

# Aerlines

International Magazine for Students & Professionals of Aviation

<http://www.aerlines.nl>

appearance: 5th June 2004     *e-zine edition Issue 26*

*Dear Reader,*

*Several **Aerius** activities took place since the publication of our previous issue. A report of maybe the most successful activity of this Academic Period is included in this issue. And this activity is of course the **Aerius** / PNL ('Platform Nederlandse Luchtvaart') Symposium held March 11th at Schiphol, which was overbooked in number of visitors and was reported about by Dutch Press. Caught your interest? Then see our report.*

*During our most recent General Members Assembly April 8th, three new board members joined the **Aerius** Board. The **Aerlines** team of Editors congratulates Daan de Jong with his exciting new position within the **Aerius** Board as our new President, Sander van de Lagemaat as our new Vice-President, Linda Bos for taking up the Internal Affairs/ Secretary position and Tom Goossens for taking care of the External Affairs. Not all positions were changed as Wouter Wester keeps continuity in the position of Treasurer. Alexander Duijn, former-External Affairs, and Willem-Jan Zondag, former-President, said their goodbyes to their Board positions. Thank you guys! A dual PS is included in this issue, have a look at what both Willem-Jan and Daan have to say about running **Aerius**.*

*Of course the Editors Team feels lucky that Willem-Jan is not giving up all his activities for **Aerius** as we as Editors may continue to enjoy his enthusiasm as our Editor-in-Chief. So, Dear Reader, we invite you to enjoy the product of this Editor-in-Chief and his team of Editors. **Aerlines** issue 26 is online now, in a freshly renewed site, have a look at the content below.*

*The **Aerlines** team of Editors Eelco Watzema, Willem-Jan Zondag, Roger Cannegieter, Ms Amrita Bose, Bram du Saar, Hubert Croes and Jasper Spruit*

*All articles are downloadable in Adobe Portable Document Format (PDF)*



*The Adobe Acrobat Reader can be downloaded for free at [Adobe.com](http://Adobe.com)*

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*Airlines Magazine* is published quarterly by *Aerius* – International Association for Students of Aviation

*Airlines'* reading public consists of academic students of aviation and senior managers of the aviation industry's leading companies and organizations, as well as the *Aerius* Advisory Board.

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## **IN THIS ISSUE**

### **1 President's Speech**

### **2 American Airlines' Takeover of TWA and Its Corporate Restructuring after the Tragedy of September 11 th, 2001**

In this contribution, Steve Swidler of the Auburn University and Triant Flouris, director of the International Aviation MBA Program, Concordia University chronicle American's takeover of TWA, its struggles subsequent to the tragedy of September 11th, 2001 and ultimately the restructuring that occurred as the airlines hovered near bankruptcy.

### **3 Anti-competitive Behavior in the Airline Industry: The Case of Predatory Pricing**

Deregulation of formerly strong regulated markets often leads to dramatic changes of market structure because increasing competitive pressure emerges for incumbent firms. However, questions arise if competition will be sustainable during the conversion of the market from government-restricted regional monopolies to an integrated competitive market. One possible threat for market development in the airline industry could be anti-competitive behavior by large dominating incumbent carriers. Such action might arise in multiple ways – one of the most important of those is predatory pricing. Daniel Zwick, student of economics at the TU Berlin reports.

### **4 Conceptual and Regression Models for Passenger Demand Prediction: A Case Study of Cairo Airport and Egyptair**

In this contribution, Khaled A. Abbas from the Egypt National Institute of Transport develops demand models for passenger aviation from/to Cairo airport. The contribution starts by forming a conceptualization of main factors affecting passenger demand for international air transport from/to Egypt.

### **5 Human Resource Management Training and Accident Prevention in the Airline Industry**

The evolution of Crew Resource Management (CRM) is informatively described in this article by Mr. Assaad Farah as an introduction to the research which analyses the relation of CRM with reduction of certain pilot errors.

