production on flag carrier airline companies in more detail. While the existing literature has examined the impact of economic globalization on the airline industry, this research distinguishes itself by specifically analyzing the role of trade openness, foreign direct investment and economic growth on the revenue and EBITDA performance of major flag carriers from economically significant countries in several regions, including North America, Europe, Asia and the Pacific.

In this research, revenues and EBITDAs of 10 major flag carrier airlines operating in North America, Europe, Asia and the Pacific region are obtained from their annual financial reports, from 2009 to 2022, in USD and assigned as dependent variables in the panel models. Selected flagged airlines are Air Canada, Air China, Air France, Australia Qantas, Japan Airlines, Korean Airlines, Germany Lufthansa, Russia Aeroflot, Singapore Airlines, Turkish Airlines. The key consideration in selecting these airlines is that they represent flag carriers with substantial revenue and significant positions within the aviation industry. Furthermore, their home countries have considerable economies and are influenced by global mobility. The relevant macro variables of the countries of the flag carrier airlines' flags are added to the model as control independent variables such as bond interest rate, exchange rate USD over local currency and oil. In addition, the dummy variable representing the Covid-19 period is also included in the model as an independent variable. Two model are established; one is revenue, and the other is EBITDA as dependent variables. Results of the model selection tests the pooled OLS model is found to be statistically appropriate for revenue model. The findings of the panel model shows that trade openness positively affect firms' revenues. The control variable exchange rate, oil and Covid-19 dummy variable are also significant in the revenue model. However, there is no significant model for EBITDA among the numerous models tried. It is recommended that flagged airlines consider the trade openness policies of the countries of which they are a part when planning their budgets.

This study aims to understand the effects of countries' macroeconomic factors such as trade openness, direct investments and economic growth on the revenue and EBITDA performance of their flagged airline companies. In this context, it makes an important contribution to a deeper understanding of the effects of the global economy on the airline industry and reveals role these effects play on the performance of airline companies. A review of the literature, the data and methods, the study's findings, and conclusions follow.

2. Literature

The literature examining the impact of the global economy and production on airline companies and travel reveals the significant effects of the components of economic globalization on the airline industry. Particularly, the effects of trade globalization and investment, which are components of economic globalization, on airline travel have been observed. In this study, the variables representing global economic mobility are chosen as trade openness and direct investments. Adıgüzel (2013) and Şahin (2021) emphasize that trade openness and direct investments, which are elements of economic globalization, play a key component role in the process of integration into the global economy. Dorman (2000) argues that economic globalization is measured by the increase and development of international trade which is measured by the ratio of foreign trade (sum of imports and exports) to GDP, known as the openness index. Although trade openness is measured by different methods, this is the most popular method (Fujii 2017; Balavaca & Pughb, 2016). Wiredu et al. (2020) and Alabi (2019) state that foreign direct investment (FDI) ensures economic growth and integration with international trade, and in this context, FDI facilitates the integration of countries into the world economy. As a proxy of the global economy, FDI and trade openness are included as independent variables in this study's models.

Eğilmez (2020) investigates the long-term relationship between export volume, air transport and economic growth, emphasizing the critical role of aviation in economic growth. Kulendran and Wilson (2000) examine the economic variables affecting business travel to Australia, finding that trade openness and the real income of the source country are important factors in explaining business travel. Choi (2023) analyses the relationship between GDP growth and air traffic volume through the case of Incheon Airport (ICN). The findings indicate that GDP growth leads to an increase in passenger and cargo. Additionally, Hazel et al. (2014) report that airline revenues in the US are closely related to nominal GDP. Furthermore, they claim that economic growth increases business and leisure travel demand. Pamungkas and Suhadak (2017) examine the impact of macroeconomic variables (exchange rates, GDP, and inflation) on the profitability of the Asian airline industry, concluding that economic growth (GDP) plays an important role in increasing the profitability of airlines. Elien Van De Vijver et al. (2014) examines the interrelationship between trade and air passenger traffic, and finding that trade facilitates air passenger traffic, vice versa. Tsui and Fung (2016) investigate the causality relationship between business travel and trade volumes between Hong Kong and Mainland China, Taiwan, and the US. Their results demonstrate that business travel has a determinant effect on trade volumes. Tanaka (2019) emphasizes the critical role of transport infrastructure in economic activities, stating that more frequent flights increase new foreign direct investment (FDI) inflows in Japan.

