CHAPTER 3

Chapter 3

TRENDS AND ANALYSIS OF REVENUE OF INDIAN AIRLINES

3.1 INTRODUCTION

The amount of revenue earned by an enterprise, among other things, depends upon the objectives of the enterprise. These objectives are reflected in the pricing policy of the business. In private enterprises, usually, fixation of price is not a difficult task, as they are generally guided by the commercial motives. However, in case of public enterprises, which are mostly public utility in nature, selection of an appropriate price structure and policy is not an easy task, as here profit making may not be the only goal Thus, before deciding about a pricing structure and policy of a public enterprise, it is necessary to examine whether a public enterprise should aim at profit maximisation or some other objectives. In the present chapter, therefore, an attempt is made to examine the objectives of a public enterprise, which is public utility in nature, and accordingly suggest a pricing system for the Indian Airlines keeping in the background, various alternative methods of pricing open for such enterprises.

The amount of revenue earned, besides the price of the product, also depends upon the quantity of output sold, which in turn is governed by various determinants. Thus, an attempt is also made to estimate the demand functions for the Indian

Airlines. As determinants of demand for passenger services are somewhat different from those of demand for cargo services, a separate sets of demand functions have been estimated for passenger and cargo services of the Indian Airlines.

3.2 OBJECTIVES OF A PUBLIC SECTOR ENTERPRISE

Regarding the objective of a public sector enterprise, some stress that a public sector enterprise should aim at welfare maximisation, while others give importance to the aim of profit maximisation by a public enterprise, as they hold the view that the maximisation of profit automatically takes care of the welfare objective also. Their views for and against profit making are discussed below.

3.2.1 No Profit No Loss Theory

Traditionally, it has been felt that the public enterprises should not be run on the objective of profit maximisation. The view is held that public enterprises should aim at maximisation of community's welfare rather than profit. One of the staunch follower of this view, W. Arthur Lewis opines, "The sort of price policy that a public corporation ought to follow can be stated simply in two rules:

i) It should make neither a loss nor a profit after meeting all capital charges; and

ii) the price it charges for different services should correspond to relative costs".[1]

In other words, Lewis suggested that corporation should fix their price in such a way that it just breaks-even at the end.

Similarly, INRICE Theory Committee states that "As a general rule public undertakings - while complying with the rule of economic viability, which applies to them also, - should refrain from seeking maximum profit and operate directly with a view to promoting the general interest".[2]

3.2.2 Profit Theory

Against the above arguments, some feel that when the responsibilities and the activities of the state are widening, public sectors should not only maintain themselves but they should also provide for their own expansion in such a way that it could ease the burden of tax payers. Rao (1962), favouring profit-making theory, observes that "...public enterprises must make profits and the larger the share of public enterprises in all enterprises, the greater is the need for their making profits. Profits constitute the surplus available for savings and investment on the one hand, and contribution to national social welfare program on the other; and if the public enterprises do not make profits, the national surplus available for stepping up the rate of investment and the increase of social welfare will suffer a corresponding reduction....Hence the need for giving up the irrational belief that public enterprises should by definition, be run on a no profit basis".[3]

In the same way the Taxation Inquiry Commission (1955) states that "... in certain cases where the State has made substantial investment, a policy of regulating prices so as to secure an adequate return on the capital invested, is not only unobjectionable but may, indeed, be desirable. This is particularly so in the conditions of economically underdeveloped countries, where public enterprise itself, fostered at state expense, may in turn play a role in financing the country's development".[4]

Fernandes (1982), when he was the Director General of the Bureau of 'Public Enterprises of India' undertook a study of over 120 public enterprises of India. He was surprised to discover that those "Public enterprises which were efficiently run, which were making profits and generally surpluses were precisely the enterprises which were contributing most towards the attainment of social objectives. On the other hand the inefficient enterprises and those, which were making enormous losses, were very poor in the discharge of social responsibilities... Thus, if being model employer is a social objective, it is equally necessary base for healthy management and growth of the enterprise and for creating the kind of motivations which will make for success".[5]

As the government's participation in economic activities is increasing far beyond what was envisaged by the classical economists, there is need of large revenue to finance these activities. The reliance on tax as a source of revenue to finance these activities would put a lot of burden on the taxpayers, which in turn, will affect their incentive to work and save. Thus, no profit theory does not provide a justification for proper pricing. Therefore, it is believed that government enterprises should not only be self-sustaining, but they should also provide for investment in new public enterprises. However, while pursuing the goal of profit, public enterprises should not follow a pricing policy of private enterprises, where maximisation of profits is the prime objective. Thus, an appropriate price policy for public enterprises will be the one, which achieves the dual objectives of maximisation of profit on the one hand, and the public satisfaction on the other.

3.3 THEORETICAL BACKGROUND : PRICING

Keeping in mind the dual objectives of a public sector enterprise, it is necessary to look at the alternative theoretical pricing methods in the context of the Indian Airlines.

3.3.1 Profit Maximising Prices

To ensure the earning of maximum profit, a firm must satisfy the following two conditions at the point of equilibrium:

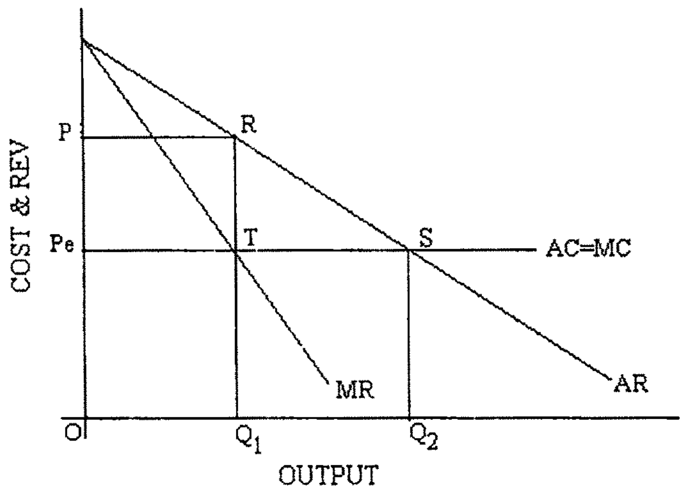
a) MC = MR and

b) MC cuts MR from the left or below.

Where, MC = Marginal Cost and MR = Marginal Revenue.

In Figure 3.1, the maximum profit earned is the area PRTPe, where both the necessary and sufficient conditions are satisfied at the point of equilibrium.

Figure 3.1 : MC Pricing, AC Pricing and Profit Maximising Pricing



This rule is compatible even in a situation of downward sloping demand (imperfect competition) and MC (decreasing cost industry) curves (Figure 3.3). The only condition required is that MC must be falling at a faster rate than the MR at the point of equilibrium. In fact, MC cannot fall faster than MR, except in the short run. In long run firms begin to dominate its market so strongly that MR falls faster than MC.[6]

3.3.2 Marginal Cost Pricing (Welfare Maximising Pricing)

As long back as in 1844, Jules Dupuit[7] suggested marginal cost (MC) pricing for public enterprises. His approach was based on certain restrictive assumptions, like cardinality of utility, interpersonal comparisons of utility, independent demand and perfect competition in other markets. Later on, Hotelling[8] (1938) also suggested the application of MC pricing principle in public enterprises and he formulated a general equilibrium model relaxing the restrictive assumptions of Dupuit.

MC rule states that so long as cost of producing an additional unit of output is smaller than the value being attached to it by the consumers, production should be increased and it should be stopped at a point where marginal cost is equal to marginal benefit (MB). If, on the other hand, MB is less than MC, production should be contracted.

