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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

INFLATION AND MONTHLY STOCK RETURNS RELATIONSHIP IN THE AIRLINE MARKET

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Abstract

The aim of this manuscript is to make an empirical analysis on the relationship between stock return and inflation in selected airlines from different regions of the world and airline alliances on a monthly selected dataset. The main results show regional, continental, or specific – country-based activities have got more impacts on inflation-stock return relations than airline alliances in the period between March 2014 and May 2022. Especially, inflation rates have got a causal, explanative and cointegrating relation with airline stock returns in Eastern countries or Asia.

Keywords: Airlines, Inflation, Fourier Analysis, Toda-Yamamoto causality test.
Jel Codes: B26, O18, R11

1. Introduction

World conjuncture offers airline companies two ways; being a big company that should sustain and complete all the necessary aviation works on its own or being a member of a partnership. Especially, a cumbersome structure is the indispensable result of the first opportunity, the latter one is open not only to new challenges such as code-sharing activities, slot activities etc. but also to alliances in a large framework.

The challenges, which relate to airlines and alliances have been analyzed also in the literature, Ivaldi et al. (2022) evaluate airline alliances with three important concepts that are market dispersion, ticket price and costs. According to their analysis, there are lower average prices, dispersion and lower costs in the situation of alliances (e.g., Star Alliances, Oneworld and SkyTeam). Considering eco-sustainability shortly here, alliances are drivers of eco-sustainability via partnerships, networks, and market forces (Fernandez, 2022). The same results are reached by Abdi et al. (2022) especially with the variables of government, other airlines or air carriers and passengers strategically. For Calzada et al. (2022), airlines may be one cause of the expansion of flights due to their research on Russian Aeroflot. Airline alliances have got also had deep impacts on airport and airport development in terms of air traffic competition, besides, this situation

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has got financial results (Peng and Lu, 2022). According to Winzar et al. (2022), all types of costs can be eliminated by airline alliance activities that are a great part of aviation trade wars. Alliances also affect airlines in all performance criteria such as personnel costs, fuel costs, repair and maintenance costs, station and ground handling costs and the number of flights, passenger kilometres and seat kilometres (Yen and Li, 2022). Yamaguchi (2022) states that alliances can increase oligopolistic behaviours in the airline markets. Considering Button et al. (2022) arguments, it can be said that alliances will have got definitive impacts on African Airlines.

Inflation, on the other hand, is one of the major variables in the macro-economic world and is definitive and decisive in all industries and household budgets and the aviation industry and passengers across the globe. It is not possible to sustain an analysis of the deep roots of the main economic and socio-economic crises such as war and negative events unless it is not looked at macro-economic variables such as inflation, unemployment and GDP. Shortly, it can be accepted as increasing in general and total price levels of selected *meta*s, inputs of industry and inputs and necessities of households. Especially, inflation rates are one of the important veins of aviation-related economies and there should not be an important analysis without them like oil prices, workforce prices, human and intellectual capital and inside dynamics of companies such as ROI (return on investment), ROE (return on equity), ROA (return on asset) and EBITDA (earnings before interest, taxes, depreciation, and amortization) analysis and investment-related variables analysis like volatility analysis or event studies.

Considering all the explanations above, we aim in this paper that whether or not there is a relationship between stock price and inflation rates of countries. When we conduct this research, we benefited from a classification of airline companies due to airline alliances. In the production process of this research, A Fourier-type econometric cointegration method by Tsong et al. (2016) is utilized to search for a Fourier-type econometric cointegration relationship between air carriers and inflation due to alliances. In the first section of this paper, there is a short literature scanning in terms of cointegrating relationships between aviation-related financial and economic activities and other activities. We also aimed to take some important insights from the literature on the "What is the importance of cointegration in aviation business?" question and "What is the importance of stock returns and inflation rates relationship?". In the methodology and analysis section, there will be a short communication of the results of the analysis. At the end of the research, in the discussion, conclusion and suggestion section, we realized a special analysis and interpretation of the results.

