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Analyzing the Impact of Civil Aviation on Economic Growth in Russia: A Combined Correlation and Co-Integration Approach

[1]Boby Thomas, [2]Hilda Jose

[1]Assistant Professor, Pavanatma College, Murickassery

[2]PG Student, Pavanatma College, Murickassery, Idukki, Kerala

ABSTRACT

Key Words:

Economic Growth, Civil Aviation, GDP, Cointegration Analysis, Engle-Granger Test, Time Series Analysis, Economic Indicators

Aviation industry and economic growth by analyzing the correlation between air passenger traffic (APT) and Gross Domestic Product (GDP) from 1988 to 2021. The research reveals a significant short-term correlation between APT and GDP, underscoring the aviation sector's role in supporting economic growth. However, the Engle-Granger cointegration test indicates the absence of a long-term cointegrated relationship, suggesting that while APT and GDP move together in the short term, they do not share a long-term equilibrium. These findings highlight the substantial impact of the aviation industry on economic development but also point to other factors influencing their long-term trends independently.

1. Introduction

Russia's economic growth holds significant importance in the global landscape due to its strategic position as a major player in international trade, and industrial growth. According to the World Bank, Russia is classified as a high-income economy with vast natural resources. Its economic strength, coupled with its geographic expanse across Europe and Asia, positions it as a vital hub for global trade and transportation. In the context of civil aviation, Russia's vast territory, spanning 11 time zones, makes air transportation crucial for both domestic connectivity and international linkages. The civil aviation industry plays a pivotal role in facilitating trade, tourism, and investment, as Russia connects Europe, Asia, and the Middle East through its airspace and airports. The continued growth of Russia's aviation industry is essential for maintaining its economic power and ensuring its participation in the global economy. This, in turn, contributes to the broader development of industries and services linked to international trade and investment.

The study aims to examine the correlation between the economic growth of Russia and the development of its key industries, particularly focusing on civil aviation. Aviation is a vital sector that facilitates global business, trade, and tourism by providing rapid transportation across nations. The relationship between industrial growth and economic development is highlighted, emphasizing aviation's role in connecting nations and boosting international trade and tourism. Additionally, the study addresses the significance of economic indicators in understanding industrial growth, specifically in Russia's context as a major global power. It fills a research gap by exploring the under-examined area of civil aviation's influence on

economic development. The study is important because Russia, a leading communist nation, has a strong industrial base, and its economic interactions with other countries heavily depend on the aviation sector. By focusing on Russia's civil aviation, the research aims to provide insights into the broader relationship between industrial growth and economic progress.

2. Literature Review and Research Gap

The Russian aviation industry has been the focus of discussion due to its significant influence by political factors, both domestically and globally. This study examines the civil aviation sector, analyzing economic processes, industry reform, and trends in domestic and foreign air travel. It also evaluates Russian and international experiences in aviation research and development financing, using both qualitative and quantitative methods to assess the current state and future prospects of the industry (P. Neverov, N. Pislegina, 2013). Erdil & Yildiz studied the contribution of the Nigerian Aviation Industry to the country's GDP. They analyzed the performance of aviation workers and the labor force in relation to the GDP, comparing contributions per worker to industry revenue and forecasting future growth. The study used secondary data from Nigeria's National Bureau of Statistics from 1985 to 2012 on GDP, labor force estimates, and aviation revenue (Erdil & Yildiz, 2011). Another study assessed the performance of aviation workers and the Nigerian labor force in contributing to the national GDP, comparing per-worker contributions in the aviation industry to overall industry revenue. It also analyzed the aviation sector's percentage contribution to the national GDP and forecasted its future growth using secondary data from 1985 to 2012, including GDP figures, labor estimates, and industry revenue from the National Bureau of Statistics (Stephens et al., 2014). Salarzadeh Jenatabadi et al. examined how economic performance, organizational capacity, and capability in the airline industry are interconnected. Their findings showed that economic performance plays a key role in improving airline capacity and organizational capability (Salarzadeh Jenatabadi et al., 2013).