If pricing is done on this basis, social benefits will be maximised. Further, this will ensure satisfaction of the Pareto optimality condition in resource allocation. Thus, each factor will get its marginal product as a reward.[9]

To maximise the net welfare of the society, social benefits and social costs are taken into account. Total benefits to a society are measured by the summation of total revenue and consumer surplus. Social costs may include various external diseconomies, distortion due to taxation, tariff subsidies etc.

$$\delta(TR + S)/\delta q = \int P(Q')\,\delta Q' \text{ (area under demand curve)}$$

$$= P(Q)$$

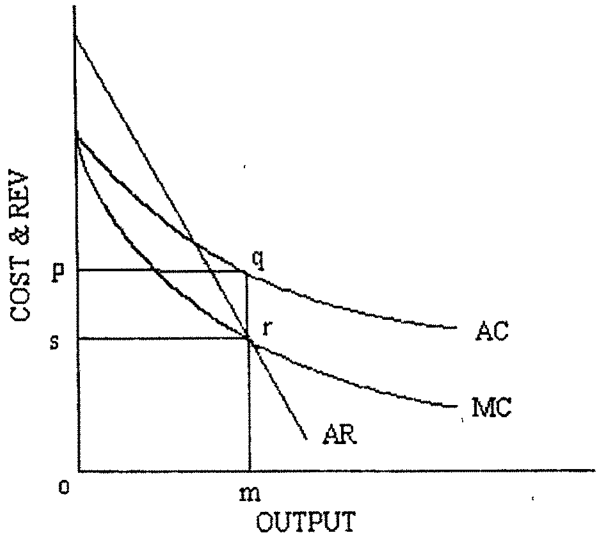
In Figure 3.1, welfare loss due to Profit maximising price (rather than MC price) is the area RST.

However, the problem with regards to application of MC pricing is peculiar in case of decreasing cost industries. As most of the public enterprises are decreasing cost industries, because of large initial investment, pricing on MC basis would involve deficit to be taken care of by the government, to facilitate the maximisation of society's satisfaction.

The Figure 3.2 depicts how a marginal cost principal of pricing in a decreasing cost industry would lead to deficit. Here MC pricing rule would result into a deficit of the area pqrs.

Hotelling[10] suggests imposition of income taxes, taxes on inheritances, taxes on the site value of land etc. Since all of these are lump sum taxes, they do not affect the price of any commodity. He further suggests that as and when public enterprises get an opportunity to earn over and above the MC, due to more demand, they should avail the opportunity, which would take care of deficit arising out of MC pricing.

Figure 3.2 : MC Pricing and Two Part Tariff



Deficit due to marginal cost pricing can, of course, be taken care of by taxation but this would involve redistribution of income, investment, work etc. This further involves making value judgement as to whether the net effect is positive, neutral or negative, which is definitely a difficult task. Similarly, in case of industry being a multi-product, assigning MC to multiple types of output is difficult, if not an impossible task.

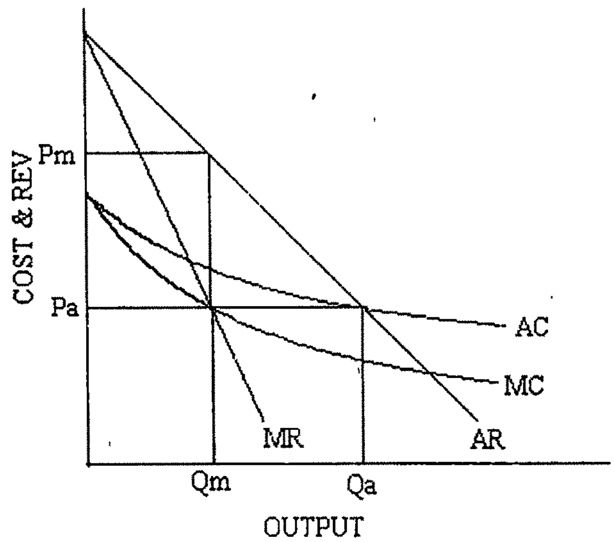
3.3.3 Average Cost Pricing

Due to various problems associated with the marginal cost pricing, some economists suggest a method of average cost (AC) pricing for public enterprises. Average cost pricing appears to be a compromise between profit maximising pricing and marginal cost pricing, thus, it provides for full recovery of the cost (including a fair return on capital).

In a constant cost industry, MC and AC solution would be the same. However, in a decreasing cost industry, AC pricing will compel the monopolist to stop his production only at the point where average cost is equal to average revenue (AR), because at any output other than this (of course, excluding at $q = 0$), total cost (TC) exceeds total revenue (TR).

AC pricing is favoured on the ground that it covers the entire expenditure, and as such does not fall on taxpayers as a tax burden. The burden falls only on those who are consumers of the product. Thus, it is self-financing. It not only covers average variable cost (AVC) but it also covers elements of average fixed cost (AFC) along with a predetermined rate of return on capital.

Figure 3.3 : Profit Maximising Pricing and AC Pricing in a Decreasing Cost Industry



However, there may be administrative difficulties in finding AC and AR equality with regards to each product and thus, may involve unnecessary administrative cost. Therefore, it may be desirable sometimes in a multi-product industry, to charge the same average variable cost from different related products or services. For example, the postal department charges the same price, within the country, irrespective of the distances.

However, the greatest limitation of this method is that it covers up the inefficiency of the enterprises, and as such, entrepreneurs do not have incentives to bring about efficiency in their functioning. This inefficiency is ultimately borne by consumers in terms of paying higher prices. Second limitation of this method is that when a fair return is allowed on the size of capital, firms have incentive to go for capital incentive techniques only, although this selection may not be feasible from economic point of view. Third criticism that is raised against this method is that it does not take in to account value of service from consumer's point of view. Fourthly, AC pricing cannot take into account the social cost associated with the production process. Fifthly, estimation of correct amount of depreciation is yet another difficulty with this method.

3.3.4 Second Best Pricing Rule: Two Part / Multi Part Tariff

Both, AC pricing and MC pricing rules have their own merits and demerits. Thus, combining the two methods together can obtain a better solution. That is, satisfying the MC pricing condition (MC = price) and at the same time also satisfying the condition that TR = TC. This can be done by following a two part / multi part tariff. Under two part tariff, a consumer has to pay a lump sum fee as well as a per unit charge. The per unit charge must equal long-run marginal cost (Paretian rule) and the lump sum fee must be fixed in such a way that the total revenue collected (quantity sold × the unit charge) plus lump sum fee × the number of consumers is equal to the total cost.[11] Thus, this method attempts to minimise the loss by not purely sticking to MC pricing rule. In Figure 3.2, a consumer has to pay marginal cost, which is mr plus contribution towards deficit, which is the area pqrs divided by the number of consumers. However, the problem with this method is that when fixed cost is huge in relation to the total cost (as is the case with most of the public utilities), it will reduce the number of consumers, which will as a result, undo the very purpose of marginal cost pricing.

To overcome this difficulty, multi-part or declining block tariff system is suggested. Here, different blocks are set according to the level of output. Prices charged declines with lower blocks and price from the last equals the LRMC of the product. Surplus earned from higher blocks compensates for the deficit arising out of LRMC pricing.

3.3.5 Ramsey Pricing

Ramsey[12] (1927) suggested a pricing rule in the context of optimal taxation. In simple form it is written as: (ignoring the cross elasticity)

$$P_i - MC_i / P_i = k(-1/e_i), \qquad i = 1, 2, \ldots\ldots\ldots\ldots n$$

Where, MC_i is marginal cost of producing the i^{th} unit, e_i is the price elasticity of demand of the i^{th} good, k is constant associated with the budget constraint, and P_i-MC/P_i is the mark up.

As per this rule, price should be charged in such a way that price cost margin for any good is proportional to its inverse price elasticity. Thus larger the price cost margin, smaller is the absolute value of its price elasticity. Ramsey pricing rule, thus, takes in to consideration the value of service principle.

3.3.6 Peak Load Pricing

A particular plant's capacity is made according to the level of demand, assuming other things given. However, due to some reasons, there may be fluctuations from an expected level of demand, resulting into either excess / idle capacity.

In short run, the size of the plant is given. However, for various reasons demand may not remain same over a period of time. There may be more demand than the normal in a particular month, season, day or hour. The period at which the highest demand occurs is called as the peak period and the demand as the peak demand. In different industries the time and duration of peak will be different, depending upon their determining conditions. On the other hand, there may be a very poor demand at the other point of time. The peak / low demand being a short-term phenomena, does not suggest change in the size of the plant. Thus, under such situations, principle of maximisation of profit would suggest to charge different prices in different periods in such a way that in every period demand and supply match. With given supply. it is demand only, which becomes an important factor during other than normal period. During peak time price mechanism may set a price, which will not only cover AFC and AVC, but it will also allow a firm to earn surplus. This surplus compensates for the deficit being made during the off periods.