## **6 Corporate Resource Management: an Integrative Approach to an Effective Aviation Organization**

The above named article gives an historic overview of Crew Resource Management and ends by introducing new principles of it, like creating a proactive organizational culture. The author of this article, Dr. Victor Ujimoto, argues that the concept of Crew Resource Management should indeed be broadened to Corporate Resource Management. By means of a couple of elaborate examples of successes, for instance by Southwest Airlines, and mishaps the proposition for this new concept is illustrated.

## **7 Airport of the World: Rotterdam Airport**

The second largest airport of The Netherlands is more in development than ever before. In this Airport of the World editor Jasper Spruit provides an overview of the most important facts and an analysis of the past and future developments.

## **8 The Graduate: Ricardo Pilon**

## **9 Airline of the World: Southwest Airlines**

As one of the most successful airlines in the low-cost market segment, Southwest Airlines is often used as an important benchmark for the airline industry. In this article, Jurjan Knol looks at the logic behind the success of Southwest Airlines from an organizational perspective, thereby using the five elements of Galbraiths STAR-model: Strategy, Structure, Processes, Rewards, and People.

## **10 Conference Report: The Future of Aviation in The Netherlands**

After almost nine months of preparations, Aerius in close co-operation with PNL (Platform Nederlandse Luchtvaart) organized On March 11 th the symposium "Aviation in the Netherlands, in a responsible way towards the Future" (in Dutch: 'Luchtvaart in Nederland, Verantwoord de Toekomst in'). Around 150 participants attended the conference that took off at 09.00 in the morning in the Auditorium of the Schiphol Group headquarters at the airport.

## **11 Company Profile: Dragonair**

Jasper Spruit about Hong Kong Dragon Airlines (Dragonair) that was founded in 1985 with a Boeing 737-200A aircraft flying from Hong Kong to Kota Kinabalu (Malaysia). Dragonair currently serves 29 Asian destinations, including 21 in the mainland, with flights to the mainland exceeding 200 per week with one of the youngest and most advanced aircraft fleets in the region.

## 12 Ashgate Book Review: "Pilot Selection"

Floris Boesveldt reviewed this book which is intended to acquaint the reader with the significance of pilot selection in terms of money, safety, and volume of training underway. It presents the history of aircraft pilot selection and the scientific methodology underlying the development of effective and valid selection procedures.

## 13 Ashgate Book Review: "Fatigue in Aviation: a Guide to staying Awake at the Stick"

The topic, fatigue, of this book is as interesting as the title suggests. Not only is it relevant for those who are working irregular shifts, the insights into sleep and the architecture thereof is also enlightening for anyone with a busy schedule. Perhaps nibbling off sleep-time is not that profitable after all...Reviewed by Amrita Bose.

*Ashgate Aviation 2003 Catalogue.*



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## *About Airlines*

*Airlines*—International Magazine for Students of Aviation— is published quarterly by *Aerius*. Its role is to be of surplus value for students interested in aviation and to offer graduates, academic relations and business relations some high-value articles. *Airlines Magazine* is nowadays published as an e-zine and distributed to approximately 7.500 recipients worldwide, including thousands of students, researchers and business men in aviation.

### **Call for papers!**

*Aerius* applauds every student and researcher writing an aviation related thesis, research paper or other document to contribute to *Airlines Magazine*. An article about your field of expertise would really add value!

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# Conceptual and Regression Models for Passenger Demand Prediction: A case study of Cairo Airport and Egyptair

By Dr. Khaled A. Abbas

## 1. Introduction

The main aim of this research is to develop demand models for passenger aviation from/to Cairo airport. The paper starts by forming a conceptualisation of main factors affecting passenger demand for international air transport from/to Egypt. In addition, a conceptualisation is drawn portraying factors influencing passenger selection of Egyptair, as a potential international carrier. Following this, historical data concerning aviation demand variables as well as other explanatory variables thought to affect this demand is collected and compiled from several sources.