A review of the literature reveals no direct link between revenue and oil prices. However, they indicate that oil price risk has a significant, strong and widespread negative impact on airline share prices. This suggests that variations in oil prices have a major effect on the airline business. The negative impact of oil price risk on airline share prices is found to be significant, strong and pervasive, as well as a worrying exposure to US dollar currency risk (Horobet et al., 2022). Mollick and Amin (2021) conduct a study showing a positive relationship between seat occupancy rate and stock returns, but they demonstrate that this relationship weakens with oil prices. Additionally, the study reveals that the impact of oil prices is asymmetric, with increases in oil prices having a more pronounced effect than decreases. Empirical findings from Hsu (2017) indicate that fuel price shocks have a statistically significant negative impact on airline stock returns. Furthermore, the study demonstrates that fuel price shocks have a stronger effect on airline stock returns during periods of rising fuel prices, but this interaction is not observed during periods of falling fuel prices. Alıcı (2024) analyzes the daily macroeconomic data of 14 airlines from 2009 to 2018, revealing significant relationships among variables including oil prices, interest rates, and airline stock prices. He also analyzes 11 conventional airline firms operating between 2009 and 2019 to determine the relationship between financial failure, calculated using the Altman Z-score, with exchange rates and interest rates. This highlights the importance of interest rates and exchange rates in airline financials (Alıcı, 2023). The extant literature indicates that oil prices, interest rates, and exchange rates exert a significant influence on the financial performance and financial structure of airline companies. Therefore, these variables are also included as independent variables in the empirical models.

Literature addresses the impact of the global economic mobility and domestic production on the performance of airline firms from various aspects and reveal the effects of factors such as economic growth, trade openness, and direct investments on the airline industry. A review of existing literature indicates a positive correlation between economic growth and airline revenues. Moreover, a rise in open trade is linked to an increase in aviation sector earnings. Similarly, the expansion of direct investments also exerts a positive influence on airline revenues. Nevertheless, it is also emphasized in the literature that oil price risk is a source of concern. Evaluating these factors together is important for understanding the revenues of the airline industry. The variables selected in the study are chosen from among similar variables mentioned in the literature aligned with the research's purpose.

3. Materials and Methods

This part of the study contains the data used for employed and the research method for panel modelling. All calculations are performed using the R statistical program.

3.1 Data

Trade openness, direct investment and growth variables are accepted as representative variables in this study as indicators of a country's global trade activities. In addition to these, bond interest rate, West Texas Intermediate oil price and exchange rates (USD over local currency) which is thought to affect the revenue and profitability of the airlines, are included in the model as control variables. The selected macroeconomic data of the countries belonging to flag carrier airlines are downloaded from the World Bank website (Table 1). Revenue and EBITDA data from 2009 to 2022 are obtained annually from the facility report of 10 major flag carrier airlines in Europe, North America, Asia and Pacific region. All revenue and EBITDA values are converted to USD from local currencies. The financial reports of Lufthansa and Air France airlines are in Euros instead of USD, so their values are converted to USD at the average annual cross rate. Canada, China, Korea and Russia flagged airlines reported their numbers in local currency in their annual reports, and these are also converted to USD, too. Figures 1 and 2 show the annual revenues and expenses of the companies in USD. Due to the Covid-19 effect, revenues and EBITDA decreased in 2020 and beyond. To eliminate this effect in the model, a dummy variable representing the post-Covid period is used for the years 2020 and 2021.

Table 1. Meta Data Description.

Variable	Description
REV_USD	Flag Airlines' Revenues in USD.
EBITDA_USD	Flag Airlines' EBITDA in USD.
FDI	Foreign direct investment, net inflows in USD.
Openness	Exports of goods and services + Imports of goods and services in USD.
GDP	GDP (annual) in USD.
BOND	Short-term government bond interest rate (1 year).
EXC	USD/Local Exchange rate.
WTI_USD	West Texas Intermediate oil price in USD.

