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FORECASTS OF SCHEDULED PASSENGER TRAFFIC FOR NEW AIRPORT WITH LIMITED DATA

(Presented by Brazil)

EXECUTIVE SUMMARY

In order to determine the economic viability of new airports, or for the planning and development of existing airports, it is necessary to forecast its demand. The Manual on Air Traffic Forecasting Part I (Doc 8991) addresses three general approaches to model and forecast airport specific demand. These approaches include: quantitative forecasting methods; qualitative forecasting methods and decision analysis. All these approaches, however, require extensive information on individual travel behaviour as well as the distribution of socio-economic characteristics in the area influenced by the new airport or judgment of several experts. In Brazil, such information and experts are often unavailable. Even times-series analysis is not available for some Brazilian airports.

This information paper presents an alternative approach where passenger demand for new Brazilian regional airports is modelled using an econometric approach relating per-capita income, population, yield and a constant calculated for airports that have similar socio-economic characteristics based on the *Instituto Brasileiro de Geografia e Estatística* (IBGE) study that gives the areas of influence of cities.

Strategic Objectives:	This working paper relates to Strategic Objective C – *Environmental Protection and Sustainable Development of Air Transport*
Financial implications:	No financial implications.
References:	Doc 8991 — Manual on Air Traffic Forecasting Report of the Ninth Meeting of the Caribbean/South American Traffic Forecasting Group (CAR/SAM/TFG), Tegucigalpa, Honduras, 30 April to 4 May 2012

1. INTRODUCTION

1.1 The Manual on Air Traffic Forecasting Part I (Doc 8991) addresses three general approaches to model and forecast specific airport demand. These approaches are:

a) quantitative forecasting methods

b) qualitative forecasting methods; and

c) decision analysis.

1.2 The quantitative forecasting methods presented in Doc 8991 can be classified into two major subcategories: time-series analysis and casual methods. Time-series analysis is based on the assumption that historical patterns will continue and they strongly depend on the availability of historical data. The casual methods infer a cause and effect relationship. To test such inferences, some kind of data is required, either historical or cross-sectional. Qualitative forecast methods are used when data is sparse or not available. These methods require judgment of experts and may be used to predict significant changes in historical patterns. Two methods are presented: the delphi technique and technological forecasting. The third approach shown in Doc 8991 is the decision analysis, which includes a combination of both quantitative and qualitative analysis methods. In the methods, the analyst's judgment is used in preparing forecasts for a particular area of his expertise in combination with statistical or mathematical techniques.

1.3 However, all three approaches require judgment of several experts or extensive information on individual travel behaviour as well as the distribution of socio-economic characteristics in the area serviced by the airport. In Brazil, such information is often unavailable. Even historical information of traffic is difficult to obtain for some regional Brazilian airports. In that sense, this information paper presents an alternative approach where passenger demand for new Brazilian regional airports is modelled using an econometric approach relating GDP, population, yield and a constant calibrated for airports that have similar socio-economic characteristics based on the *Instituto Brasileiro de Geografia e Estatística* (IBGE) study that establishes the areas of influence of cities.

2. STRUCTURE OF ALTERNATIVE DEMAND MODEL

2.1 The alternative model proposed in this paper can be categorized as a quantitative forecasting methodology, as presented in Doc 8991, specifically into the casual method category: regression analysis. The alternative model proposed is based on the econometric method proposed by Jacobsen[1] to forecast regional schedule air passenger traffic for regional airports in Virginia. Jacobsen's model considers the following predictive variables:

a) population of catchment area;

b) average airfare per mile;

c) per-capita income of catchment area; and

[1] Jacobsen, I. D (1978). Final Report. Demand Modelling of Passenger Air Travel: An Analysis and Extension. Volume II. Technical Report. Research laboratories for the engineering sciences. School of engineering and applied science. University of Virginia. Submitted to: NASA Scientific and Technical Information Facility.

d) a constant calibrated to each regional airport to predict passenger enplanements.