Demand variables are historically plotted to determine the most proper and representative ones. A correlation matrix is then computed using Pearson coefficient to show extent of relation between demand variables and selected explanatory variables. Based on these analyses, it is decided to develop single and multiple variable models, using different functional forms, relating air passenger demand to population, GDP and number of foreign tourists. All calibrated models are subjected to logical and statistical tests. The paper concludes with a demonstration of usefulness of selected models in terms of ability to predict future passenger demand levels.

## 2. Factors Affecting Passenger Demand: A Conceptual Model

A conceptualisation of main factors affecting demand for travelling by air from/to Egypt is depicted in figure 1. Aviation demand to/from Egypt is composed of Egyptian as well as foreign passengers. It can be represented by number of international flights or number of passengers using international flights to/from Egypt. Ten factors were identified as affecting demand generated by Egyptian nationals and attracted to other countries. Three can be grouped under socio-economic factors. These include population size, GDP, and GDP/Capita in Egypt. The increase in any of these factors is expected to generate more demand for travelling by air. One factor is related to a pillar of the Islamic religion, namely performance of Haij (pilgrimage). Each year, and according to quota, Saudi Arabia grants a number of Haij visas equivalent to 0.001 of the Egyptian population. Egyptian pilgrims travel to the holy cities of Makkah and Madina in order to perform Haij once a year. In addition, Omra another Islamic ritual and a smaller version of Haij, can be

performed at any time of the year but its peak season is during Ramadan (the Muslim fasting month). Egyptians are known to frequently travel to Saudi Arabia to perform Omra. The other six factors are all related to attractions abroad, including:

- Egyptians immigrants travelling to/from countries of immigration such as USA, Australia.
- Egyptians working abroad and travelling to/from working destinations, such as Saudi Arabia and other Gulf countries.
- Egyptian tourists visiting other countries, especially in summer such as Turkey, UK and Greece.
- Egyptian businessmen travelling to countries to conduct business meetings.
- Diplomats and officials representing Egypt abroad.
- Egyptian graduate students, academics, and scholars travelling to other countries for higher education, research and exchange programs.

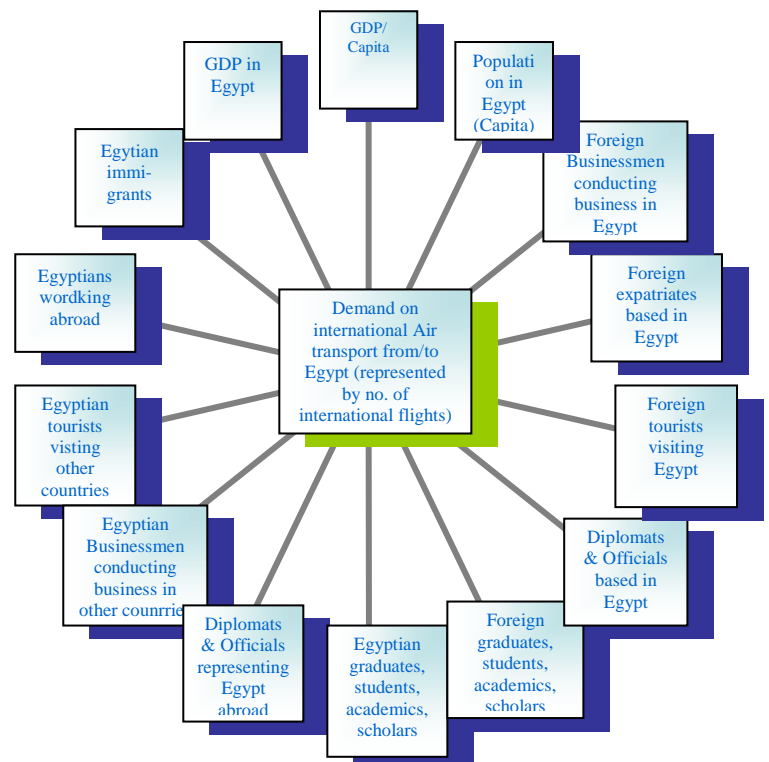


Figure 1: Conceptual Model of Factors Affecting Air Passenger Demand from/to Egypt



On the other hand, five factors were identified as affecting demand generated by foreign nationals and attracted to Egypt including:

- Foreign tourists attracted to visit historical and archaeological Egyptian heritage.
- Foreign nationals, probably expatriate, working in Egypt.
- Foreign businessmen travelling to Egypt to conduct business meetings.
- Foreign diplomats and officials representing other countries and international bodies.
- Foreign graduate students, academics, and scholars travelling to Egypt for higher education, research and exchange programs.

