Pricing, Cost Recovery and Production Efficiency in Railways

Anand Venkatesh

Associate Professor

Institute of Rural Management Anand

Presentation Flow

- Railway Pricing – The Context
- Review of Optimal Pricing Policies from Economic Theory
  - Economic Efficiency
  - Marginal Cost Pricing
  - Peak Load Pricing
  - Indivisibilities
  - Joint and Common Costs
  - Monopoly
- Pricing and Production Efficiency- A Critique
- Railway Pricing Revisited

Railway Pricing - The Context

Railway Problems and Causes

Problems	Causes
Chronic financial deficits	Constraints on charges imposed through government regulation; persistent excess capacity; provision of guaranteed service levels at fixed prices or with 'excess' competition; provision of services at below marginal cost; failure to understand costs; ineffectiveness in collecting revenues; low productivity; unduly high operating costs; overmanning.
Growing operating subsidies	Chronic financial deficits; lack of corporatization; inadequate distinction between the role of the government and that of the railway operator; unsustainable subsidy policies.
Archaic pricing structures	Prices are not related to marginal costs; costs not properly identified or measured; inadequate financial and management accounting systems; inadequate or non-existent objectives of pricing policy.

Problems	Causes
Lack of equitable fare structure and excessive fares	Lack of user or community representation in service and price decision-making; public or private monopoly.
Excessive costs; low managerial and technical efficiency; low productivity	Lack of competition or existence of a 'natural' monopoly; overmanning; inadequate funds for investment.
Low service quality; congested services; services failing to respond to needs	Lack of competition; no peak-load pricing; inadequate cost recovery in pricing policies; inability to reinvest operating surpluses or raise funds for investment.
Deficiencies in physical infrastructure; insufficient investment funding; lack of proper maintenance of assets	Failure of pricing policies to recover capital costs; structural inability to retain/reinvest surplus funds; constraints on investment or borrowing.
Widespread state ownership of infrastructure and services; low private sector participation	Lack of policy or strategic commitment to competition/corporatization/privatization.

Optimal Pricing Policies

Pricing Strategies

- Pricing a method of resource allocation

- No such thing as the "Right" price- optimal pricing strategies to permit specified aims to be achieved

- Need to examine appropriate pricing policies for transport undertakings faced with variety of objectives and range of market conditions

- Possible objectives
  - Economic efficiency
  - Profitability
  - Income distribution

Economic Efficiency

- Derived from Welfare Economics
- Concerned with the allocation of resources in a economy
- Inefficient resource allocation- one which can be changed to make some people better off and non worse off in terms of their own preferences
- Efficient resource allocation – such change is not possible
- Implies managerial and technological efficiency where services are provided at their lowest costs
- Means that the "full costs" (including social, environmental and opportunity costs)
- Argument that economic efficiency take precedence over other objectives while designing pricing policies

Profitability

- Gross trading surplus- excess of total revenue of enterprise over its operating costs

- Profit – excess of gross trading surplus over interest and depreciation provisions

- Governments focus on gross trading surplus while enterprise focus on profits

- Has implications for public finances and motivation in enterprise

Income distributions

- Governments have explicit views of real income distribution in society
- Reflected in instruments such as taxation and public expenditure
- Also reflected in provision of services such as transport at subsidised prices
- Such subsidies permit higher level of usage by certain income groups than they could otherwise afford
- Lead to higher levels of output of particular services
- Benefits certain factors of production such as labour inform of greater employment and higher wages
- Facilitates redistribution of real income through provision of subsidised factor inputs which ultimately reflects in transport prices

Economically Efficient "First Best" Pricing

- Social Welfare or Surplus-Defined as the sum of consumer surplus(net consumer benefit) and producer surplus (Economic Profit)

- Assumptions of a "First Best" Scenario

  -Perfectly Competitive market

  -No indivisibilities in supply or demand

  -perfect information about tastes and preferences

  -no subsidies

- Social Surplus maximized when price is equated to marginal (social)cost

- Setting profit maximizing price reduces social welfare. Denies some consumers of service even if they are willing to pay the marginal cost of the same

- This fear of monopoly exploitation has led to widespread price regulation by numerous governments

