

AIR TRANSPORTATION ECONOMICS

Every economic system is divided into three sectors 1) primary 2) secondary and 3) territory sector. Territory sector consists banking, insurance, power distribution, education, communication and transportation. Transportation is one of the biggest industries in territory sector. The transportation sector consists of rail transportation, road transportation, sea and inland water transportation, and air transportation. Air transportation is used of passenger transportation as well as for freight transportation. The present chapter is dealing with the demand and supply factors of air transportation, what type of market this air transportation is having? And how the price is fixed in the market?

In the present chapter we are going discuss demand and supply factors of air transportation, Type of air transportation market and the fixation of price in the air transportation market.

DEMAND ANALYSIS FOR AIR TRANSPORTATION

Demand means a person willingness and ability to pay for a commodity. In other words it is particular quantity purchased at given price and in a given time period. The demand for air transportation can be explained as “the consumer’s willingness to purchase that service at given ticket price”. Generally the demand is a dependent variable it depends on price, taste of the consumer, ability of the consumer to pay for the product etc. of all these things price is the major influencing factor of demand. Same way the demand for air transportation is influenced by the following factors.

- Price
- Competitors price
- The level of income of the consumer
- The level of development of the economy
- Availability and possibility of other mode of transportation
- Benefits and amenities received from the transportation.
- Frequency of services: and
- Other external factors like terrorism, and development of tourism in other countries.

$$D_{at} = f \{P, P_y, Y, D, O_t, A, \dots, n\}$$

D_{at} = demand for air transportation.

P = ticket price

P_y = price of the other competitors

Y= income of the consumer

D= level of development of the country

O_t= availability/possibility of other types of transportation.

A=amenities and facilities provided

N= other factors like development of tourism or terrorism, outbreak of war etc.

The relationship between demand for air transportation is positive or negative depends on the factor what is influencing. Than all other factors price is the most influencing factor of demand for any product. In the same way the demand for air transportation is highly influenced by price of the ticket or the charges collected for the transportation. At the same time the other factors almost all does not change in the short period. So the demand function of air transportation can be written as

$$D_{at} = f [P]$$

When it comes to the price, the price and demand are inversely related. The relationship between demand for air transportation and ticket price is negative. When the ticket price is high the demand for air transportation is low or vice versa¹.

(To illustrate the negative impact of price on air transportation, the demand schedule can be used)

¹

Law of demand-while all other things keeping constant price and demand are inversely related. Higher the

Demand schedule

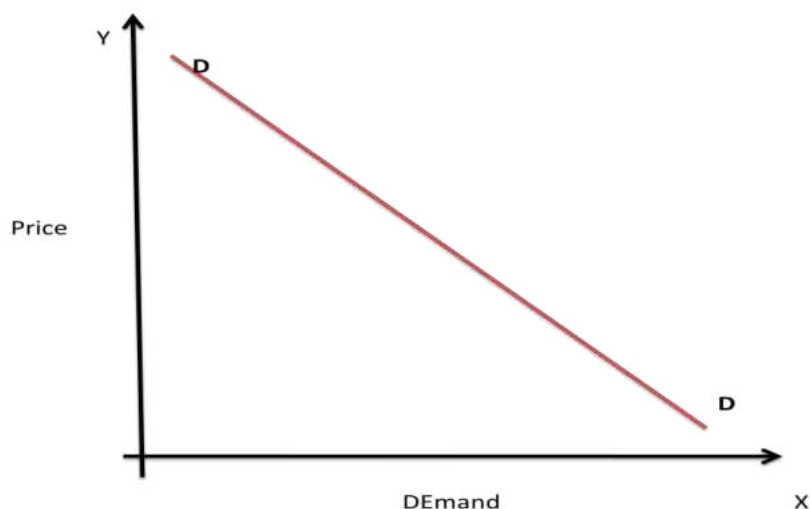
A demand schedule is a numerical explanation of the inverse relationship between price and demand.

Price	Demand
1000	3000
1500	2100
2050	1875
2650	1190
3100	890
3675	675

The given schedule is known as demand schedule. To a given increase in the price the demand for air transportation is decreased. Thus the demand schedule tells the inverse relationship between price and demand for the air transportation. We can use the demand curve to understand the inverse relationship between price and demand for air transportation.

Demand curve

Demand curve is the graphical representation of the inverse relationship between price and demand. It is a negative sloping curve falling from left to right downwards. This negative slope of the demand curve indicates the inverse relationship between price and demand. The demand curve can be used to understand the inverse relationship between price and demand.



In The above graph the x-axis is indicating number of passengers/the demand for air transportation. The Y-axis is indicated by ticket price. The demand curve is negative sloping curve indicating that at higher prices quantity demanded is low and at lower price the demand for air transportation is high. Thus graphically also we can understand the inverse relationship between price and demand for air transportation. As we discussed in the previous concepts the demand for air transportation is not only dependent on the ticket price but also on the level of development of the country, geographical conditions of the country and Income of the consumer etc.

If the country is highly developed and personnel incomes are high then people opt for air transportation. In a competitive environment the flight frequency of particular airlines is also influences the demand for air transportation. Expansion of business also influences the demand for air transportation because business is more time sensitive. Sometimes the production of certain goods like perishable goods, sensitive electronic goods needs a quick transportation which leads to increase in demand air transportation.

Along with these main factors some other factors like, consumer loyalty, terrorist attack etc. also influences the demand either positively or negatively. Generally the demand for any product remains almost all constant in short period and varies according to the change in the factors. But the demand for air transportation is having unique characteristic, they are constant fluctuation, cyclicality, seasonality and directional flow.