To ensure the integrity of the constructed models, it is essential to check for stationarity in the financial series. To avoid potential unit roots and non-stationary conditions, a percentage return transformation (R) is applied to the variables (Equation 1). The changes in value between the variables are analyzed using the models applied in this context.

$$R = \frac{X_t}{X_{t-1}} - 1 \quad (1)$$

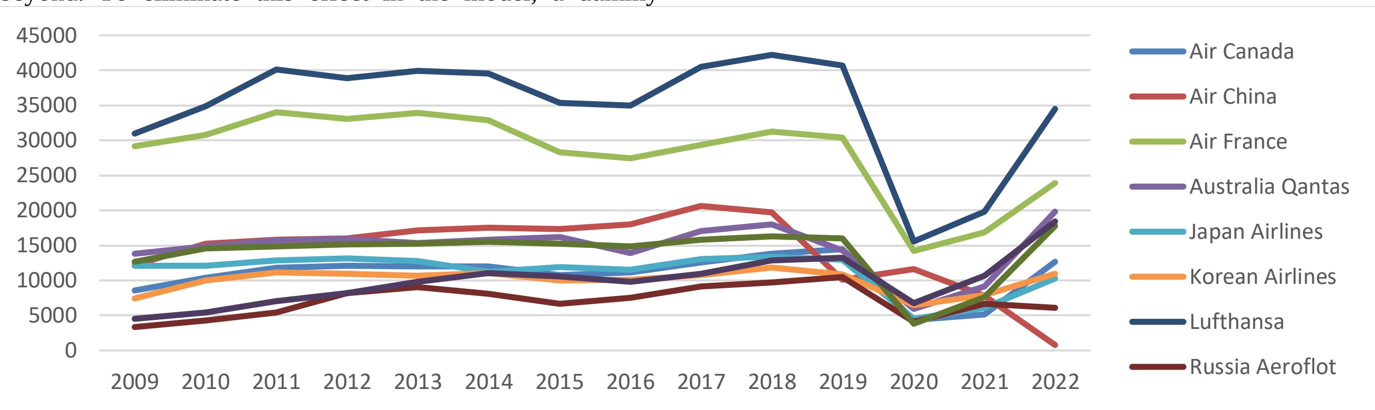

Figure 1. Flagged Airlines' Revenue (in Million USD), * Compiled by the author.

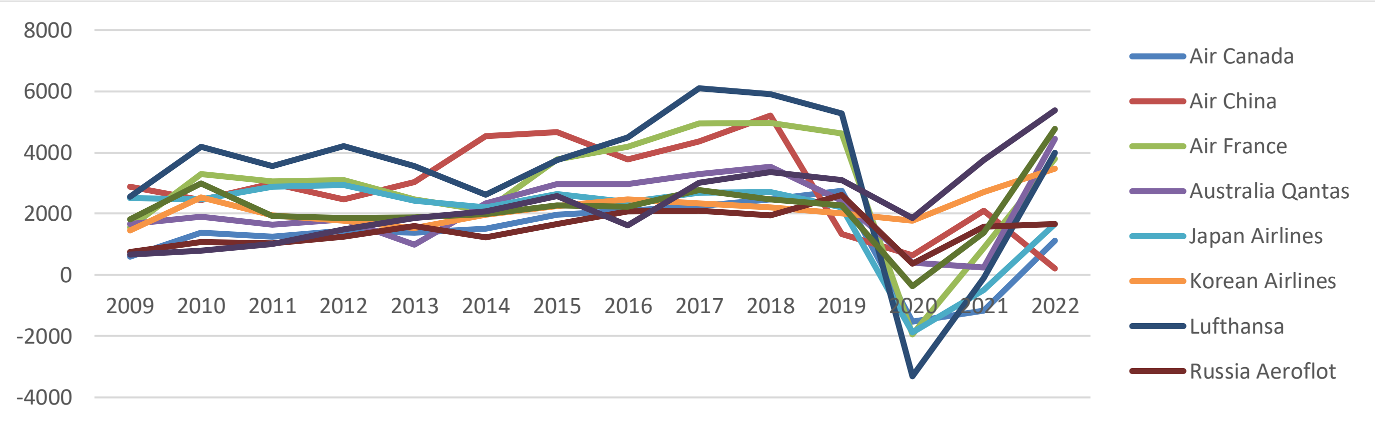

Figure 2. Flagged Airlines' EBITDA (in Million USD), * Compiled by the author.

