# STUDY OF CAUSALITY BETWEEN CIVIL AVIATION SECTOR AND ECONOMIC DEVELOPMENT IN SAUDI ARABIA

Meshaal Alshammary *

* Arab Open University, Kingdom of Saudi Arabia

OPEN ACCESS

**How to cite this paper:** Alshammary, M. (2017). Study of causality between civil aviation sector and economic development in Saudi Arabia. *Journal of Governance & Regulation, 6(2), 22-31.* doi: 10.22495/jgr_v6_i2_p3

**How to access this paper online:** http://dx.doi.org/10.22495/jgr_v6_i2_p3



**ISSN Online:** 2220-9352
**ISSN Print:** 2306-6784

**Received:** 12.03.2017
**Accepted:** 12.05.2017

**JEL Classification:** C32, H54, L93, N15, O11, 018, R40

**DOI:** 10.22495/jgr_v6_i2_p3

## Abstract

Recently, Saudi Arabia is undergoing major privatization and Public Private Partnership (PPP) projects, as guided by the Saudi National Transformation Program (NTP) 2020 and the Saudi Arabia's Vision 2030, attempting to shift the oil-based economy toward more diverse and sustainable economy. The main purpose of the paper is to empirically examine the aviation-led growth hypothesis for Saudi Arabia by testing causality between civil aviation and economic development, applying econometric tests such as Granger causality tests for the time period from 1975 to 2011. Empirical results reveal the existence of the Civil aviation Led-Economic growth hypothesis (economic expansion causing the civil aviation sector to grow) for a developing country like Saudi Arabia. As guided by both the NTP 2020 and Saudi Arabia's Vision 2030, policy makers should consider updating civil aviation infrastructure, nation-wide airport privatization programs, increase the number of airports in major cities and establish long term partnerships with international airlines and carriers. This will strengthen the private sector and diversify the oil-based economy toward a sustainable economy.

**Keywords:** Civil Aviation, Infrastructure Governance, Economic development, Saudi Arabia, NTP 2020, Vision 2030, Causality Test

## 1. INTRODUCTION

The superior features of air transportation, such as superior speed, safety, and reliability over alternative types, create positive economic effects from both the expenditure and the transportation effects of air transportation (Özcam 2014). The expenditure effects of air transportation arise from the construction and operation of airports. In the construction phase, payments to construction workers and to suppliers of construction materials have relatively short-run effects, whereas payments in the operational phase, such as wages of employees at the airport site, are more sustainable. For example, airports provide some direct employment related to the ground facilities of the airlines, ground handling companies, maintenance, repair, and overhaul (MRO) establishments, freight operations, and other commercial activities such as duty-free shops, restaurants, banks, and post offices. It is estimated that each 1000 annual passengers in an airport could create one job in the airport (Robertson 1995).

However, transportation economists and policymakers focused more on transportation effects, which include the stimulated benefits when an improvement in transportation investments and services reduces transportation costs as a result of reduced travel time, enhanced reliability, and safety and lowered emissions (Taylor & Samples 2002). The decline in transportation costs not only reduces the total production costs of firms but also attracts new businesses aiming to enjoy the reduced costs. The transportation effect of improved air services is crucial for industries dependent on face-to-face interaction, especially in service industries where the core of the businesses is human contact.

The study is encouraged by the lack of comprehensive literature on the Saudi Arabian civil aviation sector and its relationship to economic growth; In addition, the results will provide contemporary information on the Saudi economy as a whole and the civil aviation sector, particularly for Saudi decision makers, academics and the industry.

The study aim to investigate the nexus between civil aviation development and economic growth observed in Saudi Arabia during 1975-2011. The rest of the study is organized as follows: Section 2 presents a brief on the Saudi civil aviation sector. Section 3 presents a brief on the Saudi economy. Section 4 presents the literature review on the relationship between civil aviation development and economic growth. Section 5 describes econometric methodology used in this study and data

descriptions. Section 6 presents empirical results and the discussion thereof. The final section 7 offers conclusion and policy implications.

## 2. OVERVIEW OF THE CIVIL AVIATION SECTOR DEVELOPMENT IN SAUDI ARABIA

The debut of the civil aviation in Saudi Arabia goes back to the year 1934 when one of the petrol companies that has later become part of Saudi Arabian Oil Company (Saudi Aramco) Services Company has established a desert runway next to Jubail city. Saudi Arabia owned its first civil aircraft in the year 1945 of the model (DC-3 Dakota) to which two other aircrafts of the same model were added at a later stage.

The first civil aviation rule in Saudi Arabia was issued in the year 1953. Upon its separation from the Saudi Royal Air Force, the Presidency of Civil Aviation used to have under its wing the Saudi Arabian Airlines and the Meteorology Department, until the Saudi Arabian Airlines was separated from the Presidency of Civil Aviation in the year 1960 and that was transformed in the year 1963 to an independent public institution. In the year 1966, the Meteorology Department was separated from the Presidency of Civil Aviation and its budget has become independent. In the year 1977, the name of the Presidency of Civil Aviation has been amended into the General Authority of Civil Aviation (GACA). During these years, Saudi Arabia has achieved unprecedented growth and quality leaps in the civil aviation domain and industry that covered major developments in passengers' transportation, air cargo, airports construction and equipment, air navigation and control.

