

Trend associations between economic growth and air transport in South Africa: an ecological and joinpoint regression analysis between 1993 and 2016

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ABSTRACT

The aim of this paper is to provide empirical evidence of the trend associations between air transport and economic growth in South Africa. Trends in air transport were assessed by calculating annual percentage changes using linear regression using joinpoint regression. In addition, the trend associations between GDP annual growth and airfreight, air transport passengers (numbers) and air transport carriers (number) were computed by plotting standardised trends. The results showed that airfreight increased between 1993 and 2016 although four distinct phases of increase and decreases were observed. This is the first study to investigate the associations between air transport and economic using ecological analysis and joinpoint regression in South Africa. The results of this study confirm an association between GDP and air transport and can be used as a basis of further investigation to justify future investments in air transport in South Africa.

BACKGROUND

Deregulation of air transport began in 1991 in South Africa, as a result of the adoption of the Domestic Air Transport Policy in 1990 and the new Air Services Licensing Act of 1990 that became effective in 1991 [3]. This opened up the market and stimulated competition. To date, the South African air transport market has experienced similar trends to global markets, such as, market turbulence, high numbers of market entrants and a similarly high number of market failures (Venter, 2010). In 2010, the estimated failure rate of private airlines was 73%, but by 2017, it was estimated to be at 80% (Venter, 2017). In South Africa, airlines generate low profit margins, if not complete financial losses [4, 5, 6].

South Africa, an emerging economy, is ranked as the second largest economy in Africa gross domestic product (GDP) [11] and is considered as the economic hub of Africa owing to its superior infrastructure. In 2016, South Africa's logistics infrastructure was given a rating of 3.78 out of 5 by users, compared to the Sub-Saharan average of 2.11 on the World Bank's logistics performance index [11]. This highlights that South Africa has the potential to improve its competitive position through the transport sector and through air transport in particular. Several empirical studies have investigated the associations and causality between air transport and economic growth in high income and higher middle-income countries [7, 12] but limited research exists on emerging

economies and on South Africa. The aim of this paper is to fill this research gap by providing empirical evidence of the trend associations between air transport and economic growth in South Africa using ecological analysis and joinpoint regression.

METHODS

Data sources

Three indicators were used to assess the trends in air transport namely; air transport: freight (hereafter referred to as airfreight), air transport: passengers carried and air transport: number of registered carrier departures. Data on airfreight volumes, air passengers, number of registered carriers and gross domestic product (GDP) annual growth for South Africa was obtained from the World Bank's world development indicators' database from 1993 to 2016. Airfreight comprises the volume of freight, express and diplomatic bags conveyed on every stage of a flight. Airfreight was calculated by multiplying the volume, measured in metric tons by the kilometers travelled. Air passengers carried include passengers of air carriers registered in the country on both domestic and international aircraft. Registered carrier departures worldwide are domestic takeoffs and takeoffs abroad of air carriers registered in the country.

Data analysis

Trends in air transport were assessed by calculating annual percentage changes (APC) using linear regression: $\log(\text{rate}_y) = b_0 + b_1 y$ with $\log(\text{rate}_y)$ being the natural log of airfreight in year y for example. The APCs and p-values were calculated using the formula: $(e^{b_1} - 1) \times 100$ from the Joinpoint Regression Program, version 4.3.1.0 in order to account for the size of the changes in air transport over time. A p-value less than 0.05 presents a statistically significant change. In addition, the trend associations between GDP annual growth and airfreight, air transport passengers and air transport carriers were computed by plotting standardised trends. All data was indexed to 2010, to provide an appropriate base for comparison for the diverse data sources. The trend associations are illustrated using logarithmic trend lines.

RESULTS

Air transport: freight

Figure 1 shows the volumes (tons) of airfreight carried per km from South Africa between 1993 -2016. The

overall trend for airfreight for the period shows four distinct phases: an initial non-significant increase in airfreight between 1993 and 1998 (APC = 6.3%; p-value=0.1) followed by a shorter period of significant increase in airfreight from 1998 -2001 (APC 532.4%; p-value=0.01). The third phase is characterised by a non-significant small decline in airfreight from 2001-2013 (APC -0.25%; p-value=0.6) and is followed by significant increases from 2013-2016 (APC= 11.7%; p-value=0.01).

