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Determinants of air travel demand: The role of low-cost carriers, ethnic links and aviation-dependent employment

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ABSTRACT

This paper presents a comprehensive gravity model in which the most important determinants for air travel demand have been identified using a two-stage least squares technique. Besides including the standard demand factors like GDP, population and tourism, the effects of other determinants such as domestic traffic, low-cost carrier (LCC) activity and public service obligations are also estimated. The profound contribution of the paper lies in the inclusion of two innovative variables in the estimations: ethnic links and aviation-dependent employment. The econometric results show that both ethnic links between countries and the share of aviation-dependent employment increase passenger demand. Moreover, the results confirm that LCC presence leads to a significant increase in passenger demand, particularly on routes where Europe's largest LCCs, Ryanair and easyJet, are active.

1. Introduction

Airlines and airports are keen on having appropriate demand forecasting models at their disposal. Various studies have focused on forecasting demand using different techniques and types of determinants. In practice, airlines also tend to base their choice for new routes on softer determinants, such as links through common business activities, common ethnic groups or other economic, social or cultural links. The aim of this study is to find empirical evidence for the determinants that are most appropriate to accurately forecast demand at individual airport pairs. A rich dataset of regional socio-economic variables for the regions around the airports is used to estimate demand at the origin-destination level. A gravity model, which can be used to forecast demand for existing and possible new air routes, including demand and service-related variables, is estimated. In comparison to most of the existing literature, this paper sheds light on a wider variety of explanatory variables. Unique variables tested include ethnic ties between origin and destination and the share of aviation-dependent employment at both ends of the airport pair. This may help airlines to decide whether a new route could be operated profitably and help airports to decide on which new routes marketing activities could be focused.

The paper is structured as follows: Section 2 provides an overview of the existing literature on passenger forecasting models and the determinants of air travel. Section 3 describes the data generating process applied to retrieve standardised catchment area data for all European airports and elaborates on other data used in the model. Section 4 presents the specification of the gravity model and presents the main results. Section 5 concludes.

2. Literature review and hypotheses

There are three common methods for forecasting air travel: trends, gravity models and stimulation models (Swan, 2008). For city

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pair or route-level forecasting, the gravity model is most common. These models are based on an analogy with Newton's gravitational law, which states that the gravity between two objects is proportional to their masses and inversely proportional to the distance between these objects. Isard (1954) was among the first to introduce the *potential* or *gravity* concept – originating from physical sciences – in economic theory to estimate trade flows between countries. The first to apply gravity models in trip distribution modelling was Casey (1955). Swan (2008), however, put forward a major drawback of gravity models, which is their disability to accurately predict when demand is small. He stated that although there is no doubt that larger origins produce more travel and larger destinations attract more travel, origin-destination pairs between large cities with little or no demand do exist. An accurate demand forecasting model should be able to explain such deviations based on the effects of other explanatory variables. Moreover, Swan (2008) stated that because demand is highly dependent on specific cultural or business relationships between cities, forecasting errors are very large. One of the main goals in this paper is to identify some of these characteristics and include these in our gravity model to reduce forecasting errors. The remainder of this paragraph focuses on the existing scientific literature on air travel demand and on identifying the gaps. From this, several hypotheses are derived.

The research on the main determinants of air travel is widespread (see e.g., Button and Taylor, 2000; Chi, 2014; Graham, 2000; Jankiewicz and Huderek-Glapska, 2016; Valdes, 2015). Jorge-Calderón (1997) distinguished two types of determinants of air travel: geo-economic characteristics of the area where transportation takes place and service-related factors, which can be influenced by the airline. Geo-economic determinants that are often taken into account are population size (Abed et al., 2001; Grosche et al., 2007), GDP (per capita) (Jorge-Calderón, 1997; Valdes, 2015), unemployment rate (Carson et al., 2011), trade, investments, exchange rates (Chi, 2014) and tourism (Jankiewicz and Huderek-Glapska, 2016; Jorge-Calderón, 1997). Service-related factors include price, frequency, load factor and aircraft size. In addition, Dobruszkes (2009) pointed at the role of LCCs in the increase of air travel demand. Grosche et al. (2007) estimated two gravity models solely including geo-economic characteristics of the regions around the connected city pairs to predict demand for routes where no air services existed. Other studies particularly focused on the service-related aspect (Bieger et al., 2007). Others used a combination of these factors (Fridström and Thune-Larsen, 1989; Bhadra, 2003). Besides socio-economic information of the region around the airport, it is worthwhile to include variables on economic, political and cultural relationships between the two countries or regions in which the airports are located (Russon and Riley, 1993). Finally, the literature discusses the use of distance as a travel impedance for air passenger forecasting using gravity models (Jorge-Calderón, 1997). While demand is inversely proportional to distance in traditional gravity models, this relationship is not clear for air travel beforehand. On short distances, more travel alternatives on other modalities are at the consumer's disposal, leading to, ceteris paribus, lower demand for air travel. On the other hand, economic links and, as a result, passenger demand is expected to be higher for regions more closely located. Abrahams (1983) tried to cater for this discrepancy by using the generalised costs of travelling by car as a variable in his model.

As shown, several scholars have explored the drivers of air passenger demand. Still, certain factors that might influence air travel demand are rather underexposed. To the best of our knowledge, there are no other papers that assess ethnic links and aviation-dependent employment variables as determinants of air travel. Although some literature points to the positive demand effect of (specific) LCCs (see e.g., Bhadra, 2003; Dobruszkes, 2009), evidence is not widespread. In addition, Valdes (2015) only found a marginal effect of LCCs on passenger demand. Therefore, testing the demand effect of specific LCCs in the European aviation market provides valuable additional evidence for a possible LCC effect. The expected positive impact is primarily driven by lower fares generally offered by LCCs. In addition, over the last decade, LCCs started to provide scheduled services on many low-density routes (De Wit and Zuidberg, 2012), which has led to substantial market generation.

H1: The higher the share of passengers travelling by LCC, the higher the demand for air travel.

Additionally, to a large extent, the existing literature does not cover the role of cultural and business relationships in fostering air travel demand (Swan, 2008), while such factors are expected to play a crucial role in estimating passenger numbers for airports pairs. This paper tries to cover this effect by including variables related to ethnic ties, business relationships and by controlling for domestic routes, leading to the following hypotheses:

H2: Domestic origin-destination pairs have higher air travel demand than international origin-destination pairs.

H3: The stronger the ethnic ties, the higher the demand for air travel.

H4: The higher the shares of aviation-dependent employment at both ends of the route, the higher the demand for air travel.

Finally, it is important to note that geo-economic data for the region around the airport, rather than data derived from predefined (national or regional) statistical entities, is used in the analyses. Carson et al. (2011) demonstrated that forecasting individual markets based on regional or airport-specific data and aggregating these to a national forecast outperformed the traditional method of predicting the total number of passengers using national macroeconomic variables. Bhadra (2003) also acknowledged the importance of using regional data and found that regional statistics outperform the national counterparts, which seems obvious because of (large) regional differences within countries.

3. Data

This section describes the data used for the analyses. Due to limited data availability, the study used cross-sectional data from 2010. A drawback of using data for only one year is that it does not allow for inclusion of time dynamics. However, a cross-sectional analysis allows for explaining the variance in passenger demand between routes based on socio-economic and service-related route characteristics.