AFFIRMATIVE PARAMETRIC STUDY OF DIFFERENT ECONOMETRICS OF PASSENGER ROAD TRANSPORT CORPORATIONS OF THE SELECTED DEVELOPED AND DEVELOPING STATES

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ABSTRACT

This paper describes the main objectives of the study. By using the development index based on the composite rank, the stratified sampling model has been applied. Next section of this paper deals with the nature and sources of data. Various concepts relating to cost, production, revenue, and efficiency of Passenger Road Transport have been defined along with their measurement and specification. Econometric models used in the study have also been discussed briefly. This study is based on the secondary data.

The necessary information and data relating to cost, revenue, productivity, loss and profit, and various indices have been collected from the performance statistics of State Transport Undertakings, an annual publication of Central Institute of Road Transport, Pune. Annual reports of the Passenger Road Transport Corporations of the sampled states have also been considered.

INTRODUCTION

The cost of Passenger Road Transport is of crucial importance to the transport planners, economists, and policymakers. It provides the empirical basis for understanding the financial characteristics of a Passenger Road Transport system and its organization. There are two important aspects of cost analysis in Passenger Road Transport. First, it describes the different ways in which the cost is defined and measured, the different types to study the cost component-wise, and reviews various ways to analyze transport cost in order to throw light on the relationship between inputs and output in Passenger Road Transport. Secondly, it discusses the Passenger Road Transport cost function to study the variation of costs with the level of output.

The nature of this study is comparative in which the results of the states of two strata have been compared. For this purpose, the data of the sampled states in each stratum have been pooled in terms of adding and then taking averages.

This study considers only the Passenger Road Transport Corporations. Thus, the other Passenger Road Transport undertakings i.e., Municipal Undertaking, Government Departments and Companies have not been taken in the preview of this study.

OBJECTIVES OF THE STUDY

The main objectives of this study are as given below—

1. To estimate the total and unit cost of Passenger Road Transport in developed and developing states of India.
2. To identify and analyze the various determinants of cost of Passenger Road Transport and thereby estimate the cost function.
3. To identify the determinants of Passenger Road Transport output and their quantitative influence and thereby estimate the production function.
4. To estimate and analyze the Passenger Road Transport cost and output differentials by decomposing them into efficiency and scale effects.
5. To identify the factor determining the Passenger Road Transport revenue and thereby estimate the revenue function.
6. To study the efficiency in Passenger Road Transport through the estimation of physical and financial criteria

SAMPLE DESIGN

This study has applied as a definite plan for obtaining the required samples. The major steps regarding the sample selection adopted for the present study are analyzed as below—

Stratification of States

All the twenty-one states of India[1] have been given ranks in descending order as per the indices of literacy (*l*), work participation (*w*), density (*d*), per capita net domestic product at current prices (*n*), road length (*r*), buses per lakh of population (*b*), and total expenditure on Passenger Road Transport activity (*e*)[2]. In this way each state has seven different rank orders which have then been summed up and this sum has again been ranked in ascending order. This ranking format can be explained as below—

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[1]. There are 26 states in India. Only the Passenger Road Transport Corporations are in the preview of this study, so the 21 states having passenger Road Transport Corporations have been considered for the purpose.

[2]. The dada regarding *l*, *w* and *d* have been taken from the 1991 census. The information about *n* is of the year 1991-92. The data about *r* and *b* have been taken for the year 1988-89 while the information about *e* is for the year 1992.93

Suppose $r_i^l, r_i^w, r_i^d, r_i^n, r_i^r, r_i^b,$ and r_i^e are the ranks given to ith state on the basis of *1*, *w*, *d*, *n*, *r*, *b*, and e respectively (where *i* = 1, 2, 3....21). Adding all these seven ranks a composite rank for ith state (R_i) has been defined. Thus,

$$R_i = r_i^l + r_i^w + r_i^d + r_i^n + r_i^r + r_i^b + r_i^e$$

These composite ranks have then again been given ranks in the ascending order and symbolized as R_i^*. In this way, the states having R^* from 1 to 7 have been put into the I stratum, states having R^* from 8 to 14 have been included into the n stratum and the states having R^* form 15 to 21 have been put into the III stratum.

Hence, the I stratum includes the states with higher composite ranks of all the considered development indicators. The n stratum includes the states with medium composite ranks of the indicators of development while the in stratum includes the states with lower composite ranks of *l*, *w*, *d*, *n*, *r*, *b* and *e*. Appendix A-2.1 shows the stratification of states attempted in the procedure.

In this way the states of I stratum represent the developed states, while the states of n stratum are the semi developed states. Finally, the states of HE stratum are the less developed states.

Sampling of States

To examine whether there is significant difference between the different variables relating to the Passenger Road Transport Corporations of the states included in samples in three different strata, the means and variances of cost, revenue, capacity utilization, fleet utilization, and no. of passengers carried have been tested While taking the sample of states, two states have been considered from each stratum. Thus, the states of Maharashtra and Punjab have been considered from the I stratum, states of Andhra Pradesh and Uttar Pradesh from n stratum, and the states of Orissa and Tripura have been taken from the m stratum.