The most important of these five factors is number of foreign tourists visiting Egypt. Majority of foreign tourists arrives to and leaves from Egypt by air.

### 3. Factors Affecting Egyptair Market Share of Passenger Demand

Some generic insights on the choice of air carrier, flight and fare classes were developed by Prousaloglou and Koppelman (1999). In this section, a conceptualisation of factors affecting the modal selection by passengers travelling on international flights from/to Egypt is shown in figure 2.

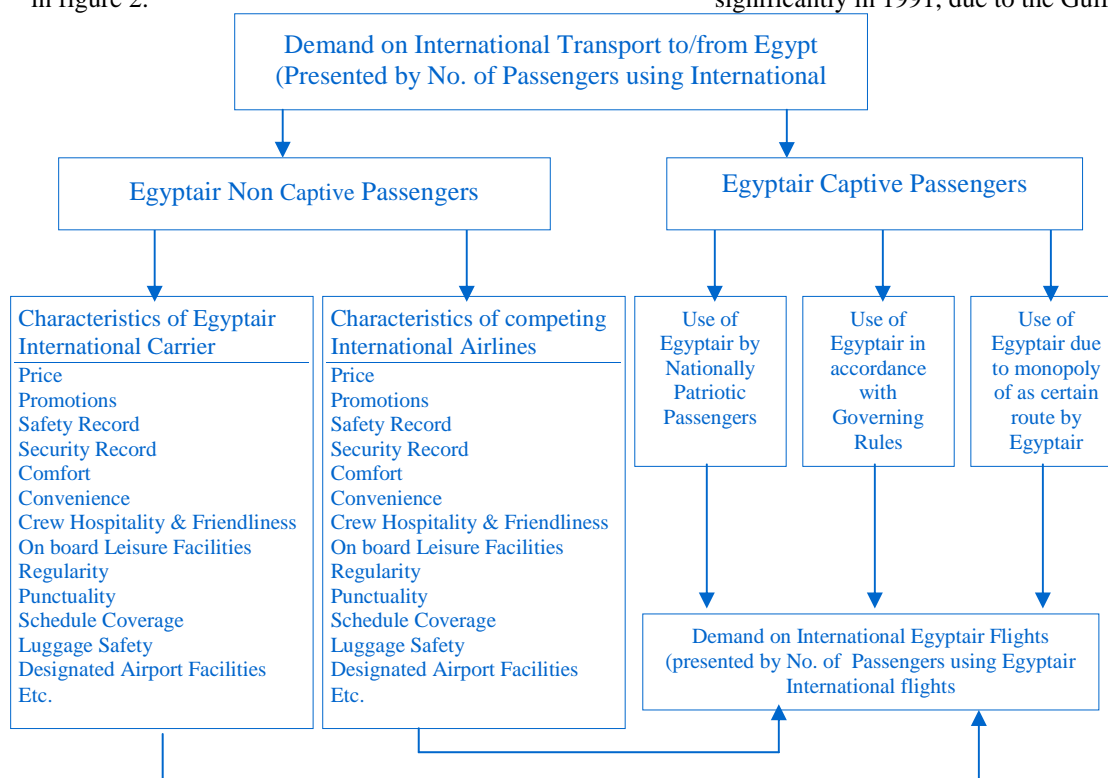


Figure 2: Conceptualisation of Factors Affecting Egyptair Market Share of Passenger Demand on International Flights from/to Egypt

The figure demonstrates the process involved in passenger selection of Egyptair versus other international carriers. Some passengers are by default Egyptair captive either due to their patriotic character, or due to Egyptian government regulations necessitating use of national carrier or due to monopoly of certain routes by Egyptair. On the other hand, the majority of passengers have the choice of selecting Egyptair versus other alternative competing airlines. In this context, price and level of service related characteristics affecting utility of competing airlines

govern passengers' mode choice. Such characteristics could include factors such as promotions, safety and security records, comfort, convenience, regularity, punctuality, schedule coverage, luggage safety, crew hospitality and friendliness, onboard entertainment facilities, designated airport facilities, etc.