- Setting prices below marginal cost also reduces welfare

Welfare Maximization
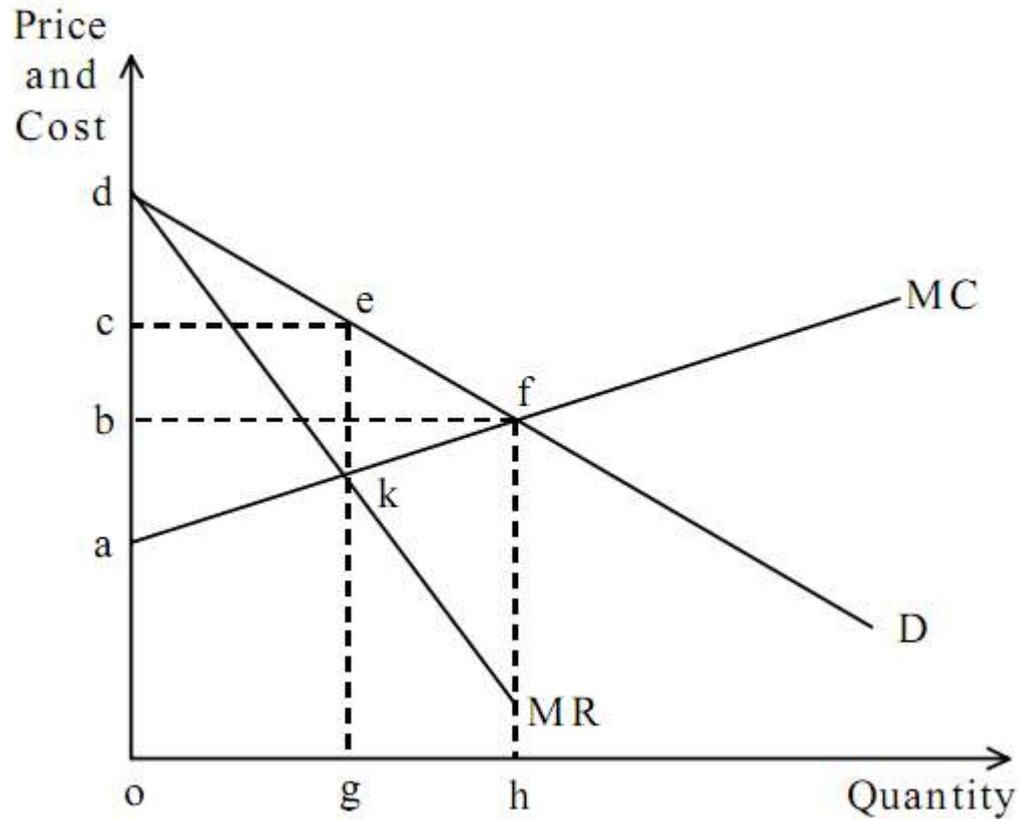
Short Run vs Long Run Marginal Costs

- Different Factors of Production have differing degree of fixedness or variability over various business planning horizons

- Need to identify those costs that can be varied (variable costs) and those which cannot (fixed costs)

- Two typical problems faced by a transport operator

    -To set, at the beginning of the planning period, a price that

    will prevail in that year

    -To choose, at the beginning of planning period, an   investment programme based on planned price and output over the period based on some demand forecasts

- MC pricing requires price to be equal to marginal cost within that period of time

- Two sets of decisions need to be taken

  -price output combination for the current period given demand

  -planning future price and output based on demand projections

- Planned price and output will be implemented in future years only if assumptions about demand and costs on which they are based turn out to be correct

- Prices should normally be set in relation to Short Run Marginal Cost which may lie above, equal to, or below long run marginal cost.

"Second Best" Pricing

- First best conditions rarely found in the real world
- Normally characterized by the following:
    - -Indivisibilities of supply; short run capacity constraints
    - -Indivisibilities of demand; peak load problem
    - -Elements of monopoly instead of perfect competition
    - -information about future prices, tastes and technologies
    - -prevalence of subsidies
- Very unlikely that market will adopt marginal cost pricing without regulation thereby not maximizing social welfare
- Challenge: to find optimal pricing strategy in a second best world

Challenges for Optimal Pricing Policy

- Balance economic efficiency, equity and transaction costs
- Offer choices and information to consumers
- Minimize distortions
- Encourage producer competition
- Avoid adverse income redistribution

Pricing With Fixed Capacity Constraints

- Consider a bridge whose output is represented by number of vehicle crossings in a year

- Short run MC- cost of maintenance and toll collection per vehicle crossing

- Long run MC- this plus additional capital cost per vehicle

- Before construction, capacity flow can be varied but once built, it is fixed atsome level.

- While planning, problem is to decide on optimal capacity (size and design). However once built, it is simply necessary to decide on price (toll)

MC pricing under various demand scenarios

- Overestimation of demand: Marginal cost pricing results in welfare maximization but results in a financial loss. However, forecast demand at capacity will enable operator to break even in the next period.

- If demand is overestimated, variable costs are likely to be covered but no contribution to fixed expenses will be made.

- If demand is less seriously overestimated, price would be set so as to ration demand to capacity and revenues will make partial contribution to capital costs.

- If demand has been underestimated, it is a signal to expand capacity in the long run, however may take some time to complete

- In short run prices acting as demand rationing device could be quite high, could evoke popular and political protests to restrict price

- An outcome of this could be to reduce price to break even level.

- However, this would lead to excess demand, congestion and queuing with additional time and fuel costs for bridge users.

