

A PROVISIONAL AIR TRANSPORT DEMAND MODEL  
FOR TRINIDAD AND TOBAGO

by

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SUMMARY

*This paper describes the development of a provisional mathematical model to identify factors influencing the number of visitors arriving in Trinidad and Tobago by air. Using a well-tried modelling technique, highly significant results were obtained for three major zones of origin, namely, U.S.A., Canada and the rest of the West Indies. The major influencing factors which were isolated were the economic population and per-capita income of the origin regions and the real values of airfare.*

## 1. INTRODUCTION

Over the past twenty years, the number of visitors arriving at and departing from airports in the Caribbean region has grown substantially and continuously. Such increases have been facilitated by improved air service links with other parts of the world and the development of intra-regional air transport.

In order to accommodate future growth in passenger volumes in the Caribbean region, it is certain that large scale capital investment programmes will be required in the air transport sector, both in terms of aircraft and in relation to airport facilities. In order to make decisions regarding alternative investment strategies, it is imperative that estimates of future travel volumes be made.

This paper reports the results of a research project undertaken at the University of the West Indies in order to develop a mathematical model to describe the number of visitors arriving in Trinidad and Tobago by air.

## 2. SCOPE OF DATA

Data concerning visitors from five regions of origin for the period 1966-74 were used. These regions were, the West Indies, United States, Canada, United Kingdom and Venezuela, which together accounted for 81% of all visitors to Trinidad and Tobago.

Data were obtained concerning the population and economic characteristics of the origin regions and the airfare between the appropriate origin region and Trinidad and Tobago from the five origin regions during the study period are shown in Figure 1. It can be seen that the year 1970 did not conform to the general trend of increased travel from the origin regions. This was caused by the unstable political climate that year in Trinidad having an adverse effect on the tourist industry. Consequently, all data for 1970 were excluded from the model. The airfares from the regions of origin to Port-of-Spain are shown in Figure 2. The level of airfare taken was the mean of the excursion rates available. For the London to Port-of-Spain route this included the "Earlybird" fare and for trips from U.S.A., the mean of the Miami and New York fares was taken. The per-capita incomes for the origin regions are shown in Figure 3 and the economic populations (number of persons employed) in the origin regions for the study period are illustrated in Figure 4.

The values of airfare and per-capita income for the West Indies were obtained by averaging the values pertaining to the various West Indian territories. The values of numbers of visitors from and economic population of the West Indies were obtained by summing over the region.

## 3. MODEL DEVELOPMENT

Previous forecasts<sup>1,2</sup> of future numbers of visitors have generally been based on extrapolative growth factor methods using past trends, or on the analysis

