The expenses involved in moving products or assets to a different place, which are often passed on to consumers. For example, a business would generally incur a transportation cost if it needs to bring its products to retailers in order to have them offered for sale to consumers.

The study of the economic aspects of transport or in other words transport economics is of prime importance both to economists as well as to geographers. Until recently, geographers have tended to ignore the fundamental importance of cost and price as influences, but now they intend to study the economic aspects realising that an efficient transportation system in many ways is the lifeblood of the economic system. Therefore, the study of the nature of transport costs and pricing, at least in so far as they affect the spatial patterns of transport phenomena, is a basis to transport geography.

The Structure of Transport Costs:

In dealing with transport costs, the distinction between private costs and social costs is important. The former, as the name suggests, are costs incurred by the individual or transport operator in providing a particular services. As Lipsey (1971) says, "this is the opportunity cost to the firm (or individual) or the resources used... these are usually based on the market value of factors purchased".

The identification of these costs is not easy. G william and Mackie (1975) have stated that "the non-storable nature of the product and the differences in the needs for and methods of providing and financing track and terminal facilities between modes, make the transport sector as a complex one even in this respect". On the other hand, social costs are different.

Lipsey defines them as "the opportunity cost to the whole of society of the resources that the firm (or individual) uses". They are costs imposed on society as a whole through an individual making a trip or a transport operator providing a service. These costs are not paid for by the user – social costs are incurred as a result of external effects of the transport activity.

Private transport costs are made up of three main elements:

(i) Track costs – of providing and maintaining a surface over which transports services can operate;

(ii) Running costs – the cost of purchasing, maintaining and operating a vehicle to run on the track surface;

(iii) Interchange costs – the cost of providing facilities at the beginning and completion of a journey.

The two broad category of transport costs are fixed costs (usually called by economists as inescapable costs) and of variable costs (escapable costs).

Fixed Costs:
These are costs, which are incurred before any traffic at all passes.

They include the costs:
(i) Of providing the infrastructure (i.e., the roads, the port or the railway line);

(ii) Of providing, equipping and staffing the terminal facilities (i.e., bus depots, railway stations or airports);

(iii) Of providing managerial, administrative and maintenance staff and their offices and workshops.

These costs are inescapable because they cannot be avoided except by abandoning the whole operation. They also do not vary with the level of traffic, but remain independent of it. A railway signal-box of the old fashioned kind, controlling a short stretch of line, must be manned (and thus incurs wage costs) whether there is one train or six trains per hour over the line.

Variable Costs:
These are costs incurred by the actual movement of traffic and therefore vary with the level of the traffic passing. They include the cost of fuel, crew wages and the maintenance of vehicles due to the operation of those vehicles in traffic service, for example the replacement of worn bus tyres or routine inspection of an aircraft after so many hours airborne. They are called escapable because

they can be avoided or escaped by not running a particular train, suspending a particular flight or a private motorist leaving his or her car in the garage and walking to the shops.

But there is one very important consideration, which complicates an otherwise simple concept. In the very short run, to suspend the last bus on Saturday night will probably see only the fuel and tyre wear, for even the driver will have to be paid the guaranteed minimum weekly wages. Over a slightly longer period, all the drivers' duties could be rearranged and perhaps one of them gives notice.

In the medium run of several years, bus schedules could be redrawn and four new buses ordered as replacements instead of five. In the long run the whole bus service could be closed down and then all the costs previously regarded as fixed would become escapable. We must therefore talk in terms of short-, medium- or long-term escapable costs and must remember that a short-term inescapable cost may become escapable in the medium term.

Because of differences in the basic technology of the various transport modes, the proportion of fixed (inescapable) and variable (escapable) costs in the total costs varies as between those modes. For example, the railway is characterised by having a high proportion of fixed costs in its total costs.

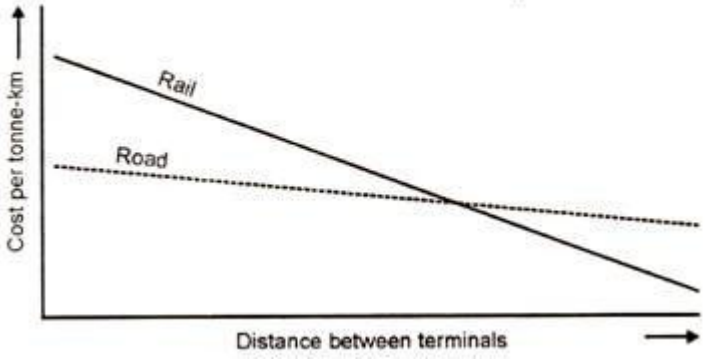
It has been calculated (Munby, 1968) that 44 per cent of railway costs are fixed and 56 per cent variable. In contrast, road transport is characterised by a much lower proportion of fixed costs in its total costs (which may of course be higher, equal to or lower than rail costs in a given situation). On average 22 per cent of road haulage costs are fixed and 78 per cent variable. The identification of fixed and variable costs for the main modes of transport is shown in Table 6.1.