The Saudi government's intention to privatise, if not lose control of oil rents, was first publicised in 1994 upon release of its sixth five-year development plan, 1995–1999 (Al-Omar 1996). In 2002, plans were announced to privatise 20 economic sectors such as, civil aviation and airport services. The purpose was to open up the country's public services and infrastructure to increase socio-economic development and work towards adoption of international standards such as the World Trade Organization (WTO) (Ramady 2010; Shoult & Anwar 2009).

## 3. OVERVIEW OF THE SAUDI ARABIAN ECONOMIC DEVELOPMENT

Economic development and growth issues continue to capture the interests of academics and policy makers around the globe. Economic growth can be quantitatively defined as an increase in real gross domestic product (GDP). Many factors could affect economic growth, for example these include investment ratio human capital, research and development. In recent times, the shift in emphasis has been from the classical concepts of maximizing production outputs and wealth distribution towards economic sustainability, as a reaction to globalization (Alshammary 2014). This has resulted in major economic reforms, especially among developing countries as they expand their markets. Hence, economic sustainability is heavily tied to investment (Alshammary 2014).

According to Chadhury (1989, 1997) and Auty (2001), the Saudi Arabia economic development path can be described as a '*Rentier*' economy, where governments attempt to maximize revenues from natural resources such as oil in the case of the Saudi Arabia and then distribute its wealth to its population (Ramady 2010).

As a developing economy and a member of the Group of Twenty (G-20), Saudi Arabia is not an exception in this international trend. In the last three Five-Year Saudi National Development Plans (2000–2014), major legal, economic and financial reforms were implemented to promote sustainable economic growth (Alshammary 2014, Ramady 2010). In addition, both the Saudi National Transformation Program (NTP) 2020 and the Saudi Arabia's Vision 2030 are major government attempts to shift the oil-based economy toward more diverse and sustainable economy that is in line with international economic practices.

## 4. CIVIL AVIATION DEVELOPMENT AND ECONOMIC GROWTH

Transportation is highly recognized as a key facilitator to sustainable economic growth (Pradhan & Bagchi 2013, Raghuram & Babu, 2001). A well-oiled transportation infrastructure expands the productive capacity of a nation, both by increasing the mobilization of available resources, and by enhancing the productivity of those resources. The support for this assertion according to Pradhan and Bagchi (2013) is straightforward and there are many ways that can justify it:

- Transportation infrastructure can enter in the production process as direct input and in many cases as an unpaid factor of production.
- Transportation infrastructure may make other existing inputs more productive. For instance, a well-designed road allows goods to be transported to market in less time and hence, reducing the transportation cost in the production process.
- Transport infrastructure can act as magnet of regional economic growth by attracting resources from other regions, which is called agglomeration. In this vein one would recall that throughout the growth of civilization, most centers of economic activities flourished along riverbanks and coast lines where water was the convenient prime carrier of raw materials, goods and labor.

Transport infrastructure can also affect economic growth by changing aggregate demand. For instance, transportation infrastructure construction can create and increase demand for intermediate inputs from other sectors and stimulate multiplier effects in the economy (Pradhan & Bagchi 2013). Briefly, transport remains a crucial infrastructure that boosts economic development.

Public transportation infrastructure, in fact, can influence economic output by crowding in or out private inputs such as labor and capital. An increase in public transport infrastructure would attract

more private investments if there is a complementing relationship between them; or it could reduce private investments when public capital has a substitute effect on private inputs (Jiang, 2001). For instance, transport infrastructure accounts for a significant share of energy consumption in Saudi Arabia, particularly for oil products and the consequent development in that sector.

Extensive literature exists on the economic impacts of air transportation. Some researchers used multiplier analysis to determine the economic impacts of air transportation. For example, Warren (2007) found that counties having an airport with commercial air service tended to have higher income, employment, population, dividends, interest, and rent. Similarly, Rasker et al. (2009) suggested that counties were more likely to have:

- Higher per capita income,
- More services and professional jobs,
- Higher mean earning per job, and
- A lower degree of specialization the closer they were to a major airport.

In addition, Alkaabi and Debbage (2007) showed that the number of professional, scientific, and technical establishments and high-technology establishments were highly correlated with air passenger traffic. For example, Button et al. (2010) estimated that a 10% increase in air passenger traffic at a small airport could create a 0.18%-0.4% increase in per capita income at a neighboring area in Virginia. Also Ozcan (2014) demonstrated the economic contributions of the Essential Air Service Program (EAS) flights to small and remote communities. Ozcan applied a two-stage least squares estimation, findings indicate that a 1% increase in air passenger traffic in EAS airports with a minimum annual air passenger traffic of 1000 likely leads to a 0.12% increase in per capita income of the community served by that airport. Ozcan suggested that EAS communities that are able to sustain their subsidized flights experienced higher per capita income growth in the 1999-2011 period than did Ex-EAS communities that lost their flights as a result of non-eligibility.

Moreover, the direction of causality is important once the relationship between civil aviation and economic growth is established. Here are few of the most recent empirical studies from developing countries such as India Pakistan and Brazil. On the one hand, Mehmood and Kiani (2013) found positive contribution of aviation demand to economic growth in Pakistan. Similar results found in India (Mehmood et al. 2013). On the other hand, findings reveal strong positive causality from GDP to aviation demand but relatively weaker causality other way around in Brazil (Marazzo et al. 2010).