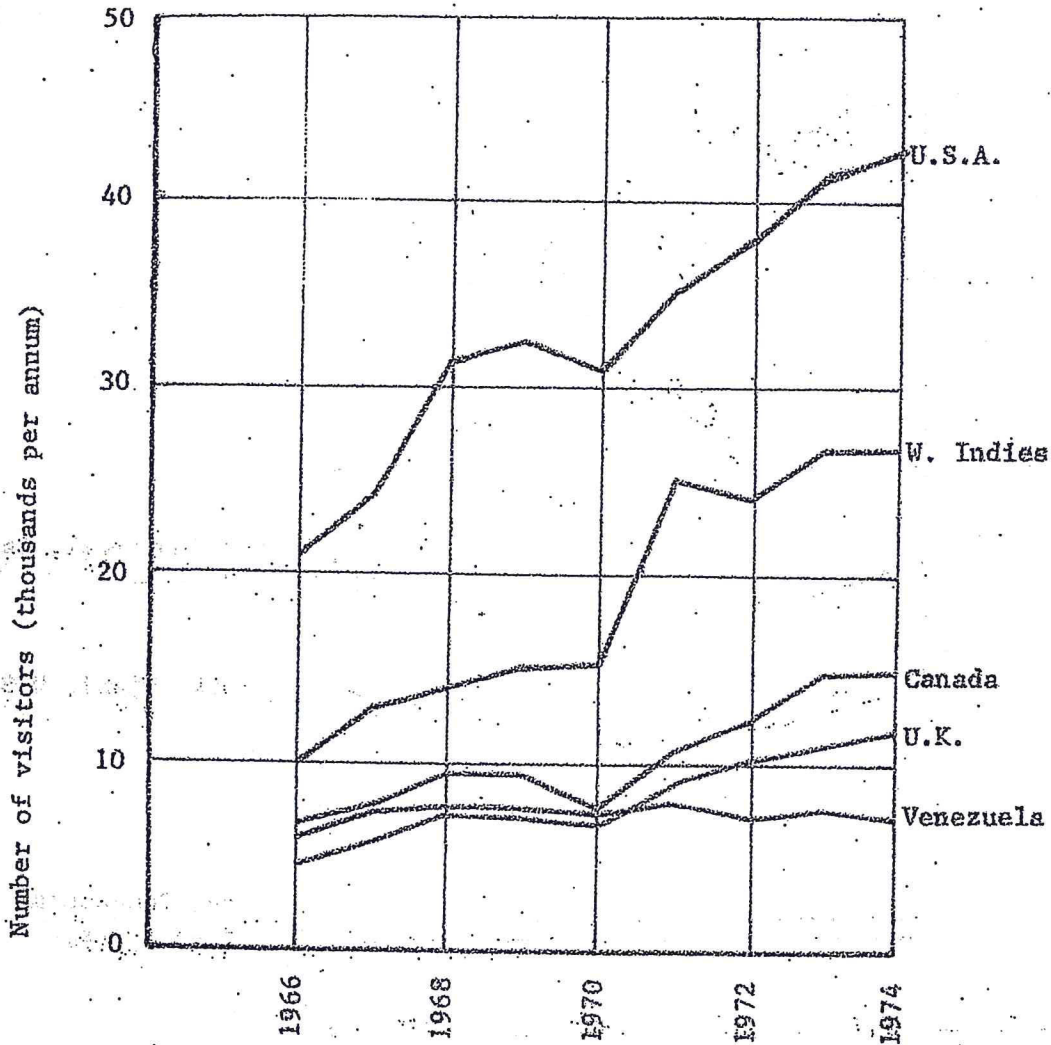


Fig. 1 : Numbers of persons visiting Trinidad and Tobago from the regions of origin under study, 1966-1974

Source : Government of Trinidad and Tobago Central Statistical Office International Travel Reports.

