

Factors Impacting Short Term Commercial Air Passengers Number

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Abstract:- Growth in the civil aviation industry is one of the most notable stories of the 21st century, with global air travel increasing sevenfold over the past four decades (from 0.65 billion in 1980 to 4.5 billion in 2019). Forecasting future air travel requires a multifaceted approach, considering a wide range of influencing factors. This paper provides an analysis of key determinants that will shape air travel demand in the coming years, including economic growth, population demographics, infrastructure development, and technological advancements. While factors such as government policies, global connectivity, tourism trends, and geopolitical stability are not included, the study uses data from 2001 to 2019 to model travel demand for the top 10 GDP countries. By integrating these factors, the paper uses advanced forecasting models and scenario planning to predict future travel demand. This research highlights the importance of understanding key parameters for forecasting and identifies conditions that may influence long-term travel demand, providing valuable insights for the industry and policymakers.

Keywords:- Commercial Passenger Forecast, Air Travel Demand, Factor Impacting Passenger Forecast.

BRIEF:- An Analysis of Determinants Shaping Air Travel Demand and Advanced Modeling Techniques for Future Predictions.

I. INTRODUCTION

The rapid progress in the civil aviation industry is a remarkable achievement of the 21st century. Since the Wright brothers' pioneering flight, air travel has revolutionized transportation, providing a fast, reliable, and comfortable mode of travel that connects nations and facilitates global interactions. This growth has made civil aviation a distinct and preferred choice for travel, surpassing other transportation modes and becoming a critical component of global connectivity and economic development.

Understanding the factors influencing air travel demand is crucial for effective planning and resource allocation. This is especially important given the significant increase in the number of people flying worldwide, which has grown sevenfold over the past four decades (from 0.65 billion in 1980 to 4.5 billion in 2019) [Reference 1, Reference 2]. Accurate forecasting of air travel demand is essential for policymakers and industry leaders to make informed deci-

sions about enhancing infrastructure, optimizing operations, and developing policies that support sustainable growth.

This paper examines key factors influencing air passenger growth across various countries and groups. By understanding these factors—such as economic growth, population demographics, infrastructure development, technological advancements, and public health—industry and policymakers can make informed decisions to enhance infrastructure, optimize operations, and develop policies supporting sustainable growth. The hypothesis of this study is that these key determinants significantly influence air passenger growth.

Overall, the study aims to enhance our understanding of the key parameters for forecasting air travel demand and identify conditions that may influence future travel trends, providing valuable insights for industry and policymakers.

II. MATERIALS AND METHODS

The study uses historical air travel data from 2001 to 2019 (pre-covid), economic indicators (GDP, Per Capita Income, inflation, employment), Social indicator (Population growth, Urbanization), Technology indicator (Journal & Technology paper published) and uses regression models to find correlation with Passenger demand growth.

A. Factors Considered for Study-

➤ Economic factor

The overall economic health of the country, including GDP growth, Income level growth of individual (Per capita income) and employment rate will significantly impact travel demand. Our Hypothesis is a growing economy typically leads to increased disposable income and higher travel propensity.

➤ Social Factor

Changes in population size, age distribution and urbanization trends can affect travel demand. Our hypothesis is growing middle class, and an increasing literacy rate in adult may lead to higher travel demand.

➤ Technology Advancement

Innovation in aviation technology such as more fuel-efficient aircraft, improved comfort inside aircraft, better operational management driven by technology can make air travel more attractive and accessible. Since there is not a

well-established data set to measure this, we have hypothesized that number of technical journals published & Patent issued by country is indicator of Technology advancement of the country and is correlated to passenger growth.

Few other factors such as Geopolitical stability, Infrastructure development is not considered for study here due to lack of available public data. All the data is taken from World Bank Open data source.

III. RESULTS

A study was initially conducted to identify the correlation between various factors and passenger growth. However,

this approach proved to be misleading because, in general, the passenger count has increased over the years, as have many of the factors considered, such as GDP, per capita income, population, urban population, literacy rate, and the number of patents and publications. This results in a strong correlation with factors that have increased over time, as shown in Table 1 and Image 1 for the entire world. While this correlation might be reasonable for long-term forecasts, as supported by other literature, it is less useful for short-term forecasts. To understand the influence of these parameters on the yearly change in passenger numbers, the year-over-year changes in these parameters need to be evaluated. A correlation of yearly change of these parameters for whole world is shown (Table 2).