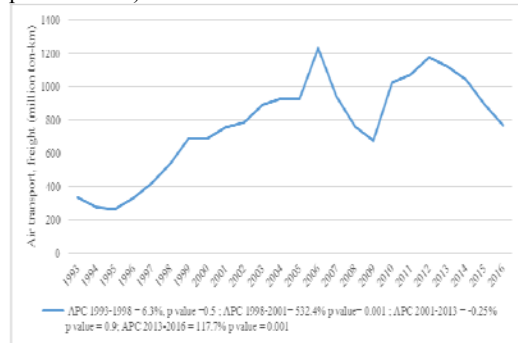


FIGURE 1: AIR TRANSPORT, FREIGHT (MILLION TON-KM) FROM 1993 – 2016

Air transport: passengers

Trends of the number of passengers carried by air transport showed an overall positive increase from 1993 – 2016 as shown in Figure 2 (APC=5.83%; p-value= 0.000).

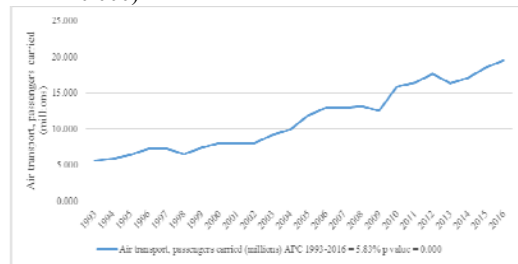


FIGURE 2: AIR TRANSPORT, PASSENGERS CARRIED (MILLIONS)

Air transport: registered carrier departures worldwide
Similar to the air transport passengers, the number of air transport carriers departing from South Africa increased significantly from 1993 - 2016 (APC=12.07%; p-value=0.000).

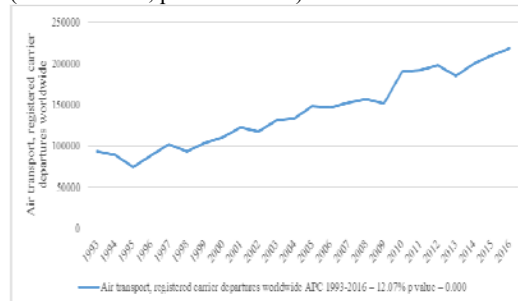


FIGURE 3: AIR TRANSPORT, REGISTERED CARRIER DEPARTURES WORLDWIDE

Trend associations: air transport and GDP growth

Trends for air transport carriers and air transport passengers show similar patterns. Both increased between 1993-2008; followed by a decrease in 2009 and an increase between 2010 and 2016. Airfreight levels were lower than passenger and carriers between 1993 and 1997 but subsequently surpassed both in 1998 before peaking in 2006. A sharp decline in airfreight was experienced in 2009 followed by a subsequent increase until 2012 and decline from 2012-2016. Between 1993 and 1998 GDP growth and passengers carried both experienced growth whilst airfreight and the number of registered carriers fluctuated. In the same period, the number of registered carriers and the volumes of freight carried declined as GDP increased. Between 1998 and 2007 all four indicators increased although GDP growth experienced more fluctuations compared to the air transport indicators. The number of passengers carried and the number of registered carriers remained relatively more stable than GDP growth and airfreight in this period. Subsequently, GDP growth and airfreight peaked in 2006 before experiencing a substantial decline in 2009. Between 2011 and 2016 the number of passengers carried and the number registered carriers increases while GDP and airfreight decreased. Airfreight showed similar trends to GDP annual growth between 1998 and 2013. shows a different pattern with air transport indicators. GDP annual growth fluctuated over the time period with substantive decreases in 1999 and 2009.

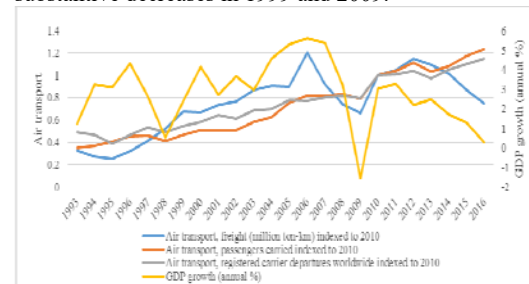


FIGURE 4: TREND ASSOCIATIONS: AIR TRANSPORT & GDP GROWTH

DISCUSSION

The aim of this study was to provide empirical evidence of the trend associations between air transport and economic growth in South Africa using ecological analysis and joinpoint regression between 1993 and 2016. The results showed that airfreight increased between 1993 and 2016 although four distinct phases of increase and decreases were observed. The decreases in airfreight were not statistically significant. For both passengers carried and number of carriers overall statistically significant increases were observed in the period. Trends for air transport carriers and air transport passengers show similar patterns. Both increased between 1993-2008; followed by a decrease in 2009 and an increase between 2010 and 2016. Airfreight levels were lower than passenger and carriers between 1993 and 1997