2. Literature Review

Time series data can show financial and economic even social information with efficient and effective utilization. Especially, causality relationships between time series take great attention from econometric theoreticians and empiricists in economics. A Cointegration analysis, which shows the direction and power of correlative relationships between two or more time series, is a product of the efforts of scientists from different fields. And, it should be added here that aviation science did not stay away from this development of the causal relationship. For example, Pot and Koster (2022) show a causal relationship between air accessibility and GDP in a country base benefiting from cointegration. In the cointegration analysis of Zhang et al. (2022) and Raghoo and Surroop (2020) aviation fuel is considered an important variable with its clear and frank impacts on the sustainability of world resources and fuel economics. Baker et al. (2015) investigate the relationship between regional aviation and economic growth in Australia, and according to their findings, there is a causal relationship between these two important variables. Hakim and Merkert (2016) find a causality between air transport and economic growth. Besides, in the light of their analyses, we can reach the conclusion that economic growth, which can be accepted as an indispensable variable in aviation infrastructure, is in a strict, strong and comprehensive relationship with air transportation. Tsui et al. (2021) claim that there is a causal relationship between aviation and tourism growth depending on a cointegration analysis. Hanson et al. (2022) state that state-dependent income elasticities can have some improving impacts on aviation forecasts. Inflation is an important macroeconomic variable that should have an impact on airline management. For Seçilmiş and Koç (2016) inflation rate has got a negative deep impact on the airline demands in European Sample. Jamuna (2016) states that inflation has got negative impacts on aviation fuels. There are a lot of works in the literature related to the stock return and inflation relationship, for example, Fama (1981) describes the negative relationships between stock returns and inflation rate. Balduzzi (1995) finds a negative correlation between the inflation rate and stock returns in NYSE. For Amihud (1996), the causes of the relationships between inflation rate and stock returns can be nominal contracting, tax effects, and investors' misperceptions. According to Pearce and Roley (1988), the debt structure of companies can help to investigate the relationship between the inflation rate and stock returns. Eldomiaty et al. (2020) state that there is a negative cointegrated relationship between the inflation rate and stock prices in DJIA30 and NASDAQ100 for the period of 1999-2016. Bui (2019) draws attention to Vietnam Market as a developing country, where policymakers can develop suitable policies to control and develop a stable stock market. Li et al. (2010) reach the conclusion that inflationary regimes are dangerous for stable stock markets. On the other hand, there is no work in the literature which directly measures the impacts of inflation on the stock returns in airline markets.

Based on the arguments above, we can state that cointegration analysis and the aviation sector are not far from each other. Especially, economic growth and development are the most investigated variables, and they are often subjects of different types of analyses and utilization of cointegration tests or analyses.

3. Dataset and Research Design

As Alliances are so important variables in aviation management and aviation business management, they have greatly impacted every industrial segment in especially the last 10 years.

The starting point of this research is these alliances. Especially, concentrating on the development of national airlines and air carriers, the impacts of alliances can observe easily. For example, membership of Turkish Airlines to Star Alliances, or membership of Chinese Eastern Airlines, Air China, and China Airways to the same or different alliances. On the other hand, the aviation industry is the third largest industry in the global economy and airlines, or air carriers are the visible faces of them. Therefore, financial approaches and analyses about air carriers and alliances, and behaviours of investors towards airline stocks have great importance. It is a well-known scientific reality that because of not only their power in financial markets but also their impacts on company analysis, stock returns gain importance.

In this research, we made an analysis of stock returns and inflation and we aim to realize an analysis using 15 airline companies that are selected randomly (their names are given in the Appendix), data has a time interval between March 2014 and May 2022 monthly. The stock price data is taken from investing.com and inflation data is taken from OECD's database. The stock prices are utilized to get the stock returns. The main cause of selecting data from these intervals is extraordinary situations such as Covid-19, the political drawing of the US from the Open skies agreement and resource-based problems related to OECD and the data resource of Investing.com.

4. Methodology, Analysis and Results

On the research design side, there are two important and main analyses. We realized, firstly, ADF (Augmented Dickey-Fuller), PP (Phillips Perron), and KPSS unit root analyses for both inflation and stock returns. Secondly, we utilized Fourier Tsong et al. (2016) cointegration analysis (TLTH) and the Toda-Yamamoto causality analysis. We utilize these methodologies, because, first of all, we follow Fama (1981)'s time series analysis strategy to develop a model, secondly, we should seek causality that Toda-Yamamoto is the most suitable way with its assumptions, and then explain cointegrated relationships between time series, there are a lot of cointegration tests, but Fourier based TLTH test is so sound, strong and innovative form of this cointegration tests with all of its power of explaining also linearity of time series. We utilize and interpret them and make some discussions, conclusions, and suggestions. In the first section of our analysis, unit root analyses are realized the results of the unit root test are attached in the following table. According to the analysis results, almost all the return series have stationary in the first difference.