Table 1. Correlation of Parameters with Passengers Count (2001-2019 world)

Parameters	Correlation with Passengers
GDP	0.93
Inflation	-0.46
Population	0.98
Per Capita Income	0.88
Passenger Per Population (derived parameter)	1.0
Unemployment	-0.72
Urban Population	0.97
Journals Published	0.97
Patents issued	0.99
Adult Literacy	0.97

Table 2. Correlation of Parameters with Passenger per Population Count (2001-2019 world)

Parameters	Correlation with Passengers per Population
GDP	0.31
Inflation	0.1
Population	-0.29
Per Capita Income	0.32
Passenger Per Population (derived parameter)	1.0
Unemployment	-0.47
Urban Population	-0.14
Journals Published	0.09
Patents issued	0.36
Adult Literacy	0.24

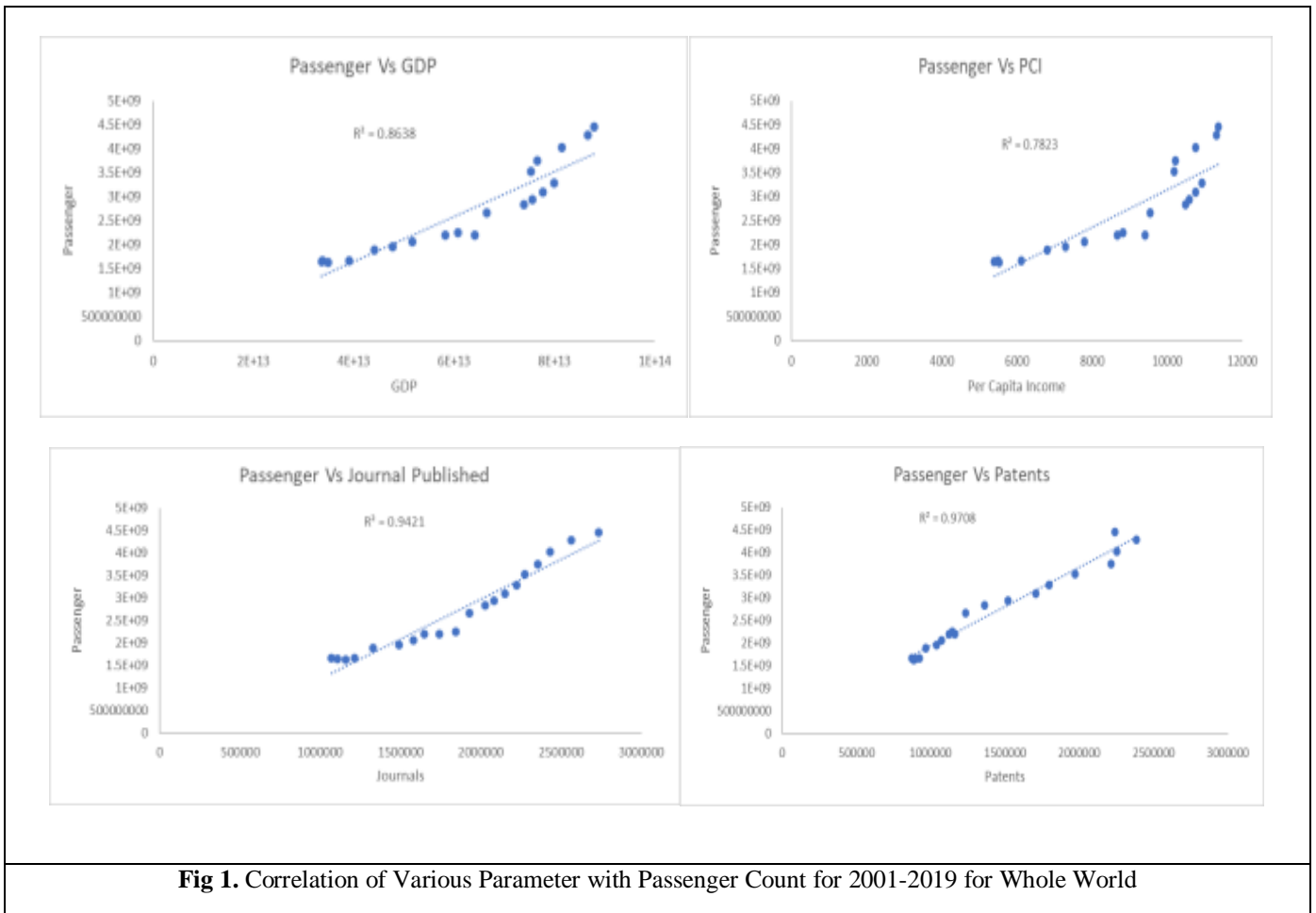


Fig 1. Correlation of Various Parameter with Passenger Count for 2001-2019 for Whole World

To avoid confounding effect of population, increase passenger count is normalized to population and a new derived parameter Pax Per Pop (passenger per population) is considered for further study.

As shown in Table 1, passenger counts have a strong and positive correlation with most of the parameters. As expected, unemployment and inflation correlate negatively with passenger counts. Table 2 illustrates that the year-over-year change in passengers per population correlates negatively with unemployment but not as significantly with inflation. Additionally, passengers per population show a correlation with changes in per capita income (PCI), GDP, technological advancements (as indicated by the number of patents), and changes in adult literacy rates.

IV. DISCUSSION

As shown in Table 3a & Table 3b, Globally, passenger numbers increased by 166% in 2019 compared to 2000. Populous and developing countries such as China, India & Brazil have experienced substantial passenger growth, establishing them as new growth engines for the aviation industry. This growth aligns closely with their overall GDP changes from 2000 to 2019, during which the world GDP increased by 160%, while China, India, and Brazil saw GDP increases of 1079%, 505%, and 186%, respectively. Technological indicators such as the number of journals and patents, in these countries also surpass the world average of 155%. Specifically, China saw journals increase by 1046% and patents by 4806%, India saw journals increase by 496% and patents by 782%, and Brazil saw journals increase by 403% and patents by 72%. Additionally, urban population growth in these countries is higher compared to the top 10 GDP countries, with China at 68%, India at 25%, and Brazil at 7%.