### 4. Dependent and Explanatory Variables for Developing Demand Models for Passengers Travelling from/to Cairo Airport

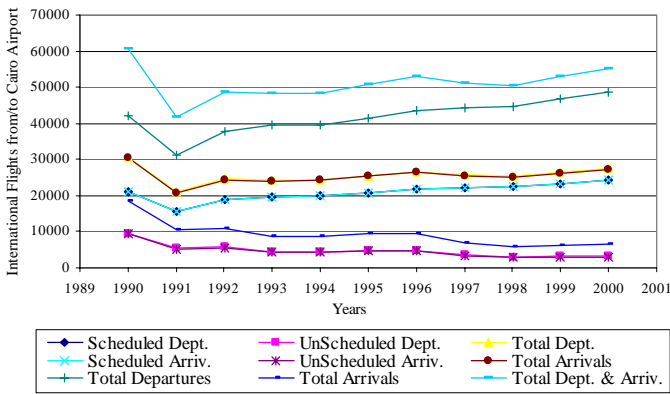
Based on the conceptualisation, depicted in figure 2, of factors affecting demand, historical data, spanning over from 1990 to 2000, concerning aviation demand variables as well as variables thought to affect this demand was collected and compiled from several sources, see ECAA (2001), Egyptair (2001), NBE (2001), and IMF (2000).

Demand variables include number of international flights (scheduled or unscheduled) as well as number of passengers using international Egyptair flights (scheduled or unscheduled) originating from or attracted to Cairo airport. Demand variables were historically plotted in an effort to determine the most proper and representative ones, see figures 3 and 4. Several observations are noted, first that demand in 1990 was relatively high, being the year just before the second Gulf war. Demand dropped significantly in 1991, due to the Gulf war and its dramatic

effects on tourism and aviation sector in Egypt. In this context, it was decided to drop data points pertaining to these two years from the development of the models. The other noted observation is that generated as well as attracted demand for both scheduled and unscheduled trips are almost similar in magnitude. This demonstrates the aviation phenomenon of passengers usually using return tickets on international

flights. Based on these analyses, it was decided to add total departures and arrivals of international flights from/to Cairo airport and use the sum as the dependent variable representing passenger aviation demand from/to Cairo airport. Similarly, it was decided to use total number of passengers using Egyptair international flights from/to Cairo airport as the dependent variable representing passenger aviation demand on Egyptair.

Historical data on a number of explanatory variables thought to affect demand was also compiled, namely