Comparing to the demand for other products or services the demand for air transportation is constantly fluctuating not only because of the price but also other volatile factors like business expansion, international exchange rates, expansion of investment opportunities, etc.

Every economy experiences cyclical fluctuations Sometimes expansion in the business and trade and for some time fall. The demand for air transportation is highly positively related with this cyclical fluctuation of the economy and attaining cyclical nature into the demand for air transportation. The other character of demand for air transportation is seasonality i.e. the demand for air transportation is highly influenced by seasonal changes whereas this is not the case with the other mode of transportations. Because the other mode of transportations are basically linked with the one region or one country.

The demand for air transportation is also directional one that means if there is any sports event or any other special event are happening in one country then the demand for air transportation to that particular country will increase.

Nature of the demand

Basing on the nature the demand for the product is divided into two, one is direct demand and second one is derived demand. If any good or service is purchased to satisfy their want directly is called as direct demand. For example if a consumer

purchased sandwich and tea to satisfy his hungry. Then we can say the demand for sandwich and tea is direct demand whereas derived demand means if the demand for any product is occurring because of the change in the demand for other product. In case of air transportation passengers do not purchase the ticket just for sake of flying instead passengers fly in order to arrive at resort (tourist place) or attend business meeting or any other emergency conditions. That means to satisfy these other needs we are using air transportation. So the demand for air transportation is a derived demand.

Elasticity of air transportation demand

In economics elasticity means responsiveness of demand to a given change in the factors. Basing on the factors what are influencing, the elasticity of demand is divided into three types, price elasticity, income elasticity, cross elasticity. In case of air transportation the elasticity of demand is price or income elastic.

Price elasticity of demand means extent of the responsiveness of demand for air transportation to a given change in the price. The price elasticity can be measured with the following equation. I.e. the sensitivity of the consumer to the price of the product?. In other way as the price is lower how much more will they buy? Or how much less as the price is raised?

Whereas income elasticity means extent of the responsiveness of demand to a given change in the income

The income elasticity of demand is particularly important to the air transportation especially with respect to tourist market. If the real income of the people is increasing demand for air travel tends to increase, but in case of under-developed economies maximum portion of real income will go for food consumption and other necessities so in under-developed economies the impact of income elasticity of demand for air transportation is having a very minor impact. But when compare to the tourist travel business travel is having less income elasticity.

Coming on to the price elasticity of demand both business travel and tourist are having price elasticity, in case of tourist travel through air transportation is also having a high degree of price elastic.

Estimation of demand for air transportation (demand forecasting)

Demand forecasting is predicting future demand for a product. It is essential for planning of the business, purchasing of raw material, advertisements and sales plan. This demand forecasting plays an important role in case of large scale business. If any air transports service provider forecasted the demand then they can change their business module, like other forms of business even in air transportation also forecasting plays a major role.

The various methods of demand forecasting are as follows

1. Survey method

This survey method is further classified into two. One is consumer survey and the second one is opinion poll method.

Under consumer survey method direct interview is taken from the consumer to know about his willingness to travel, willingness to travel through air transportation and his options why he is opted air transportation etc. there are two different methods to collect these information from the consumers. First one is complete enumeration and the other one is sample survey.

a) Complete enumeration method

Under complete enumeration method almost all potential consumers are interviewed to know about their willingness to opt air transportation. Under this method the information about their willingness to opt air transportation at different prices, at different levels of income for what purpose(business, education, tourism etc.) at what levels of income and even their expectations about rise in their income, offers or other benefits provided by air transportation service providers. By summing up of this data the companies can forecast the demand for the air transportation in a particular area and the factors like, income, purpose, or the offers which are influencing them to opt air transportation.

b) Sample survey method

Sample survey method is very economic, when compare to complete senses method. Under sample survey method a sample i.e. a group people were selected and they are interviewed to know about their choice to travel through air transportation. Like in complete enumeration method, in sample survey method the groups of people are questioned to know the factors influenced them to opt air transportation. The result whatever is obtained from this group can be imputed to same type of other big group or that particular locality and by that demand can be forecasted.

2. Cross section analysis

Under this method two different places or cities are taken and factors like geographical distance, incomes, other attractions like business, education, tourism are considered. By using this factors companies tries to estimate the demand for all types of transportations ought to be. Out of that what proportion will go for air transportation at the same time the companies will assess the actual portion of demand met by this air transportation and it is compared with the portion of demand for air transportation ought to be. This gives them clear and detailed information about future demand for their services.

A more common principle in case of surface transportation is “while all other things keeping constant, traffic and distance are inversely related” but this principle may not applicable in case of air transportation because the demand for air transportation is not

only depending on distance but also incomes of the consumers, purpose of transportation, price of tickets.

Cause and effect analysis method

Under this method air transportation companies collect information about the number of passengers opted the air transportation to a given change like introduction of low prices, provision of pick-up, provision of launch pack etc. in this method companies tries to estimate to a given change in the policy what type of effect created on their business, like increase or decrease in the number of passengers. But it is not suggestible to depend always on past experience while we are forecasting the demand under this method on one hand we have to depend on the past experience on the other hand we have to consider the present situations too.

Time series analysis method

In this method data related to number of passengers travelled over a period of time is collected more clearly to say data about number of passengers travelled for business purpose, passengers travelled tourism purpose in a particular year is collected. In the same way the data is collected for so many years continuously without a time gap. Then by using graphical methods or by using statistical techniques companies can forecast the demand.