Parameters	USA	China	Japan	Germany	India
GDP	110%	1079%	3%	100%	505%
Passengers	39%	966%	19%	89%	868%
Inflation	-46%	734%	-169%	0	-7%
Population	16%	11%	0%	1%	31%
Per Capita Income (PCI)	80%	957%	3%	98%	364%
Passenger per population	20%	856%	20%	87%	642%
Unemployment	-8%	40%	-50%	-60%	-17%
Urban Population	4%	68%	17%	3%	25%
Journal	43%	1046%	5%	56%	496%
Patents	73%	4806%	-37%	-10%	782%

Parameters	UK	France	Canada	Italy	Brazil	World
GDP	71%	100%	134%	75%	186%	160%
Passengers	102%	36%	124%	-9%	229%	166%
Inflation	47%	-34%	-28%	-76%	-47%	-36%
Population	13%	11%	23%	5%	20%	26%
Per Capita Income (PCI)	51%	81%	91%	67%	137%	106%
Passenger per population	78%	23%	82%	-13%	173%	111%
Unemployment	-33%	-18%	-17%	-8%	10%	-9%
Urban Population	6%	6%	3%	5%	7%	19%
Journal	30%	31%	83%	111%	403%	155%
Patents	-45%	2%	1%	17%	72%	156%

The study reveals several key insights into the correlation between various economic indicators and passenger growth across different countries. Year-over-year changes in GDP show a strong correlation with passenger growth in the USA, Germany, India, Canada, the UK, and Brazil, indicating that economic growth in these countries significantly drives increased passenger numbers. Per capita income (PCI) changes correlate well with passenger growth in countries where GDP changes also show a strong correlation, reinforcing the link between economic prosperity and increased air travel. In contrast, inflation does not correlate well with passenger growth for most countries, except for China, the UK, and Canada, suggesting that inflation has minimal short-term impact on passenger numbers in most regions.

Unemployment rates correlate negatively with passenger growth for most countries, including the global average. Specifically, the USA, Brazil, and Italy show a relatively strong negative correlation, indicating that higher unemployment rates lead to fewer passengers flying in short term.

In countries where the change in urban population has been less than 5% over the last 20 years, there is no significant correlation with passenger growth. However, for countries with more substantial urban population growth, there is a positive correlation with passenger numbers. The number of journals and patents generally correlates positively with passenger growth, except in countries where these indicators have declined in last 20 years, such as Japan (journals down 40%, patents down 45%), the UK (journals down 45%), and Germany (journals down 10%).

Parameters	USA	China	Japan	Germany	India
GDP	0.60	0.08	-0.15	0.58	0.61
Passengers	0.99	0.99	0.99	0.99	0.99
Inflation	-.01	0.29	-0.11	-0.22	0.11
Population	-0.3	0.08	-0.12	-0.35	-0.05
Per Capita Income (PCI)	0.62	0.08	-0.14	0.59	0.61
Unemployment	-0.61	-0.18	-0.15	0.47	0.10
Urban Population	0.21	0.36	-0.22	0.45	0.215
Journal	0.43	0.53	-0.22	0.29	0.22
Patents	0.01	-0.16	0.16	-0.29	0.25

Parameters	UK	France	Canada	Italy	Brazil	World
GDP	0.41	-0.01	0.45	0.22	0.33	0.32
Passengers	0.99	0.99	0.99	0.99	0.99	0.99
Inflation	0.30	0.18	0.25	0.19	-0.011	0.10
Population	0.13	-0.03	-0.29	-0.21	0.10	-0.29
Per Capita Income (PCI)	0.4	-0.01	0.46	0.23	0.33	0.32
Unemployment	-0.17	-0.11	-0.26	-0.35	-0.53	-0.47
Urban Population	0.25	-0.42	-0.05	-0.15	0.17	0.09
Journal	0.33	0.25	-0.02	0.27	0.3	0.09
Patents	0.06	0.46	0.01	No data	-0.25	0.36

V. CONCLUSION

In conclusion, this study elucidates the significant correlations between various economic indicators and passenger growth across different countries. The data reveal that year-over-year changes in GDP and per capita income are strong drivers of increased passenger numbers, particularly in the USA, Germany, India, Canada, the UK, and Brazil. Conversely, inflation shows minimal impact on passenger growth, with exceptions in China, the UK, and Canada. Unemployment rates exhibit a negative correlation with passenger growth, notably in the USA, Brazil, and Italy. Additionally, substantial urban population growth aligns positively with increased passenger numbers. Technological advancements, as evidenced by the rise in journals and patents, generally correlate with passenger growth, except in countries experiencing declines in these indicators, such as Japan, the UK, and Germany. These findings underscore the intricate relationship between economic prosperity, technological progress, and the aviation industry's expansion.

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