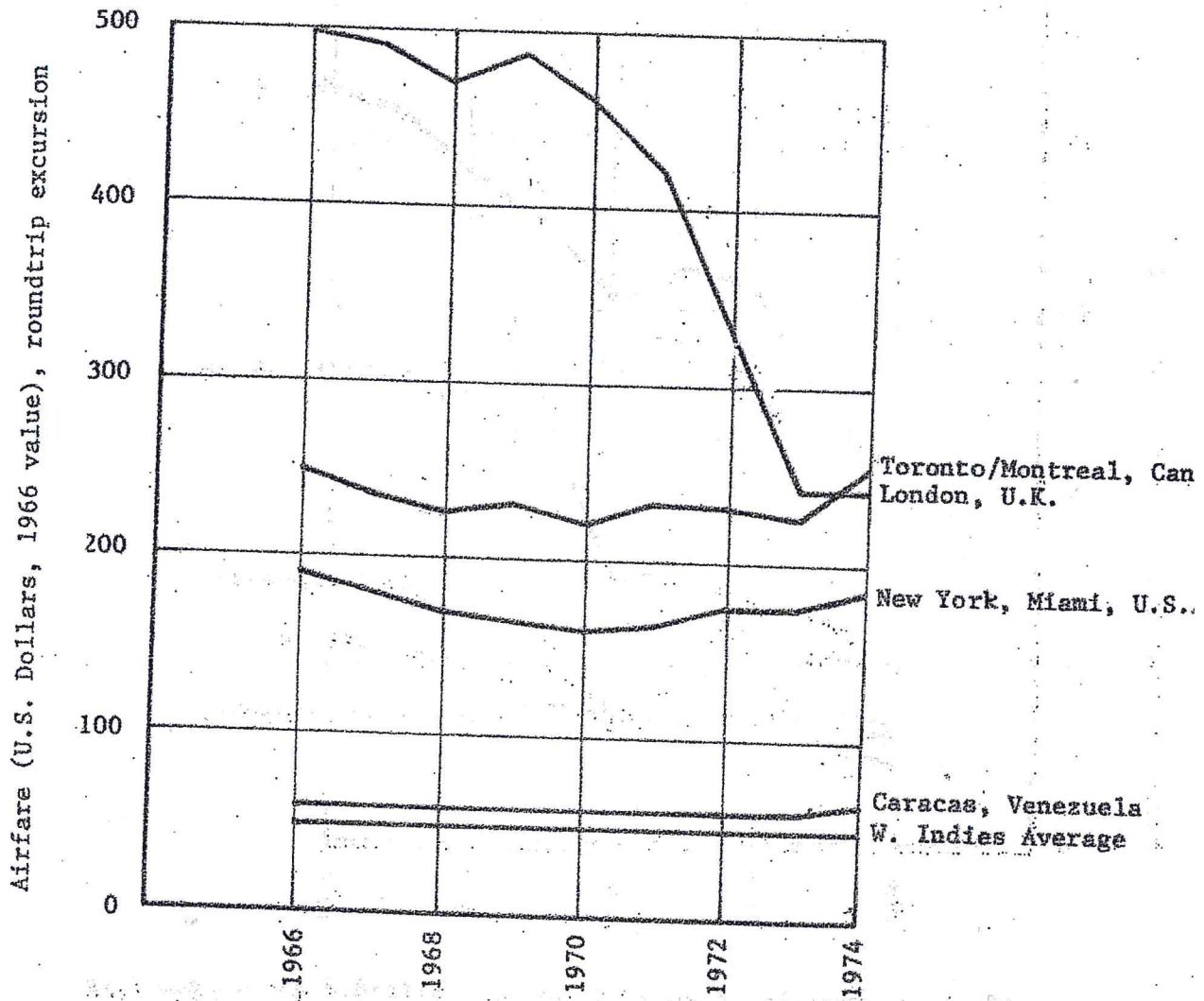


Fig. 2 : Airfare (U.S. Dollars, 1966 value) to Port-of-Spain from the regions of origin under study, 1966-1974.

Source : I.A.T.A. Air Tarrifs.