A study that links civil aviation development and economic growth of Saudi Arabia is an unaddressed topic in empirical literature. The paper aims at analyzing the civil aviation-economic growth nexus in Saudi Arabia. Specific proposition is as follows:

- Civil aviation Led-Economic growth hypothesis (economic expansion causing the aviation sector to grow), Marazzo et al. (2010)
- Economic growth Led-Civil aviation hypothesis (expanding aviation sector help the economy to grow) Mehmood and Kiani (2013), Button and Yuan (2012) Mehmood et al. (2013).

## 5. METHODOLOGY

### 5.1 Data, Scope & Variables

This study investigates the relationship between civil aviation development and economic growth of the Saudi economy over the period 1975 to 2011. The secondary annual data (37 observations) of the variables selected for the models are collected from the Saudi Arabian General Authority of Civil Aviation (GACA) and the Saudi Arabian Central Department of Statistics and Information (CDSI). Note, only annual data are publicly available for our study's variables.

We used GDP growth rate and nominal gross fixed capital formation (NGFCF) as proxies for economic development; The number of passengers (PAX) and cargo (CARGO) as proxies for Civil aviation development (AVD). Controlled by (1) Saudi Population (PPL); (2) Jet fuel production (JET_FUEL) in Saudi Arabia; (3) Bank Credit to Private sector (BCP).

Economic growth in Saudi Arabia has been based, to a large extent, on the development of hydrocarbon (oil and gas) resources. The production of hydrocarbon sector, while having met world demand, has also been conditioned by the need to finance domestic development. To a more limited extent, economic growth has also reflected the development of non-hydrocarbon sector in response to the economic diversification policy initiated in the late1970s aiming at minimizing the negative effects of international oil price fluctuations. The development of the non-hydrocarbon sector is based mostly on the development of industries using the abundant hydrocarbon resources as inputs, such as petrochemicals, fertilizers, electricity generation for aluminum production. It has also been derived from growth in industries that are not based on hydrocarbon and that are important in specific countries. To measure economic growth in Saudi Arabia, we use two proxies.

***Real GDP Growth Rates (GDP)***

Economic growth is defined as the increase in a nation's ability to produce goods and services over time as is shown by increased production levels in the economy. This research employs real GDP growth rates (base-year 1999) as a proxy for economic growth as it focuses on actual domestic production (see Graph 1). Following the empirical study of King and Levine (1993), the variable of economic growth (GDP) is measured by the rate of change of real GDP.

***Nominal Gross Fixed Capital Formation (NGFCF)***

Investment refers to an increase in capital stock in the economy and is one of the traditional determinants of economic growth. It can also enhance the operation of the capital market and the aviation sector, which eventually feeds into the growth of the economy. Domestic investment is expected to exert a positive influence on economic

growth. For example, According to endogenous growth theory, investment provides a positive link to economic growth. The nominal GFCF in million S.R (see Graph 2) measurement was used by Alshammary (2014).

***Number of Flights (FLIGHTS)***

The number of flights is the sum of all departing and arriving flights both international and domestic from the commercial, general aviation, royal and cargo terminals nationwide per year (see Graph 3).

***Number of Passengers (PAX)***

The number of passengers is the sum of all departing and arriving passengers both international and domestic from the commercial, general aviation, and royal terminals nationwide per year (see Graph 4).

***Cargo (CARGO)***

The weight of cargo is the sum (in thousand tons) of all departing and arriving cargo both international and domestic from the cargo terminals nationwide per year (see Graph 5).

***Saudi Population (PPL)***

Population (PPL) is one of the most important factors that have direct impact on any economy. Thus, Saudi Arabia is not an exception. In addition, the aviation industry depends heavily on the numbers of passengers.

***Bank Credit to Private Sector (BCP)***

The bank credit to the private sector as a ratio of nominal GDP (BCP) represents more accurately the role of intermediaries to channel funds to private sector and it is more closely associated with investment and hence economic growth. Levine, Loyaza and Beck (2000) emphasized that BCP is (1) a good representation of the role of capital intermediaries in channeling funds to private market participants. (2) BCP can be an indicator of the functioning of the capital market because it is a measure of the quantity and quality of investment. (3) BCP excludes credit to the public sector which better reflects the extent of efficient resources allocation. Commercial banks, in the modern economy, create most of the money supply by issuing loans. Therefore, when banks create an excess supply of money, the prices of assets, goods, and services tend to rise. Conversely, when not enough money is created, the prices of assets, goods, and services decrease. Thus, it is reasonable to hypothesize that a strong positive relationship exists between asset prices and bank lending.

***Jet Fuel (JET_FUEL)***

The Saudi economy is a small oil-based economy that possesses nearly 20 per cent of the world's known petroleum reserves and is ranked as the largest exporter of petroleum (OPEC 2013). The oil sector in the Saudi economy contributes more than 85 per cent of the country's exports and government revenues (SAMA 2013). As a result, oil revenue plays a vital role in all major economic activities in Saudi Arabia. Hence, Jet fuel production will have direct impact on the aviation sector.

Regressive model is adopted to estimate the effects of civil aviation development on economic growth. In order to test the causal relationships, the following model is to be estimated

$$Y = f(AVD, CV) \quad (1)$$

Where:
Y = Economic growth variables.
AVD = Civil aviation development variables.
CV = Control variables.