After having examined the theoretical backgrounds of pricing, which are generally followed in public enterprises, the historical background of pricing in domestic civil aviation is analysed below, so as to suggest an appropriate pricing system, which satisfies the dual objectives mentioned earlier.

3.4 HISTORICAL BACKGROUND OF PRICING POLICY IN CIVIL AVIATION INDUSTRY OF INDIA

Before nationalisation, the existing airlines, depending upon their economies and diseconomies of operation, were charging different fare rates. When the Indian Airlines took over these airlines, it had to evolve a fare and freight structure, which would satisfy the goals it was set to serve. It may be mentioned here that before nationalisation of domestic airlines, Air Transport Licensing Board (ATLB) used to regulate fare and freight rates. It set maximum and minimum limits with regards to fare rates per passenger mile and freight rates per ton-mile. On 15th July 1955, the Minister of Communication (air transport system was then under it), decided to call upon Air Transport Council (ATC) to re-examine the fare and freight structure of Indian Airlines; and also suggest the basis for the determination of passenger and freight rates. The ATC in its report (1957), observed the following points with regards to passenger fare and freight rates:

A) Passenger Fare

The ATC identified some main objectives to be fulfilled by the rate structure. It classified the objectives into two parts: commercial and social. With regard to the commercial objective, the council stated that the air transport should not be a burden for the taxpayers; it should cover at least its cost of operation. There was, however, disagreement among members with regard to the social objectives. Taking into consideration the divergent views, the council finally stipulated the following objectives of the rate fixing:

i) It should stimulate maximum economic volume of traffic. This would not only serve commercial objective via increasing total revenue, but also serve the social objective of making it available to larger population.

ii) It should generate large surplus on high-density traffic routes to compensate, as long as possible, for the loss making routes.

iii) It sustains and promotes air traffic by creating a preference for it, on account of its inherent advantages.

The Council sought to establish a relationship between Airfare and AC railway fare. It, however, observed that there is no scientific basis to relate these two on account of:

i) The unit cost of any selected group of stage length of air route and rail route does not correspond.

ii) The rail and air distance between the two given stations are generally different.

iii) While in the railway route the share of air condition class was hardly 0.6 per cent of the total revenue, in air route the revenue from a single class of passenger was 60 per cent of the total revenue.

On the subject of Commercial principle of rate making, it recognised the two principles:

a) Cost of service, and

b) Value of service

The council stated that in normal conditions, cost of service should determine the lower limit and the value of service the upper limit. But this principle cannot be followed because fare rate based on cost basis would be so high that it would limit the demand. However, it further stated that to make fare rate reasonable, it should be related to cost. In case of air transport, cost per unit falls more sharply with the haul of services as compared to the other modes of transport. This is because with the increase in haul of services, a huge fixed cost is spread over to larger kilometres performed. Therefore, the Council suggested that the fare should be based on a tapering structure.

Preferring the application of the 'value of service' to 'cost of service' principle for short haul services, the council gives the following two reasons in its support:

i) Cost on short haul services would be so high in comparison to other modes of transport that it will drive airline services out of market.

ii) The difference of time taken by air and other modes of transport declines with distance, lowering consumer's preference for air to other modes of transport. Therefore, it suggested fixation of fares lower than what it would be required on purely cost basis.

The tapering design suggested by the 'Air Transport Council' for all types of aircraft' is shown in Table 3.1.

Table 3.1 : Tapering Design

Mileage Slab (miles)	Rate per each pax. Mile (Paise)
1-30	66
31-100	50
101-200	49
201-500	46
501- 900	43
901 and above	40

Source: Nawab A. W., 1967, p. 295.

B) Freight Rates

The ATC also discussed the reasonable freight rates. It recognised the need for charging different rates for different commodities depending upon its value.

In view of the elastic demand for freight, while fixing the freight rates, it suggested the consideration of the following factors:

i) Physical, transportation, and the economic characteristics of the cargo,

ii) Social utility of the cargo,

iii) Historical or other considerations,

iv) Competition from similar and other modes of transport.

Thus, it concluded that the freight rates should be flexible so as to take in to account the above-mentioned factors.

3.4.1 An Appropriate Pricing Policy for Indian Airlines

In the light of various theoretical concepts of pricing discussed, a suitable pricing method for the Indian Airlines can now be examined. The selection of a particular method of pricing is subjective, as it depends upon number of factors. However, keeping in mind the main objectives and constraints of a given public utility, one can always prefer one pricing method to the other.

Therefore, while suggesting a fare structure, the following factors have to be considered:

i) Pricing should be such that it allows a regular and satisfactory volume of service required by customers,

ii) It makes it financially self reliant,

iii) It promotes the growth and the maximum development of the market,

iv) It allows new entry into the market, making addition to the quality supply a spontaneous process,

v) It allows a reasonable growth of capital formation,

vi) It should allocate the total cost of service among different class of customers in a justified manner

It was seen earlier that the marginal cost pricing maximises the welfare of the society, and thus, from the consumer's point of view it is the best pricing principle. But the application of this method is possible only if there are economies of scale. In case of decreasing economies of scale, however, this method leads to the problem of deficit.

It is pertinent to note here that in airlines industry with longer flight hour, marginal cost falls sharply. In other words, airlines are a case of decreasing cost industry. This being so, application of MC pricing will lead to deficit. Thus, it becomes necessary to consider an alternative method of pricing - second best pricing rule. In second best pricing rule, multi part tariff suits the most for the Indian Airlines. For, it ensures the satisfaction of the condition of price = LRMC (long run marginal cost), and at the same time it also ensures the equalisation of TC and TR. The 'Air Tariff Committee Report'[13] (1989) did it by dividing the whole range of output into several increasing blocks (of the same size), and considering output of each block as a unit. There is, then, declining LRMC for higher blocks. It then suggested charging the corresponding LRMC from each block, which is the average cost of producing the output of a respective block.

Although the situation has changed from 1989, when the 'Air Tariff Committee Report' was submitted; and as now the Indian Airlines is no more a monopoly, its recommendations about the fare structure are still relevant. Fare below the long run marginal cost, either on short or long haul services, will only discourage the small private airlines in the industry as they may find it difficult to compete with the Indian Airlines at low fares. In addition, it will also call for either heavy cross subsidisation between short and long haul services or deficit to be taken care of by the government. Both of these alternatives are, however, detrimental to the health of the airlines industry of India. Fares at par with the LRMC, on the other hand, will not only make the Indian Airlines self-reliant financially, but it will also promote healthy and sound competition among airlines, resulting into the quality and the stability of the output. Therefore, implementation of LRMC pricing principle holds the key for the healthy growth of domestic airlines industry of India.

3.5 DEMAND FUNCTIONS : THE INDIAN AIRLINES

Demand function identifies the functional relationship between demand for a good and its major determinants. This helps a business in manipulating its demand through some of these determinants. Further, demand function facilitates demand forecasting which helps a business in decision making with regard to the level of output to be produced even before the factors of production are employed.

Keeping in mind the various utilities of the demand function, an attempt is made here to estimate the following two separate demand functions for passenger and cargo services for the Indian Airlines.

3.5.1 Passenger Demand Function : Determinants, Estimation and Findings

Following are the main factors, which affect the passenger demand for the air services.

i) Gross Domestic Product

Air travel being expensive is positively related with the growth of real gross domestic product.

ii) Industrial Growth

Another factor that contributes to air transport demand is the growth of industrial production. Fast growth in industrial production speeds up the economic activities and thus, the need for a speedy mode of transport – air transport.

iii) Cost of Travel

Yet another factor that affects the growth of air travel is the cost of air travel, which has a negative relationship with the demand for air services.

iv) Growth of Tourism

Growth in number of tourist from foreign countries also affects the demand favourably, as most of the tourists travel within the country by air.