Table 1: Augmented Dickey-Fuller (ADF), Phillips Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) Test Results for Inflation and Stock Returns

Augmented Dickey-Fuller (ADF) Null hypothesis: There is a unit root in the time series (p-values ***=. 01, **=.05, *=0.1)				
	inflation[0]	**stock returns[0]**	**inflation[1]**	**stock returns[1]**
AAL	0.102	-10.475	-5.512***	-11.653***
AC	-1.025	-10.746	-9.100***	-9.589***
AFLT	-0.709	-9.467	-1.532***	-8.404***
AGNR	3.531	-12.08	-4.161***	-10.960***
AIR CHINA	-2.523	-10.377	-9.100***	-11.502***
ASIANA	0.459	-10.679	-8.860***	-11.714***
CATHAY	-2.523	-11.358	-9.100***	-8.894***
CEA	-2.523	-10.144	-9.100***	-12.979***
CHINA	-2.523	-12.056	-9.100***	-9.431***

DELTA	0.102	-10.221	-5.512***	-12.966***
ELAL	0.368	-9.227	-7.885***	-13.314***
FINNAIR	3.991	-9.366	-4.194***	-8.198***
KOREAN	0.459	-8.966	-8.870***	-9.575***
LHAG	1.768	-9.616	-10.161***	-12.069***
QAN	1.444	-10.015	-7.992***	-13.506***
THYAO	-0.021	-9.306	-2.415***	-7.9154***
Phillips Perron (PP) Null hypothesis: There is a unit root in the time series (p-values ***=. 01, **=.05, *=0.1)				
	inflation[0]	**stock returns[0]**	**inflation[1]**	**stock prices[1]**
AAL	1.007	-10.459	-5.352***	-49.027***
AC	-0.791	-10.724	-9.082***	-41.352***
AFLT	-0.876	-9.468	-1.892***	-46.113***
AGNR	2.562	-12.330	-7.894***	-53.519***
AIR CHINA	-2.743**	-10.366	-9.082***	-52.043***
ASIANA	0.706	-10.676	-8.800***	-69.614***
CATHAY	-2.743**	-11.366	-9.082***	-96.242***
CEA	-2.743**	-10.150	-9.082***	-46.458***
CHINA	-2.743**	-11.878	-9.082***	-68.778***
DELTA	1.007	-10.213	-5.352***	-28.427***
ELAL	-0.025	-9.299	-7.892***	-53.466***
FINNAIR	3.894	-9.397	-9.635***	-46.584***
KOREAN	0.707	-8.970	-8.811***	-76.525***
LHAG	2.109	-9.679	-10.180***	-22.094***
QAN	1.204	-10.030	-7.997***	-43.830***
THYAO	3.938	-9.388	-4.425***	-66.923***
Kwiatkowski–Phillips–Schmidt–Shin (KPSS) Null hypothesis: The time series is stationary (p-values ***=. 01, **=.05, *=0.1)				
	inflation[0]	**stock returns[0]**	**inflation[1]**	**stock returns[1]**
AAL	0.658**	0.102	0.423***	0.211***
AC	0.301	0.123	0.051***	0.067***
AFLT	0.472**	0.394**	0.310**	0.178***
AGNR	0.495**	0.031	0.452**	0.041***
AIR CHINA	0.107	0.077	0.051***	0.191***
ASIANA	0.313	0.175	0.409**	0.436***
CATHAY	0.107	0.055	0.051***	0.219***
CEA	0.107	0.230	0.051***	0.060***
CHINA	0.107	0.253	0.051***	0.237***
DELTA	0.658**	0.053	0.423***	0.025***
ELAL	0.501	0.345	0.454***	0.135***
FINNAIR	0.610**	0.175	0.708*	0.048***
KOREAN	0.313	0.113	0.409**	0.134***
LHAG	0.589**	0.075	0.552**	0.023***
QAN	0.429**	0.297	0.482**	0.068***
THYAO	0.753	0.308	0.427**	0.230***

The second unit root test groups are Fourier KSS and Fourier ADF Unit Root tests groups. Fourier ADF results of inflation and stock price are given in Table 2.