## 5.2 Analytical Framework

Granger causality is used for testing the long-run relationship among the variables in the model. The Granger procedure is selected here because it is a simple way of testing causal relationship (Granger 1986, 1988). The following bivariate model is estimated:

$$Y_t = a_{10} + \sum_{J=1}^{K} a_{1j} Y_{t-J} + \sum_{j=1}^{k} \beta_{1j} X_{t-j} + u_t \quad (2)$$

$$X_t = a_{20} + \sum_{J=1}^{K} a_{2j} Y_{t-J} + \sum_{j=1}^{k} \beta_{2j} X_{t-j} + v_t \quad (3)$$

where $Y_t$ is the dependent and $X_t$ is the explanatory variable and $u_t$ is the white noise error term in (2), while $X_t$ is the dependent and $Y_t$ is the explanatory variable and $v_t$ is the white noise error term in (3).

Four different null hypotheses can be tested to determine the direction of the relationship between $X$ and $Y$.

If $\sum_{j=1}^{n} \beta_j$ and $\sum_{j=1}^{n} d_j = 0$, it can be concluded that $X$ and $Y$ do not help to predict one another. If a feedback relationship exists between the two variables $X$ and $Y$, which we call bidirectional Granger causality, $\sum_{j=1}^{n} \beta_j$ and $\sum_{j=1}^{n} d_j$ are both significantly different from zero. In the case where $\sum_{j=1}^{n} \beta_j = 0$ but $\sum_{j=1}^{n} d_j \neq 0$, unidirectional Granger causality exists from $X$ to $Y$, but not vice versa. In other words, changes in $X$ can help to predict future values of $Y$, but $Y$ cannot help to predict future values of $X$. Finally, the converse relationship is true when $\sum_{j=1}^{n} \beta_j \neq 0$ and $\sum_{j=1}^{n} d_j = 0$, where changes in $Y$ can help to predict future values of $X$ but not the other way around. These four null hypotheses can be tested using an $F$-test given by the following formula as in Brandt and Williams (2006):

$$F_{\text{Calculated}} = \left[ \frac{(RSS_R - RSS_{UR})/P}{(RSS_{UR}/n-k-1)} \right] \quad (4)$$

where: $p$ is the number of lagged terms, $k$ is the number of parameters estimated in the unrestricted model, $n$ is the number of observations, and $RSS_R$ and $RSS_{UR}$ are residual sum of squares of the restricted and unrestricted models, respectively. The restricted model occurs when the above model's parameters are restricted by the null hypotheses conditions mentioned above. It should be noted also that the null hypotheses will be rejected if the F-statistic is greater than the critical value for a chosen level of significance (Brandt and Williams, 2006).

The validity of the test depends on the order of the VAR model and on the stationarity or non-stationarity of the variables. Thus these are the VAR estimation models:

**Model 1**

$$GDP = f(PAX, PPL, JET\_FUEL, BCP) \quad (5)$$

**Model 2**

$$GDP = f(CARGO, PPL, JET\_FUEL, BCP) \quad (6)$$

**Model 3**

$$NGFCF = f(PAX, PPL, JET\_FUEL, BCP) \quad (7)$$

**Model 4**

$$NGFCF = f(CARGO, PPL, JET\_FUEL, BCP) \quad (8)$$

Where:
GDP = Real GDP Growth Rates.
NGFC = Nominal Gross Fixed Capital Formation.
PAX = Number of Passengers (millions).
CARGO = Cargo (thousand tons).
PPL = Population (million).
JET_FUEL = Jet fuel production (thousand barrels).
BCP = Bank Credit to Private Sector (million riyals).

## 6. RESULTS

### 6.1 Descriptive Analyses

Table 1 summarizes the basic statistical features of the data under consideration, including the mean, the minimum and maximum values, standard deviation, kurtosis, skewness and the Jarque-Bera test for the data in their levels. This descriptive statistics provide a historical background for the behavior of the data in this study (Also see Graphs 1-8). For instance, the standard deviations indicate that GDP, NGFCF, FLIGHTS and JET_FUEL are more volatile than PAX, CARGO, BCP and PPL (see Table 1). This might be related to the nature of the oil-based economy dependents on the fluctuations of the oil prices (SAMA 2013). In addition, all variables except GDP showed a positive increase from the year 1990 onwards (post the Gulf war -Iraq invasion). Furthermore, the early 2000s showed a significant increase in NGFCF, FLIGHTS, PAX, CARGO and BCP, this can be related to the high oil prices, the global and domestic developments in the aviation industry and the massive infrastructure projects, development programs and reform measures carried by King Abdullah (on 3 August 2005 succeeded to the throne upon the death of his half-brother King Fahd).

*P*-values associated with the Jarque-Bera statistics, a test for departures from normality, show that the sample skewness and kurtosis are significantly different from zero and three respectively (Table 1). Given that the kurtosis of CARGO, PPL and JET_FUEL variables are all less than three, the distributions of these variables exhibit non-normality (Stock & Watson 2006). The positive values of the skewness tests for NGFCF, FLIGHTS, PAX, PPL and BCP suggest that these variables have long right tails, while negative values of the skewness tests for GDP, CARGO and JET_FUEL suggest that these three variables have long left tails.

Although there is no indication of causation, the results reported in Table 2 reveal information on the strength of the relationships connecting the macroeconomic variables. In particular, Table 2 shows a positive correlation between the economic growth variable NGFCF and the rest of the macroeconomic variables in the time-series (FLIGHTS, PAX, CARGO, PPL, JET_FUEL and BCP). This is resulted from the increase of oil prices, the political stability post the Gulf war and the national reform measures carried by King Abdullah. Surprisingly, there are no relationship exists between all the variables in the series with GDP, this might be associated with the unstable nature of the oil-based economy due to the fluctuations of oil prices.