but subsequently surpassed both in 1998 before peaking in 2006. A sharp decline in airfreight was experienced in 2009 followed by a subsequent increase until 2012 and decline from 2012-2016. Airfreight showed similar trends to GDP annual growth between 1998 and 2013. GDP annual growth fluctuated over the period with substantive decreases in 1999 and 2009.

Numerous reasons have been suggested for the high levels of turbulence in the market. Venter [5] cites global trends such as oil price volatility, hybridisation of airline models and IT advances, amongst others. Africa is generally a poor performing region in terms of air transport, with a small middle class population, slow innovation and high taxes and operating charges. Market entry costs are considered higher than the global average. Open skies have not been appropriately implemented and the continent's air transport market is dominated by bilateral agreements, and state-owned airlines have poor economies of scale and are globally uncompetitive. Luke's [13] analysis shows that there are various reasons for the turbulence, including uncertainty in fuel prices, bad operational or management decisions, a lack of understanding of market requirements and unfair competition in the market place from state-owned carrier, South African Airways (SAA), through subsidies and government guarantees. It is thus clear that the airline industry in South Africa is extremely volatile, which ultimately affects the ability to provide the service to the air transport goods and passenger markets.

In addition to the general reasons stated for market volatility in the South African air transport market, it should be noted that air transport forecasting models are generally based on gross domestic product and the demand for air passenger and freight transport services is thus largely associated with economic performance in a particular country [14]. The demand for air passenger transport services tends to be elastic; as luxury goods, the demand for travel services is strongly associated with price and income. Increases in fares or decreases in disposable income tend to reduce the demand for air travel [15]. Similarly, air cargo movements are strongly associated with trade and industrialisation [16] and slow economic performance will thus negatively impact air cargo volumes.

In the period from 1999 to 2008, South Africa, on the back of high commodity prices and political stability, experienced high economic growth rates, with the GDP reflecting 36 consecutive positive economic growth. The end of this period was however marked by the removal of the president, as well as a global economic recession. This led to negative economic growth over the nine-month period under the caretaker president at the time. From 2009, volatile commodity prices, the slow recovery from the global recession and political uncertainty have hampered economic growth significantly. Although hosting the 2010 FIFA world cup boosted economic as well as air transport

figures for South Africa during the global recession, growth since then has steadily declined [19, 18].

Aside from economic performance, the demand for air transport in South Africa was also impacted by developments in the airline industry, both locally and globally. At the time of deregulation in 1991, only four airlines were active in the market and SAA had an estimated domestic market share of more than 90% of all scheduled passengers [20]. The first ten years following deregulation was characterised by a number of new entrants to the market; most of which failed in their original form. The only reconfigured or new airlines that were still operating at the end of this period were BA/Comair, SA Express and SA Airlink. It was therefore a turbulent time for the air traveller, as the market was characterised by significant instability. However, SAA remained dominant in the domestic market and strengthened this dominance through alliances with SA Express and SA Airlink [21]. Since 2001, the South African domestic air transport environment has been characterised by the entry of the low-cost carriers. The entry of the low-cost carriers led to a significant change in the functioning of the domestic market, primarily due to the growth that these carriers have affected [21]. Globally, there are several developments that have impacted the airline industry and have thus also impacted the South African air transport market. Fuel price uncertainty and the global recession had had major impacts on air traffic movements and the cost of doing business for South African airlines [5]. The growth of the low cost carrier, both globally and locally, has changed the way South Africans fly. The global economy, developments in the airline industry and the South African economic and political environment thus have considerable impacts on the way in which the domestic industry functions. A limitation of this study is that it does not provide inferences into causal relationship between GDP growth and air transport. Future research can explore causality between these variables.

CONCLUSION

This is the first study to investigate the associations between air transport and economic using ecological analysis and joinpoint regression in South Africa. The results of this study confirm an association between GDP and air transport and can be used as a basis of further investigation to justify future investments in air transport in South Africa.

REFERENCES

Available on request