Table1: Sample of States

Stratum I: Developed States	Stratum I: Developing States
Maharashtra	Uttar Pradesh
Punjab	Orrisa
Andhra Pradesh	Tripura

Measurement and Specification

For the estimation of total and unit cost, total and unit and revenue, and various aspects of physical and financial efficiency regarding Passenger Road Transport, following procedures have been adopted.

(A) Estimation of Passenger Road Transport Cost[3]

The total transport cost is the sum of personnel cost, material cost, taxes, interest, depreciation and other items.

This study considered the four measures of Passenger Road Trans-port output so there are four types of unit Passenger Road Transport cost, relating to each measure of transport output. These are—

(a) $UCSK_i = \frac{TC_i}{SK_i}$

where, *UCSK*—unit Passenger Road Transport cost regarding seat kms, *TC*—total Passenger Road Transport cost and *SK*—seat kms.

$i = 1, 2, 3.....n$ are the years considered in the study.

(b) $UCPK_i = \frac{TC_i}{PK_i}$

where, *UCPK*—unit Passenger Road Transport cost regarding passenger kms, *TC*—total Passenger Road Transport cost and *PK*—passenger kms.

$i = 1, 2, 3.....n$ are the years considered in the study.

(c) $UCEK_i = \frac{TC_i}{EK_i}$

where, *UCEK*—unit Passenger Road Transport cost regarding effective kms, *TC*—total Passenger Road Transport cost and *EK*—effective kms.

$i = 1, 2, 3.....n$ are the years considered in the study.

(d) $UCPC_i = \frac{TC_i}{PC_i}$

where, *UCPC*—unit Passenger Road Transport cost regarding no. of passengers carried, *TC*—total Passenger Road Transport cost and *PC*—no. of passenger carried.

$i = 1, 2, 3.....n$ are the years considered in the study.

(B) Estimation of Revenue

The total revenue has been obtained by summing up the traffic and non-traffic revenues.

Unit Passenger Road Transport revenue has been estimated in case of each measure of Passenger Road Transport output separately according to the following procedure—

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[3]. While estimating the unit and total cost, real cost has been considered. This study considers only the real cost wherever the concept of cost is used.

(a) $URSK_i = \frac{TR_i}{SK_i}$

where, *URSK*—unit Passenger Road Transport revenue regarding seat kms, *TR*—total Passenger Road Transport revenue and *SK*—seat kms.

i = 1, 2, 3.....*n* are the years considered in the study.

(b) $URPK_i = \frac{TR_i}{PK_i}$

where, *URPK*—unit Passenger Road Transport revenue regarding passenger kms, *TR*—total Passenger Road Transport revenue and *PK*—passenger kms.

i = 1, 2, 3.....*n* are the years considered in the study.

(c) $UREK_i = \frac{TR_i}{EK_i}$

where, *UREK*—unit Passenger Road Transport revenue regarding effective kms, *TR*—total Passenger Road Transport revenue and *EK*—effective kms.

i = 1, 2, 3.....*n* are the years considered in the study.

(d) $URPC_i = \frac{TR_i}{PC_i}$

where, *URPC*—unit Passenger Road Transport cost regarding no. of passengers carried, *TR*—total Passenger Road Transport revenue and *PC*—no. of passenger carried.

i = 1, 2, 3.....*n* are the years considered in the study.

In all the above estimates regarding total and unit revenues, the real revenue has been considered assuming 1981-82 as the base year.

(C) Estimation of Efficiency in Passenger Road Transport

To analyze the efficiency in Passenger Road Transport physical and financial criteria have been discussed.

(I) The Physical Criteria—Under the physical criterion, the following indices have been used to measures the physical efficiency.

1. Fleet Utilization—Fleet utilization is the ratio of the number of vehicles on road to the fleet held by the Passenger Road Transport organization. Fleet utilization is expressed in terms of percentage. It indicates how many of the total vehicles held are actually utilized for operation. Thus,

$$\text{Fleet Utilization} = \frac{\text{Number of vehicles on the road}}{\text{Number of vehicles held}} \times 100$$

2. **KMPL (HSD) over all**—Fuel consumption is in terms of kms obtained per litre of diesel. Low consumption of oil indicates economy in fuel consumption and higher productivity and better performance. A higher number of kms per litre will mean lower cost of production and therefore, should be termed as a higher level of efficiency.