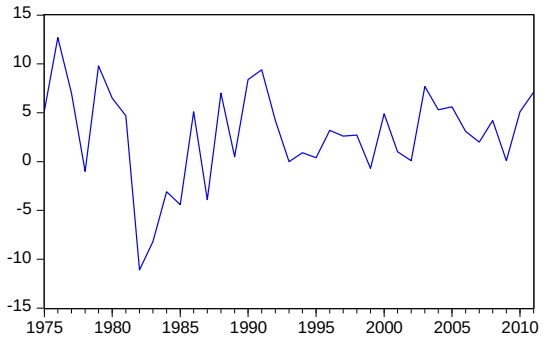
**Table 1.** Statistical features of the Macroeconomic variables (1975-2011)

| | *GDP* | *NGFCF* | *FLIGHTS* | *PAX* | *CARGO* | *PPL* | *JET_FUEL* | *BCP* |
|---|---|---|---|---|---|---|---|---|
| ***Mean*** | 2.8 | 147473.4 | 244755.9 | 25.6 | 364.5 | 17.45 | 39503.9 | 202450.2 |
| ***Median*** | 3.2 | 117563.0 | 228618.0 | 25 | 397 | 17.7 | 56174.0 | 101932.0 |
| ***Maximum*** | 12.7 | 471830.0 | 468648.0 | 52 | 642 | 29.2 | 80908.0 | 858365.0 |
| ***Minimum*** | -11.1 | 32688.0 | 75228.0 | 3 | 39 | 7.65 | 190 | 8413.0 |
| ***Std. Dev.*** | 4.9 | 107144.9 | 82871.2 | 10.2 | 155.8 | 6.3 | 28595.7 | 240632.2 |
| ***Skewness*** | -0.67 | 1.67 | 0.93 | 0.33 | -0.72 | 0.12 | -0.3 | 1.58 |
| ***Kurtosis*** | 3.7 | 4.85 | 4.24 | 3.54 | **2.77** | **1.9** | **1.37** | 4.2 |
| ***Jarque-Bera*** | 3.58 | 22.57 | 7.8 | 1.16 | 3.28 | 1.9 | 4.7 | 17.8 |
| ***Probability*** | 0.16 | **0.0** | **0.02** | 0.55 | 0.2 | 0.38 | **0.1** | **0.0** |
| ***Sum*** | 104.1 | 5456516. | 9055970. | 948.0 | 13487.0 | 645.9 | 1461644. | 7490659. |
| ***Sum Sq. Dev.*** | 869.5 | 4.13 | 2.47 | 3736.7 | 874479.2 | 1450.8 | 2.94 | 2.08 |
| | | | | | | | | |
| ***Observations*** | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |

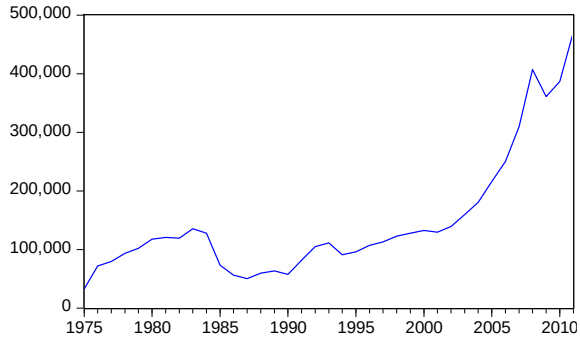
**Table 2.** Correlation Analysis (1975-2011)

| ***Correlation*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***Probability*** | ***GDP*** | ***NGFCF*** | ***FLIGHTS*** | ***PAX*** | ***CARGO*** | ***PPL*** | ***JET_FUEL*** | ***BCP*** |
| ***GDP*** | 1.000000 | | | | | | | |
| | ----- | | | | | | | |
| ***NGFCF*** | 0.065384 | 1.000000 | | | | | | |
| | 0.7006 | ----- | | | | | | |
| ***FLIGHTS*** | -0.198958 | 0.889556 | 1.000000 | | | | | |
| | 0.2378 | **0.0000** | ----- | | | | | |
| ***PAX*** | -0.084279 | 0.882840 | 0.909353 | 1.000000 | | | | |
| | 0.6199 | **0.0000** | **0.0000** | ----- | | | | |
| ***CARGO*** | -0.106620 | 0.655809 | 0.707550 | 0.902484 | 1.000000 | | | |
| | 0.5300 | **0.0000** | **0.0000** | **0.0000** | ----- | | | |
| ***PPL*** | 0.079433 | 0.780048 | 0.708988 | 0.920391 | 0.933437 | 1.000000 | | |
| | 0.6403 | **0.0000** | **0.0000** | **0.0000** | **0.0000** | ----- | | |
| ***JET_FUEL*** | 0.146283 | 0.511509 | 0.391893 | 0.715162 | 0.839833 | 0.903241 | 1.000000 | |
| | 0.3876 | **0.0012** | **0.0164** | **0.0000** | **0.0000** | **0.0000** | ----- | |
| ***BCP*** | 0.108163 | 0.972617 | 0.858017 | 0.900475 | 0.729691 | 0.860071 | 0.615198 | 1.000000 |
| | 0.5240 | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0001** | ----- |

