



Fitting a Multiple Regression Line to Travel Demand Forecasting: The Case of the Prefecture of Xanthi, Northern Greece

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Abstract—In the last decades, there has been substantial development in modeling techniques of travel demand estimation. Most of the techniques concerning the construction and the calibration of these models, where developed in industrialized countries of the world. In Greece, the construction and calibration of intercity travel demand follow mostly either the extrapolation of historical data, such as growth rates, or the recalibration of models initially formulated and estimated for scenarios in industrialized countries.

The aim of this paper is to identify and estimate the main variables, which affect the travel demand, and to develop models to predict it. The study is focused in the intercity passenger transportation concerning the prefecture of Xanthi in Northern Greece.

The models that have been developed and calibrated are aggregate and they are based on multiple linear regression analysis. The final demand models have statistics within the acceptable regions and, also, they are conceptually reasonable. © 2005 Elsevier Ltd. All rights reserved.

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1. INTRODUCTION

The aim of the paper is to identify and select the main variables, which affect the intercity travel demand, and to develop models to predict it in the prefecture of Xanthi in Northern Greece. The models that are developed and calibrated are aggregate and they are based on the multiple linear regression analysis. Most of the variables are not readily available.

Aggregate models of the gravity type have typically been used to estimate mode-specific travel demand while disaggregate models have normally been used for modal choice analyses of estimates of total travel demand.

One of the first approaches used was the statistical methods and especially the linear or quasi-linear regression (simple or multiple). The performance of the regression models are evaluated by

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several techniques, e.g., the correlation coefficient (R^2), analysis of variance, factor, and cluster analysis, discriminant analysis, etc. (see [1,2]).

Alcaly [3] summarized the application of regression analysis in estimating time series demand models in air Transport. Quandt and Baumol [4] made a notable contribution to such models in an attempt to explain not only total travel demand, but also travel by mode.

Lave [5] re-examines some demand models based on regression analysis that have been estimated and stressed the limitations of these models. He generalized and re-estimated some of these models and suggested a more general class of demand models based in this analysis. He also pointed out some of the inherent limitations of these models.

Lioukas [6] estimated a multinomial logit model for interurban travel in Greece, but due to its functional complex structure, it does not lend itself to easy estimation and ultimately he changed it into a linear one.

More recently, Alfa *et al.* [7] used regression models for estimating bus running times for fixed-route and fixed-schedule transit service in Winnipeg, Canada.

The method has been criticized for having drawbacks. Despite its shortcomings it is still in use for its simplicity and where other more complex methods fail to perform satisfactorily.

Cohen *et al.* [8] developed a model to predict the mode split in the New York–Buffalo Corridor. Thirty-one city pairs were split included in the study area. The “total demand” model was a gravity type model with a pivot-point analysis to reduce the forecasting error. A binary logit model was used for the mode split model. Ellis, Rassam and Bennet [9] applied a similar mode split model for intercity passenger travel using the 1967 National Travel Survey. They used aggregate travel information and the least squares method for estimation.

Most intercity models constructed until now are of aggregate type: gravity, MNL, logit, nested, probit, etc. Disaggregate models are used mainly for urban travel demand. A new attempt made to apply disaggregate models to intercity modeling have limited success.

Rice *et al.* [10] and Koppelman *et al.* [11,12] reviewed some of the better known models in intercity travel demand. They discussed the calibration and application contexts, the peculiarities and the characteristics of these models. Kanafani [13] has reviewed much of the earlier on air travel demand models.

Hutchinson [14] has reviewed attempts made in Canada to model air travel demand using aggregate and disaggregate demand models. He concluded that “most of the models estimated so far have very limited success in reflecting changes in the spatial socioeconomic organization and/or in the transport milieu . . .”.

In conclusion, most of the aggregate travel demand models in intercity transport presented until now manage to predict future demand and modal split, so far as there is not much change in the forces driving the market, such as spatial distribution of economic activity and their economic linkages. As far as the disaggregate travel demand models in intercity transport are concerned they have limited success. The reason is that the structure of the utility functions has been difficult to interpret in any behavioral sense and they are insensitive to changes in levels of services provided by the transport mode.

In Greece, the construction and the calibration of intercity travel demand models is not well developed. The few documented attempts at calibrating intercity travel demand follow either the extrapolation of historical data, such as growth rates, of the recalibration of models initially formulated and estimated for scenarios in industrialized countries.

Although the theoretical basis in the formulation of travel demand models is universally valid, the internal organization and the travel behavior among the societies are distinctly different. Even societies in various parts of the same country differ much. Thus, models developed in this way have limited success in forecasting the travel behavior of the Greek society.

In the following sections, aggregate models for intercity auto travel demand in Xanthi, Northern Greece using multiple linear regression analysis are presented.

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