Table 6.1
Fixed and Variable Costs of the Main Modes of Transport

Mode	*Fixed Costs*	*Variable Costs*
Private car	Insurance, road fund tax, depreciation, interest	Petrol, oil, vehicle maintenance and tyres
Public Service vehicle	Administrative and workshop overheads, depreciation, interest, insurance and licences	Fuel oil, lubricants, maintenance and cleaning, labour costs
Rail	Track, administrative and technical overheads, terminal costs, depreciation and interest	Fuel, vehicle servicing and maintenance, labour costs
Air	Terminal and engineering overheads, insurance, depreciation and interest, central administration	Fuel, landing fees, certain servicing costs and labour costs
Sea	Terminal and engineering overheads, insurance, depreciation and interest	Fuel and oil, in-voyage maintenance, crew costs and expenses

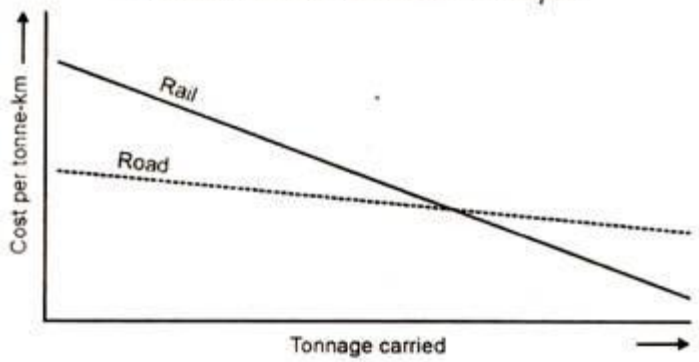
The transport costs per unit varies with the increase in traffic, it falls off rapidly in case of rail than road (Figure 6.1). If traffic is light, unit costs of rail are impossibly high, but if flows are very heavy unit costs are greatly reduced and rail becomes very competitive.

Figure 6.1
Unit Costs in Road and Rail Transport



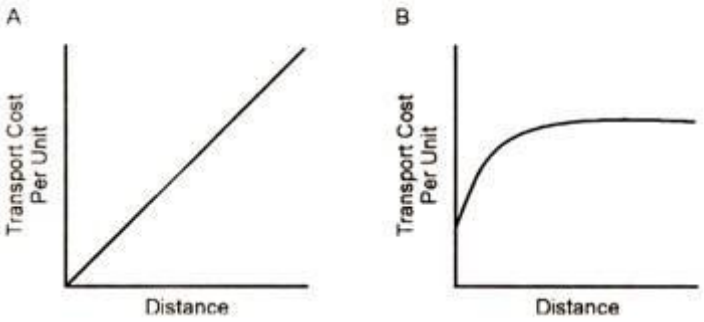
All transport operation also gives rise to terminal costs (Figure 6.2). These are both fixed and variable. The proportion of terminal costs in the total costs varies between modes. In road haulage the terminal costs can be negligible. On the other hand, to send goods by rail may entail conveying them by lorry from factory to goods depot, loading them into wagons and reversing the process at the other end.

Figure 6.2
Terminal Costs in Road and Rail Transport



The transport costs are also proportional to distance, in other words, each additional unit of distance added an equal increment of cost to total transportation costs as shown in Figure 6.3.

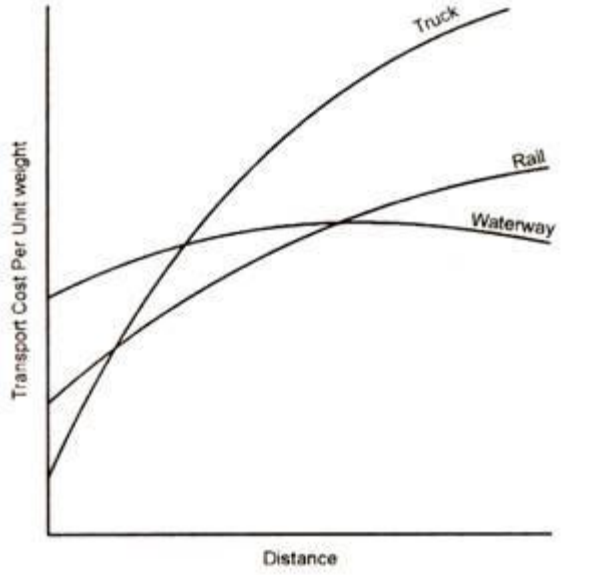
Figure 6.3
Transport Cost Curves (A) Proportion to distance; (B) Less than proportion to distance



As a result of these varying cost characteristics, each transportation medium offers advantages over different length of haul. Figure 6.4 depicts and idealized transport cost curves for three transportation media.