3.2 Panel Regression

A typical specification of the simple linear model used in panel data regression analysis, where the dependent variable Y is stated as a linear function of the independent variable X and an error term u, is as follows (Equation 2):

$$Y_{it} = \alpha_{it} + \beta_{it}X_{it} + u_{it} \quad (2)$$

Panel data include time periods and cross-sectional dimensions. In formula, i is cross-sectional units: 1, 2, ..., N, t is 1, 2, ..., T time periods, Y_{it} is the value of the i'th unit of the dependent variable at time t, X_{it} is the value of the i'th unit of the independent variable at time t, u_{it} is the error term with zero mean and constant variance, and β is the slope coefficient. In this study, the variables of the panel model are used as in equation 3 and 4, as variables follows, D_Revenue is flagged airlines' revenues in USD, D_EBITDA is flagged airlines' EBITDA in USD, D_FDI is foreign direct investment inflows, D_GDP is GDP growth (annual %), D_Openness is exports of goods and services + imports of goods and services in USD, D_Bond is short-term government bond interest rate (1 year), D_EXC is the USD over local currency exchange rate, D_WTI is the West Texas Intermediate oil price in USD and a dummy variable representing the covid-19 period is also included in the model (Equations 3 and 4).

$$D_{Revenue_{it}} = \alpha_{it} + \beta_{1it}D_{FDI_{it}} + \beta_{2it}D_{Openness_{it}} + \beta_{3it}D_{GDP_{it}} + \beta_{4it}Dummy_{it} + \beta_{5it}D_{Bond_{it}} + \beta_{6it}D_{EXC_{it}} + \beta_{7it}D_{WTI_{it}} + u_{it} \quad (3)$$

$$D_{Ebitda_{it}} = \alpha_{it} + \beta_{1it}D_{FDI_{it}} + \beta_{2it}D_{Openness_{it}} + \beta_{3it}D_{GDP_{it}} + \beta_{4it}Dummy_{it} + \beta_{5it}D_{Bond_{it}} + \beta_{6it}D_{EXC_{it}} + \beta_{7it}D_{WTI_{it}} + u_{it} \quad (4)$$

The concept of cross-sectional dependence in panel data analysis pertains to the interdependence among units (e.g., countries, firms, or individuals) in a panel data set. In other words, variables within one unit can influence variables in other units. The presence of cross-sectional dependence can give rise to several challenges in panel data models. These include the potential for estimation bias and inconsistency, which can result from cross-sectional dependence. To ascertain the cross-sectional independence in panel data, it is necessary to consider both the time and cross-sectional dimensions of the series. The Breusch and Pagan (1980) CD-LM test can be employed when the time dimension of the panel is greater than the cross-sectional dimension (T>N). Conversely, the Pesaran (2004) CD-LM test can be applied when the time dimension is smaller than the cross-sectional dimension (T<N) or when the time dimension is equal to the cross-sectional dimension (T=N). In this study, given that T (Year) = 13 and N (Airline) = 10, the Breusch and Pagan (1980) CD-LM test is performed, which adheres to the T>N constraint.

Panel data, which are a combination of cross-section and time series data, also exhibit time series characteristics similar to those of their individual components. Consequently, the same statistical problems that arise in time series analysis are also evident in panel data studies. In panel data analysis, it is expected that the series should be stationary, as this is also the case with time series. The unit root tests, employed to ascertain the stationarity of the sample series in panel data analysis, are categorized into two distinct groups: first-generation and second-generation panel unit root tests. This classification is based on the presence or absence of cross-sectional dependence among the units comprising the panel. In this study, the Cross-sectional Augmented Dickey Fuller (CADF) test, one of the new second generation unit root tests proposed by Choi (2001) and Demetrescu, Hassler and Tarcolea (2006), is employed to analyze series exhibiting cross-sectional dependence.

As in regression analysis, the assumption of no correlation between the errors of different observations is a fundamental a priori expectation of panel data analysis. If the error terms of the series in the model are correlated with each other, this is called autocorrelation or serial correlation. Prior to proceeding to panel regression analyses, it is necessary to investigate whether there is autocorrelation in the model. If the probability value of the panel autocorrelation test statistic is lower than the desired confidence level (1% or 5%), the null hypothesis is rejected and the alternative hypothesis (H1) is accepted (Breusch, 1978; Godfrey, 1978; Wooldridge, 2010). This indicates that there is autocorrelation between the series used in the data set.