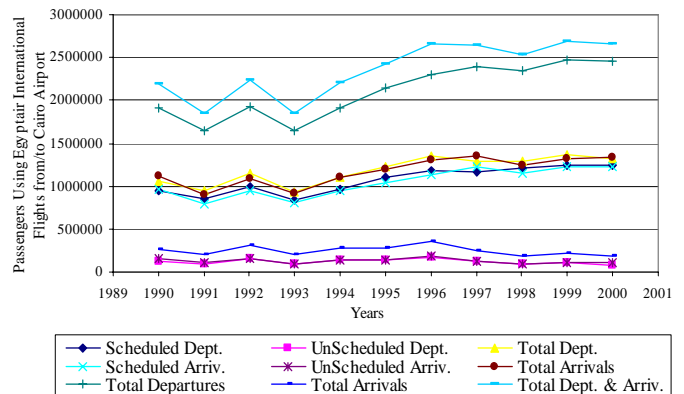


**Figure 3: Pattern of Historical Demand of International Passenger Flights from/to Cairo Airport**

population, GDP, GDP/Capita, number of Egyptian Hajj pilgrims, number of foreign tourists, number of Egyptians working abroad, as well as number of Egyptian immigrants. A correlation matrix was then developed containing values of Pearson coefficient and its significance in an effort to demonstrate extent of linear correlation between demand variables and selected explanatory variables, see table 1. The matrix shows the collinearity between population and Hajj pilgrims as well as between GDP and GDP/capita. This was expected as number of yearly pilgrims is determined in accordance with Saudi quota being a percentage of population of Muslim countries. In addition the matrix showed illogical negative signs of correlation coefficients between demand variables and number of Egyptian working abroad as well as Egyptian immigrants. Based on these analyses, it was decided to develop models relating demand variables to population, GDP and number of foreign tourists.

### 5. Developing Passenger Demand Models for International Aviation from/to Egypt

Traditionally, econometric models are utilised in the forecast of air transport demand. Recently fuzzy models see Profillidis (2000) as well as models based on scenario forecasts see Cline (1998), were developed for air transport passenger demand forecasting. In this section, selected demand and explanatory variables were utilized to calibrate two types of econometric models. The first type is single variable models, where four functional relations, namely linear, logarithmic, power and exponential functions, were tested to obtain a best fit. All calibrated models were subjected to a number of statistical tests. To establish goodness of fit and statistical significance of the models, two indicators were computed, namely the R2 and the F-statistic. It became obvious that number of foreign tourists visiting Egypt represents the best fitted explanatory variable and that the power function was the best non linear function in terms of simulating the dependency of annual total international flights from/to Cairo Airport on annual number of foreign tourists. On the other hand, the logarithmic function was the best function in terms of simulating the dependency of total international passengers using Egyptair from/to Cairo Airport on annual number of foreign tourists. Such models have a significant limitation in terms of modelling demand as a function of a single explanatory variable. These variables are either representative of demand generated by Egyptian nationals such as the case of



**Figure 4: Pattern of Historical Demand of Passengers Using Egyptair International Flights from/to Cairo Airport**

population, and GDP or alternatively representative of demand generated by foreign nationals such as the case of number of foreign tourists visiting Egypt. In this context, it was felt that a multiple regression containing at least two explanatory variables, one representing demand of Egyptian nationals and the other representing demand of foreign nationals, would be more appropriate and representative. Several trials were conducted using three selected explanatory variables as well as combination of two. The multiple regression models using three variables had less degrees of freedom and produced negative signs for some calibrated parameters. This was neither statistically nor logically accepted. On the other hand, models including population or GDP in combination with number of foreign tourists as independent variables were calibrated, see table 2. The table shows that those models with population and number of foreign tourists produced the best fit as well as proved to be the most logical and statistically significant models.

### 6. Applicability of Developed Models in Forecasting Future Demand

In this section, the two selected models are used to perform a short term forecasting of expected demand in terms of number of international flights as well as number of passengers using Egyptair international flights. In order to carry out such forecasts, expected future values for explanatory variables should be first obtained. In this context, two time series models were developed to simulate changes in population in Egypt as well as in number of foreign tourists visiting Egypt. The population model is based on an 11 points data set spanning from 1990 to 2000, while tourists model is based on a 9 points data set spanning from 1992 to 2000. It was assumed that the second Gulf crisis did not affect the population growth but definitely affected the pattern for number of tourists visiting Egypt and that was the reason for ignoring the 1990 and 1991 data points for the tourists model. The two models took the exponential form as follows:

$$\text{Population in Egypt} = 5E+07 * e^{0.0219(\text{Years})}$$

with 1990 as the base year

$$\text{Foreign Tourists Visiting Egypt} = 2E+06 * e^{0.0939(\text{Years})}$$

with 1992 as the base year

The above models were used to forecast expected population and number of foreign tourists in 2004 and 2005. These forecasts, shown in table 3, were then fed into the selected models displayed in table 2 and forecasts of passenger aviation demand represented by number of international flights as well as number of passengers using Egyptair were obtained. These can be averaged from annual into daily forecasts and further more into arrivals and departures.