Table 2: Fourier ADF Unit Root Test for Inflation and Stock Returns

INFLATION (FADF-m: Test result; Fm(k)= F test results, k=lags)					
COUNTRY	**k**	**FADF-m**	**Fm(k)**	**Optimal lag**	**MinSSR**
CANADA	2	-7.060	3.748	1	15.912
RUSSIA	2	-5.414	6.094	1	93.947
GREECE	3	-4.733	4.876	1	31.073
CHINA	4	-7.077	2.628	1	22.390
INDONESIA	2	-6.021	2.078	1	12.469
USA	2	-6.209	6.137	1	11.866
ISRAEL	2	-6.966	4.226	1	9.677
FINLAND	2	-4.928	4.378	1	9.755
KOREAN	2	-6.013	2.076	1	12.466
GERMANY	2	-6.495	3.442	1	17.410
CANADA	2	-7.060	3.748	1	15.912
TURKIYE	2	-5.240	7.926	1	578.200
AIRLINES (STOCK RETURNS)					
AAL	4	-7.185	2.202	1	1.485
AC	4	-8.554	2.700	1	1.919
AFLT	2	-7.868	4.609	1	1.097
AGNR	5	-12.540	1.379	0	1.525
AIR CHINA	4	-11.033	2.804	0	1.204
ASIANA	4	-7.066	2.498	1	7.889
CATHAY	2	-11.768	1.703	0	0.675
CEA	3	-7.861	2.164	1	1.184
CHINA	1	-12.563	1.528	0	0.861
DELTA	5	-10.698	2.007	0	0.844
ELAL	2	-7.189	2.971	1	1.993
FINNAIR	5	-10.155	4.281	0	1.797
KOREAN	4	9.607	4.590	0	0.801
LHAG	5	-6.173	2.249	1	1.069
QAN	4	-7.566	2.484	1	0.971
THYAO	2	-10.769	7.104**	0	1.335

According to the results of Fourier ADF in Table 2, which is a powerful form of unit root test, due to its definitive vulnerability on important economic events with its structural sinusoidal waves like other Fourier type econometric tests, all the airline stock series have stationary in the first difference according to Beckers, Enders and Lee (2006) [1]. For it's another stronger version, the other unit root test of Fourier KSS (Christopoulos, 2010) is utilized, and the results can be given in Table 3

1 Looking at Fm(k) statistical results first, then FADF-m (Hepsağ, 2022), we can observe all of the reuslts are significant. For this reason, ADF results are suitable in Table 1 to evaluate these series.

Table 3: Fourier KSS Unit Root Tests Inflation and Stock Returns

COUNTRY(INFLATION) (FKSS: F-tnl-m= Test result; Fm(k)= F test results, k=lags)					
	k	**F-tnl-m**	**Fm(k)**	**Optimal lag**	**MinSSR**
CANADA	2	-3.721	3.748	1	15.912
RUSSIA	2	-1.490	5.575	1	94.865
GREECE	3	-2.711	4.876	1	31.073
CHINA	4	-3.919	2.628	1	22.390
INDONESIA	2	-4.318	2.078	1	12.469
USA	2	-3.922	6.137	1	11.866
ISRAEL	2	-3.414	4.226	1	9.677
FINLAND	2	-3.238	4.378	1	9.755
KOREAN	2	-4.308	2.076	1	12.466
GERMANY	2	-2.648	3.442	1	17.410
CANADA	2	-3.721	3.748	1	15.912
TURKIYE	2	-2.908	7.926	1	578.200
AIRLINES (STOCK RETURNS)					
AAL	4	-5.691	2.202	1	1.485
AC	4	-5.038	2.700	1	1.919
AFLT**	2	-4.363	4.609	1	1.097
AGNR	5	-2.231	1.379	1	1.525
AIR CHINA	4	-3.728	2.804	1	1.204
ASIANA	4	-3.646	2.498	1	7.889
CATHAY	2	-2.907	1.703	1	0.675
CEA	3	-4.386	2.164	1	1.184
CHINA	1	-4.818	1.528	1	0.861
DELTA	5	-2.775	2.007	1	0.844
ELAL	2	-2.607	2.971	1	1.993
FINNAIR	5	-1.922	4.281	1	1.797
KOREAN**	4	-4.916	4.590	1	0.801
LHAG	5	-2.806	2.249	1	1.069
QAN	4	-5.344	2.484	1	0.971
THYAO*	2	-5.784	7.104	1	1.335

According to Fourier KSS unit root tests, all the series do not have a unit root. For other stock prices, we should look at the KSS unit root test in Table 1, so the inference is the same, the series are stationary in the first difference [2].

Utilization of the Toda-Yamamoto test is the next step. It is a VAR-dependent test, and its most basic and important feature is that it can be utilized with a simple reasoning and without employing a unit root test. The results of this analysis are given in Table 4.

2 Regarding Fm(k) statistical results firstly, then FADF-m (Hepsağ, 2022), we can observe that all of the results are not statistically significant. For this reason, Fourier KSS results are suitable for these series.