A few studies have been conducted to estimate the demand function for domestic airlines industry. The Tata Economic Consultancy Services[14] (TECS) in the year 1986 developed an econometric model to forecast the demand for domestic air services for a sixteen-year period from 1970-71 to 1985-86. They regressed log of revenue passenger kilometres (RPK) on the log of gross domestic product (GDP), index of industrial production (IIP), passenger yield (PYD), foreign tourist arrivals (FTA) and the trend variable (T). The dependent variable was regressed on different combinations of independent variables. Finally, in the light of logical choice and the values of R^2, D_w and t - statistics, they selected the following model:

$$\log(RPK) = 0.334791 \log(FTA) + 1.87144 \log(GDP) - 5.53275$$

The above econometric model, however, underestimate the aggregate demand for passenger services in India. In India, it is found that in most of the public utilities including the Indian Airlines, the demand is usually greater than the supply. Many passengers are found to be in waiting list, which for most of the time do not get confirmed seat. Thus, the actual revenue flown kilometres underestimates the aggregate demand for airline seats in the country. Not surprisingly, therefore, it is the available seat kilometres, which may affect the demand more than any other determinants, mentioned above. In other words, in India, air traffic demand has been more often than not, constrained by the supply factor. Thus, while forecasting the demand for air travel, one should take into account the supply side also.

Jung[15] (1996) came down heavily on the demand-forecast model of Tata Economic Consultancy Services. He argued that the above model assumed the demand factor and the changes in demand to be independent of internal decisions of the industry, which is not correct. He further argued that the internal decisions of the industry in terms of policies and regulations get reflected in two ways: **a)** total supply and **b)** cost and yield environment. Therefore, he suggested that the inclusion of these two variables in the model will not just explain the past growth trends and factors contributing to the same, as it did in the model of TECS, but it will also provide a tool for taking internal decision and determining growth targets.

He further made reference of the traffic demand forecast model developed by Ms. Jung for the Indian domestic air market at the University of Surrey (U.K.), where it was found that the capacity and the yield both played an important role in determination of Indian air domestic market. However, due to data constraints, Ms. Jung represented the capacity and the yield parameters by a combined factor – Seat Factor and Fare Index (SFFI) - which is the rate of change of capacity and the yield from a base value. She developed the following model[16]:

$$\log (RPK) = C + 1.3 \log (GDP) + 0.3 \log (FTA) - 0.7 \log (SFFI)$$

Rashid Jung argued that the inclusion of capacity and the yield parameters in the above model offers a mechanism to the industry to manipulate the demand.

Keeping in mind the above argument, in this study, the seat capacity and the yield have been incorporated. Further, the availability of the data on capacity and the yield permitted the inclusion of these two variables separately, which helped to analyse their individual effects on passenger demand, with the data from 1964-65 to 1993-94.

The following demand functions for the passenger services are attempted in this chapter:

(a) $\log(RPK) = \beta_1 + \beta_2 \log(GDP) - \beta_3 \log(PYD) + \beta_4 \log(ASK)$

(b) $\log(RPK) = \beta_1 + \beta_2 \log(PCI) - \beta_3 \log(PYD) + \beta_4 \log(ASK)$

Where, RPK = Revenue Passenger Kilometre, GDP = Gross domestic Product at 1980-81 prices, PCI = Per Capita Income, PYD = Passenger Yield, and ASK = Available Seat Kilometre.

I. Methodology for Estimating Passenger Demand Function

Two alternative demand models are estimated with the output in physical and monetary units. Two passenger demand functions in each model are estimated for gross domestic product (GDP) and per capita income (PCI) separately, keeping other variables same. While Model I attempts to estimate the elasticity of passenger demand in physical unit, Model II provides the elasticity of revenue earned in monetary unit with respect to change in various determinants. It should be noted that in Model I, passenger yield (PYD) is used at constant prices, whereas in Model II, it is used at current prices, other determinants remaining same in corresponding demand functions of both the models.

The 'Ordinary Least Square' method of regression has been used to estimate these models.

II. Variables for Passenger demand Function: Rationale and Procedure

A) Dependent Variables

Revenue passenger kilometre is used as dependent variable in both the models. The following two alternative measures of revenue passenger kilometre have been employed for the estimation of Model I and Model II respectively:

i) Revenue Passenger Kilometre - Physical Unit

Revenue passenger kilometre (RPK) in physical unit is defined as that part of the available seat kilometres (ASK) on which revenue is earned.

ii) Revenue Passenger Kilometre - Monetary Unit

The revenue passenger kilometre in monetary unit refers to the total revenue earned from the passenger kilometres performed. In present analysis, it is measured in rupees and at current prices.

The rationale of taking two alternative measures of output for the two models is to estimate the quantitative effects of various determinants of passenger demand in physical and monetary units separately. Thus, while Model I provides measures of elasticity of passenger demand, the Model II provides the same of passenger revenue earned with respect to various determinants separately.

B) Independent Variables

The following independent variables have been considered for the two models:

i) Gross Domestic Product

Out of the two alternative measures; gross domestic product (GDP) and the index of industrial production (IIP), former was preferred to the later as the Tata Economic Consultancy Services in their domestic air forecast study preferred gross domestic product to index of industrial production on the basis of the relative values of R^2, D_w and t-statistics.[17] Including both the variables together in the model would have created the problem of multicollenearity. The gross domestic product at factor cost and at 1980-81 prices is used for the analysis.

ii) Per Capita Income

The per capita income can be defined as the national income per person of a country. Thus, it has been calculated by dividing the gross domestic product at factor cost by the population figure in the corresponding year. For both the models, it is measured at 1980-81 prices.

This variable is used in alternative demand function in both the models, where it has replaced GDP. The rationale of replacing PCI with GDP is that it is the former, which on an average indicates consumer's capacity to afford the service and not the later. In expensive services like air transport service, it is the level of PCI, which is more important for the purchase of the service than the level of GDP itself. There may be a country with a large GDP but large population as well, thus a lower per capita income.

iii) Foreign Tourist Arrivals

The foreign tourist arrivals (FTA) significantly add to the traffic demand for air. To take this factor in to account all the tourists arrived during respective years, except those from the Pakistan and the Bangladesh, have been tried in the demand functions.

iv) Passenger Yield

The passenger yield (PYD) can be defined as the revenue obtained per passenger kilometre. For Model I, PYD at constant prices is arrived at by dividing the total operating revenue from passenger services at 1980-81 prices by the revenue passenger kilometre (RPK) performed in the corresponding year. Similarly, for purpose of the Model II, PYD at current prices has been calculated by dividing the total operating revenue from passenger services by the revenue passenger kilometre flown in the related year.

v) Available Seat Kilometre

The available seat kilometre (ASK) shows the potential supply of service in a year. The rationale of including this variable has been already discussed.

vi) Trend Variable

In order to see the impact of trend on demand for passenger services, the trend variable (T) has been tried in the demand functions.

III. Trends in Output and Yields used for Estimation of Passenger Demand Functions

i) Output

The trends in alternative measures of output are shown in Table 3.2. Available seat kilometres and revenue passenger kilometres have moved in the same direction for most of the years. Available seat kilometre was 1461.25 million in 1964-65, which increased to 10532.58 million by the year 1993-94, showing an increase of 621 per cent. During this period, revenue passenger kilometre increased from 957.55 million to 7237.13 million, which is an increase of 656 per cent. There have been negative growths in available seat kilometre and revenue passenger kilometre during 1970-71, 1973-74, 1990-91 and 1992-93. Out of these, however, the major declines were experienced in the years 1973-74 and 1990-91. The reductions in available seat kilometre and revenue passenger kilometre in 1973-74 were mainly due to the following two reasons:

a) Temporary grounding of the entire fleet of HS-748, as a result of the accidents occurred in May and July 1973.

b) The problem between Indian Airlines management and the employees union kept the part of the fleet inoperative for nearly four months during that financial year.