- A recommended solution is to provide targeted subsidies to the poor after appropriately identifying them thereby using up some of the profits

- This is an acceptable price to pay to ward off political pressure arising from income distributional consequences of a market clearing price.
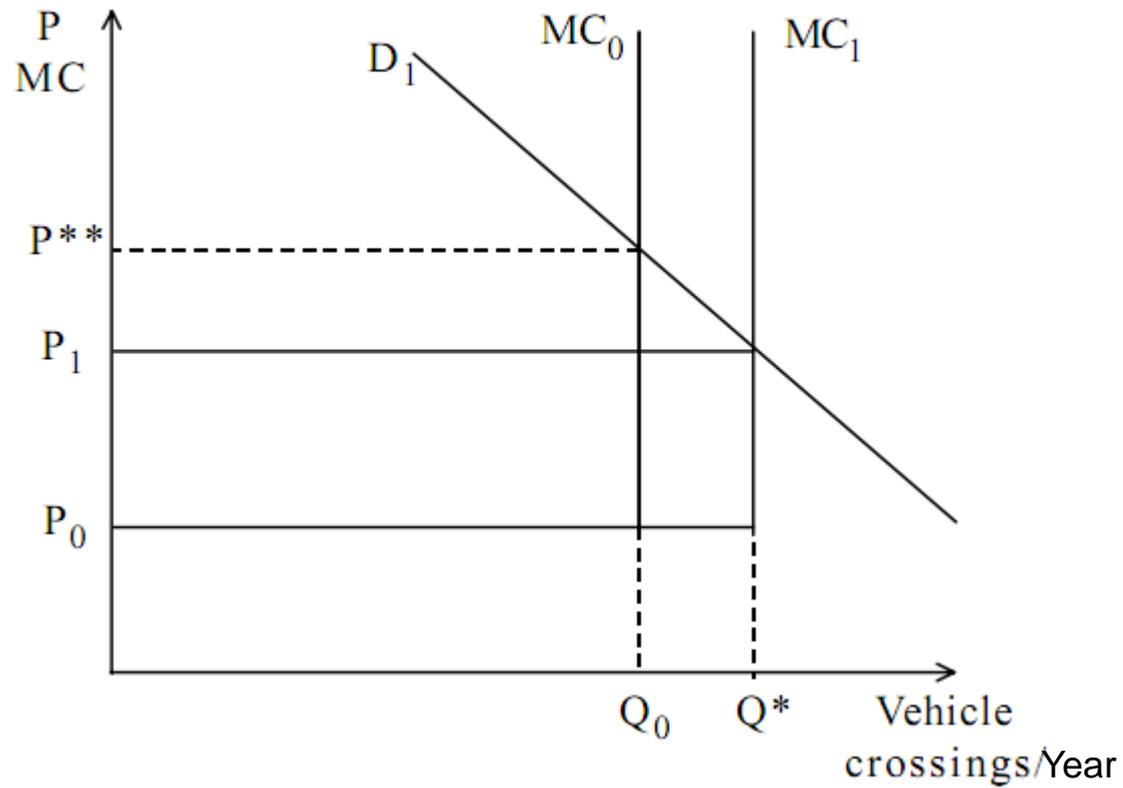
Pricing with Excess Capacity
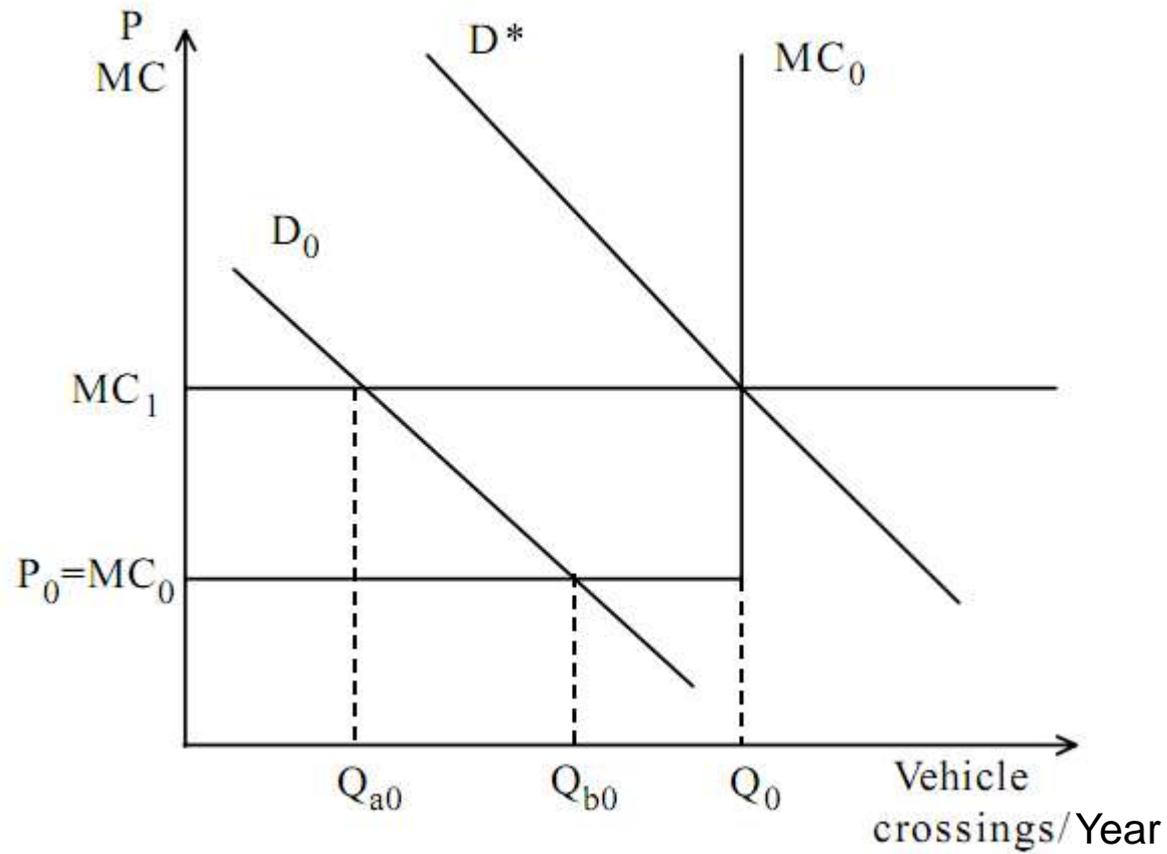
# Full Capacity Utilization
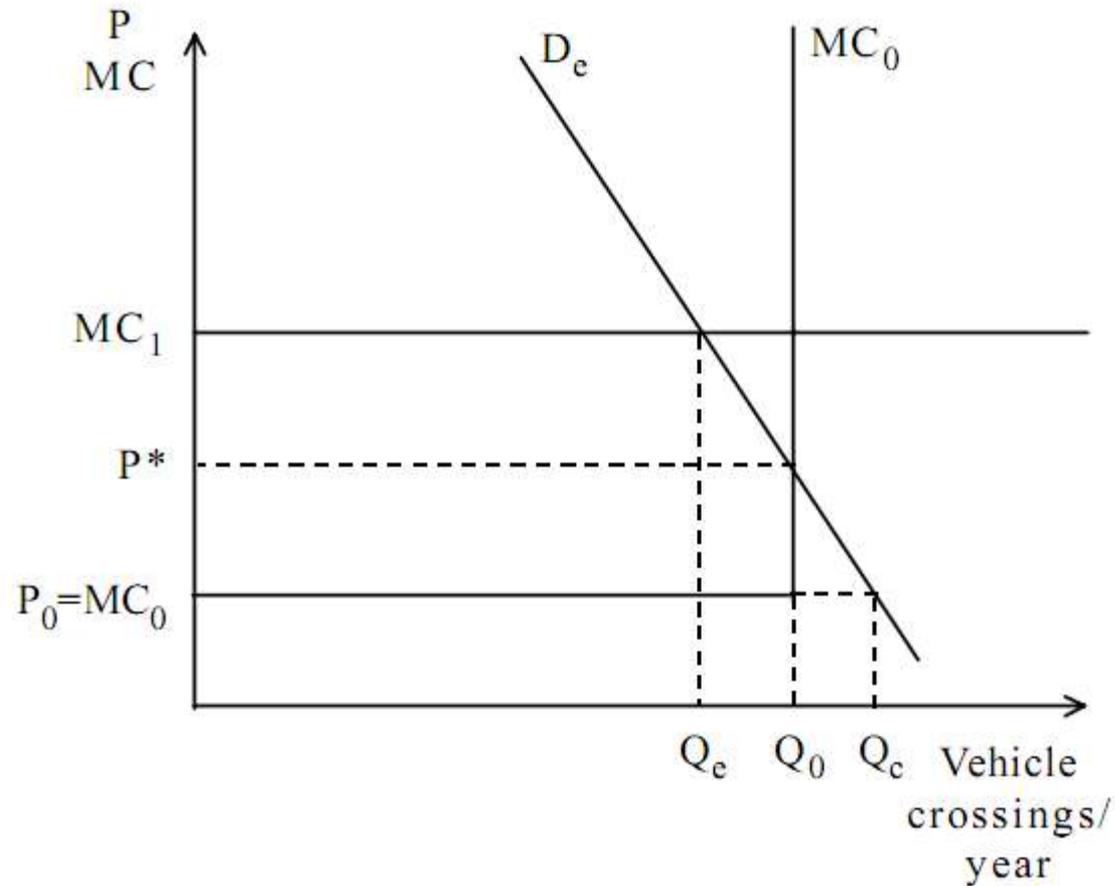
Excess Demand