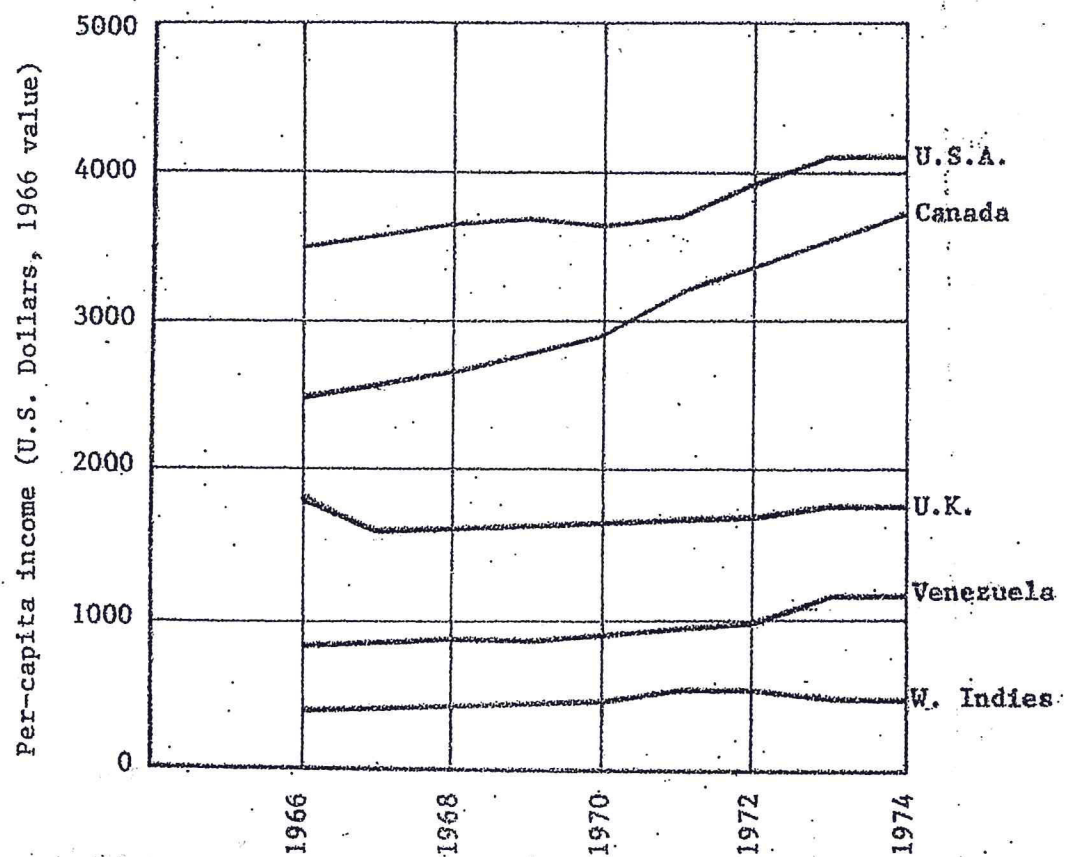


Fig. 3 : Per-capita income (U.S. Dollars, 1966 value) per annum of the origin regions under study, 1966-1974.

Source : United Nations Statistical Yearbooks.