The decline in available seat kilometre and revenue passenger kilometre in year 1990-91 was mainly because of the suspension in the operation of the entire fleet of Airbus A-320, following the Bangalore air crash. From the year 1974-75 to 1978-79, there has been a consistent growth of available seat kilometres and revenue passenger kilometres. The year 1988-89 saw a severe crunch from the capacity side. This was due to the grounding of two Boeing B-737 aircrafts for repair following accidents for a considerable period of time and the complete damage of a Boeing B-737 at Ahmedabad crash in October, 1988. However, in spite of reduced capacity, due to better utilisation there was a small increase in revenue passenger kilometre.

In the year 1989-90, shortage in supply was made up with the induction of A-320 in a phased manner from July 1989. However, the performance was affected due to industrial unrest and grounding of A-320 following the Bangalore air crash. Due to the full fledge operation of A-320, there was an improvement in both available seat kilometres and revenue passenger kilometres during 1991-92.

Revenue earned from passenger kilometre performed at current prices has been growing steadily. There were negative growths only in 1970-71 and 1973-74, mainly due to the reduction in available seat kilometre and revenue passenger kilometre

ii) Yields

The trends in two alternative measures of yields can be seen in Table 3.3. The Passenger yield at 1980-81 wholesale prices shows only a 12.06 per cent increase between the years 1964-65 and 1993-94. In the year 1964-65 the yield was Rs. 0.69 per RPK, which increased to only Rs. 0.78 per RPK in the year 1993-94. It can be noticed that yield at constant prices has remained below the 1964-65 level for the years prior to 1991-92.

The passenger yield at current prices has increased from Rs. 0.18 in 1964-65 to Rs. 2.11 by the year 1993-94, which is an increase of 1057 per cent. Major increases came in 1974-75, 1980-82, and in the last five years from 1989-90 to 1993-94.

Table 3.2 : Available Seat Kilometre and Revenue Passenger Kilometre of Indian Airlines

(in million)

Year	ASK	Index	RPK	Index	RPKM (Rs.)	Index
1964-65	1461.25	100.00	957.55	100.00	174.25	100.00
1965-66	1418.98	97.11	985.51	102.92	177.83	102.05
1966-67	1511.59	103.44	1101.10	114.99	214.28	122.97
1967-68	1881.09	128.73	1263.14	131.91	276.82	158.87
1968-69	1986.09	135.92	1445.11	150.92	328.84	188.72
1969-70	2175.22	148.86	1630.93	170.32	381.24	218.79
1970-71	2017.64	138.08	1545.04	161.35	372.03	213.50
1971-72	2688.60	183.99	1782.47	186.15	455.08	261.17
1972-73	3479.05	238.09	2167.23	226.33	583.08	334.62
1973-74	2700.73	184.82	1904.46	198.89	570.92	327.65
1974-75	3216.20	220.10	2229.86	232.87	804.82	461.88
1975-76	3870.63	264.88	2609.18	272.48	933.74	535.86
1976-77	4128.78	282.55	2926.83	305.66	1110.05	637.04
1977-78	4806.47	328.93	3388.80	353.90	1303.33	747.97
1978-79	5568.89	381.10	4081.36	426.23	1569.05	900.46
1979-80	5720.33	391.47	4199.14	438.53	1767.70	1014.46
1980-81	6466.14	442.51	4323.16	451.48	2440.36	1400.49
1981-82	7127.70	487.78	4902.65	512.00	3321.50	1906.17
1982-83	7965.39	545.11	5408.18	564.79	3873.57	2222.99
1983-84	8252.73	564.77	5994.26	626.00	4545.28	2608.48
1984-85	9042.94	618.85	6676.49	697.25	5120.61	2938.66
1985-86	9924.23	679.16	7336.38	766.16	6129.02	3517.37
1986-87	10897.10	745.74	8036.32	839.26	7194.53	4128.86
1987-88	11347.54	776.56	8665.99	905.02	8041.63	4615.00
1988-89	10773.83	737.30	8677.85	906.26	8338.09	4785.13
1989-90	11252.06	770.03	8622.08	900.43	9234.77	5299.72
1990-91	9136.30	625.24	7199.88	751.91	9457.66	5427.64
1991-92	10891.43	745.35	7990.26	834.45	12661.49	7266.28
1992-93	9790.08	669.98	7200.70	751.99	13336.02	7653.38
1993-94	10532.58	720.79	7237.13	755.80	15242.54	8747.51

Source Compiled from various Annual Reports of the Indian Airlines, New Delhi

Notes a) ASK = Available Seat Kilometre, b) RPK = Revenue Passenger Kilometre, c) RPKM = Revenue Earned from RPK.

Table 3.3 : Passenger Yields at Constant and Current prices of Indian Airlines

(in Rs.)

Year	PYDC	Index	PYDR	Index
1964-65	0.69	100.00	0.18	100.00
1965-66	0.64	92.06	0.18	99.15
1966-67	0.60	87.16	0.19	106.94
1967-68	0.61	87.96	0.22	120.43
1968-69	0.64	92.44	0.23	125.04
1969-70	0.63	91.46	0.23	128.45
1970-71	0.62	89.29	0.24	132.32
1971-72	0.62	89.67	0.26	140.30
1972-73	0.60	85.79	0.27	147.84
1973-74	0.55	79.59	0.30	164.73
1974-75	0.53	76.53	0.36	198.33
1975-76	0.53	76.71	0.36	196.65
1976-77	0.55	79.64	0.38	208.41
1977-78	0.53	76.77	0.38	211.34
1978-79	0.53	76.69	0.38	211.26
1979-80	0.50	71.75	0.42	231.33
1980-81	0.56	81.42	0.56	310.19
1981-82	0.62	89.32	0.68	372.29
1982-83	0.64	92.01	0.72	393.58
1983-84	0.62	88.99	0.76	416.68
1984-85	0.58	84.05	0.77	421.45
1985-86	0.60	86.59	0.84	459.08
1986-87	0.61	88.12	0.90	491.95
1987-88	0.59	84.89	0.93	509.92
1988-89	0.57	82.05	0.96	528.00
1989-90	0.59	85.22	1.07	588.56
1990-91	0.66	94.79	1.31	721.83
1991-92	0.70	100.54	1.58	870.76
1992-93	0.74	106.76	1.85	1017.72
1993-94	0.78	112.06	2.11	1157.36

Source Derived from various Annual Reports of the Indian Airlines, New Delhi.

Notes a) PYDC = Passenger Yield at 1980-81 prices, b) PYDR = Passenger Yield at Current Prices.

IV. The Empirical Findings

The main findings of the passenger demand function analysis of the Indian Airlines and various related implications are discussed below:

Model I

a)

$$\log(RPK) = -4\ 324 + 0.46626 \log(GDP) - 0.49651 \log(PYDC) + 0.79619 \log(ASK)$$

(-4 502) (4 152) (-3 585) (14 507)

$R^2 = 99.63$, $D_W = 2.00$, t-Statistics in brackets.

b)

$$\log(RPK) = -4.3339 + 0.6146 \log(PCI) - 0\ 41904 \log(PYDC) + 0.90807 \log(ASK)$$

(-3 774) (3 273) (-2 986) (22 791)

$R^2 = 99\ 65$, $D_W = 2.04$, t-Statistics in brackets.

Model II

c)

$$\log(RPKM) = -6.5672 + 0\ 5346 \log(GDP) + 0.78706 \log(PYDR) + 0.97879 \log(ASK)$$

(-3 448) (3 265) (9 939) (27 058)

$R^2 = 99.63$, $D_W = 1.53$, t-Statistics in brackets.

d)

$$\log(RPKM) = -5\ 0725 + 0.59514 \log(PCI) + 0.88004 \log(PYDR) + 1.0274 \log(ASK)$$

(-2 954) (2 752) (14 149) (28 156)

$R^2 = 99.91$, $D_W = 1.72$, t-Statistics in brackets.