Peak Load Pricing

- Rail transport often experiences a systematic pattern of demand fluctuations within a given period, pattern repeating from period to period.

- Duration too short to match by capacity variations

- Demand at all times met from same installed capacity, hence corresponding fluctuations in capacity utilization.

- If capacity is provided to meet the peaks, then the rest of the time varying amounts of it lie idle

- Demand for a particular period depends on the price of that period as well as price of other periods.

- Pricing policy to "flatten peaks" and raise the troughs to get a more even rate of capacity utilization and lower level of required capacity.

- Problem: Applying MC pricing to a system with fluctuating demand

Daily Demand Cycle
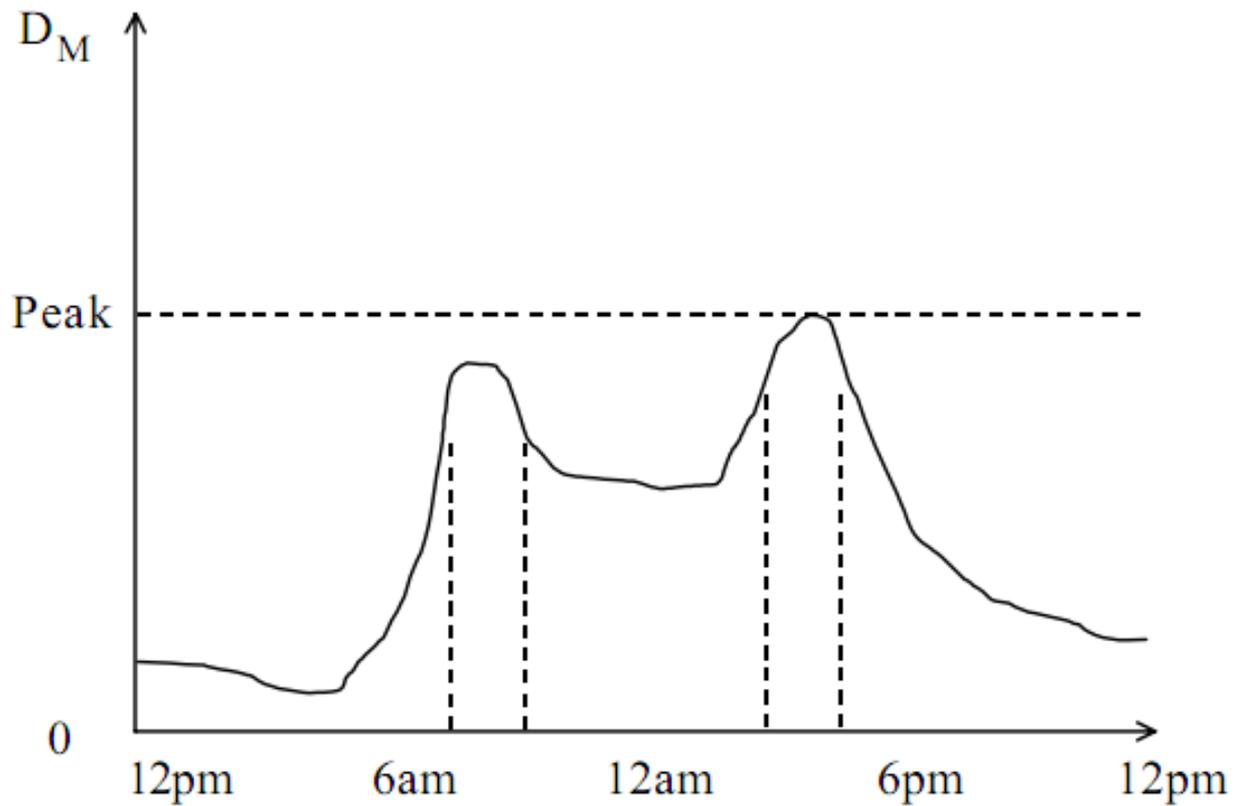
Peak and Off-Peak Demand
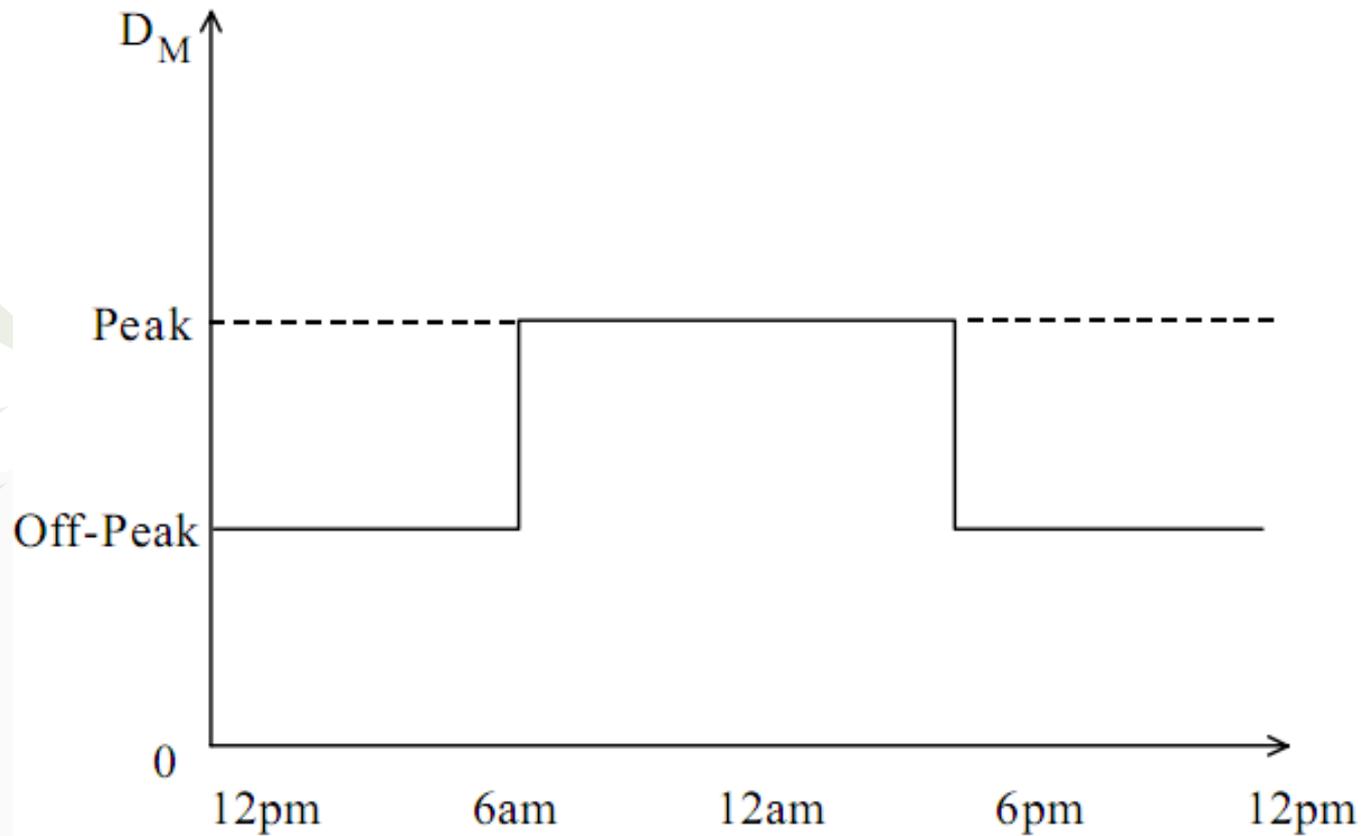
Problem