3. **Average Tyre Kilometres**—Another indication of the physical efficiency of the transport undertaking can be the tyre kms. Tyre kms represent the life of the tyre. The average tyre kms can be worked out by dividing the effective kms given by all the tyres by the number of tyres used in the particular year.

$$\text{Average Tyre Kilometres} = \frac{\text{Effective kms given by all tyres}}{\text{Total number of tyres}} \times 100$$

4. **Regularity Index**—Quality of service is also a measure of physical efficiency of Passenger Road Transport. The regularity index can be used as a representative index of the quality of service. The purpose of the transport undertaking is to provide passenger transport facilities to public economically, adequately, and efficiently. The regularity index is defined as below—

$$\text{Regularity Index} = \frac{\text{Trips operated}}{\text{SCheduled tripes}} \times 100$$

5. **Bus Utilization**—Bus utilization is also known as vehicle productivity or the productivity of capital. It is the ratio of total effective kms to the total number of buses on road. Thus,

$$\text{Bus Utilization} = \frac{\text{Total effective kms}}{\text{Total number of buses on the road}} \times 100$$

6. **Manpower Productivity**—The manpower productivity is a complementary input to the capital in Passenger Road Transport. The manpower productivity can also be regarded as an index of physical efficiency. It is defined as below—

$$\text{Manpower Productivity} = \frac{\text{Total effective kms}}{\text{Total number of employees}} \times 100$$

7. **Average Passenger per Bus per Day**—Average passenger per bus per day is the average no. of passengers carried by one bus in one day. It may be regarded as the vehicle productivity in reference to the passengers carried. This index is defined as below—

Average Passenger per Bus per Day

$$= \frac{\text{Total no. of Passenger carried}}{\text{Total number of buses on the road} \times 365}$$

Econometric Analysis

The various empirical relationships have been examined and discussed by applying the Ordinary Least Squares method of estimation. The econometric analysis regarding cost, revenue, and output have been dealt in all the following areas:

(a) Estimation of Trends

Trends have been estimated through linear, quadratic, and exponential models: x total cost, total personnel cost, total material cost, total cost excluding interest and depreciation, per staff payment, and unit costs regarding seat km, passenger km, effective km, and no. of passengers carried. Trends have also been estimated through the above three models for traffic revenue, non-traffic revenue, and total revenue.

The Passenger Road Transport activity has been studied by estimating the trends through linear, quadratic, and exponential models for seat km, passenger km, effective km., no. of passengers carried, vehicle productivity, and manpower productivity.

(b) Estimation of Passenger Road Transport Cost Function

Passenger Road Transport cost functions have been estimated under the size-cost relation approach. Cost functions for total and unit costs have been estimated in linear, quadratic, cubic, reciprocal, and log linear forms. Scale elasticises with respect to different measures of Passenger Road Transport output have been estimated by fitting the total cost curve in multiplicative form.

Under the determinant of cost approach, total and unit cost functions have been estimated by considering the different combinations of various determinants of Passenger Road Transport cost. These cost functions have been fitted in additive and multiplicative forms.

All the above cost functions have been estimated through the technique of Ordinary Least Squares.

(c) Estimation of Cost Differentials

Cost differentials between the Passenger Road Transport system of developed 2nd developing states have been estimated and decomposed into efficiency and scale effects.

(d) Estimation of Passenger Road Transport Production Function

The Passenger Road Transport production functions have been fitted for all the considered measures of transport output considered in the study in additive and multiplicative forms. Various determinants of transport output have been used in different combinations in various estimated models. The function coefficient has also been calculated with the help of the estimated output elasticises. Ordinary Least Squares method has been used for the estimation.

(e) Estimation of Output Differentials

Output differentials between the Passenger Road Transport system of developed and developing states have been estimated and decomposed into efficiency and scale effects.

(f) Estimation of Passenger Road Transport Revenue Function

The revenue functions have been estimated under size—revenue relation and determinants of revenue approaches. Under the size-revenue relation approach, revenue functions for traffic revenue, non-traffic revenue, and total revenue have been estimated in linear, quadratic, cubic, and log linear models considering the different measures of transport output.

Under the determinants of revenue approach, the total revenue functions have been estimated by considering the different combinations of various determinants of revenue. These revenue functions have been fitted in additive and multiplicative forms. The estimation technique used is the Ordinary Least Squares.

LIMITATIONS

The limitations from which this study suffers are discussed as below—

1. While collecting the data about cost, output, and revenue some information was not available for one or two years. This problem was solved by applying the technique of interpolation.
2. The flexible and better form of cost function applied to Passenger Road Transport sector is the translog cost function which has not been estimated in this study because of the non-availability of data for the sufficient number of years.
3. The Passenger Road Transport service deals in both passenger and luggage. While taking the transport output into account the luggage component has completely been ignored.
4. The study considers only the recurring costs and ignores the non-recurring cost because of the measurement and calculation difficulties.

CONCLUSION

Various objectives of this study have been described on which this study is based. A development index based on the composite rank has been developed and used for the stratification of states in India. All the states have been grouped into two strata: Developed states and developing states. Various concepts relating to cost, production, revenue, and efficiency of Passenger Road Transport have been defined and measured. Econometric models used in the study have been discussed in brief.

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