Where, RPK = Revenue Passenger Kilometre (in physical unit), RPKM = Revenue Earned from Passenger Kilometre at current prices, GDP = Gross Domestic Product at 1980-81 prices, PCI = Per Capita Income at 1980-81 Prices, PYDC = Passenger Yield at Constant Prices (1980-81), PYDR = Passenger Yield at current prices, and ASK = Available Seat Kilometre (in physical unit).

i) The final selections of two alternative demand functions in Model I, are on the basis of the values of R^2 and t-statistics.

ii) Both the demand functions of Model I, when estimated for monetary measures of output and yield at current prices (demand functions of Model II) still provided satisfactory R^2 and t-statistics.

iii) The results in Model I show a negative relationship between passenger yield and the demand for passenger services. This is consistent with the economic theory. This result is due to the fact that there are always some people, who are at the margin to leave or join the air travel even if there is a slightest variation in the fare.

iv) The values of coefficients associated with cargo yield at constant prices (PYDC) in both the demand functions in Model I are less than one, which implies inelastic demand for passenger services. This is partly explained by the supply constraint and partly by the fact that it serves an elite class of people, who do not care much for the changes in fare. The results show that a one per cent increase of passenger yield at constant prices (PYDC) would lead to a decrease in demand by 0.50 per cent as per demand function – a) and 0 42 per cent as per the demand function - b).

v) The results of model II show that there is a positive relationship between revenue earned from passenger kilometre (RPKM) and passenger yield at current prices (PYDR). This strengthens the argument of inelastic demand for passenger services. The positive coefficients associated with PYDR explain that a one per cent increase of passenger yield at current prices would lead to an increase in revenue earned from passenger kilometre by 0.79 per cent as per demand function - c), and 0.88 per cent as per the demand function - d).

vi) On the basis of the results, suggesting inelastic demand for passenger services, it can be argued that the Indian Airlines would benefit if it increases it's fare up to a point where demand for passenger services becomes elastic.

vii) The results of demand functions - a) and c) further exhibit a positive relationship between GDP and RPK / RPKM. The results show that if the real gross domestic product increases by 1 per cent, passenger demand will increase by 0.47 per cent and passenger revenue will increase by 0.53 per cent Thus, a faster growth of real gross domestic product will contribute immensely to a faster growth of demand for passenger services and hence revenue earned for the airlines.

viii) The coefficients associated with per capita income (PCI) in both the demand functions – b) and d) are positive and are larger than their corresponding values associated with GDP. From the results it can be interpreted that 1 per cent increase of real per capita income would lead to an increase of 0.61 per cent in demand for passenger services and 0.60 per cent in revenue earned from passenger services (at current prices).

ix) In all the demand functions of Model I and Model II, coefficients associated with available seat kilometre (ASK) are positive and significant. This indicates that the demand for passenger services is constrained by the supply factor. Therefore, there is a need to start new services.

x) The results do not suggest the inclusion of foreign tourist arrivals in the models due to poor t-statistics. This may be due to the fact that where supply itself is the constraint, actual demand is not the potential demand. Thus, the foreign tourist arrival has influenced the potential demand rather than the actual demand Unfortunately, there is no way to measure the extent of this potential demand. Even if we are able to get the whole data on waiting list, it would not reflect the whole of potential demand as there are quite some people who are deterred by the presence of already long waiting list and thus, do not get themselves even wait-listed. Thus, there is no surprise if the fluctuation in foreign tourist arrivals is not explaining the air passenger demand significantly.

xi) Trend variable 'T' is also not included in the finally selected models due to its poor t -statistics. Moreover dropping of this variable alone from the model does not affect R^2 as can be seen from the results shown in Table 3.4 and Table 3.5.

Table 3.4 : Regression Results of the Passenger Demand Function of the Indian Airlines (Dependent Variable - RPK in physical unit)

Sr	Const.	GDP	PYDC	ASK	Tourist	Trend	R^2	D_W
1	-1 8082	0 2541	-0.32999	0.71854	0 090395	0.5696	99.67	1.92
	(-0 981)	(1 314)	(-1.966)	(11 646)	(0.910)	(1 245)		
2	-2 8827	0 32099	-0.41097	0.75235	0.10653	-	99.67	1.95
	(-1 734)	(1 753)	(-2 547)	(12.374)	(1 119)			
3	-6 8911	1 2461	-0 52936	-		-	94.92	2.12
	(1 698)	(3 664)	(-1.369)		-			
4	-1 276	0 4416	-	-	0.6655	-	96.34	2.17
	(-0 343)	(1 074)			(3 222)			
5	-6 8911	1 2461	-0 52936	-	-	-	94.92	2.12
	(-1 698)	(3.664)	(-1.369)					
6	-4 324	0 46626	-0 49651	0.79619	-	-	99.63	2 00
	(-4 502)	(4 152)	(-3.585)	(14 507)				

Notes: a) t-values in parentheses, a) GDP = Gross Domestic Product at 1980-81 Prices, b) PYDC = Passenger Yield at 1980-81 Prices, c) ASK = Available Seat Kilometre.

Table 3.5 : Regression Results of the Passenger Demand Function of the Indian Airlines (Dependent Variable - RPK in physical unit)

Sr.	Const	PCI	PYDC	ASK	Tourist	Trend	R^2	D_W
1	-5 0597	0.71878	-0.40593	0 98391	-0 1179	0 02527	99.71	1.68
	(3 976)	(3 653)	(-2 921)	(15 963)	(1 442)	(0 709)		
2	-5 0361	0 69505	-0 4127	0 98703	-0.0885	-	99.71	1.67
	(-3 999)	(3 620)	(-3 007)	(16.217)	(-1 268)			
3	1 8426	0 79463	-0 37614	-	-	-	90.05	1 59
	(0 416)	(1.376)	(-0.864)					
4	4 1245	-0.17232	-	-	0.83344	-	96.19	2 18
	(1 135)	(-0 303)			(5 295)			
5	1 8426	0 79463	-0 3761	-	-	-	89.90	1.59
	(0 416)	(1.376)	(-0.864)					
6	-4 3339	0 6146	-0 41904	0 90807	-	-	99.65	2.04
	(-3 774)	(3.273)	(-2.986)	(22.791)				

Notes a) t-values in parentheses, a) PCI = Per Capita Income at 1980-81 Prices, b) PYDC = Passenger Yield at 1980-81 Prices, c) ASK = Available Seat Kilometre.

3.5.2 Cargo Demand Function : Determinants, Estimation and Findings

Following are the main quantitative factors, which affect the cargo demand:

i) Gross Domestic Product

The gross domestic product, which is the reflection of the general economic health of the country, is expected to have a positive effect on the demand for cargo services.

ii) Index of Industrial Production

The index of industrial production is tried in the model as it reflects fluctuations not only in industrial production but also in allied factors such as business / trade, and thus is expected to have a bearing on demand for cargo services.

iii) Cargo Yield / Freight Rate

In view of the alternatives available in form of road and rail transport, there is expected to be a negative relationship between cargo rates and the demand for cargo services.

iv) Available Ton Kilometre

Due to the supply constraint, as mentioned earlier, actual demand falls short of the potential demand. In such a case, if supply fluctuates, it results into the fluctuation in demand automatically. Therefore, available ton kilometre is expected to have a positive relationship with the demand for cargo services.

v) Time trend

The trend of demand over the period also plays an important role in governing the demand. When the economic activities are increasing and getting faster and faster day-by-day, there is expected to be again a positive relationship between Trend and the demand for cargo services.

Tata Economic Consultancy Services[18] also estimated the demand function for cargo traffic. They tried the combinations of different variables like, gross domestic product (GDP), index of industrial production (IIP), cargo yield (CYD) and the trend variable (T). Finally, in the light of econometrics reasoning, they selected only cargo yield and trend 'T' as the explanatory variables. Following was the demand function for cargo traffic they estimated:

$$\log(FTT) = 10.9576 - \underset{(-2.64)}{2.32821} \log(CYD) + \underset{(2.37)}{0.378264} \log(T)$$

$$\bar{R}^2 = 87.41, \qquad D_W = 1.43$$

Where, FTT = Freight in tonnes, CYD = Cargo Yield and T = Time Trend.

Tata Economic Consultancy Services, like in case of passenger services, here also did not take into consideration the supply factor in the model. If the supply is subject to fluctuation from year to year, then it has effect on demand. Therefore, the impact of the change of other variables on demand cannot be estimated correctly, if the supply is limited and fluctuating widely, which may result in to mis-specification of the model.