Regarding panel data analysis, especially in pooled OLS models, the presence of a high degree of correlation between explanatory independent variables is referred to as multicollinearity. This situation indicates an undesirable situation in regression analysis. The Variance Inflation Factor (VIF) is employed to determine the extent of multicollinearity. The variance inflation factor (VIF) for X_1 is calculated using the following formula: $VIF(X_1) = 1 / (1- R_1^2)$. This is derived from the regression model, where each independent variable is formed with other independent variables. A VIF value less than 5 for each independent variable indicates that it is not highly correlated with other independent variables.

Three methods can be used to estimate the model using panel regression as the estimation method for both time and cross-sectional data. These methods are the Pooled Panel Data Method (OLS), the Fixed Effects Method and the Random Effects Method. If it can be assumed that the coefficients between time and cross-sections are constant, the model can be constructed with pooled panel data analysis. In this instance, the most straightforward approach is to disregard the cross-sectional and time dimensions of the pooled data and estimate with the classical ordinary least squares method (OLS). Thus, the fixed parameter (α) and the slope parameters (β) of the independent variables do not vary across units or across units and time but remain constant.

The model in which the coefficients are assumed to vary across units or units and time is called the fixed effects model (Pazarlıoğlu & Gürler, 2007, p. 4). To account for the unique characteristics of each cross-section, it is necessary to assume that the constant coefficients (α) are different for each category, whereas the slope coefficients (β) are the same. The constant coefficient is distinct for each categorical unit, yet the constant of each categorical unit remains unchanged over time. In such a case, estimation can be conducted with the fixed effects model.

In the fixed effects model, it is assumed that the independent variable(s) and the error term are related. In contrast, in the random effects model, it is assumed that there is no relationship between the error term and the independent variable(s). Unlike the fixed effects model, it is stated that the effects arising from the categorical units are not fixed, but random. The random effects model assumes that there is no relationship between the independent variables and the unit effect (Nwakuya & Ijomah, 2017). This distinction is the most significant aspect differentiating the random effects model from the fixed effects model.

Appropriate statistical tests help to decide between models. The F-test can be used to decide on the choice of the pooled

OLS model. The test's alternative hypothesis asserts that there is a difference between the squares of the residuals for the two models under comparison, whereas the null hypothesis claims that there is no difference at all. If the null hypothesis is rejected at the end of the test, it is decided that there is an effect between units and therefore the classical model is not valid and cannot be preferred. The Breusch-Pagan LM test establishes a hypothesis like the F-test using the likelihood function estimator. If the H0 hypothesis is rejected, it is decided that there are unit and/or time effects, that is, the classical model is not appropriate (Tatoğlu, 2012). After determining the existence of unit effects, that is, the classical model is not valid, it is necessary to choose between fixed effects and random effects model. The random effects model is stated by hypothesis H0 in Hausman's (1978) test, while the fixed effects model is stated by alternative hypothesis H1. If the H0 hypothesis cannot be rejected, the random effects model is preferred by deciding that the components of the error term are related to the independent variables.

4. Result and Discussion

The initial descriptive statistics of the variables are presented, followed by the application of cross-sectional independent tests, unit root tests, model selection tests, and multicollinearity tests. Finally, the model coefficient and statistical results are reported.

All the variables used in the analysis are transformed into their percentage return values. Table 2 displays the variables' descriptive statistics. Additionally, the level form of the revenue, EBITDA, FDI, openness and GDP data is submitted in billions of USD. Between 2009 and 2022, the average revenues of the 10 flag carriers increase annually. However, the average EBITDA remains low due to the Covid-19 effect. During this period, the trade openness, growth, foreign direct investment and exchange rates of flagged carriers' countries increase on average. Oil prices also increase on average globally, while 1-year short-term interest rates decrease on average for selected countries.

Table 2. Descriptive Statistics of the Model Variables.