Conclusion

From the above we can understand the nature of the demand for the air transportation. The demand for the air transportation depends on the various factors; among that price is the major influencing factor which affects the demand for the air transportation. We discussed this relationship with the help of demand schedule and with the help of graphical representation i.e. demand curve. Further we discussed the nature of demand for air transportation and various methods which can be followed to estimate the demand for air transportation.

AIRLINE SUPPLY ANALYSIS

Supply is one of subject matters of micro economics. In economics supply means stock offered for sale at a given price and in a given time period or it is particular quantity sold by the seller at a given and in a given time period whereas airline supply refers either the number of seats or number of trips can be provided by an air service provider at a given price and in a given time period. Like demand, supply is also dependent variable, generally, price, technology, price of the factors, entry of new firms, government policies etc. are the factors influencing the supply. price of tickets, price of resources, technology, entry of new service providers are the factors which influences the supply of air transportation.

$$S_A = f \{p_t, p_r, T, N_s, G, \dots, n\}$$

S_A = supply of air transportation

F = functional relation

P_t = price of ticket

P_r = price of resources

T = technology

N_s = new service providers

G = government policies

N = other factors

In case of other goods and services price and supply are directly related. Even in case of air transportation also price of ticket and supply are directly related. but the price of resources and airline supply are inversely related i.e. the price of resources like price of aircraft, fuel prices, labour cost and other charges paid by the company are more than supply tends to decrease.

The other most influencing factor of air transportation supply is technology. Its impact on supply of air transportation is very vast and we can say the technology is directly related with supply of air transportation. To understand this relation let us take an example that due to the technical advancement big aeroplane which can bare more number of passengers and run with less fuel are developed. Obviously the companies can increase the supply. Who own these advance flights. After these factors entry of new service providers are the other factors which influences supply of air transportation. Due to the entry of new service providers into this sector supply of air transportation tends to increase. At the same time due to the increased competition among the air transportation companies, every service provider tries to have lion share in the market either by increasing the number of seats with big aircrafts or by increasing the number of trips. This ultimately leads to an increase in the supply.

Along with all these factors government policies like liberalisation, privatisation influences the air transportation sector. Every company tries to utilise this advantage and increases the supply of its services. All these factors are having significant influence on the supply of air transportation. Of all these factors price of ticket is most influencing factor of supply of air transportation. As we know that these two are directly related and subjected to law of supply².

We can explain this direct relation between price and supply with the help of a hypothetical supply schedule. A supply schedule is a numerical representation of the

²

related.

While all things keeping constant price and supply are directly

direct relationship between price and supply. In the following table first column is indicating price of air ticket from country A to B and the second column is indicating supply of air transportation.

Supply schedule

Price of Air ticket	Supply of Air transportation
2500	75
3400	90
4000	125
5500	150
6300	175
7000	230

In the given table when the ticket price is at Rs2500, the supply is 75. We can see the consequent increase in the supply with a given increase in the price. This schedule is known as individual supply schedule because it is exhibiting the relationship between the price and supply of an individual air transportation provider. The other type of supply schedule is known as market supply schedule. Which tell the supply pattern of various service providers at the same level of price. We can understand this market supply schedule with the following hypothetical table and example.

Market supply schedule

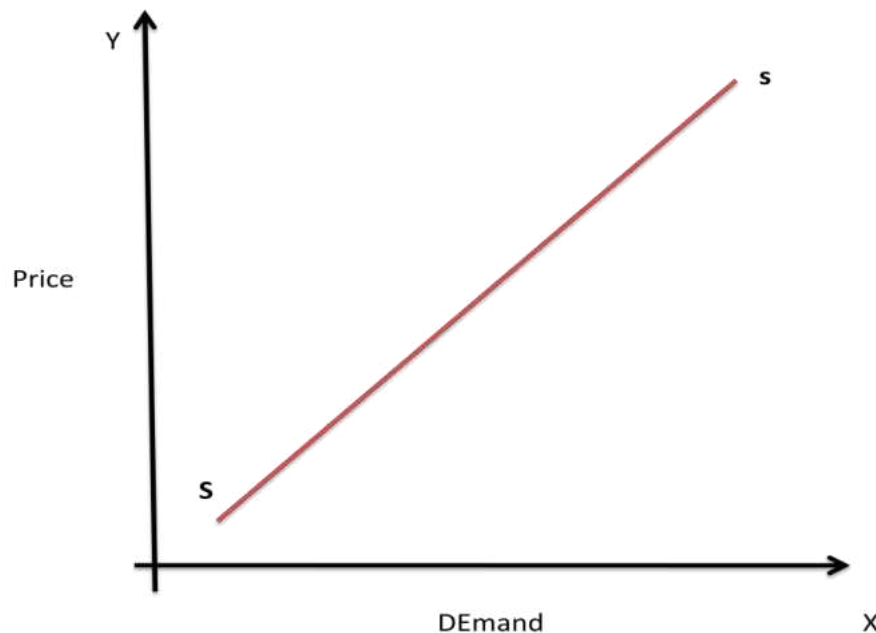
price	jet	Indigo	kingfisher	TOTAL
1000	100	75	200	375
1500	200	125	250	575
2300	300	150	325	775
2700	400	175	375	950

At the price of 1000 rupees the spice jet is able to provide supply of 100 **seat miles.(ASMS & ATMS)** whereas indigo is providing 75 seat miles. Later when the price increased to 2700. At this price spice jet is providing 400 seat miles, whereas 175 and 375seat miles are provided by indigo and kingfisher respectively. It is evident that there is a difference in the supply among these three companies. It is because of other factors of supply influencing them. For Example- assume the air craft used by kingfisher are technically advanced than the air crafts used by other two companies. Obviously kingfisher can provide either more services or more number of seats.

