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An Econometric Dynamic Model to estimate passenger demand for air transport industry

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Abstract

In this paper, we propose an Econometric Dynamic Model (EDM) to estimate pax demand. We apply the panel data Arellano-Bover method to calibrate the EDM, which is validated by the Sargan test and the Arellano-Bond Autocorrelation test. We propose a forecasting approach using the EDM to foresee pax demand. Finally, we show an application of the EDM by proposing an approach to solve the Airline Airport Hub (AAH) location problem. The case study is about the Mexican air transport industry, AAHs are identified for each predicted year.

1. Introduction

The air transport passenger (pax) demand is in continuous growth. The increment has a direct impact on airlines and airports. The market expansion has made it possible for airports to develop and grow, because airlines have developed by opening new routes. This has changed the airport/airline relationship. On the airports side, they have changed from generating their profits from airlines to reducing the airlines fees to increase pax demand and generate non-aeronautical revenues. On the airline side, the competition between airlines has increased. Carmona-Benitez (2012) mentioned that airlines have improved their business developing new strategies to reduce costs and fares, and to maximize profits and market share.

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Nomenclature

AAH	Airline Airport Hub
DE	Total number of people within legal age to work but without a job
EDM	Econometric Dynamic Model
FAA	Federal Aviation Administration
GMM	Generalized Method of Moments
GDP	Gross Domestic Product
INPC	National Consumer Price Index
ITAEE	Indicator of Economic Activity
L	Distance
LH	Large Hub
ME	Foreign Exchange Earnings from International Arrivals
MH	Medium Hub
OC	Employed Population
pax	Air transport passenger
PEA	Indicator of Economically Active Population
Pop	Population
SH	Small Hub
TUR	Hotel Occupancy Index of Domestic and Foreign Visitors
u	Individual effects
freq	Total number of flights (international and national)
ε	Error

The evolution of new airline business models has increased pax demand and therefore the need for more airport infrastructure. Some airports have been bought by private firms, though most are owned by local and/or state/regional governments (Neufville and Odoni, 2003). Some airlines have been subsidized by local governments to fly to their airports and grow the economy by increasing the pax demand, air transport services, and business and tourism activities (Papatheodorou and Lei, 2006). It is for these economic benefits that the main objective and contribution of this paper is to develop an Econometric Dynamic Model (EDM) to estimate the pax demand based on economic indicators. In this article, the EDM is calibrated using the panel data Arellano-Bover method to estimate the pax demand at a State level. We decided to do it at a State level because usually economic indicators are not reported locally. The Arellano-Bover method determines which economic variables are significant for estimating the pax demand at a State level. The EDM is validated by the Sargan test and the Arellano-Bond Autocorrelation test.

Normally, local governments, airports and airlines must invest large amounts of money to achieve the mentioned economic benefits. Therefore, the pax demand must be forecasted to ensure that the demand is enough to overcome investments. In this paper, we demonstrate how the EDM can easily be adapted to forecast the pax demand at a State level.

Besides proposing the EDM and demonstrate how it can be used to forecast the pax demand at a State level, we want to show an application of the EDM by proposing an approach to solve the Airline Airport Hub (AAH) location problem. The solution to this problem is important because one of the airline strategies is to operate a hub-and-spoke system. In such system, airlines consolidate traffic from different origins, sort it, and then send it to different destinations, then spoke cities can have better services at lower prices while hub cities offer better services at higher fares (Ehmer et al., 2008). Therefore, an AAH is where an airline centralizes its air traffic operations, pax and cargo (Anton, 1992). For an airline, operating an airport as its hub means a business strategy, because it allows airlines to offer more frequent flights and to expand the number of routes to more destinations (Kafani and Ghobrial, 1985; Cook and Goodwin, 2008), the number of transfer pax increased the operational efficiency of the airline by reducing costs through economies of scale (Tretheway and Kincaid, 2010), airlines can serve more routes and gain market power at the hub (Ehmer et al., 2008), airlines increase aircrafts utilization given the connections, most pax are