The usefulness of such forecasts lies in their potential utilisation in resource planning in terms of airport capacity and sufficiency of resources as well as in terms of fleet purchase by Egyptair. Such demand forecasts can be also used as input into Cairo airport and Egyptair cost and revenue models.

## 7. Conclusions

The main aim of this research was to develop demand models for passenger aviation from/to Cairo airport. In pursuing this objective the research developed two

conceptual models, the first pertaining to factors affecting the passenger aviation demand to/from Egypt, while the second depicted factors influencing the selection of Egyptair as a potential international carrier by passengers. Two demand variables were selected, namely total international flights from/to Cairo airport as well as total number of passengers using Egyptair international flights from/to Cairo airport. In addition, two explanatory variables were also selected to represent demand of Egyptian nationals i.e. population and GDP as well as one variable selected to represent demand of foreign nationals i.e. number of foreign tourists visiting Egypt. These variables were then used to develop several single and multiple variable models with different functional forms. Finally two models were selected based on their logical acceptability, best fit and statistical significance. In an effort to demonstrate the applicability and practicality of the developed models, these were utilised to forecast future expected passenger aviation demand from/to Cairo airport.

**Table 1: Pearson Correlation Coefficients Between Variables Representing International Passenger Demand from/to Cairo Airport (CA) and Explanatory Variables**

Explanatory Variables	Population (Capita)	GDP*	GDP/ Capita	Egyptian Pilgrims (Haij)	Foreign Tourists	Egyptian Working Abroad	Egyptian Immigrants
<b>Air Passenger Demand</b>							
Total International Flights from/to CA	0.85 (0.004) Sig.	0.861 (0.003) Sig.	0.86 (0.003) Sig.	0.85 (0.004) Sig.	0.903 (0.001) Sig.	-0.855 (0.003) Not Logical	-0.494 (0.176) Not Logical
Total International Passengers Using Egyptair from/to CA	0.82 (0.007) Sig.	0.804 (0.009) Sig.	0.81 (0.008) Sig.	0.82 (0.007) Sig.	0.822 (0.007) Sig.	-0.922 (0.00) Not Logical	-0.651 (0.057) Not Logical

GDP in Current Prices Using Local Currency i.e. Egyptian Pound (L.E.) Currently 1US\$  $\cong$  6.13 L.E.  
Sig.= Significant i.e. the hypothesis H0 stating that the two variables are independent is rejected.

**Table 2: Multiple Regression Models Relating Air Passenger Demand Variables to Selected Explanatory Variables**

Forecasting Years	2004	2005
<b>Forecasts</b>		
Population in Egypt	69444162	70981764
Foreign Tourists Visiting Egypt	6779119	7446523
Total International Flights from/to Cairo Airport (Annually)	56752	58040
Passengers Using Egyptair International Flights from/to Cairo Airport (Annual Departures or Arrivals)	3071693	3201854

**Table 3: Applicability of Developed Models in Forecasting Future Passenger Aviation Demand from/to Cairo Airport**

Explanatory Variables	Population (X1) & Foreign Tourists (X2)	GDP (X1) & Foreign Tourists (X2)
<b>Air Passenger Demand</b>		
Total International Flights from/to Cairo Airport (Y)	Y=1.0E-04(X1)+1.7E-03(X2)+38283 R2 =0.82, F = 13.7, Significant d.f. = 6 (SELECTED MODEL)	Y=6.8E-09(X1)+1.6E-03(X2)+43227 R2 =0.82, F = 13.8, Significant d.f. = 6
Total International Passengers Using Egyptair from/to Cairo Airport (Y)	Y=3.3E-02(X1)+0.119(X2)-26680 R2 =0.71, F = 7.2, Significant d.f. = 6 (SELECTED MODEL)	Y=1.32E-06(X1)+0.145(X2)+1584746 R2 =0.69, F = 6.7, Significant d.f. = 6

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