In the light of the argument provided by Rashid Jung, discussed in the passenger demand function analysis earlier, available ton kilometre, as a supply factor has been included in the models to explain the demand. This inclusion, as argued by Rashid Jung in passenger demand function study, will not just explain the past growth trends and the factors contributing to the same, but it will also provide a tool for taking internal decisions and determining growth targets.

Thus, the following two alternative demand functions for cargo services are chosen in this chapter:

i) $\log(CRTK) = \beta_1 + \beta_2 \log(GDP) - \beta_3 \log(CYD) - \beta_4 \log(T) + \beta_5 \log(ATK)$

ii) $\log(CRTK) = \beta_1 + \beta_2 \log(IIP) - \beta_3 \log(CYD) - \beta_4 \log(T) + \beta_5 \log(ATK)$

Where, CRTK = Cargo Revenue Ton Kilometre, GDP = Gross Domestic Product at factor cost (1980-81 prices), IIP = Index of Industrial Production at 1980-81 prices, CYD = Cargo Yield, T = Trend Variable and ATK = Available Ton Kilometre.

I. Methodology for Estimating the Cargo Demand Function

Two alternative models have been estimated with cargo output in physical and monetary units. The cargo yield in Model I is considered at constant prices, whereas the same in Model II is taken at current prices, keeping other determinants the same in respective cargo demand functions of both the models. Each of the two models estimate two alternative cargo demand functions for gross domestic product (GDP) and index of industrial production (IIP) separately. The 'Ordinary Least Square' technique has been used to run the multivariate demand functions mentioned above.

II. Variables for Cargo Demand Function: Rationale and Procedure

All the variables pertaining to the present analysis have been divided under the following two heads:

A) Dependent Variables

The following two measures of cargo output is used in alternative cargo demand functions:

i) Cargo Revenue Ton Kilometre – Physical Unit

Cargo revenue ton kilometre (CRTK) in physical unit is taken as the dependent variables in Model I. This is defined as the ton kilometre of cargo carried on which revenue was earned.

ii) Cargo Revenue Ton Kilometre – Monetary Unit

In Model II cargo revenue ton kilometre in monetary unit (CRTKM) is used as dependent variables. Here, it refers to the revenue realised in rupees on account of the carriage of ton kilometre of cargo.

The rationale of taking two alternative measures of output for the two models is the same as the rationale of taking two alternative measures of output for the passenger demand functions analyse, mentioned earlier in this chapter.

B) Independent Variables

The following independent variables have been considered for the present analysis:

i) Gross Domestic Product

Gross domestic product at factor cost and at 1980-81 prices has been used in both the models

ii) Index of Industrial Production

Index of industrial production at 1980-81 prices has been used for the models.

iii) Cargo yield

Cargo yield (CYD) has been defined as the yield per revenue ton kilometre of cargo carried. Cargo yield at constant prices (CYDC) for Model I has been arrived at by deflating the cargo revenue with the whole sale price index with 1980-81 = 100 before dividing it by the total cargo ton kilometre performed. Cargo yield at current prices (CYDR) for the purpose of Model II, is arrived at by dividing the revenue at current prices by the cargo ton kilometres performed in corresponding years.

iv) Available Ton Kilometre

Available ton kilometre is the actual capacity available in a year. This has been included in model in the light of the fact that supply has largely governed the demand for air services. This has happened because supply of air services has mostly fallen short of the actual demand and thus any variation in supply has directly been followed by variation in demand as well.

v) Time Trend

Time trend (T), as a variable, has been included in the model to examine the relationship between change in demand for cargo services and the time, if any.

III. Trends in Output and Yields used for Estimation of the Models

i) Output

The trends in physical and monetary measures of cargo output are depicted in Table 3.6. Cargo revenue ton kilometre (CRTK) in physical unit in between 1964-65 and 1993-94 has increased from 23.92 million to 109.20 million, which is an increase of 357 per cent. During this period the revenue earned from cargo carriage (CRTKM) increased from Rs. 39.77 million to Rs. 1272.05 million, an increase of about 3100 per cent. The movement in CRTK has been high positively related to the movement of Available ton kilometres (ATK), as the coefficient of correlation between these two variables is 0.99. It can be observed that from 1967-68 to 1987-88, except two years, 1970-71 and 1973-74, there has been a steady and consistent growth in CRTK. During 1988-89 to 1992-93 growth has suffered badly; mainly because of wide fluctuations in available ton kilometres. Negative growth in available ton kilometres during 1965-66, 1970-71, 1973-74, and 1993-94 has resulted into negative growth in cargo revenue (CRTKM) as well, in corresponding years.

ii) Yields

The Table 3 7 gives a picture of trends in Yields at constant and current prices. The cargo yield at constant price (CYDC) has gradually declined from Rs. 6.34 to Rs. 4.30 over the study period. This decline is of about 32 per cent.

Cargo yield at current price (CYDR) on the other hand has increased from Rs 1.66 in 1964-65 to Rs 11.65 in the year 1993-94, showing an increase of about 700 per cent It can be noticed that major increases in CYDR were experienced in 1974-75, 1980-81 and in the last five years from 1989-90 to 1993-94.

Table 3.6 : Cargo Revenue Ton Kilometre of Indian Airlines

(in million)

Year	CRTK	Index	CRTKM (Rs.)	Index
1964-65	23.92	100	39.77	100.00
1965-66	20.69	86.51	36.44	91.64
1966-67	21.38	89.40	38.46	96.70
1967-68	23.71	99.14	47.77	120.11
1968-69	25.38	106.12	50.82	127.78
1969-70	27.24	113.89	56.17	141.25
1970-71	24.57	102.73	51.37	129.18
1971-72	28.00	117.05	64.60	162.45
1972-73	35.97	150.41	86.93	218.59
1973-74	27.99	117.04	72.87	183.25
1974-75	29.47	123.21	106.39	267.53
1975-76	35.13	146.88	118.10	296.98
1976-77	38.43	160.68	127.92	321.68
1977-78	49.09	205.23	159.53	401.17
1978-79	60.22	251.76	193.65	486.97
1979-80	63.02	263 48	228.80	575.34
1980-81	70.51	294.79	311.87	784.23
1981-82	83.87	350.66	398.93	1003.15
1982-83	91.53	382.66	444.15	1116.88
1983-84	108.74	454.65	528.99	1330.21
1984-85	125.07	522.90	605.42	1522.42
1985-86	127.61	533.54	649.12	1632.29
1986-87	132.85	555.42	703.65	1769.42
1987-88	146.94	614.35	786.27	1977.19
1988-89	149.13	623.50	829.80	2086.64
1989-90	137.53	575.01	881.89	2217.64
1990-91	122.98	514.19	866.04	2177.78
1991-92	121.26	506.99	974.83	2451.33
1992-93	109.58	458.14	1047.96	2635.23
1993-94	109.20	456.56	1272.05	3198.73

Source Compiled from various Annual Reports of the Indian Airlines, New Delhi.

Notes a) Trends in ATK is shown in Table 2.4 of chapter 2, b) CRTK = Cargo Revenue Ton Kilometre, c) CRTKM = Revenue Earned from CRTK.

Table 3.7 : Cargo Yields at Constant and Current Prices of Indian Airlines

(in Rs.)