From the supply schedule we understood price and supply are directly related. This direct relationship between price and supply can be explained with the help of supply curve.

Supply curve

Supply curve is a graphical representation of the direct relationship between price and supply. By taking supply on X-axis and price on Y-axis if we are drawing supply curve will get a positive sloping curve called as supply curve. A positive sloping curve means a curve which is raising left to right upwards; this positive slope indicates the direct relationship between the price and supply.



Now it is clear to us price and supply are directly related and price is the most influencing factor of supply but we know that not only the price but also the technology, income of the consumer, national income etc. are the influencing factors of supply of air transportation. The change occurred either in price or in other factors causes a change in supply to understand it more clearly the changes in supply are classified into expansion, contraction, increase and decrease.

Expansion of supply or contraction of supply takes place to a given change in the price. Assume if the ticket price is decreased either because of excessive demand or because of other factors if the price of ticket is increased then the air transportation service provider's tries to raise their supply. This rise in the supply is known as supply expansion.

If supply is expanding the same supply curve is extended towards the right side. In the same way fall in the number of trips or reduction of seat miles to a given fall in the price of the ticket is known as supply contraction. When the supply is contrasting the same supply curve is reduced towards the left side. Either it is expansion or contraction both are exhibited with movement along the supply curve. Expansion or contraction of supply is exhibited in the following two diagrams.

Supply increase and supply decrease

Raise in the number of trips or seat miles to a given change in the factors other than price is known as supply increase. Without change in the price

Elasticity of supply

From the previous concepts we understood price and supply are directly related. but the relationship between price and supply is not only sufficient to understand the market behaviour, we require another concept which is elasticity of supply

Elasticity of supply means *extent of the responsiveness of supply to a given change in price*. I.e. to a given change in price how much change in supply is occurring . for example if there is 5 units of fall in the price of ticket then to that fall how many units of supply will increase. In the same way to a given fall in price how many units of supply will fall. The elasticity of supply can be measure with the help coefficient of price elasticity of supply which can be measured with the following equation.

$$E_{sp} =$$

Q = change in the quantity

P = change in the price

P = initial price

Q = initial quantity

Basing on the co-efficient, elasticity of supply is divided into five types.

- 1 **Perfect elastic supply:** when EDP value is equal to infinite then it is called as perfectly elastic supply or to a given slight change in the price changes in the supply are extreme. That means either supply may go to infinite or comes to zero but it is a theoretical extremity which is not applicable in practical business.

A perfect elastic supply is indicated with horizontal straight line.

- 2 **Perfectly in elastic supply:** to any given change in the price supply remains constant. When EDP value is equal to zero, then it can be called as perfectly in elastic supply. A perfectly in-elastic supply is indicated with vertical straight line. Even this perfectly in-elastic supply also a theoretical extremity not applicable in the practical business

- 3 **Relatively elastic supply:** proportionate change in the supply is greater than proportionate change in the price. When EDP value is greater than one then supply will be relatively elastic.

- 4 **Relatively In-elastic supply:** proportionate change in the supply is less than proportionate change in the price. When EDP value is less than one then supply will be relatively in-elastic.

- 5 **Unitary elastic supply:** proportionate change in the supply is equal to proportionate change in the price. When EDP value is equal to one then supply will be unitary elastic.

COST ANALYSIS

Cost is the amount invested by the producer on four factors of production to produce a good or services. Cost is classified into various types, they are money cost, real cost, opportunity cost etc.

Money cost means the amounts invested in the form of money in the process of production of a good or services by the producer is known as money cost. Whereas the sacrifices done by the labour are known as real cost, opportunity cost means next best alternative cost.

There are some other types of costs known as implicit and explicit cost. Costs which are not expressed in the books of accounts are known implicit cost, costs which are expressed in the books of accounts are known as explicit cost. Cost invested over a period of time is known as historical cost. There are other types of costs which are known as economic costs or accounting costs, they are fixed costs, variable cost, total cost, average fixed cost, average variable cost, average total cost or average cost.

Let us understand the different types of costs invested in air transportation sector and how they can be classified. The list of various types of cost invested in the air transportation sector

- 1) Flying operation expenditure
- 2) Direct maintenance expenditure
- 3) Passenger services expenditure
- 4) Aircraft servicing
- 5) Reservation and sales of ticket
- 6) Advertisement and publicity
- 7) General and administrative expenditure

Flying operation expenditure includes crew wages, fuel expenditure. Direct maintenance covers the cost of labour and material directly related to maintenance and repair of aircrafts which includes periodical overhauls and other flight equipment, the other cost invested by air transportation sector is maintenance burden, and maintenance burden means overhead cost related to the upkeep and repair of flight equipment and other property. Passenger service expenditure covers the cost of food provided to the passengers and provision of cabin attendance or any other services provided for the comfort of the passengers. Aircraft service expenditure refers to routine service such as washing the aircraft, cleaning the cabin passenger but not mechanical servicing. This aircraft servicing expenditure also includes landing fees, reservation and sales of tickets as well as advertising and publicity expenditure comes under selling cost. That means cost invested to increase the demand for their service or

product. General and administrative costs are the expenditures made for general administration of the organisation or for any other purpose to run the organisation.

The above classification of cost in air transportation is one type but there are other types of classification of cost in air transportation. One of the other ways of classification cost in air transportation is 1) capacity cost 2) overhead cost 3) traffic related cost. The expenditures made for the maintenance of aircrafts, for landing fees fuel expenditure, pilot salaries, cabin crew wages etc. comes under capacity cost. Overhead costs are the costs which are invested by the service provider to maintain the office administrative functions or any other type of general administration. Whereas the traffic related costs are the expenditures made on ticketing, passenger facilities, and baggage handling charges, aircraft services and terminal expenses.