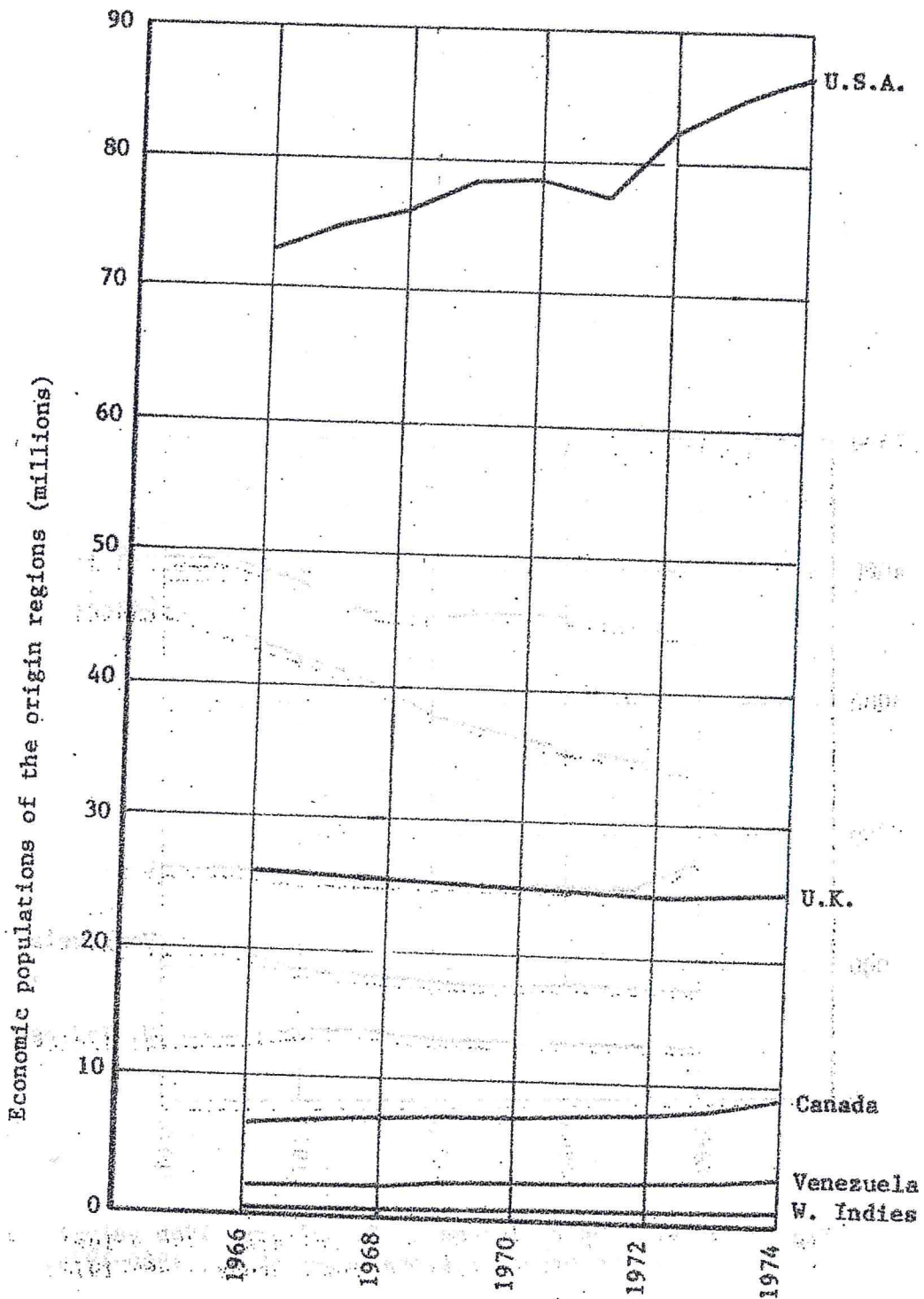


Fig. 4 : Economic populations of the origin regions under study, 1966-1974.

Source : I.L.O. Yearbooks of Labour Statistics.

of influencing factors internal to Trinidad and Tobago, without making attempts to develop causal relationships with influencing variables in the travellers' origin regions. The development of a descriptive model should seek to determine those factors which lead to growth and those factors which tend to restrain that growth.

In addition, such a model exhibit the following properties:-

- a) the modelling technique should be as simple as possible, particularly in view of the likely accuracy of the inputs;
- b) the model should be shown to be capable of accurately reproducing an existing situation;
- c) the basis of the model equation should be philosophically satisfactory;
- d) the generated values of the calibration constants should be logically consistent and intuitively realistic.

Initially, seven variables, which were considered to reflect the underlying factors in the creation of travel demand, were investigated. These were:-

1. Total population of origin regions.
2. Economic population of origin region.
3. Airfare from origin region to Trinidad and Tobago.
4. Per-capita GNP of origin region.
5. Per-capita national income of origin region.
6. Per-capita GDP of origin region.
7. Number of visitors.

The values of these variables were obtained from various literature sources<sup>3,4,5,6</sup>. Preliminary analysis indicated that the following variables bore the best relationships with the number of visitors:-

1. Economic population of the origin region.
2. Airfare from origin to Trinidad and Tobago.
3. Per-capita national income of origin region.

The modelling approach chosen was the well-tried method of multiple regression, the format being that investigated by Soliman and Sharma<sup>7</sup> to analyse travel between sixty-nine city pairs in Canada in terms of population, airfare and income.

In this present analysis, the model equation used, therefore, was:-

$$T_{ij} = A_0 \cdot (EP_i)^{A_1} \cdot (F_{ij})^{A_2} \cdot (PCI_i)^{A_3} \text{ ----- (1)}$$

where  $T_{ij}$  = number of visitors per annum from origin region (i) to Trinidad and Tobago (j)

$EP_i$  = economic population (thousands) of origin region (i)

$F_{ij}$  = airfare from origin region (i) to Trinidad and Tobago (j)

$PCI_i$  = per-capita income per annum of origin region (i)

$A_0 \dots A_3$  = calibration constants

$$\ln(T_{ij}) = \ln(A_0) + A_1 \ln(EP_i) + A_2 \ln(F_{ij}) + A_3 \ln(PCI_i) \text{ ---- (2)}$$

All money values were computed at constant (1966) values of the U.S. dollar. The values of these variables were obtained by dividing the current values of airfare and per-capita income by the appropriate indices of prices from the origin region in question. The computer program used to perform the model calibration was the Biometrics Library Program BLP2 at the University of the West Indies Computer Centre, St. Augustine, Trinidad.

#### 4. CALIBRATION RESULTS

The calibration procedure involved the determination of the best-fit values of the constants  $A_0 \dots A_3$  of Equation 1. These values together with the coefficients of multiple determination and its level of significance are shown for each of the studied origin regions in Table 1.

The calibrated models in respect of visitors from Canada, U.S.A., and the West Indies, analysed separately, gave  $R^2$  values in excess of 90% indicating a highly significant relationship. For visitors from Venezuela, no such significant relation was found to exist and for United Kingdom data no meaningful results were obtained at all. The low correlation for Venezuela data was thought to be due to the uncertain political relations between that country and Trinidad and Tobago in addition to historical, cultural and language differences. The lack of meaningful results in regard to travellers from the United Kingdom may be caused by the failure of the model to take into account family and cultural ties.