Figure 6.4

Idealised Transport Cost Curves for Three Transport Mode



Marginal and Average Costs:

Marginal cost is the additional cost incurred in order to produce one more unit of output. Marginal cost may be incurred by carrying an extra passenger on a bus with seats to spare or another tonne of goods on a half-empty lorry or of a wagon on a freight train. It may even mean to allow 25 trains in a day instead of 20. Marginal costs are therefore time linked and it may be of short-run or long-run nature.

Marginal costs do not represent constant additional to costs. Up to the capacity of the transport unit (bus, aircraft, train, ship), any further increase in traffic incurs negligible marginal costs. Then, there is a sharp increase at the point, where a second unit becomes necessary. Marginal costs also vary between modes of transport.

Average costs are abstained by dividing the total costs of the operation by the work done, expressed in terms of passenger-km, tonne-km or transport-unit-km. Average costs will of course vary with output, for greater the product the more the fixed costs can be spread.

Step freight rates are often applied in case of railways. In such case, calculation of such rates would have been by adopting grouping of rates, i.e., group a number of neighbouring railroad stations together and treat them as a single station from a rate making of

view. Thus, all the stations in a single group would operate the same rate to any other group.

Transport Costs and Quality of Service:
Quality of service is of equal importance to cost of service, and in many cases users are prepared to pay for quality. As Table 6.2 shows, the attributes of quality vary as between passengers and freight.

Table 6.2
Quality of Service – Not Necessarily in Order of Importance

Passenger	*Freight*
Reliability	Reliability
Frequency	Speed
Speed	Freedom from damage and pilferage
Comfort	
Safety	

Passenger looks for reliability above all, the likelihood that the service will fulfil the promise of the time table. For urban bus passengers the most frustrating experience is to wait 15 minutes for the next bus on a 5-minute service at the end of which time three buses come along together. For short journeys frequency is important, as this reduces waiting time. Speed is important for the businessman an he is prepared to pay higher fares for a faster service.

Conversely, for the student, money is important than time and he will be prepared (if he cannot hitch) to go by motor coach, slower but cheaper than rail, at least before the introduction of railcars. Comfort is another quality that passengers are prepared to pay for. To provide first-class accommodation in trains and aircraft is more costly to the operator because fewer passengers can be accommodated in a given space.

First-class fares are therefore higher, but some people are prepared to pay these. Obviously, too, passengers demand safety and because of this pay higher fares, though they may not realise that the higher the safety standard the higher the costs.

The freight shipper may be prepared to pay more for better quality service, as this may allow him to reduce his total transport costs.

Although rates for air cargo are higher than by surface routes, it may pay the shipper to use the air, as the extra cost may be outweighed by the reduction in cost of packing and insurance (due to greater freedom from pilferage and breakage) and the reduction of the quantity of goods in transit due to greater speed. If the service reduction of the quantity of goods in transit due to greater speed. If the service is reliable and frequent, warehouse charges can be reduced or eliminated

Pricing:
The price of transport to the user is the other side of the coin from the cost to the producer of providing the service. In the long run, of course, price must be related to cost so that revenue can be related to expenditure, even if the revenue is made up by open or concealed subsidy. But in the short run of the day or the week or in one direction of a two-way service, or on some branches of a system this is by no means necessary. In fact, sometimes price is fixed irrespective of cost.

This is because a transport service cannot be stored. Once created, the service is wasted if unused. To run a 50-seater bus 20 km produces 1,000 seat-km. If only 10 passengers travel for 10 km, only 100 seat-km are sold and 900 seat-km are wasted yet the costs incurred are the same as they would be if the bus were full.

Airlines are particularly concerned with this, the load factor, on which they base their fares. Thus, a load factor of 50 per cent on a particular service means the airline can expect to sell half the seat-km produced. Fares are therefore fixed to cover costs on the assumption that half the seats as sold. To increase profitability, every effort must be made to fill the otherwise empty capacity.

It may cost no more to provide a seat on a suburban train at 08.00, 14.00, 17.00 or 22.00 hours. Suppose the cost per seat-km is 2p, the distance 20 km and an 80 per cent load factor is expected, the cost per passenger would be 50p. At 08.00 hours and 17.00 hours large numbers want to travel to and from work. It may be possible to charge them 60p without driving them on to slower buses or to using their cars.