The above classifications are made based on accounting system but practically speaking the air transportation costs are further classified into various types to make managerial decisions. They are common cost, separable cost, fixed cost, variable cost, fully allocated cost, out of pocket cost, direct operating cost, terminal cost, and Line haul cost.

Separable cost / discrete cost

Expenditure made by the service provider for a particular purpose like facilities provided for the passengers in the cabin attendant wages, ticketing or sales costs comes under separable cost or discrete cost. These are all the expenditures which we can discrete them from other type of expenditures which cannot be specified.

Common cost/ Non-discrete cost

This non-discrete costs or common cost cannot be logically understood for what purpose the cost is made. For example pilot and crew expenditure is the best example for this non-discrete cost. Because pilot or crew expenditure is made for both passenger as well as freight transportation but we never expressed this cost in such a way that pilot wages for passenger flight or for cargo flight.

Separable cost / discrete cost

Cost which are incurred for a specific purpose or the cost which can be expressed specifically that they have incurred for a specific purpose are known as separable cost or discrete cost. The expenditure made by the service provider for a particular purposes like provision of special food, drinks, these expenditures are logically separable from other type of non-discrete cost.

Out of pocket cost /frontier cost/ marginal cost

The cost invested by the service provider to provide an additional service Or It is an additional amount invested to provide service for an extra passenger. In air transportation it is almost all considered as marginal cost. For example if suddenly one extra passenger boarded the flight then the cost invested to provide the service to that extra passenger is known as out of pocket cost or frontier cost. Just adding one passenger to the same flight will not change the frontier cost but if the service provider

wants to increase the number of flights then that rise in consumption of fuel, pilot charges, terminal charges, in turn this increases frontier cost.

Constant cost/ static cost / fixed cost

The static costs are the cost which does not varies according to change in the traffic. For example cost invested on the fixed assets and certain type of general administrative costs comes under this static cost. These costs are called as static costs because they are fixed in nature and do not vary in short period and according to traffic.

Dispatched cost

The cost incurred to carry a particular unit of traffic or passenger is known as dispatched cost or fully allocated cost. This includes frontier cost as well as static cost for example, if any passenger booked a round trip ticket for a tourism purpose where the return trip ticket can be used only after few days whenever the passenger wants to return. if the passenger wants to board to a flight then the service provider has to meet this surprise expenditure. That means a service provider has to provide food and other services (frontier cost) to that passenger and at the same time the service provider has to use his administrative staff also (static cost) to provide him boarding pass and other things.

Line haul cost

Line haul costs are the expenditures which are directly related to the time and mileage while the aircraft is flight. This includes pilot and other crew wages fuel cost etc. if the time and mileage is more then it leads to raise in this line haul cost.

Terminal cost

The terminal costs are the amount spent by the service providers like, aircraft servicing, expenditure on reservation, or any other expenditures made at airport. This terminal costs are not related to mileage or time, but they are related to number of passengers or freight but the amount spent by the service provider on warehouse to keep the freight comes under overhead cost. At the same time the amounts spent by the service provider to pick-up and book the freight to mobilise it to the warehouse and aircraft comes under terminal cost. This terminal costs are also known as ground cost.

Direct operational cost / trip cost

As already we discussed in the previous concept the expenditures which are incurred by the service providers when the aeroplane is in flight such as pilot and cabin crew wages, fuel cost etc. this does not includes ground cost. Perhaps ground cost some times is also considered as indirect operational cost.

Indirect operational cost

The costs which are spent by the service provider irrespective of amount of traffic are known as indirect operating cost. As we discussed in the previous concept the ground costs are the terminal costs are also considered as indirect operational cost.

Seat mile cost / a unit's trip cost

The total amount which service provider has to spent transport a unit of freight or a single passenger This seat mile cost is higher in case of short haul flights when compare to long haul flights.

In the above paragraphs we discussed various terms and types of costs which are used in the air transportation economics. Now we will try to fit these costs into the framework of micro economic cost theory.

In micro economic theory cost analysis play a major role in understanding markets and to take business decisions. Cost concepts are classified in a different way basing on the nature of cost. i.e. to a given change in the quantity of output and time how cost is responding is considered and basing on the response of the cost basically it is classified into two types, Fixed cost and variable cost. By using these two types of costs we can derive the other various types of costs which are used in micro economics or in business economics.

There are different factors which are influencing the cost. The influence of some of factors can be identifiable in the behaviour of the cost. This can be understood with the help of cost function.

Cost function

A cost function is the functional representation of the relationship between cost and cost factors like price of inputs, size plant, and level of technology.

$$C = f(F, Q, P, T)$$

C stands for the costs,

f denotes functional relationship,

F refers to the factor-input prices,

O stands for the rate of output,

P refers to the size of plant, and

T stands for the state of technology.

In short period to any given change in these factors if the cost remains same then it is called as total fixed cost and if the cost is also varying according to the change in the factors then it is called as total variable cost. Now we will try to discuss more about total fixed cost and total variable cost.

Total fixed cost (TFC)

The fixed can also be defined as the cost which does not alters in short period. This total fixed cost will not change with a change in the output in short period. The main characters of fixed cost are a) it does not alter in short period, b) Even though there is no production of good or services the producer has to bare the fixed cost. Examples for

fixed costs are infrastructure expenditure. In air transportation sector the expenditure made on overheads or any other fixed assets will come under fixed cost, at the same time cost invested to purchase the aircrafts also comes under fixed cost, but the fixed cost will remain constant only in short period, if the producer is going to change his production function in long run then he has to increase his infrastructure, for instance if service provider running with one aircraft, and he wants to increase the number of services, then he has to purchase another flight or he has to increase the infrastructure. Thus it leads to a raise in the total fixed cost in long run.

