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FORECASTING AUSTRALIA'S DOMESTIC LOW COST CARRIER PASSENGER DEMAND USING A GENETIC ALGORITHM APPROACH

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Abstract. This study has proposed and empirically tested for the first time Genetic Algorithm (GA) models for forecasting Australia's domestic low cost carriers' demand, as measured by enplaned passengers (GAPAXDE Model) and revenue passenger kilometres performed (GARPKSDE Model). Data was divided into training and testing data sets, 36 training data sets were used to estimate the weighting factors of the GA models and 6 data sets were used for testing the robustness of the GA models. The genetic algorithm parameters used in this study comprised population size (n): 1000, the generation number: 200, and mutation rate: 0.01. The modelling results have shown that both the linear GAPAXDE and GARPKSDE models are more accurate, reliable, and have a slightly greater predictive capability compared to the quadratic models. The overall mean absolute percentage error (MAPE) of the GAPAXDE and GARPKSDE models are 3.33 per cent and 4.48 per cent, respectively.

Keywords: Australia, forecasting method, genetic algorithm (GA); low cost carriers; air transport.

1. Introduction

Australia's airline industry was born on connecting regional communities to the country's major cities (Baker, Donnet 2012). Due to the vast distances across the country as well as between urban centres, Australia is heavily reliant upon its air transport industry (Nolan 1996). Australia's air transport industry was historically tightly controlled by the government. However, following the deregulation of Australia's domestic airline market in 1990, which permitted other airlines to compete with the established carriers (Forsyth 2003; Nolan 1996), a number of low cost carriers (LCCs) have entered the market. The low cost carriers now have around 31 per cent market share, with the two major incumbent LCCs being Jetstar and Tiger Airways.

Reliable forecasts of air transport activity play a vital role in the planning processes of States, airports, airlines, engine and airframe manufacturers, suppliers, air navigation service providers and other relevant bodies. In addition to assisting States in facilitating the orderly development of civil aviation and to aid all levels of government in the planning of air space and airport infrastructure, for example, air traffic control (ATC), airport air side and landside facilities, reliable forecasts also assist aircraft manufacturers in planning future aircraft types (in terms of size and range) and when to develop them (International Civil Aviation Organization 2006).

Despite the significance of Australia's low cost carrier domestic airline market sector, there has been no previously reported study that has developed and empirically examined genetic algorithm-based models for forecasting Australia's domestic low cost carrier passenger demand. The primary objective of this study is therefore to develop new genetic algorithm-based models to forecast Australia's LCCs passenger demand and also to identify whether the GA approach is a useful tool for this application. Therefore, various forms of the mathematical expressions were proposed and tested. Genetic algorithm enplaned passengers (GAPAXDE) and genetic algorithm revenue passenger kilometres performed[1] (GARPKSDE) are proposed to forecast Australia's LCC quarterly enplaned passengers and revenue passenger kilometres performed, respectively.

2. Traditional air travel demand forecasting approaches

Forecasting passenger transport demand is of critical importance for airlines as well as for investors, since investment efficiency is greatly influenced by the accuracy and adequacy of the estimation performed (Blinova 2007). Air traffic forecasts are therefore one of the key inputs into an airline's fleet planning, route network development, and are also used in the preparation of the airline's annual operating plan (Ba-Fail *et al.* 2000; Doganis 2009). Furthermore, analysing and forecasting air travel demand may also assist an airline in reducing its risk through an objective evaluation of the demand side of the airline business (Ba-Fail *et al.* 2000). In addition, forecasts assist airlines in their decision-making regarding the development of infrastructure facilities, thereby enhancing services provided to passengers (Abed *et al.* 2001).

In the air transport industry, many service providers and government regulatory agencies follow the International Civil Aviation Organization's (ICAO) *Manual on Air Traffic Forecasting*. This manual was originally developed in 1985 using traditional modelling techniques

1 Airline passenger traffic can be measured in two ways; the number of passengers carried and also by revenue passenger kilometres performed (RPKs) (Belobaba 2009; Holloway 2008).