Table 4: Toda-Yamamoto Causality Test for Inflation and Stock Returns

INFLATION TO STOCK PRICES	RESULTS	LAG	P value (0.05 Significance)
AAL	2.979	2	0.225
AC	1.426	1	0.232
AFLT	7.235	3	0.064*
AGNR	2.547	2	0.279
AIR CHINA	17.740	6	0.006
ASIANA	1.3119	1	0.252
CATHAY	6.876	1	0.008
CEA	1.313	1	0.251
CHINA AIRLINES	6.302	1	0.012
DELTA	9.311	8	0.316
FINNAIR	2.729	3	0.435
KOREAN	22.384	7	0.002
LHAG	3.808	3	0.282
QANTAS	2.513	1	0.1128
THYAO	15.573	4	0.003

According to analysis results, Air China, Cathay, China Airlines, Finnair, Korean Airlines and Turkish Airlines stock prices have a relationship between country inflation rates. More scientifically, the country's inflation rate has descriptive impacts on this airline's stock prices.

A strong unit cointegration test is our next step, and TSTH is utilized to get more powerful results. One of the main conditions of the TSTH test is, the data should complete all of the necessary Fourier unit root tests such as Fourier ADF and Fourier KSS. According to alliances, the results are given in Table 5.

Table 5: Tsong, Lee, Tsai and Hu (2016) Cointegration Test for Stock Returns and Inflation

ALLIANCES	AIRLINES	K	$C_1 0_F$	FM(K)	MINSSR	LOPT
ONEWORLD	AAL (USA)	1	0.054	43.525	1.466	4
STAR ALLIANCE	AC (CHINA)	2	0.105	55.676	1.787	4
SKYTEAM	AFLT (CHINA	1	0.064	52.645	0.898	4
STAR ALLIANCE	AGNR (GREECE)	2	0.071	71.828	1.367	4
STAR ALLIANCE	AIR CHINA (CHINA)	2	0.103	51.804	1.136	4
STAR ALLIANCE	ASIANA (SOUTH KOREA)	1	0.052	55.491	7.788	4

ONEWORLD	CATHAY (CANADA)	2	0.153	63.941	0.628	4
SKYTEAM	CEA (CHINA)	3	0.191	51.117	1.131	4
SKYTEAM	CHINA AIRLINES (CHINA)	2	0.218	65.655	0.766	4
SKYTEAM	DELTA (USA)	2	0.099	46.395	0.827	4
INDEPENDENT	ELAL (ISRAEL)	1	NA	35.360	1.704	4
ONEWORLD	FINNAIR (FINLAND)	1	0.042	37.735	1.746	4
SKYTEAM	KOREAN (SOUTH KOREA)	2	0.081	36.748	0.801	4
STAR ALLIANCE	LHAG (GERMANY)	2	0.344	46.504	0.987	4
ONEWORLD	QAN (AUSTRALIA)	3	0.197	45.223	0.896	4
STAR ALLIANCE	THYAO (TURKEY)	2	0.081	45.738	1.154	4

According to TSTH Cointegration test results, Lufthansa (Germany), Qantas (Canada), China Airlines (Taiwan), China Eastern Airlines (China), Cathay Pacific (China), and Air China (China) stock returns are in a cointegrating relationship with the Inflation rate of related countries in parentheses. For Israeli ELAL, there is no meaningful relationship between these two variables according to $C_1 0_f$ test statistics, and Fm(k) F-statistic results in Table 5.

5. Discussion, Suggestion and Conclusion

According to the research results, it is not possible to explain the cointegration and causality relationship with airline alliances. Nevertheless, the research gives some important insights from the airline companies' world. Especially, the inflation rate can be accepted as an indicator of the economic power of states in airline-related – financial markets. The most specific and clear feature of this research, besides being the first research to analyze the direct stock return and inflation cointegration and causality with a powerful form. During financial crises and normal times, governing inflation with strong and consistent policies is an indicator of a strong state like aviation policies of states that show the national independence of the state according to the Paris Agreement of 1919 and the Chicago Convention of 1944. Especially, the relationship between inflation and stock returns for eastern (China) airline companies, these findings can shed more light on the next research and market players. Besides, underlining here that the first foreign trade partner of Germany is China, according to important economical magazines such as Economist, Deutsche Welle etc., the situation of Lufthansa is not so strange. The question of "Can policymakers reshape their inflation politics according to the interests of the airline financial market?" may be asserted here further research.

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Appendix: Airline Codes

Airline Code	Airline Name
AAL	American Airlines
AC	Air China
AFLT	Aeroflot
AGNR	Aegean Airlines
AIR CHINA	Airchina
ASIANA	Asiana Airlines
CATHAY	Cathay Pacific
CEA	China Eastern Airlines
CHINA	China Airways
DELTA	Delta Airlines
ELAL	Elal Airlines
FINNAIR	Finland Airlines
KOREAN	Korean Airlines
LHAG	Lufhansa Airlines
QAN	Quantas Airways
THYAO	Turkish Airlines