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Brazilian airport economics from a geographical perspective

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ABSTRACT

This paper discusses the revenue and expenditure functions of a sample of Brazil's airports administered by Infraero, the Brazilian State enterprise responsible for administering the country's major airports. It aims to identify what volume of movement at the airports associates with positive net earnings, i.e., the break-even point between revenue and expenditure, in view of aspects of airport movement and geographical factors. It examines airports serving regular airlines and with movement of up to 8 million passengers in 2010. Revenues and expenditures are explained by total passengers embarked and disembarked at each airport and by the potential of the airport's 'anchor city'. Multiple regression analysis achieved a high level of explanation for the dependent variables studied, i.e., revenues and expenditures. The model explains 81% and 91% of the variations in revenues and expenditures, respectively. The analysis shows that, considering the ranking of cities, Brazilian airports with less than 2 million passengers tend to operate at a financial loss, those with between 2 and 3 million passengers are at the transition stage between positive and negative earnings, while airports with more than 3 million passengers tend to make gains. However, the simulation modelling shows that the break-even point between expenditure and revenue functions can vary considerably when different 'city potentials' are considered. In this respect, the modelling offers investors a tool for analyzing passenger demand risk in the light of expectations for Brazilian cities' potential.

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1. Introduction

Brazil has one of the fastest-growing air transport markets in the world (ACI, 2012; Harmel, 2012). Despite this promise, however, it faces enormous difficulties in providing airport infrastructure compatible with present, and expected future, growth in air transport demand. The difficulties in bringing airport infrastructure – currently administered largely by the State enterprise *Empresa Brasileira de Infraestrutura Aeroportuária* (Infraero) – up to scale have led the government to decide on a gradual process of granting major airport concessions to private enterprise through public auctions. Although Infraero is not a loss-making enterprise (depreciation of government assets aside), it returns only a small margin and is publicly perceived to administer inefficiently and to offer poor service at its airports. The decision by private enterprise to take over airports and foster the development they need hinges fundamentally on their capacity to generate revenues and related expenditures. Accordingly, parameters must be established for expected profitability at any given airport in Brazil. That Brazil's large airports offer positive operating margins is not in doubt, but to what extent may its medium and small airports be of interest to the private sector?

This paper will discuss, and add knowledge about, this little-explored issue of revenue generation and related expenditures at Brazilian airports handling up to eight million embarked/disembarked passengers annually. It does not conduct an accounting analysis of revenues and expenditures in terms of components such as aeronautical and non-aeronautical revenues, or payroll and social benefit costs. Rather, what is intended is an econometric analysis of the factors that generate revenue and expenditures, considering also the volume of airport output and the status of the city where the airport is located. Three large airports offered at auction in 2011 drew tenders well above the minimum prices set by the government. Brasilia Airport drew the largest agio (673.39% of the minimum price); Guarulhos Airport, the second largest (373.51%); and lastly Campinas brought 159.75% of the minimum price. This suggests that these airports have been perceived by private enterprise as having the potential to generate revenues far in excess of those observed while under administration by Infraero. For this process to advance, however, and to contemplate the other airports in the network it is necessary to learn more about the demand risk at medium and small airports, primarily those not anchored by special situations. For example, Manaus Airport's activities are anchored in the Manaus Industrial Zone, which benefits from strong federal government tax incentives. In Brazil, other conjunctural

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factors generate what could be termed market imperfections, which can alter an airport's profitability profile.

Such cases are considered beyond the scope of this study, which seeks to examine the break-even point at airports that receive minimal interference from conjunctural factors. However, given that Brazil's tax system is rather complex, some conjunctural elements of federal, state, and municipal government policy may still interfere in market mechanisms at the airports considered in the sample. Moreover, equally important in this analysis is a clearer understanding of potential changes in airport growth and passenger demand across Brazil, in light of changing trading and investment patterns in the global economy.

2. Literature review

Doganis et al. (1978) conducted an economic and financial analysis of the United Kingdom's 22 main airports to explore the structure of airport revenue and expenditure formation. Doganis and Nuutinen (1983) presented an economic study involving 14 European airports, which sought to examine the hypothesis that continental Europe's major airports have the same economic and financial characteristics as their United Kingdom counterparts. Extending previous studies, they also evaluated the impact of international traffic on airports' financial performance. In a later study, Doganis and Graham (1987) expanded precursor studies by presenting a variety of performance indicators (commercial, financial, etc.) for a sample of 24 European airports that showed the average structure of revenues and expenditures.

Assailly (1989) used 1986 data for French commercial airports to determine the break-even point between revenues and expenditures on the basis of passenger volume, load factor and percentage international traffic. Doganis et al. (1995) analysed the performance of 25 European airports by estimating airport expenditures and revenue functions. Profitability was established as the ratio of total revenue to total expenditure, using work load unit (WLU) as the key variable in the estimates. These approaches provide a model for similar assessments in contemporary periods.