It will be noted that no value for  $A_3$  was obtained for U.S.A. data. The reason for this is uncertain but may indicate that changes in per-capita income of the order experienced during the study period for a country as wealthy as U.S.A. do not exert a significant influence on the numbers travelling.



	$\ln(A_0)$	$A_1$	$A_2$	$A_3$	$R^2$	Std. Devn	Sig of $R^2$
CANADA	8.82	1.986	-2.903	1.153	0.991	0.037	99.9%
U.S.A.	-1.13	6.466	-2.349	-	0.964	0.056	99.9%
W.I.	-5.95	2.674	-1.370	1.944	0.901	0.162	99.9%
VENEZUELA	9.95	1.043	-0.796	-	0.343	0.109	-
U.K.	-	-	-	-	-	-	-
CANADA U.S.A. W.I.	4.32	1.538	-2.592	1.684	0.968	0.109	99.9%

Table 1: CALIBRATION CONSTANTS FOR REGRESSION ANALYSIS OF THE EQUATION

$$\ln T_{ij} = \ln(A_0) + A_1 \ln(EP_i) + A_2 \ln(F_{ij}) + A_3 \ln(PCI_i)$$

where  $T_{ij}$  = no. of visitors travelling from origin region (i) to Trinidad and Tobago (j)

$EP_i$  = economic population of origin region (thousands)

$F_{ij}$  = airfare from origin region to Port-of-Spain

$PCI_i$  = per-capita income of origin region

$A_0 \dots A_3$  calibration constants

The joint data for Canada, U.S.A., and the West Indies which, it should be noted, accounted for 65% of all visitors travelling were analysed together, and the values of the calibration constants are also shown in Table 1, a highly significant level of correlation being obtained. Substituting these obtained calibration constants into Equation 1 yields the following relationship:-

$$\frac{T_{ij}}{(F_{ij})^{2.592}} = \frac{75.7 \cdot (EP_i)^{1.538} \cdot (PCI_i)^{1.684}}{\dots} \quad (3)$$

From this equation, it would seem that in general, increases in either economic population or per-capita income of the origin regions result in a greater than direct proportional increase in the number of visitors to Trinidad and Tobago.

A 1% increase in economic population would result in approximately 1.54% increase in the number of visitors and a 1% increase in per-capita income would result in an approximately 1.68% increase in visitors. The derived power index for the airfare identifies this factor as a major influence in determining the number of visitors, the model indicating that changes in the real value of airfares would precipitate substantial changes in the number of visitors, a 1% decrease in airfare resulting in an approximately 2.59% increase in travel.

Whilst this modelling approach was able to generate high levels of correlation for Canada, U.S.A., and the West Indies, it obviously did not take into account a complete set of potential influences upon demand. For example, no account was taken of the "attractiveness" of the destination region (in this case Trinidad and Tobago) for visitors, particularly tourists. Also, the standard of airline services, particularly the availability of direct flights, was not included.

## 5. CONCLUSIONS

A mathematical model was developed to describe the numbers of persons visiting Trinidad and Tobago during the years 1966-69 and 1971-74. The model took account of the influencing factors in the visitors' countries of origin (economic population and per capita income) and of the airfare between the origin region and Trinidad and Tobago. High levels of correlation were obtained in the multiple regression analysis concerning the calibration of the model using data on Canada, U.S.A., and West Indies. A general model was calibrated using data from these three regions. No meaningful results were obtained concerning visitors from Venezuela and United Kingdom.

The successfully calibrated models exhibited characteristics essential to the development of descriptive mathematical models:-

1. They were simple both in concept and calibration, using well-tried techniques.
2. High levels of correlation were obtained, indicating accurate reproduction of an existing situation.
3. The generated values of the power indices of the model equation were logically consistent.

Whilst high levels of correlation were obtained, it is apparent that the model possessed certain deficiencies, in that it failed to take account of the following demand influencing variables:-

1. the attractiveness of the destination region (Trinidad and Tobago) for visitors;

2. journey purpose;
3. airline service levels (e.g. the availability and frequency of direct flights);
4. family, historical, cultural and political ties and barriers.

Further research is needed to incorporate these factors into a model structure for Trinidad and Tobago and to develop descriptive models of similar nature for other countries within the Caribbean region to enable realistic estimates of future demand to be made. This research continues.

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