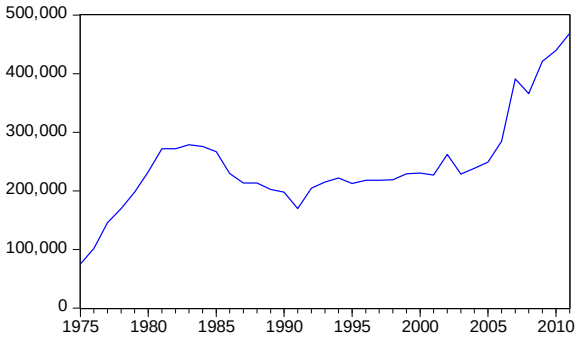
Graph 1: Real GDP Growth Rate (1999-base year)



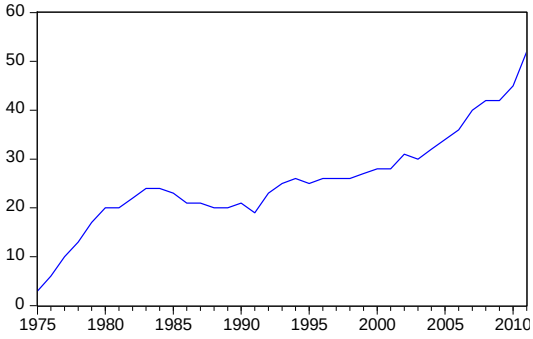

Graph 2: Nominal GFCF (million S.R)



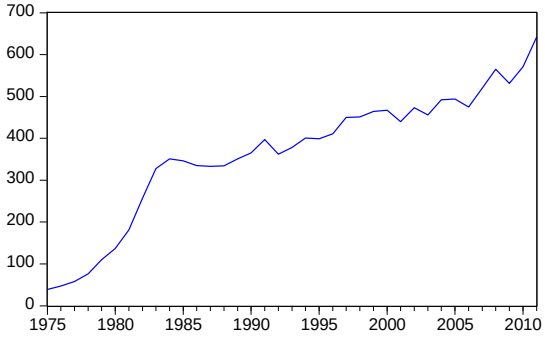

Graph 3: Number of Flights



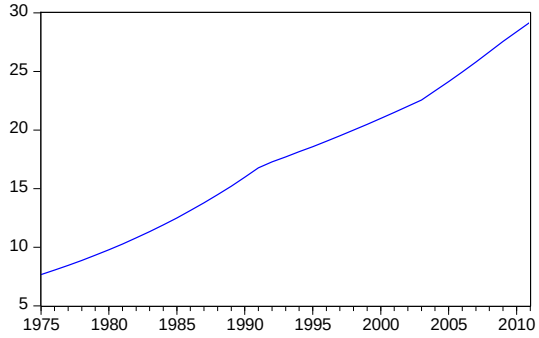

Graph 4: Number of Passengers (million)



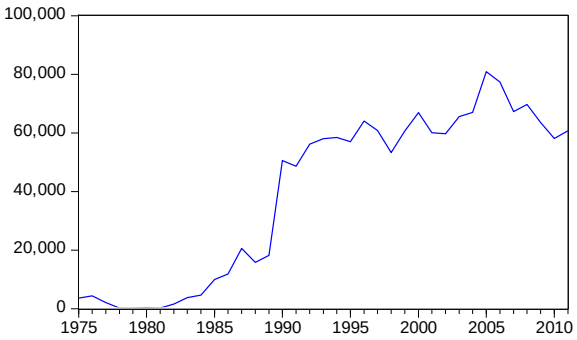

Graph 5: Cargo (thousand tons)



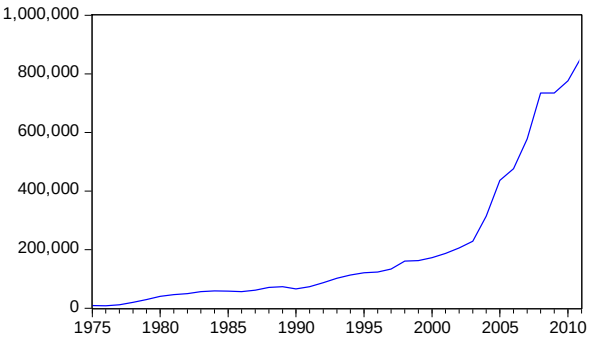

Graph 6: Population (million)




Graph 7: Production of Jet-Fuel (thousand barrels)




Graph 8: Bank Credit to Private sector (million S.R)




## 6.2 Causality Analyses

### *6.2.1 Unit Root Test*

The results from the augmented Dickey-Fuller (1979) (ADF) unit root test, and Phillips-Perron (1988) (PP) tests provide additional support for treating all the individual series as non-stationary in their levels but stationary in their first differences.

### *6.2.2 Optimal Lag Selection*

We precede our analysis using (1 & 2) lags suggested by Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ).

### *6.2.4 Granger Causality test*

The Granger causality test (See Tables 3 & 4) shows that: GDP Granger causes both the number of flights (FLIGHTS) and the number of passengers (PAX). The numbers of flights (FLIGHTS) Granger cause NGFCF. The NGFCF Granger causes both the number of passengers (PAX) and Cargo (CARGO).