Variable	Mean	Std. Deviation	Min	Max
D_Rev	0.0744	0.3359	-0.7611	1.4845
D_EBITDA	-0.1676	3.8272	-38.4942	17.2922
D_FDI	0.4145	1.9655	-1.9839	18.4683
D_Openness	0.0592	0.1284	-0.3163	0.3531
D_GDP	3.0291	3.2048	-7.5405	14.5197
D_Bond	-0.8665	12.2483	-136.76	23.4020
D_EXC	0.0391	0.1204	-0.1433	0.8122
D_WTI	0.0986	0.4067	-0.4619	1.2112
REVENUE (Bln USD)	15.7591	10.2044	0.7820	42.2013
EBITDA (Bln USD)	2.3384	1.5497	-3.3115	6.0971
FDI (Bln USD)	62.5917	69.3566	-39.7998	344.07
Openness (Bln USD)	1701.1603	1327.7246	362.80	6851
GDP (Bln USD)	3127.3578	3448.8685	239.80	17963

The stationarity of the series in econometric modeling is frequently recommended in the literature for the robustness of the models. In order to confide in which, the series is stationary, differences between the series can be taken into account. In this empirical research, the return transformations and growth changes of the series are analyzed to avoid the unit root risk of the variable series in the models created in this study. The employed panel data is balanced, defined as a panel containing the same number of observations for each observation unit within a given period (in this study relatively airline companies and years).

The Breusch-Pagan LM (BPLM) test is used for cross-sectional independence in panel data analysis. The statistics, p-values and parameters obtained as a result of the test are used to assess whether or not cross-sectional independence is rejected. This test used when time scale samples are more than unit samples in panel data, thus our panel data is so it is. According to the results of the BPLM test in the models where both revenue and EBITDA are dependent variables, the null hypothesis (existence of cross-sectional independence) is rejected, and the alternative hypothesis (existence of cross-sectional dependence) is accepted (Table 3). Based on these results, it is deemed necessary to apply the second-generation unit root tests to ascertain whether the data contains unit roots and to evaluate whether the series is stationary.

Table 3. Breusch-Pagan LM Cross-Sectional independence Test.

Model	Statistics	p.value
Revenue Model	129.66	0.00
EBITDA Model	176.27	0.00

Following the results of the Breusch-Pagan LM cross-sectional independence test, the second-generation panel covariate augmented Dickey-Fuller (panel-CADF) unit root tests are applied to the variables in the model (Choi, 2001; Demetrescu et.al, 2006). There is no unit root in the panel data without constant and trend and with constant and trend (Table 4).

Table 4. Second Generation Covariate Augmented Dickey-Fuller (panel-CADF) Test Results.

pCADF unit root	Revenue			EBITDA		
	None	Const.	Trend	None	Const.	Trend
Test statistic	-14.40	-14.70	-14.03	-14.40	-14.96	-14.28
p-value	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***

*** 1% significance, **5% significance, *10% significance. There is no unit root according to 2nd generation pCADF unit root tests

Panel regression offers three methods for estimating the model and is a useful technique for handling both cross-sectional and time series data. These are the Pooled Panel Data Method (OLS), the Fixed Effects Method and the Random Effects Method. The tests performed to determine the most appropriate panel model among them, reveal that the pooled OLS panel model is the most effective for both the revenue model. The F-Test, Breusch-Pagan LM test, and Hausman test are employed relatively (Table 5) to identify the most suitable model for revenue model. The Chow F-test distinguishes between fixed effects (FE) and pooled OLS models. The F-test statistic is 0.91, with a p-value of 0.52. This indicates that the null hypothesis H0 cannot be rejected, and thus that the pooled OLS model should be preferred. The Breusch-Pagan LM test is used to decide between the random effect model and the pooled OLS regression. The resulting test statistic is 0.49, with a p-value of 0.48, indicating that the pooled OLS regression model should be preferred. Hausman is employed to select whether fixed effects (FE) or random effects (RE) models. The Hausman test statistic is 3.54, with a corresponding p-value of 0.83. Thus, the null hypothesis H0 cannot be rejected, and the random effects model should be preferred. The results of the applied model selection tests, in particular the F-test and BPLM test, indicate that the pooled OLS is the most appropriate model for the revenue panel model.