Total variable cost (TVC)

Cost which alters in short period is known as variable cost or otherwise we can define total variable cost as a cost which is invested on variable assets. For example; fuel cost, passenger service cost, terminal cost, pilot crew charges are variable costs. The main characters of variable cost are; it changes according to change in the output in short run, if there is no output, variable cost does not exist for example, if the service provider cancelled a trip then he need not spend any amount on fuel or on crew.

If the service provider wants to increase number of trips then he requires to use more fuel and at the same time he requires more number of pilot and cabin crew thus it leads to increase in variable cost with an increase in the number of trips.

This TVC will not increase in the same proportion, initially it increases at a decreasing rate (slow manner) but after a point it starts raising at an increasing rate (rapidly) this is because of operation of law of variable proportions.

Total cost

The sum of total fixed cost and total variable cost is known as total cost.

$$TC = TFC + TVC$$

In air transportation sector total cost is the sum of total fixed cost and variable cost like fuel, pilot and crew charges, terminal expenditure, passenger service expenditure, aircraft service expenditure.

The unique character of total cost is the TC becomes equal to TVC in short period because fixed cost remains constant in short period. That means in short period anyhow overhead cost, general administration cost remains same, but passenger services expenditure, fuel expenditure, terminal cost will vary according to change in the traffic or number of trips. Because of this relation varies in the same proportion as TVC

The behaviour of TC, TFC, and TVC is explained in the following table and diagram.

QUANTITY	TFC	TVC	TC
0	100	0	100
1	100	15.15	115.15
2	100	18.8	118.8
3	100	21.25	121.25
4	100	23.75	123.75
5	100	27.05	127.05
6	100	30	130
7	100	33.65	133.65
8	100	40.75	140.75

From the above hypothetical schedule and graph we can find out the following important characteristics of TC, TVC, and TFC. In the above figure TFC is the total fixed cost which is the horizontal straight line because the TFC remains same throughout the short period, TVC is indicating total variable cost curve when the service provider is not providing any trip or services to passengers then he need not spend anything on fuel or on passenger services then TVC is zero so it starts from origin.

Here TC indicates total cost. The TC curve starts above from origin, in another way it starts from the point where TFC curve is starting. Remember that Total cost is the aggregation of Total Fixed cost and Total variable cost and the distance between TC curve and origin indicates Total fixed cost.

Basing on TC, TVC and TFC we can derive other types of costs Average cost, Marginal cost etc. we have already came across these types of costs, perhaps called with different terms in air transportation sector. Now we are going study the micro economic analysis of other various types of costs along with terms and examples from air transportation sector. To understand the other types of costs we are using the following hypothetical cost schedule.

Average fixed cost

Per unit fixed cost is known as average fixed cost, the other way to explain the average fixed cost is, 'it is the minimum fixed cost required to provide a service per one unit of traffic i.e. either for one passenger or particular unit of freight'. For example if service provider wants has to provide trip even to a single passenger he has to maintain a minimum general administration and an aircraft.

The average fixed cost can be calculated by dividing the total cost with number of units of traffic.

$$AFC = \text{Average fixed cost}$$

$$TFC = \text{Total fixed cost}$$

$$Q = \text{Units of traffic (passengers or freight)}$$

Average fixed cost tends to decline with every increase in the output because whatever the fixed cost invested by the service provider get spread over in number of units, therefore average fixed cost tends to decline.

Average fixed cost curve is a negative sloping curve falling from left to right downward. (Graph)

Average variable cost

It is the minimum variable cost required to provide service for a single unit of traffic. This average cost can be calculated with the following equation.

$$AVC =$$

$$AVC = \text{Average variable cost}$$

$$TVC = \text{Total variable cost}$$

$$Q = \text{Quantity}$$

This average variable cost initially declines with an increase in the output but once if the service provider is able to run the trip with full occupancy then after every increase in his service increases average variable cost. For example the service provider is providing aircraft from city to A to B he is incurring the cost of X on fuel he has to incur this cost even if one passenger is travelling or more than one passenger is travelling. the average variable cost tends to decrease with every increase in the number of passengers. Once after reaching full occupancy then for further increase in the service again the service provider has to spend some required amount of variable cost.

AVC curve is slightly 'U' shaped curve. That 'U' shape of the AVC curve indicates initially average variable cost tends to decrease later it tends to rise. (Graph)

Average cost / Average total cost

Average cost is the sum of average total cost and average variable cost. AC can be calculated with the following equation.

$$\Rightarrow AC = AFC + AVC$$

This AC is derived from the summation of AFC and AVC, even this AC curve is also derived by super imposition of average variable cost curve over average fixed curve. ATC curve is a 'U' shaped curve because AC curve is determined by AFC and AVC curves respectively. Initially because of the pre-dominance of AFC, though the AVC is raising but ATC tends to decline. But after certain point due to the expansion of output AFC continues its fall but AVC starts rising rapidly. Because of the rising trend of AVC, AC starts rising, again AC-curve attains a positive slope. In total initially AC-curve is a negative sloping curve later it attains positive slope, so it is 'U' shaped curve. Another important point about the ATC behaviour is while it is diminishing it diminishes rapidly but while raising it rises slowly. (Graph)

Marginal cost

Additional cost invested to produce one additional unit is known as marginal cost. "Frontier cost" or "Out of pocket cost" in air transportation sector comes under marginal cost.

$$MC = TC_n - TC_{n-1}$$

MC = marginal cost

TC_n = Total cost of n^{th} unit

TC_{n-1} = total cost of last but one unit

Marginal cost is the rate of change in the total cost. The marginal cost is the slope of total cost curve at corresponding quantity. We can derive MC curve from TVC curve also, though AVC and MC curves can be derived from TVC, but AVC and MC curves will not be the same. MC curve is a 'U' shaped curve as we discussed at 'Average total cost' ATC curve is also 'U' shaped curve but there is a difference in the behaviour of MC, initially MC declines slowly but after a point it starts rising rapidly. (Graph)

Revenue analysis

The amounts received by the service provider after sale of his service are known as revenue. Revenues classified into total revenue, average revenue and marginal revenue.