**Table 3.** Granger Causality test (1 Lag) (1975-2011)

| *Null Hypothesis:* | *Obs* | *F-Statistic* | *Prob.* |
|---|---|---|---|
| NGFCF does not Granger Cause GDP | 36 | 0.01142 | 0.9156 |
| GDP does not Granger Cause NGFCF | | 2.20935 | 0.1467 |
| FLIGHTS does not Granger Cause GDP | 36 | 0.65175 | 0.4253 |
| GDP does not Granger Cause FLIGHTS | | 3.88311 | **0.0572** |
| PAX does not Granger Cause GDP | 36 | 0.06507 | 0.8002 |
| GDP does not Granger Cause PAX | | 3.96226 | **0.0549** |
| CARGO does not Granger Cause GDP | 36 | 1.6E-06 | 0.9990 |
| GDP does not Granger Cause CARGO | | 0.75145 | 0.3923 |
| FLIGHTS does not Granger Cause NGFCF | 36 | 0.41102 | 0.5259 |
| NGFCF does not Granger Cause FLIGHTS | | 36.5125 | 9.E-07 |
| PAX does not Granger Cause NGFCF | 36 | 0.01084 | 0.9177 |
| NGFCF does not Granger Cause PAX | | 19.9953 | 9.E-05 |
| CARGO does not Granger Cause NGFCF | 36 | 0.06751 | 0.7966 |
| NGFCF does not Granger Cause CARGO | | 5.26369 | **0.0283** |

**Table 4.** Granger Causality test (2 Lags) (1975-2011)

| *Null Hypothesis:* | *Obs* | *F-Statistic* | *Prob.* |
|---|---|---|---|
| *NGFCF does not Granger Cause GDP* | 35 | 0.20863 | 0.8129 |
| *GDP does not Granger Cause NGFCF* | | 2.02315 | 0.1499 |
| *FLIGHTS does not Granger Cause GDP* | 35 | 0.00637 | 0.9937 |
| *GDP does not Granger Cause FLIGHTS* | | 5.24118 | **0.0112** |
| *PAX does not Granger Cause GDP* | 35 | 0.43234 | 0.6530 |
| *GDP does not Granger Cause PAX* | | 3.86451 | **0.0321** |
| *CARGO does not Granger Cause GDP* | 35 | 0.59599 | 0.5574 |
| *GDP does not Granger Cause CARGO* | | 0.59990 | 0.5553 |
| *FLIGHTS does not Granger Cause NGFCF* | 35 | 3.92424 | **0.0306** |
| *NGFCF does not Granger Cause FLIGHTS* | | 17.1678 | 1.E-05 |
| *PAX does not Granger Cause NGFCF* | 35 | 2.03707 | 0.1481 |
| *NGFCF does not Granger Cause PAX* | | 5.98198 | **0.0065** |
| *CARGO does not Granger Cause NGFCF* | 35 | 0.03799 | 0.9628 |
| *NGFCF does not Granger Cause CARGO* | | 3.84865 | **0.0325** |

The Granger causality tests results support the Civil aviation Led-Economic growth hypothesis (economic expansion causing the civil aviation sector to grow). This is also supported by the empirical study of Mehmood et al. (2013). This result can be easily absorbed for many reasons in the case of Saudi Arabia. However, the main reason is that for many years GACA operates as a bureaucratic public service provider with least business orientation. This led to low service quality thus low customer satisfaction (ACI 2014). Such organizational characteristics are generally associated with lack of efficacy, low performance, low return on investment, corruption, and lack of customer social responsibility programs.

Thus, as stressed by the Saudi NTP 2020 and Saudi Arabia's Vision 2030, policy makers should consider updating the civil aviation infrastructure, nation-wide airport privatization programs, expand public private partnership (PPP) projects, increase the number of airports in major cities and establish long term partnerships with international airlines and carriers. Once, these measures take place negative symptoms can be reversible, along with the continuous growth trend of the level of investment, aviation sector, population and the development of the private sector (see Graphs 2-6 & 8) in Saudi Arabia. Finally, this will strengthen the private sector and diversify the oil-based economy toward a sustainable economy.

## 7. CONCLUSION

The main purpose of the study is to empirically examine the civil aviation-led economic growth and economic growth-led civil aviation hypothesizes for Saudi Arabia by testing causality between civil aviation and economic development. We resorted to econometric tests such as Granger causality tests for the time period from 1975 to 2011. The results from the Granger causality test support the Civil aviation Led-Economic growth hypothesis (economic expansion causing the civil aviation sector to grow).

This unsurprising result is due to the fact that the highly bureaucratic GACA operates as a public service provider with least business orientation. This led to low service quality thus low customer satisfaction (IATA 2014). Such organizational characteristics are generally associated with lack of efficacy, low performance, low return on investment, corruption, and lack of customer social responsibility programs. Hence, these negative symptoms can be reversible

As a result, policy makers should follow the guidance and initiatives of both the Saudi NTP 2020 and Saudi Arabia's Vision 2030, by considering updating the civil aviation infrastructure, nation-wide airport privatization programs, expand public private partnership (PPP) projects, increase the number of airports in major cities and establish long term partnerships with international airlines and carriers. Finally, developing and investing in the fast growing civil aviation sector which is supported by the continuous growth trend of the population will have direct impact on the development of the economy as a whole and the strength of the private sector. Ultimately this will lead to a diversified and sustainable economy.

The available short and annual time series is a major limitation that might affect the quality of this study outcome. This is due to the lack of available long time-series data for Saudi Arabia in general and the civil aviation sector in particular. This study encourages future research that applies qualitative or mixed methodologies to further investigate the civil aviation-economic growth nexus.