- To identify the optimal number of pricing periods, given the cost and complexity of introducing pricing structures.

- To determine the optimal total capacity and uniform prices within these periods.

Pricing policy

- Off peak users simply cover their running costs and make no contribution to capacity costs

- peak users make a conribution to capacity costs of the difference between price they pay and running costs.

- Losses if made are due to overestimation of demand during previous investment decisions.

- Justifiable to install extra capacity if user willingness to pay for that unit of capacity exceeded its cost during both periods.

- Optimal capacity level is one at which the sum of this "marginal willingness to pay" just equals marginal capacity costs.

- Charging off-peak users more than their marginal willingness to pay, i.e. marginal running costs would lead to welfare losses.

- Flattening the peak not an objective in itself

- As a result of optimal pricing an optimal load curve can be obtained, not necessarily flat.

- Difference between peak and off peak usage with marginal cost pricing depends on size of marginal capacity costs and elasticity of demand in both periods

..

Indivisibilities

- For Rail infrastructure and services, capacity can be increased only increased in relatively large indivisible units.

- Economic problem is therefore the appropriate scale of operation

- Assuming uniform demand, it is necessary to compare welfare implications (benefits and costs) under current and enhanced capacity

- Issue essentially one of optimal investment timing since under growing demand, there will come a point where an increase in capacity is "worthwhile"

- Whether facility makes a profit or loss under MC pricing depends on whether price lies above or below Long Run MC. However, over time its NPV must be positive

- Tradeoff between raising price floor above marginal running cost resulting during times of excess capacity (resulting in underutilization) vs setting price ceiling during periods of excess demand

- Premature investment in capacity likely to represent waste of natural resources though it will keep MC based prices low