Total revenue (TR)

It is an amount received by the service provider after selling all units of his service. It can be calculated by multiplying price with quantity. For example price of a ticket multiplied with number of seats will gives us the total revenue received by the service provider from that particular trip. We have to understand that TR depends on the number of units of service sold because price charged by the service provider is almost all same for that particular trip. Total revenue always increase with every increase in

the sale of tickets for that trip. TR curve is the positive sloping curve which starts from origin.

$$TR = P \times Q$$

TR = Total Revenue

P = Price

Q = Quantity

Graph

Average revenue

Revenue received from the sale of one unit. It is calculated by dividing total revenue with quantity sold. Average revenue depends on the type of market.

$$AR =$$

$$\Rightarrow AR =$$

$$\Rightarrow AR = P$$

AR = Average Revenue

TR = Total Revenue

Q = Quantity

From the above equation we can say average revenue depends on the price but the price charged depends on the type of the market (which we are going to study in next concept and in next chapter)

Marginal Revenue

Additional Revenue received from the sale of one additional unit of service. It is calculated by subtracting the revenue received from last but unit from revenue received from last unit.

$$MR = TR_n - TR_{n-1}$$

Or

$$MR =$$

MR = Marginal Revenue

TR_n = Total Revenue of n^{th} Revenue

TR_{n-1} = Total Revenue of last but one unit

Markets

The most important chapter in micro economics theory is market analysis it is also known as price theory. In this chapter we will discuss about price fixation in various types of markets and at the same time we will discuss about price fixation in air transportation sector. First of all we have to understand the basic structure of markets and the basic classification of the market. According to traditional definitions market is the place where the buyer and the seller are in contact and exchange of goods and services is taking place but due to the advancement of technology in present days market need not be a place but exchange of goods and services should take place. Market is classified into various types basing on three elements they are place, time, and competition. Before going to study this classification one thing we have to understand some of the types of markets which are classified basing on place, time may not exists as it is. This is due to the advancement of technology but for basic knowledge and understanding we should study about those types also. Basing on the place i.e. the area in which the exchange of goods or services are taking place market is divided into three types

Chapter

The air transportation sector will not come under perfect competition market structure under any circumstances but, to understand the price theory under air transportation it is essential to understand the perfect competition market. A perfect competitive market is an imaginary market which should have the following important characters.

- Homogenous products
- Too many buyers and sellers
- Perfect knowledge about market conditions
- No entry and exit barriers
- No government interference
- No transportation cost
- Role of market forces in price fixation

Very few sectors satisfy may have some of the above characters. It is very difficult to find the nearest example for perfect competitive market but knowledge about competition helps us in understanding price theory in different type of markets

Whether Air transportation is perfect competition or not?

Air transportation sector cannot come under perfect competitive market because though the service provided is the homogenous but we cannot expect too many buyers and sellers in the market. At the same time both buyer and seller cannot have perfect knowledge about the market conditions, for example air transportation service provider

cannot expect the exact number of passengers in a particular season. We cannot expect complete government non-interference in some countries like India there is a ministry of civil aviation which regulates the aviation industry and at the same time another governmental organisation **Director General of Civil Aviation (DGCA)** controls the air traffic, Aircraft registration and other regulating authorities were established to control other important aspects of aviation industry like **Airport Authority of India (AAI)** for regulating the airports and the standards to be maintained at the airports .

Another important character of perfect competition is no entry and exit barriers but we cannot expect aviation industry without entry and exit barriers **International civil aviation organisation (ICAO)** which regulates the civil Aviation at the international level. At the same time some international conventions like Chicago conventions regulates the international civil aviation. At the same time all the member countries of WTO has to follow the Agreement in WTO regime in *toto* including the pluri-lateral agreement on civil aviation which is a part of WTO Agreement.

The most important character of perfect competition is market forces play a dominant role in price fixation. No doubt even in aviation sector also market forces plays a major role even then the decision like price fixation etc. are in the hands of service provider.

From the above discussion it is clear to us that the air transportation sector is not a perfect competition market.

Though the air transportation is not a perfect competitive market it is essential to know the function of perfect competitive market to understand the function of other markets.

Price fixation under perfect competition

As we know that government, buyer, seller or the transportation cost cannot decide the price in perfect competitive market. The two market forces demand and supply can fix the price.

Price fixation

In perfect competition price is fixed by the demand and supply. Where the demand is equal to supply the price is considered as market price in perfect competition market.

$$D = S$$

D= Demand

S= Supply

With the help of following schedule we can explain the price fixation in the perfect competition market

Price	Demand	Supply
100	1500	700
150	1300	900
220	1000	1000
290	900	1100
370	700	1300

In the given table first column is indicating price, second column is indicating demand and third column is indicating supply. We know that price and demand are inversely related whereas price and supply are directly related (law of demand and law of supply). At one price demand is becoming equal to supply that price is fixed as market price

Why this is an equilibrium price?