## REFERENCES


1. Airport Council International (ACI), 2014, 'Airport Service Quality' http://www.aci.aero/Airport-Service-Quality/About-ASQ.
2. Alkaabi, K. A., Debbage, K.G., 2007, 'Air passenger demand and skilled labor markets by US metropolitan area', Journal of Air Transport Management, vol. 13, no. 3, pp. 121-130.
3. Alshammary, Meshaal, 2014, 'Financial Development and Economic Growth in Developing Countries: Evidence from Saudi Arabia', Corporate Ownership and Control, vol. 11, no. 2, pp. 660-684.
4. Al-Omar, F 1996, 'Privatization in the Gulf Cooperation Council (GCC) countries: the need and the process', Islamic Economic Studies, vol. 2, no. 2, pp. 35–55.
5. Button, Kenneth and Yuan, Junyang, 2012, 'Airfreight Transport and Economic Development: An Examination of Causality', Urban Studies, vol. 50, no. 2, pp. 329–340.
6. Button, K. J., Doh, S. and Yuan, J. 2010, 'The role of small airports in economic development', Journal of Airport Management, vol. 4, pp. 125–136
7. Chadhury, Kiren Aziz1989,'The price of wealth: business and state in labor remittance and oil economies', International Organization, vol. 43, Winter, pp. 101–45.
8. Chadhury, Kiren Aziz1997, The price of wealth: economies and institutions in the Middle East, Cornell University Press, Ithaca, NY.
9. Dickey, D & Fuller, W 1979, 'Distributions of the estimators for autoregressive time series with a unit root', Journal of the American Statistical Association, vol. 75, pp. 427–431.
10. General Authority of Civil Aviation (GACA), 2014 'About GACA-Company Profile' Accessed 24 August 2014: http://www.gaca.gov.sa/AboutGaca/Default.aspx?ARID=30.
11. Granger, CWJ 1986, 'Developments in the study of cointegrated economic variables', Oxford Bulletin of Economics and Statistics, vol. 48, pp.213–228.
12. Granger, CWJ 1988, 'Some recent developments in a concept of causality', Journal of Econometrics, vol. 39, pp. 199–211.
13. Johansen, S 1988, 'Statistical analysis of cointegrating vectors', Journal of Economic Dynamics and Control, vol. 12, pp. 231–254.
14. Jiang, B. 2001, 'A review of studies on the relationship between transport infra-structure investments and economic growth', Canada Transportation Act Review. Vancouver: British Columbia.
15. King, RG and Levine, R 1993, 'Finance and growth: Schumpeter might be right', Quarterly Journal of Economics, vol.108, no. 3, pp. 717–738.
16. Levine, R, Loyaza, N & Beck, T 2000, 'Financial intermediation and growth: causality and causes', Journal of Monetary Economics, vol. 46, pp.31–77.
17. OPEC 2013, 'Saudi Arabia'.
18. Marazzo, M., Scherre, R. and Fernandes, E. 2010. 'Air Transport Demand and Economic Growth in Brazil: A Time Series Analysis', Transportation Research. Vol. 46, pp. 261–269.
19. Mehmood, Bilal, Shahid, Amna and Younas, Zahid Irshad, 2013, 'Interdepencies Between Aviation Demand and Economic Growth in India: Cointegration Equation Estimation', Economic Affairs, vol. 58, no. 4, pp. 337-347.
20. Mehmood, B. and Kiani, K. 2013. 'An Inquiry into Nexus between Demand for Aviation and Economic Growth in Pakistan', Academicia.
21. Özcam, Ismail Çagr 2014, 'Economic contribution of essential air service flights on small and remote communities', Journal of Air Transport Management, vol. 34, pp. 24-29.
22. Phillips, P. C. B. & Perron, P. 1988, 'Testing for a unit root in time series regression', Biometrika, vol. 75, pp. 335–346.
23. Pradhan, Rudra P. and Bagchi, Tapan P. 2013, 'Effect of transportation infrastructure on economic growth in India: The VECM approach', Research in Transportation Economics, vol. 38, pp. 139-148.
24. Ramady, A. M 2010, The Saudi Arabian economy: policies, achievements, and challenges, 2nd edn, Springer, New York, NY.
25. Rasker, R., Gude, P.H., Gude, J.A., Noort, J.V.D., 2009, 'The economic importance of air travel in high-amenity rural areas', Journal of Rural Studies, vol. 25, no. 3, pp. 343-353.
26. Raghuram, G., & Babu, R. 2001, 'Alternative means of financing railways'. In G. Raghuram, R. Jain, S. Sinha, P. Pangotra, & S. Morris (Eds.), Infrastructure development and financing: Towards a public-private partnership. New Delhi: Macmillan.

27. Robertson, J.A.W., 1995. 'Airports and economic regeneration', Journal of Air Transport Management, vol. 2, no. 2, pp. 81-88.
28. SAMA 2013, Database, www.sama.gov.sa.
29. Shoult, A and Anwar, H 2009, Doing business with Saudi Arabia, 4th edn, GMB Publishing, London, UK.
30. Taylor, B. D., Samples, K., 2002, 'Jobs, jobs, jobs: political perceptions, economic reality, and capital bias in U.S. transit subsidy policy', Public Works Management & Policy, vol. 6, no. 4, pp. 250-263.
31. Warren, D. E., 2007, 'The Regional Economic Effects of Airport Infrastructure and Commercial Air Service: Quasi-experimental Evaluation of the Economic Effects of Commercial Air Service Near Smaller Airports', Working paper, University of Illinois at Urbana-Champaign Department of Agricultural and Consumer Economics.