While previous studies have explored the impact of aviation on national GDP in countries like Nigeria and examined global trends post-pandemic, there is limited research on the long-term relationship between civil aviation growth and economic indicators in Russia. Most existing studies focus on other regions or general economic trends, leaving a gap in understanding how aviation specifically influences Russia's economic growth. This study aims to address that gap by using time series analysis to examine the connection between the growth of Russia's civil aviation industry and key economic indicators, such as GDP and air traffic, over a 33-year period (1988–2021).

In this scenario the study was conducted with the following objectives:

1. To see if the growth of Russia's civil aviation industry is related to the growth of its GDP.
2. To find out if there is a long-term relationship between air passenger traffic and GDP growth.

3. Research Methodology

The study employs secondary data from the World Bank for the period 1988 to 2021 to examine the relationship between air passenger traffic and GDP growth in Russia. Data related to the airline industry in Russia over this 33-year period were analyzed. Engle-Granger co-integration test is used as a tool for analysis. The aviation industry was chosen as the subject of the study to explore its connection with economic development. The following hypothesis was formulated for the study:

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$H_0 1$ The Growth of the Airline industry of GDP in Russia is not correlated with the growth of its Air Passenger Traffic.

$H_1 1$ The Growth of Air Passenger traffic in Russia and GDP shows a cointegrated relationship.

4. Data Analysis

Summary statistics highlight the salient characteristics of the dataset and offer a concise and comprehensible overview of it. This aids in comprehending the primary traits of the secondary data that were employed in the analysis. Below are these summary data in Table 1.

Table 1 Summary Statistics

Statistics	GDP in Crores	APT in '000
Mean	99646	1697.3
Median	67752	1337.8
Minimum	19591	6.9202
Maximum	229250	5630.3
SD	66631.0	1842.7
CV	0.7	1.1
Skewness	0.5	0.5
kurtosis	-1.2	-1.2

Source: Secondary Data

The summary statistics reveal key characteristics of the dataset on GDP, air passenger traffic. The mean values are 99,646 crore for GDP, and 1,697.3 thousand for air passenger traffic. The median values are 67,752 crore for GDP, and 1,337.8 for air passenger traffic. The minimum values are 19,591 crore for GDP and 6.9 thousand for air passenger traffic, while the maximum values are 229,250 crore for GDP, and 5,630.3 thousand for air passenger traffic. The standard deviations are 66,631 crore for GDP, and 1,842.7 for air passenger traffic, indicating variability around the means. The coefficient of variation is 0.7 for GDP and 1.1 for air passenger traffic, reflecting relative dispersion. Skewness values are positive, showing mild right skewness for all variables, while kurtosis values are negative, indicating relatively flat distributions with fewer extreme values.

Growth trend of the period is given in figure 1

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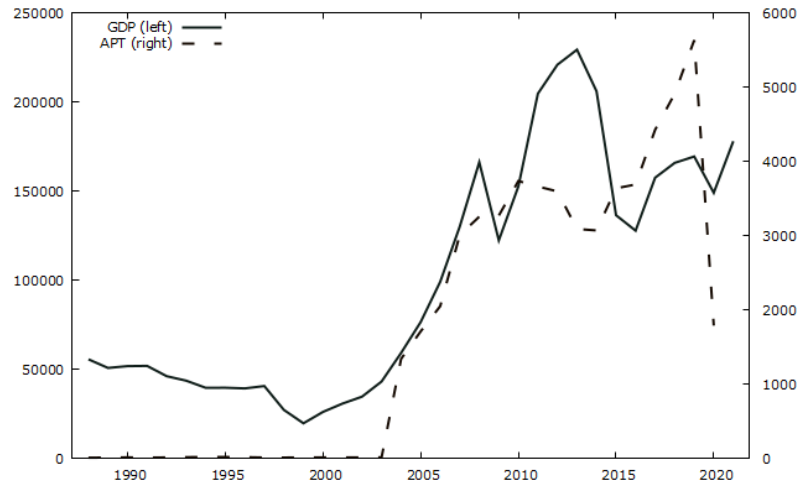