On the other hand, shoppers and theatregoers have to be enticed on to the 14.00 hours and 22.00 hours trains (which have to be run anyway) by charging them only 40p. The whole secret of success in this form of fare manipulation is to maximise revenue. There is no point in raising fares beyond the point that loss of passengers more than counteracts increased revenue from those remaining; or to fix them so low that the extra passengers do not compensate for the reduced revenue for each passenger. In practice, too, extra costs may be incurred by providing peak-hour services.

Sometimes a different fare or rate may be charged for a service which costs the same to provide. Thus, on almost any train you will find people with ordinary tickets, cheap-day returns, concession tickets, season tickets and children with half-fare tickets. All these are in possession of tickets based on different mileage rates, but are occupying seats which cost exactly the same per kilometre to provide.

Economists refer to this as discriminatory charging. With careful manipulation, discriminatory charging can ensure that revenue is maximised, but care must be taken lest too many people buy tickets below the cost they would otherwise be willing to pay. In the middle 1960s the then British European Airways introduced on their domestic flights very low standby fares. In theory these would have led to the selling of a few extra seats above the expected normal load factor, which, as we have seen would represent a clear profit.

In practice, too, many regular travellers, well aware of the usual loading of their planes, came for standby tickets knowing they would be available. In contrast to charging different rates for a similar service is the practice of charging the same rates for services with widely differing costs.

This system is known as cross-subsidisation. Many economists are much opposed to cross-subsidisation as they consider prices should reflect cost difference. But some measures of cross-subsidisation is necessary between various journeys on a single route or between routes on a system. For the geographer it is necessary to bear cross-

subsidisation in mind as an important factor in shaping the physical layout of networks.

The principle of cross-subsidisation is an important practical aspect of transport pricing. As distinct from subsidies, cross-subsidisation takes place from within a transport agency. In simple terms, profits from viable services are used to offset losses on unremunerative routes. There are numerous examples, which could be used to illustrate this principle. For railways, revenue on inter-city routes provides a contribution towards the running of certain local and rural services.

Bus companies use revenue from busy urban routes to offset losses on rural services. Domestic air travel in Britain is loss-making yet profits are made on European routes. These examples therefore illustrate an important real-world consideration. In practice, therefore, the theoretical ideal of marginal cost pricing is unpossible to apply, yet it still remains as a basis for the pricing policies of public sector transport agencies.

Transport Investment and Cost-Benefit Analysis:
In the usual sense, investment is the term used by economists to denote expenditure on items of fixed capital such as buildings, plant and machinery. Investment in transport infrastructure for example roads, airports, railway track and termini, could be termed as this type of investment. In addition, transport investment also takes the form of investment in transport vehicles such as cars, Lorries, airplanes and ships.

One important contrast between the two main types of transport investment is that the latter tends to have a much shorter length of life and the operating costs are high in relation to the initial capital cost. Transport infrastructure, on the other hand, has a considerable life span and the annual maintenance costs tend to be very low in relation to total investment. In this section, the word investment refers to fixed investment in transport in infrastructure.

The cost-benefit analysis considers all the relevant costs and benefits pertaining to a project. As Prest and Turvey (1966) say, “It

is a practical way of assessing the desirability of a project to take both a long and a wide view". A 'long' view is necessary because transport infrastructure, for example, is built to last for a considerable length of time while a 'wide' view implies that projects are considered in terms of their overall value to society as a whole.

Cost-benefit analysis is therefore concerned with the enumeration and evaluation of all the relevant costs and benefits. On this basis, those projects, which give the greatest 'rate of return', are those, which are given the go-ahead. Conversely, projects, which give lower rates of return on capital employed, may not get the go-ahead due to limitations on capital available.

As a technique, cost-benefit analysis only emerged during the 1960s, although pioneer studies were undertaken in the late 1950s. Until about 1958, investment decisions in transport infrastructure were based on rather different criteria. For roads, the criteria for investment were one of need, and in general, road space was provided in whatever areas it was required. Other transport investment was on a commercial basis, with the general principle for adoption being that a given project should produce a profit.

The technique of cost-benefit analysis is still in its infancy and has been continuously refined. In contrast to pre-1958 situation, it takes into account some of the repercussions of a project on society as whole. Even so it seems appropriate to voice a word of warning about cost-benefit analysis – it is by no means a rapier-like technique for at the best, it provides but a rough and ready guide as to which projects should be built.

There are various stages in a cost-benefit calculation. These are:
(i) The identification of the various costs and benefits;

(ii) The measurement or enumeration of these costs and benefits;

(iii) The assessment of the effect of time or length of life on the investment appraisal; and

(iv) The decision on an investment criterion so that all projects in a particular field can be assessed and ranked in order of priority according to this criterion.

The cost-benefit analysis forms the basis for investment decision in transport infrastructure, but at the same time it is only a guide for investment decision and has certain limitations. The environmental and social considerations are also important and should be taken into consideration properly.