2.2 The data on population, average airfare per mile and per-capita income are available as time-series for the Brazilian municipalities, but planed passengers and the regional airport constant are not (at least for all the municipalities). It is therefore recommended to use our alternative method, for the airports that do not have available information, making it impossible to calculate the constant, which is the key to adapt the model to different socio-economic regimes, and, to use a constant calculated to regional airports that have similar socio-economic characteristics based on the IBGE (a study that establishes the areas of influence of cities).

2.3 The aforementioned the IBGE study creates a hierarchy between urban cities and limits the areas of influence of each one, starting with the identification of public (government) and private management centers, proceeding to map the territory points which concentrate the supply of equipment and services, and also the ones from which decisions are issued in order to command a network of cities. As such, data from a specific research were used, and secondarily, data from other surveys carried out by IBGE, as well as records originated from public organizations and private businesses. In the end, the Brazilian municipalities were classified in twelve categories, by its influence from 1A (more influent) to 5 (less influent).

2.4 The estimated equation is presented below[2]:

$$\beta \cdot lnE_i = -6{,}14 + 0{,}94 \cdot lnP + 1{,}42 \cdot lnY_i - 0{,}631 \cdot F$$
$$R^2 = .978$$

Where:

β: constant calculated for each *IBGE* category;

E: predicted passenger enplanements;

P: population of catchment area (the area of influence);

F: average airfare per mile;

Y: per-capita income of catchment area.

2.5 All parameters were estimated with Brazilian data and have the economically expected signs: population and per-capita income of catchment area have positives signs, since the increase in any of them should increase the predicted passenger enplanements, while average airfare per mile has negative sign, showing the negative effect of price increases of expected passenger enplanements. The model presented in topic 2.2.4 of thereport of the Ninth Meeting of the Caribbean/South American Traffic Forecasting Group (CAR/SAM/TFG) has a GDP elasticity of +1.93 and a yield elasticity of -0.74, which agrees with the parameters presented here in our alternative model.

2.6 The constant β was calculated for all the regional airports that have available information to input into the model and aggregated by its IBGE study classification. The next step consisted in calculating a weighted average for each category, obtaining one "representative" regional airport constant for each IBGE category. The method used regression analysis and the IBGE study to match localities with

[2] All the coefficients shown are statistically significant with at least 95% confidence.

traffic data with others with limited or no data making possible to estimate passenger enplanements for the later.

3. RESULTS OF ESTIMATION

3.1 Given the assumptions about the constants and knowing that the population of the catchment areas and their per-capita incomes can be found in the IBGE database and the time-series for average airfares per mile are available in the Agência Nacional de Aviação Civil (ANAC) website, the estimated demand, for selected cities, is compared with real data in Table 1:

Table 1: Comparison of estimated and real demand using the alternative method

Airport	2009 Annual demand estimated by alternative method	2009 Realized Annual demand	Difference (%)
TABATINGA - AM	30,114	31,373	-4.01%
LONDRINA - PR	720,732	731,817	-1.51%
ORIXIMINÁ - PA	48,142	46,411	+3.73%
FONTE BOA - AM	4,606	4,428	+4.02%
DIAMANTINA - MG	4,281	4,334	-1.22%
TEFÉ - AM	34,976	36,839	-5.09%

4. CONCLUSION

4.1 The potential air traffic demand is crucial for airport planning. For new airports the task is especially challenging since no previous data is available to forecast such demand. The alternative model proposed here is a potential solution for those cases and for forecasting demand of airports that have limited data, either on traffic or on explanatory variables. The method uses regression analysis and matches the airports based on socio-economic characteristics, according to a study proposed by the *Instituto Brasileiro de Geografia e Estatística* (IBGE). The results show that in the sample predictive error of the model is small, and hence it is a viable option to estimate demand for the aforementioned airports.

4.2 The results of passenger forecasts are been used to plan ahead the Brazilian regional airports facilities and measure benefits in an analysis of economic viability. Nevertheless it is important to mention that this is an alternative method that should be used in cases with limited data.

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