Indivisibilities
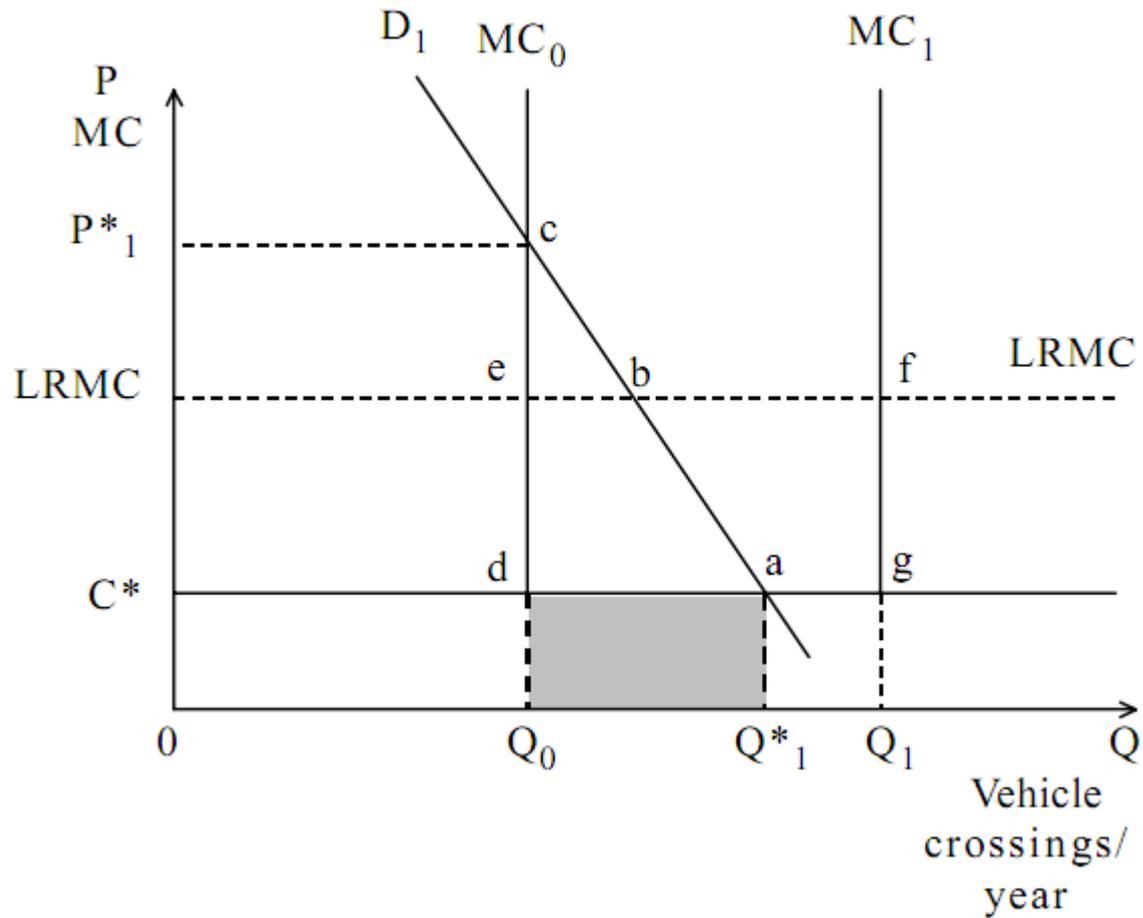
Joint and Common Costs

- Many costs in railways fall under the category of "joint" or "common" costs

- Joint costs: provision of a specific service necessarily entails the output of some other service. Eg: return trip or back haul

- Not allocable to specific traffics and can be escaped jointly only when service is withdrawn

- Price would generally be determined by differences in demand in each direction

- Number of trips (trucks) would be reduced till joint costs are covered in event of losses

- Common costs: incurred as a result of providing services to a range of users

- Differ from joint costs in that resources used for providing one service do not inevitably result in another service. eg: same infrastructure used for passenger and freight services

- Joint or common costs can be fixed or variable in nature

Monopoly

- If the transport market is fairly small relative to the size of capacity, a "natural monopoly" is likely to emerge since market is unlikely to be able to support more than one optimal sized firm

- Risk of unregulated market not providing optimal transport prices

- Thus government often intervenes by either directly providing transport services or by regulating the prices

- Existence of declining costs (economies of scale) is an important reason for emergence of natural monopolies in railways

- Flipside of monopolies: increase costs, no incentives for development of alternatives, lack of innovation , etc

Price Determination under Monopoly vs Perfect Competition
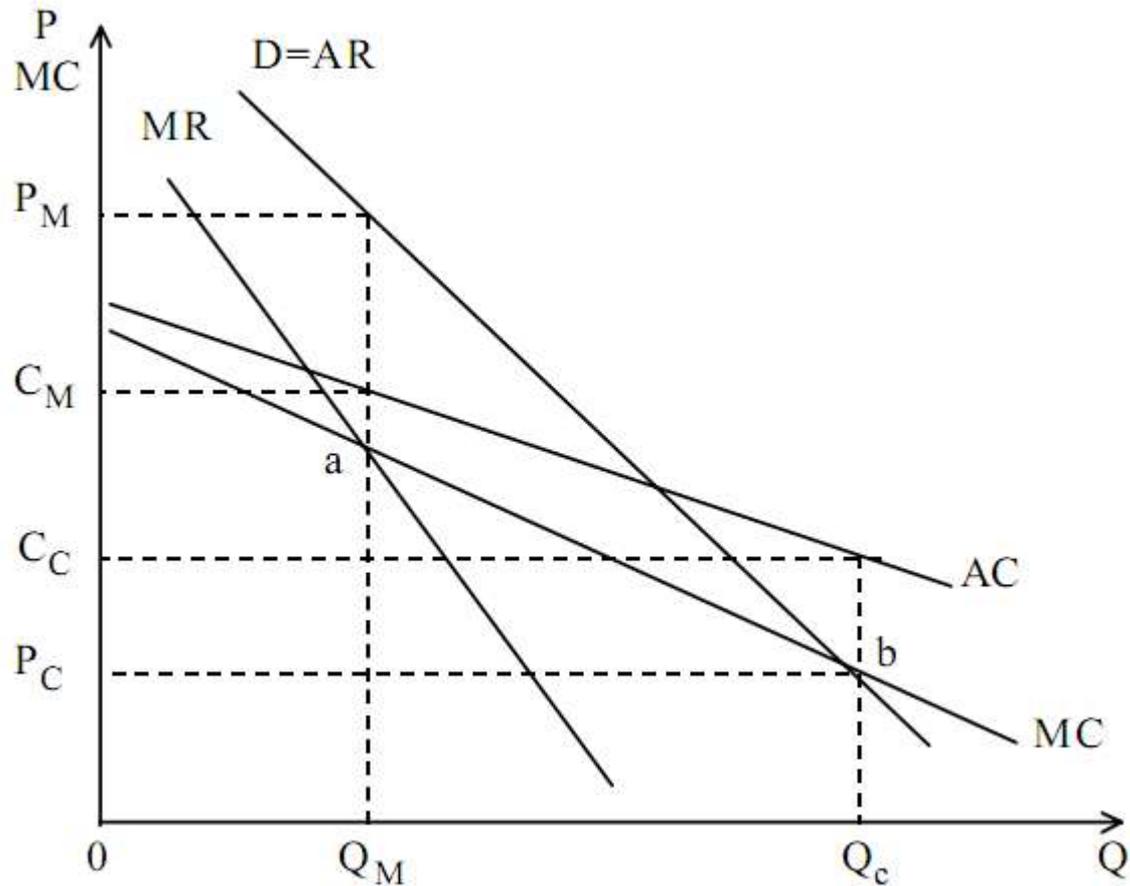
Railway pricing Revisited