Table 5. Statistical Tests for Revenue Model Selection

Model	Test	Statistic	p-value	Result
Revenue	**F Test**	0.9061	0.52	POOLED OLS
	BPLM Test	0.4928	0.48	POOLED OLS
	Hausman Test	3.5481	0.83	RANDOM EFFECT

The presence of multicollinearity, which reduces the predictive power of an independent variable according to the degree of its relationship with other independent variables, is tested in the pooled OLS model. Since both the Revenue model and the EBITDA model include the same explanatory variables, the variance inflation factors (VIF) yield similar results (Table 7). The VIF values for the variables are lower than the accepted value of 5. As a result, it is reasonable to conclude that the models' multicollinearity is not a significant problem.

Table 6. Correlation table and VIF statistical result for independent variables of the models.

Variable	Rev	Ebitda	Bond	GDP	FDI	Openness	WTI
Ebitda	-0.02						
Bond	0.12	0.08					
GDP	0.47	0.09	0.08				
FDI	0.04	0.06	-0.29	0.04			
Openness	0.59	0.07	0.08	0.60	-0.02		
WTI	0.61	-0.03	0.07	0.44	0.07	0.76	
EXC	0.08	-0.02	0.09	-0.02	0.08	-0.31	-0.19

Variable	VIF
D_FDI	1.1298
D_Openness	3.5409
D_GDP	1.7602
Dummy	1.2887
D_Bond	1.1263
D_EXC	1.1953
D_WTI	2.9439

The last, serial correlation of the panel model residuals should be tested to avoid spurious regression. The Breusch-Godfrey/Wooldridge test is employed to analyze whether the revenue of the pooled OLS panel model residuals exhibit serial correlation. The 0.28 significance result of the test is found to be above the 5% significance level, indicating that the presence of autocorrelation in the residuals is rejected. For testing heteroscedasticity in the panel data, Breusch-Pagan test (1979) is applied. According to test results, presence of heteroscedasticity in the residuals is also rejected (Table 7).

Table 7. Serial Correlation and Heteroscedasticity test in Revenue Panel Model

Test	Model	Statistics	p.value
Serial Correlation	Revenue	15.4843	0.28
Heteroscedasticity	Revenue	7.152	0.41

Table 8 displays the revenue outcomes of the pooled OLS model. The model's R-square is 60%, and it have an adjusted R-square of 58%, these values are relatively high explanatory indicators for the revenue. The model significance probability value of the F statistic is less than 1%. The coefficients of the model variables D_Openness, D_EXC, D_WTI and Dummy are significant at the 10% level. Among the variables measuring and representing trade dynamism, the coefficient of D_Openness is significant at the 10% probability level, whereas the coefficients of D_FDI and D_GDP are not significant in the model. Trade openness is a variable that increases international air mobility. In particular, the coefficient effect of openness in the model is high compared to other variables, suggesting that it is an important indicator that increases airline revenues. A 1% increase in trade openness is associated with a 0.47% increase in airline revenues. These results are similar to literature (Kulendran & Wilson, 2000; Eğilmez, 2020). However, increase or decrease in GDP and direct investment do not yield significant results in the model. It can be concluded that FDI does not have as significant an effect on airline revenues as openness. In contrast to literature that debates domestic production and air traffic volume relationships (Choi, 2023; Hazel et. al., 2014) in this study the GDP coefficient is not found to be significant in the model. One possible explanation for this discrepancy is the influence of other variables, such as openness and oil and exchange rates, which act as control variables and may affect the revenue. Oil prices effected airline revenues and move in the same direction; increasing 1% in oil prices rise revenue for 0.51%. Although fluctuations in oil prices presented a risk factor for companies and affect their profitability, airline companies would adjust ticket prices to mitigate this risk. The revenue model indicated that the Covid-19 dummy variable is significant at the 1% level and negatively correlated. During the period of the Covid-19 pandemic, there is a marked decline in the volume of air travel. These results show that trade openness, as a global economic activities indicator, is a considerable factor to determining flagged airline’s revenue.