Year	CYDC	Index	CYDR	Index
1964-65	6.34	100.00	1.66	100.00
1965-66	6.23	98.35	1.76	105.92
1966-67	5.59	88.17	1.80	108.17
1967-68	5.61	88.50	2.01	121.16
1968-69	5.64	89.02	2.00	120.42
1969-70	5.60	88.30	2.06	124.02
1970-71	5.38	84.86	2.09	125.75
1971-72	5.62	88.71	2.31	138.79
1972-73	5.35	84.34	2.42	145.34
1973-74	4.80	75.65	2.60	156.58
1974-75	5.31	83.78	3.61	217.13
1975-76	5.00	78.88	3.36	202.20
1976-77	4.85	76.50	3.33	200.19
1977-78	4.50	71.00	3.25	195.47
1978-79	4.45	70.22	3.22	193.43
1979-80	4.29	67.73	3.63	218.36
1980-81	4.42	69.78	4.42	266.03
1981-82	4.35	68.63	4 76	286.08
1982-83	4.33	68.23	4.85	291:87
1983-84	3.96	62.49	4.86	292.58
1984-85	3.68	58.07	4.84	291.15
1985-86	3.66	57.71	5.09	305.94
1986-87	3.62	57.06	5.30	318.57
1987-88	3.40	53.58	5.35	321.84
1988-89	3.30	52.01	5.56	334.67
1989-90	3.54	55.84	6.41	385.67
1990-91	3.53	55.62	7.04	423.54
1991-92	3.54	55.82	8.04	483.50
1992-93	3.82	60.34	9.56	575.20
1993-94	4.30	67.84	11.65	700.63

Source. Derived from various Annual Reports of the Indian Airlines, New Delhi.

Notes: a) CYDC = Cargo Yield at Constant Prices (1980-81), b) CYDR = Cargo Yield at Current Prices

IV. The Empirical Findings

The findings of the analysis of cargo demand functions of the Indian Airlines and various implications associated are mentioned below:

Model I

a)

$$\log(CRTK) = \underset{(-1\ 919)}{-2\ 1907} + \underset{(1\ 571)}{0\ 16515} \log(GDP) \underset{(-4\ 392)}{-0.78018} \log(CYDC) \underset{(-6\ 603)}{-0.25038} \log(T)$$

$$+ \underset{(13\ 663)}{0\ 98330} \log(ATK)$$

$R^2 = 99.52$, $D_W = 2\ 11$, t–Statistics in brackets.

b)

$$\log(CRTK) = \underset{(-1\ 584)}{-\ 0.91845} + \underset{(1\ 659)}{0\ 1493} \log(IIP) - \underset{(-4.236)}{0\ 75665} \log(CYDC) - \underset{(-6.386)}{0.24931} \log(T)$$

$$+ \underset{(13\ 269)}{0\ 97278} \log(ATK)$$

$R^2 = 99.51$, $D_W = 2.11$, t–Statistics in brackets.

Model II

c)

$$\log(CRTKM) = \underset{(-7\ 326)}{-10.180} + \underset{(4\ 963)}{0.67708} \log(GDP) - \underset{(6\ 656)}{0.59246} \log(CYDR) - \underset{(-6.928)}{0.22166} \log(T)$$

$$+ \underset{(23\ 502)}{1.1896} \log(ATK)$$

$R^2 = 99\ 83$, $D_W = 1.78$, t–Statistics in brackets.

d)

$$\log(CRTKM) = \underset{(-14.621)}{-4.4569} + \underset{(4.81)}{0.48305} \log(IIP) - \underset{(7.823)}{0.64577} \log(CYDR) - \underset{(-6.877)}{0.22316} \log(T) + \underset{(22.178)}{1.1754} \log(ATK)$$

$R^2 = 99.86$, $D_W = 1.61$, t–Statistics in brackets.

Where, CRTK = Cargo Revenue Ton Kilometres, CRTKM = Revenue Earned from CRTK, GDP = Gross Domestic Product at 1980-81 Prices, IIP = Index of industrial Production at 1980-81 Prices, CYDR = Cargo Yield at Current Prices, CYDC = Cargo Yield at Constant Prices (1980-81), T = Trend Variable and ATK = Available Ton Kilometre.

i) The Model I, consistent with the economic theory, reveals a negative relationship between cargo demand and cargo yield / freight rate.

ii) Results show a relatively elastic demand for cargo services. This is because there are other modes of transport competing with airlines for the carriage of goods. Thus, the Indian Airlines can increase its revenue by reducing the cargo carriage rate. The coefficients of cargo yield at current prices (CYDR) in both the demand functions of Model II describe a negative relationship between revenue earned and cargo yield at current prices. The results in Model II show that 1 per cent reduction of cargo yield at current prices will increase the revenue earned from cargo carriage by 0.59 per cent as per the demand function – c) and by 0.65 per cent as per the demand function d)

iii) Gross domestic product and the index of industrial production both separately explain variations in cargo demand. However, when these are taken together in the model, t-statistics get affected adversely as can be seen in Table 3.8.

iv) The two regressions, with gross domestic product and index of industrial production as independent variables, do not differ in terms of the sign of coefficients. However, there is a marginal difference in the values of the coefficients associated with these two variables.

v) An increase of real gross domestic product by 1 per cent leads to an increase in demand for cargo services by 0.17 per cent, whereas 1 percent increase of index of industrial production increases the same by 0.15 per cent. Thus, there is a small difference as far as the separate effects of these two on demand for cargo services are concerned.

vi) Coefficients associated with available ton kilometre in Model II show that a proportionate increase of total available ton kilometre leads to more than proportionate increase in revenue from air cargo services. This speaks of the need for the expansion of the cargo services.

vii) Coefficients associated with trend variable (T) are negative, showing a declining trend of cargo demand with respect to time. This declining trend can mainly be attributed to the supply constraint. The Indian Airlines can make effort to reverse this trend by reducing the cargo carriage rate on the one hand and by increasing the supply on the other. Thus, there lies a scope for exploiting the demand for air cargo services.

On the basis of various discussions related to revenue of the Indian Airlines, this chapter has provided various policy implications. The discussion on pricing suggests the application of multi part tariff rule, specifically the long run marginal cost pricing suggested by the 'Air Tariff Committee Report'. Demand function analysis reveals relatively price inelastic demand for passenger services and price elastic demand for cargo services. This indicates a scope of increasing passenger fare on the one hand and a need for reducing the freight rate on the other so as to increase the total revenue of the Indian Airlines. Since there is a positive relationship between demand for airlines services and the growth of gross domestic product (GDP) and per capita income (PCI), capacity output should be increased from time to time to take care of additional demand. Further, the relatively large coefficients associated with capacity output in passenger and cargo demand functions, calls for an expansion of these services. Demand for cargo services showed a negative trend over the study period, thereby pointing towards a need to expand these services, which can be done by reducing the freight rate and increasing the cargo capacity output.

After having examined the scope of increasing revenue of the Indian Airlines; and also having noted a need for expansion of domestic air transport services, it is important to examine the production side also. This is because in ultimate analysis, the profitability depends not only on revenue earned, but it also depends upon the behaviour of cost. Therefore, in the next chapter, cost behaviour of the Indian Airlines will be discussed.

Table 3.8 : Regression Results of the Cargo Demand Functions of the Indian Airlines (Dependent Variable - CRTK in physical unit)

Sr.	Const	GDP	IIP	CYDC	Trend	ATK	R^2	Dw
1	0 9396	0 002682	0 14713	-0 7569	-0 24931	0 9728	99.5	2.11
	(-0 317)	(0.007)	(0 483)	(-4.095)	(-6.251)	(12.99)		
2	-2 1907	0 16515	-	-0.78018	-0.25038	0 98330	99.5	2.11
	(-1 919)	(1 571)		(-4 392)	(-6 603)	(13.66)		
3	-0 91845	-	0 1493	-0.75665	-0.24931	0.97278	99.5	2 11
	(-1 584)		(1.659)	(-4.236)	(-6.386)	(13.27)		
4	-0 62344	-	-	-0 81057	-0.2438	1.0486	99.4	2 12
	(-1 094)			(-4 466)	(-6.326)	(17 17)		
5	4.7026	-	-	-0 55433	0.08208	-	92.7	1.70
	(4 870)			(-1.253)	(0.621)			
6	-7 8123	1.0735	-	-0 50701	-0.00671	-	94.7	1 94
	(-1 714)	(2 786)		(-1 216)	(-0.053)			
7	-0 21446	-	1 1367	-0.52944	-0.10791	-	94.6	1 85
	(-0 131)		(3.393)	(-1.324)	(-0.807)			

Notes a) t-values in parentheses, b) GDP = Gross Domestic Product at 1980-81 prices, c) IIP = Index of Industrial Production at 1980-81 Prices, d) CYDC = Cargo Yield at 1980-81 Prices. e) ATK= Available Ton Kilometre.

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