Source: Secondary Data

The figure compares the trends of GDP and air passenger traffic in Russia from 1988 to 2021. The data shows that air passenger traffic followed a nearly linear trend until 2003, with a sharp increase up to 2007. GDP also increased after 2003, but experienced a decline from 2006 to 2009, while air passenger traffic did not decline during this period. Since 2009, GDP grew significantly, peaking in 2012, but air passenger traffic did not keep pace. From 2015 onwards, air passenger traffic grew faster than GDP. The COVID-19 pandemic led to a sharp decline in both GDP and air passenger traffic due to travel restrictions and the resulting economic crisis.

Correlation Analysis

The study examines the relationship between Russia's GDP and Air Passenger Traffic (APT) using Spearman's rank correlation coefficient (rho). The test results show a strong positive correlation between the two variables, with a coefficient of 0.7811 and a p-value of 0.001, which is less than the significance level of 0.05. Therefore, the null hypothesis (H01) that there is no correlation between the growth of Russia's GDP and its airline industry, represented by APT, is rejected. This indicates a significant correlation between GDP growth and the expansion of air passenger traffic in Russia.

Co-integration Analysis

The Engle-Granger cointegration test (EGC Test) is used to assess whether a long-term relationship exists between two time series data, such as GDP and air passenger traffic. The hypothesis being tested is that these two variables are cointegrated. Figure 1 shows that GDP and air passenger traffic trends are similar. To verify this, an EGC test is performed, which requires stationary data. The stationarity is first checked using the ADF unit root test, with lag selection being the initial step in this process.

Augmented Dickey-Fuller test for GDP

testing down from 10 lags, criterion AIC

sample size 26

unit-root null hypothesis: a = 1

test with constant including 6 lags of (1-L)GDP in Crores

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model: (1-L)y = b0 + (a-1)*y(-1) + ... + e

the estimated value of (a - 1): -0.173126

test statistic: tau_c(1) = -2.25153

asymptotic p-value 0.1882

1st-order autocorrelation coeff. for e: -0.023

lagged differences: F(6, 18) = 2.330 [0.0767]

Since the P value is greater than 0.05, the unit root null hypothesis is accepted. The unit-root hypothesis is not rejected for the individual variable GDP.

Testing for a unit root in APTin1000

Augmented Dickey-Fuller test for APTin1000

testing down from 10 lags, criterion AIC, sample size 32

unit-root null hypothesis: a = 1

test with constant

including 0 lags of (1-L) APT in 1000

model: (1-L)y = b0 + (a-1)*y(-1) + e

the estimated value of (a - 1): -0.104497

test statistic: tau_c(1) = -1.38397

asymptotic p-value 0.5918

1st-order autocorrelation coeff. for e: -0.035

Since P value is greater than 0.05, accepted. The unit-root hypothesis is not rejected for the individual variable APT.

Cointegrating Regression:

OLS, using observations 1988-2020 (T = 33)

Dependent variable: GDP in Crores

Table 2 OLS Regression Results

	coefficient	std. error	t-ratio	p-value	Significance
const	43422.7	7514.53	5.778	2.31e-06	***
APTin1000	31.7295	3.02442	10.49	1.01e-011	***

Source: Gretl output.

As per Table 4.13, there exists a statistically significant relationship between GDP and APT.