Table 8. Panel Pooled-OLS Model for Revenue (D_Revenue)

Variable	Estimate	Std.error	Statistic	p.value
(Intercept)	0.0195	0.0314	0.6201	0.54
D_FDI	0.0011	0.0104	0.1092	0.91
D_Openness	0.4706	0.2811	1.6745	0.10*
D_GDP	0.0031	0.0079	0.3876	0.70
Dummy	-0.3565	0.0601	-5.9313	0.00***
D_Bond	0.0013	0.0017	0.7762	0.44
D_EXC	0.5950	0.1742	3.4163	0.00***
D_WTI	0.5071	0.0809	6.2665	0.00***

P-OLS Model Stats:	R2	Adj-R2	F-stat	F-prob
	0.60	0.58	184.68	0.00***

*** 1% significance, **5% significance, *10% significance

To establish the EBITDA model, the same test steps are repeated as the revenue model. Numerous panel models are tested with different combination of control variables. Nevertheless, coefficient results are not significant with low r-squares. As the statistics of the EBITDA model does not give any significant results, it is not considered appropriate to present them here in the form of a table. There is no unanimous view on EBITDA in the literature. Several potential reasons may explain this outcome. EBITDA is a profitability information that assesses the company's degree of financial efficiency. Internal dynamics of the company may be more important than the external macroeconomic variables in determining EBITDA. The impact of internal dynamics of the company such as management processes, input costs, and sales strategies on EBITDA may be more forceful than macroeconomic variables. In conclusion, the macroeconomic variables used in the study are found not to be significantly related to EBITDA.

Kulendran and Wilson (2000), in their research on the economic variables affecting business travel, find that trade openness is a significant factor in explaining business travel. The findings of this study indicate that trade openness plays a significant role among the factors affecting airline revenues similar to the literature. The results of the model demonstrate that trade openness is associated with a notable increase in airline revenues and has a more pronounced impact than other variables. Thus, trade openness enhances international travel mobility in the airline industry, thereby positively affecting revenues. Conversely, GDP and direct investments do not yield significant results in the model. This indicates that the effects of GDP and direct investments on airline revenues are not as significant as that of trade openness. Nevertheless, the impact of oil prices on revenues is considerable, with increases in oil prices resulting in a corresponding rise in airline revenues. This finding indicates that oil prices represent a pivotal factor in airline revenues and that airlines are responsive to these price fluctuations. Furthermore, a significant negative correlation is observed between the Covid-19 era dummies and a significant drop in air travel. This suggests that contingencies, especially pandemic outbreaks, negatively affect the revenues of the airline industry.

5. Conclusion

The global economy is undergoing a period of rapid change, which is significantly impacting the airline industry. As a result of this change and transformation, various factors affecting the performance of airline companies are emerging. Research in the literature shows that factors such as trade openness, direct investments and economic production growth impact the airline industry. This study aims to investigate in further depth the effects of selected macro factors representing global economic mobility and volume on the revenue and EBITDA performance of the flagged carrier airlines.

The findings of the panel model study indicate that international economic mobility and volume have a positive impact on airline revenues. As a result, trade openness leads to an increase in airline revenues, furthermore, control variables like oil and exchange rates positively affect revenues. However, factors such as direct investment and domestic production do not have a significant effect on revenues. In addition, the study reveals that the impact of the COVID-19 pandemic has a detrimental effect on revenue. Although there is no direct relationship between the research variables in the existing literature, a similar relationship is observed between the increase in trade openness and airline revenues due to the connection between trade openness and airline travel volume. Moreover, GDP and FDI do not have a significant impact on revenue, and therefore, this result is not directly supported by the literature.

In the analyses conducted for EBITDA performance, financial indicators do not have the same degree of influence as revenues. The macro variables considered in the model do not have a significant effect on EBITDA. This may be since the internal dynamics of companies may have a more pronounced effect on EBITDA. Further research could investigate the relationship between these variables.

This research primarily provides flagged airline companies with valuable insights that can inform the strategic planning of their budgets and financial forecasts. By closely monitoring the key macroeconomic indicators that have been highlighted, flagged airlines are better positioned to navigate economic fluctuations and sustain financial health. For policymakers, the findings emphasize the importance of considering the effects of trade openness and economic policies that promote global mobility, as these factors directly influence the revenue generation of national airlines. Additionally, investors can leverage the study's results to more accurately assess the financial resilience of airline companies in response to macroeconomic changes, particularly during times of economic uncertainty.

In conclusion, this study sheds light on the effects of global economic factors on revenue and EBITDA performance in the airline industry. The study's novel approach, combining panel models with flagged airlines' financial data and macroeconomic indicators, offers fresh insights that expand upon previous findings in the field. These findings emphasize that global economic factors such as trade openness should be considered when evaluating the revenue performance of airlines.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

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