ABSTRACT

Flight delays affect passenger travel satisfaction and increase airline costs. The authors explore airline differences with a focus on their delays based on autoregressive integrated moving averages. Aviation daily data were used in the analysis and model development. Time series modelling for six airlines was done to predict delays as a function of airport’s timeliness performance. Findings show differences in the time series prediction models by airline. Differential analysis in the time series prediction models for airline delay suggests variations in airline efficiencies though at the same airport. The differences could be attributed to different management styles in the countries where the airlines originate. Thus, to improve airport timeliness performance, the study recommends airline disaggregated studies to explore the dynamics attributable to determinants of airline unique characteristics.

Keywords: Airline, ARIMA Model, Delay Differentials, Developing Airport, Forecasting

INTRODUCTION

Most of the foreign exchange earnings of growing economies such as Uganda largely depend on transactions conducted through airports (Voltes-Dorta & Lei, 2014; Zhang, Yang, Wang, & Zhang, 2014). Efficient operation at such airports is therefore mandatory to nurture a strategic position towards economic development of the country. Air traffic flow at Entebbe International Airport, the only international airport in Uganda, has greatly increased since the year 1991, faster than was projected to grow. Suffice to note that international passenger numbers sprung from a mere 118,000 in 1991 to over one million by 2011. Such an increase often relates to more
congestion and delays (Bilotkach & Lakew, 2014; Civil Aviation Authority, 2012; Lam, Tang, Chan, & Tam, 2006; Noland, Quddus, & Ochieng, 2008; Zou & Hansen, 2014). Flight delays do not only affect passenger satisfaction but also bring along costly consequences to airlines.

According to the Civil Aviation Authority (2012) in the year 2007, sixteen international airlines had scheduled operations to and from the airport, serving fourteen different destinations. Consequently, EIA has developed as Uganda’s international gateway with its traffic growing from a paltry 27,000 passengers in 1962 to 1.2 million at the turn of Uganda’s fiftieth independence anniversary. The growth in traffic has inadvertently led to significant delays in air traffic flow at the airport as often predicted (Ryerson, Hansen, & Bonn, 2014).

As a standard, a flight is considered delayed if it leaves the gate more than fifteen minutes from the originally scheduled departure time (International Civil Aviation Organization, 1995; Kanafani & Ghobrial, 1985). However, in the context of this study, the interest was on the total expected additional time that should be included for departing flights from the airport after the scheduled time of departure.

A summary of the different methods for analysing delays was made into five categories: regression and related methods, time series analysis, Bayesian networks model analysis, and cluster and classification analysis and simulation (Konishi & Kitagawa, 2007; Ninj, 2007). It was further noted that regression included methods for using observations to predict or explain the delays. In time series analysis, the trend analysis, spectral analysis, and Markov Chain analysis are introduced. Regression analysis approach is used in the analysis of arrival delays given different causes of the delays (Gano & Banavar, 2005; Sridhar, Grabbe, & Mukherjee, 2008).

In this paper, non-traffic flow delays at airports have been correlated with sets of causal factors and created models to predict aggregate delays at airports on a daily basis. In order for this study to be consistent with the way traffic is managed, Wesonga and Nabugoomu (2014) and Wesonga, Nabugoomu, and Jehopio (2012) proposed and evaluated models of causal factors of delays that would provide the analytical bases for contributing toward the improvement of the efficiency for traffic flow management at Entebbe International Airport (EIA). In their analysis, parameterized approaches were applied to develop models that determine airport delay where both aviation and meteorological parameters have been studied (Zou & Hansen, 2014).

**DATA AND METHODS**

**Data Management**

To achieve objectives of the study, a number of tools were applied to the data collected. Aviation data, collected for the years 2006, 2007, and 2008 included daily records for all twelve months of the year. The dataset had eight attributes, namely: date, operator (airline/carrier), type of aircraft, nationality (origin), from/to (where the aircraft came from and its destination), category (international/local), expected time of arrival/departure (ETA/D), and actual time of arrival/departure. Samples of six airlines considered to have busy schedules were identified: Eagle Air (EA), Kenya Airways (KQ), South African Airways (SAA), Royal Dutch Airlines (KLM), Ethiopian Airlines (ET), and British Airways (BA). To achieve the stated objectives and hypotheses, four relevant fields were extracted: date, operator (airline), scheduled time of departure/arrival (ETA/D), actual time of departure/arrival (ATA/D). Four derived data fields were added to each record namely month, day of the week, delays (minutes), and schedule per day (number of schedules per airline per day/count). The formula in Equation 1 was used in the computation of the delays for each record:
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