Where the demand is equal to supply that price is fixed as market price and also called as equilibrium price because below to that price demand is more and supply is less that means scarcity exists in the market. Above to that price demand is less and supply is more, that means surplus supply is there than the consumption but at the particular price where the demand is becoming equal to supply no scarcity and no surplus.

In the given graph the X-axis is indicating quantity demanded and quantity supplied Y-axis is indicating price, negative sloping curve DD is the demand curve and the positive sloping curve SS is the supply curve. These two curves are intersecting at the point E. at this point equilibrium price 'P' is fixed.

Nature of price in perfect competition market

In perfect competition common price prevails throughout the market. Every seller is a price taker but not a price maker because every seller is selling a small part of total product. Perfect competition price can be influenced only by two market forces namely demand and supply. From the following graphs we can understand when the demand is increasing price is also increasing and vice versa in the same way with every increase in the supply price is falling and vice versa. If both market forces are remaining constant or both are changing in the same ratio then price remains the same. The same price prevails throughout the market in short period. (Graph)

In perfect competition price is equal to average revenue and marginal revenue (Average revenue and marginal revenue are discussed in cost analysis chapter). This we can understand with the following schedule

Quantity	Price	Total Revenue	Average Revenue	Marginal Revenue
1	10	10	10	-
2	10	20	10	10
3	10	30	10	10
4	10	40	10	10
5	10	50	10	10

By observing the above table we can say price is equal to Average Revenue and Marginal revenue. That's why in perfect competition price, AR and MR are indicated with horizontal straight line. Which we can draw by taking quantity on X-axis and price and revenue on Y-axis

equilibrium of firm and industry

Equilibrium means it is a situation from which the seller is not willing to move. The seller earns maximum profits at this situation in perfect competition equilibrium is technically explained as where the marginal cost is equal to marginal revenue ($MC = MR$). at the same time before they become equal it is essential that marginal cost must be less than marginal revenue. Diagrametically MC curve should intersect MR curve from the bottom and as we know that in perfect competition $AR = MR$ (*Refer revenue analysis*) so AR curve coincides with MR curve (graph)

in the given figure MC curve is intersecting MR curve at two points that means MC is equal to MR at two places but the essential condition for equilibrium is MC must intersect MR curve from the bottom, so in our graph out of E 1 and E 2 points where MC = MR, E2 is the exact equilibrium point because at E2 MC = MR and before they become equal MC is less than MR or MC curve is intersecting MR from bottom.

Here our question why E2 is considered as equilibrium point and what the essential condition tell us? Here if seller is stopping at the point E1 he is missing further profits because if he is moving from E1 that is if he is increasing his sale his marginal cost is decreasing and it is becoming less than marginal revenue we know that if cost is less than revenue seller will receive profit, no rational economic seller wants to loss these profit. Seller will receive profit till 'MC' reaches to minimum, after reaching minimum point MC starts rising rapidly, but even now also seller will receive profit because still MC is less than MR upto the point E2 once after reaching point E2 again MC become equal to MR and MC curve is intersecting MR curve from bottom in increase phase and any further increase in sales will increase MC then MC will become greater than MR. At this situation seller will receive loss, no rational economic seller wants to take loss finally seller will remain at the point E2 and he cannot go back because they have to reduce the quantity of sale which is also reduces his profit. From this explanation we can say that E2 is equilibrium point.

Equilibrium of industry

when there is no tendency of entry or exit of firms into industry and at the same time every firm must be in equilibrium. The condition for equilibrium of all firms in the industry is

$$AC = AR = MC$$

long run may be defined as period in which the industry can adjust its total output completely according to the increase in the demand. In this long period some firms in the industry try to adjust with decrease in demand by reducing its output and some firms will quite the industry. Thus in long period the supply can be perfectly equated with the demand. Generally long period price is known as normal price which is fixed by the interaction between long run demand and supply. We know that this normal price is stable. So, in long run every firm should try to equate its long run average cost with long run price (normal price which is also a long run revenue curve) the firms who are able to equate can get normal profit and they remain in the market. The other firms who failed to equate their long run cost with long run price will quite the market. Then we can say there is no tendency for new firms to enter the industry or old firms for exit. Thus industry will attain equilibrium. **[require further development of the concept]**

Monopoly

monopoly is the market where a single seller is existing, there is no close substitute and entry barriers exist. There are different types of monopolies they are public monopoly, private

monopoly, natural monopoly and artificial monopoly. A monopolist can control either the price or the supply. If the elasticity of the good is relatively inelastic then he fixes high prices. If his good is having relatively elastic demand then he controls the supply which leads to rise in the demand and in turn leads to rise in the price. Thus the monopolist by controlling the either the price or supply ultimately tries to rise the price and maximizing his profits. But at the same time he will also tries to reduce the price to equate his supply with demand so here in monopoly market law of demand is applicable. Unlike in perfect competition in monopoly average and marginal revenues are indicated with two different revenue curves as law of demand is applicable so the revenue curves are downward sloped. So AR curve lies above to MR curve. (revenue curves under monopoly graphs)

Then compare to air transportation the other type of transportation requires to invest a lot of fixed capital like construction of roads, station or platforms or rail roads.

In case of air transportation the service provider need not to own the airport. He can use the airport on lease or rent basis. If the service provider is using the airport on rent or lease basis then it can be considered as fixed cost.

A variable cost is a cost which alters in shorter period or the cost invested on variable assets is known as variable cost. In air transportation sector amount invested to purchase new aircrafts comes under variable cost, along with this direct maintenance cost.

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