Vasigh and Hamzaee (1998) developed an analytical model to measure financial performance at airports in the United States, considering financial agreements in place between airlines and airports. Their study considered traffic volume and price variables, as defined by the airport managers themselves. Graham (2008) addressed a range of factors that influence the level and structure of airport expenditures and revenues. For example, different types of airport operation – whether destined for international traffic or for low-cost and charter passengers – will generate different expenditure and revenue structures. Kato et al. (2011) examined the accounts of 41 airports in Japan. They concluded that the airports become profitable when they process more than 5.2 million passengers per year. Using econometric modelling, they estimated total revenue and expenditure functions, relating them exclusively to total passengers transported.

One consequence of airport privatisation or concession in Brazil has been to turn attention to airport revenue and expenditure trends, management, and profitability. Studies of this kind relating to Brazil are very generic, most focusing on airport performance and using analytical tools such as data envelopment analysis or total factor productivity (Pacheco and Fernandes, 2003; Wanke, 2012). Pacheco et al. (2006) addressed Infraero's management style, but did not consider airports individually. Other studies, such as Gonçalves (2010) and Palhares and Espírito Santo (2000), have considered the impact of airport management in Brazil, but produced no quantitative estimate of such impact.

Passengers and the WLU are the main constituent elements in the analysis conducted by the studies cited, most of which examine cases in Europe and North America and focus on airport operating structure. The studies develop their revenue and expenditure functions in terms of airport profile, with no reference to geographical aspects of the anchor city. Although not directly connected with the study of airport revenue, expenditure and profitability, O'Connor and Fuellhart (2012) looked at how airlines allocate aircraft to airports at various levels in a hierarchy of cities. They showed that differences in aircraft type, size, and mode of operation associate with the city's level in the hierarchy. Variations in level of service and position in the hierarchy of cities point to differential quality in revenues and profits.

The literature shows approaches directed to specific airport revenue and expenditure structures and other more generic approaches focusing on aspects of overall airport movement. In line with the finding of O'Connor and Fuellhart (2012), this present study introduces the geographical component (i.e., the city's potential) as an important element in defining an airport's revenue and expenditure functions. This geographical component is based on a survey by Brazil's official statistics agency, the *Instituto Brasileiro de Geografia e Estatística* (IBGE, 2008). This study of Brazilian cities' regions of influence drew up a hierarchy of urban centres, delimiting their regions of influence and inter-city flows. It classified Brazilian cities into five major groups – 'metropolises', 'regional capitals', 'sub-regional centres', 'zone centres' and 'local centres' – and subdivided these groups in turn into two or three sub-levels. In this way, IBGE (2008) defined the set of Brazil's cities into an 11 – level hierarchy by importance. That study provides the basis for defining the 'city potential' variable (pcity) for the cities that we will term the anchors of the airports in the sample studied.

3. Conceptual basis and case study

The present study uses multiple regression analysis to define a revenue function (recobs) and an expenditure function (despobs) for Brazilian airports handling up to eight million passengers, using 'total passengers' (paxtot) and 'city potential' (pcity) as explanatory variables. By way of these functions, it examines the break-even point between revenue and expenditure for airports in cities at different levels in the hierarchy of Brazil's urban network. The study data are sourced from Infraero and the IBGE. The expenditure data do not consider government asset depreciation.

Infraero administers 66 of Brazil's major airports distributed throughout the country. In 2010, Infraero handled 155 million passengers, 139 million domestic and 16 million international. Of those, about 15.5 million domestic and 1.5 million international passengers were connecting passengers. Until 2011, Infraero administered all the airports of Brazil's 26 state capitals and the Federal District (the national capital). In 2012 Campinas and Guarulhos airports in São Paulo State and Brasília in the Federal District were transferred to private enterprise. Infraero also administers airports in medium-sized and small cities that are of strategic interest to the Brazilian government. The great majority of the airports handled 2 million passengers or less in 2010 and operated at a loss. The sample was selected with a view to operational uniformity among airports. The features considered are detailed below.

The airports of Brasília, Rio de Janeiro and São Paulo represent around 50% of passenger movement processed at Infraero airports. These three cities' airports, which account for about 86% of Brazil's international air passenger traffic, handled over eight million passengers each in the study year, 2010. Brasília, with the smallest movement of the three, processed more than 14 million passengers. There are no cities with airports handling between 8 and 14 million passengers. Ranking above Brasília are Rio de Janeiro with more than 20 million and São Paulo with more than 42 million passengers in 2010. Accordingly, these cities were not considered in

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