Testing for a unit root in uhat

Augmented Dickey-Fuller test for uhat

testing down from 10 lags, criterion AIC, sample size 22

unit-root null hypothesis: a = 1

test without constant

including 10 lags of (1-L)uhat

model: (1-L)y = (a-1)*y(-1) + ... + e

the estimated value of (a - 1): -1.12333

test statistic: tau_c(2) = -1.69593

asymptotic p-value 0.6801

1st-order autocorrelation coeff. for e: -0.287

lagged differences: F(10, 11) = 3.339 [0.0301]

Since P value is greater than 0.05, and hence null hypothesis is accepted. The unit-root hypothesis is not rejected for the individual variables GDP and APT.

Cointegration Result

As per EGC criteria, "there is evidence for a cointegrating relationship if:

(a) The unit-root hypothesis is not rejected for the individual variables,

(b) If regression results are significant, and

(c) The unit-root hypothesis is rejected for the residuals (uhat) from the cointegrating regression."

The Engle-Granger cointegration test result shows that the first two criteria of cointegration relationships are satisfied. But the test results satisfied the third criterion. Hence it is concluded that there exists no cointegrated relationship between GDP and APT.

As per the trend analysis, there is a correlation between the Russian civil aviation industry and the growth of GDP and Air Passenger Traffic. The conclusion from this analysis is that there is mostly an increasing trend in GDP and Air Passenger Traffic in Russia. Even though there exists a significant relationship between GDP and APT, there is no cointegrated relationship between the two variables.

5. Discussion of the Result

The research shows a significant correlation between the growth of Russia's GDP and air passenger traffic (APT), though no long-term cointegrated relationship exists between the two. With a Spearman's rank correlation of 0.7811 and a p-value of 0.001, the data suggests that as GDP rises, APT generally follows, indicating short-term alignment.

The trends indicate steady APT growth until 2003, followed by a sharp increase until 2007. Despite a GDP decline from 2006 to 2009, APT remained stable, suggesting resilience in the aviation sector. Since 2015, APT has grown faster than GDP, possibly driven by domestic demand or infrastructure improvements, though the pandemic caused a sharp decline in both metrics.

The lack of a cointegrated relationship from the Engle-Granger test suggests that while GDP and APT may move together in the short term, they do not share a long-term equilibrium. This implies that aviation growth in Russia could be influenced by factors beyond GDP, such as

government policies or external shocks. The result also indicates that stimulating aviation alone may not lead to sustained economic growth.

6. Conclusion

The study reveals a significant short-term relationship between the civil aviation industry and GDP in Russia but no long-term cointegration. The lack of long-term connection implies that policies aimed at growing the aviation sector may not ensure sustained economic growth. Complementary strategies might be needed to strengthen this relationship. While the aviation sector contributes to short-term economic activity, its long-term effects are influenced by various external factors, making the relationship more complex than it first appears.

REFERENCE

Dube, K., Nhamo, G., & Chikodzi, D. (2021a). COVID-19 pandemic and prospects for recovery of the global aviation industry. *Journal of Air Transport Management*, *92*(May 2021), 1–28.

P. Neverov, N. Pislegina, S. L. & S. S. B. (2013). The analysis of problems and development prospects of civil aviation in Russia. *Paper Knowledge. Toward a Media History of Documents*, 12–26.

Erdil, S. T., & Yildiz, O. (2011). Measuring service quality and a comparative analysis in the passenger carriage of airline industry. *Procedia - Social and Behavioral Sciences*, *24*, 1232–1242. https://doi.org/10.1016/j.sbspro.2011.09.117

Salarzadeh Jenatabadi, H., Huang, H., Ismail, N. A., Satar, N. B. M., & Mohamed Radzi, C. W. J. bt W. (2013). Impact of Economic Performance in Organizational Capacity, Capability: A Case Study in Airline Industry. *International Journal of Business and Management*, *8*(17), 112–120. https://doi.org/10.5539/ijbm.v8n17p112

Stephens, M. S., Ikeogu, V., Stephens, O. B., & Ukpere, W. I. (2014). *Empirical Analysis of the Contribution of the Aviation Industry to the Nigerian Economy*. *5*(3), 115–125. https://doi.org/10.5901/mjss.2014.v5n3p115