- Rationale for Public Control in Railways

    -Duplication wasteful or impractical

    -Unregulated competition could lead to frequent timetable changes and volatile fares

    -adverse equity effects

Justify need for control but do they justify continued state operations?

- Competitive awarding of long term concessions, licenses or leases of facilities a means of introducing market forces into provision and management of railway infrastructure?

- PPP in railways?

- Corporatization of provision of rail infrastructure?

Economic Principles for Charging Framework

- Comprehensibility
- Transparency
- Stability
- Measurability, cost effectiveness and objectivity
- Cost-reflectivity

      -variable costs-vary with output, maintenance, operations and replacement

      -fixed costs-which are incurred irrespective of whether more or less traffic is carried

      -need for distinction between price signals based on variable costs which guide operating decisions and charges to recover fixed costs, which need to be levied in the least distortionary way

- Efficient production and allocation of railway infrastructural resources should be based on the avoidable (marginal) costs of changes in use of existing network and in the network itself
- Charges should reflect the incremental (or avoidable) costs involved. Can often be different from "decremental costs"
- Examples of avoidable costs
  - Increases or decreases in operating costs (eg. Signaling staff)
  - Increases or decreases in maintenance and renewal costs
  - Compensation to be paid during construction
  - Capital costs

Consequences of Indivisibility (lumpiness) of Assets

- Congestion Costs: As the network becomes more crowded, less flexibility to recover from effects of delays

- Opportunity Costs: the costs of having slots occupied by lower valued services in place of higher valued services

- If fully reflected in charges, could lead to a wide divergence between SRMC and LRMC and associated price signals.

Inter Urban Passenger Railways

- Charges usually based on distance with a tapering charge per Km as distance increases

- Differential pricing consistent with public interest in economic utilization of resources

- Three most important dimensions in designing a differentiated fare structure are:
  - Periodic aspects (Day of the week, Month, etc)
  - Journey purpose
  - Personal characteristics

- Difficult to easily ascertain the last two, need for proxy measures

Main Factors for Fare Structure

- Period of travel and return travel
  - Weekend leisure trips, vacation trips, etc
- Quality of Service
  - Fast convenient services likely to attract business travellers
- Quality of Competition
  - Strong competition from say, bus transport will lead to higher price and service elasticities
- Type of persons travelling
  - Children, students, pensioners
- Number and characteristics of persons travelling together
  - Family groups, including children

Possible pricing mechanism

- Highest fares to be charged from business passengers travelling alone in first class during peak times on weekdays

- Lowest fares could be charged to students or children or students travelling second class, at off peak times, possibly in groups

- Operators need to determine how complex they would like the pricing structure needs to be as also the number of classes of travel to be offered

- Need to carefully assess the elasticity of demand and changes in the same due to internal or external changes

Rail Freight Pricing

- Dominant element in trainload freight costs is capital charge on locomotives, wagons and terminals

- Hence asset utilization becomes crucial

- Most favourable traffic-Regular, large consignments in sufficient frequency for rolling stock to be permanently committed to traffic, even if it means empty back hauling

- Costs usually minimized by operating largest and heaviest trains permitted by the infrastructure

- Additional costs of trip working and marshaling and empty running if traffic has to be combined-reduces asset utilization and increases unit costs.

- Economies of scale critical for competitive advantage

- Asset utilization increases with traffic flow on particular route

- Nothing inherently wrong in promoting a competitive rail freight industry as no real evidence of economies of firm size
- Risk of wasteful competition only present in common carrier services eg. Parcels business
- For bulk traffic, no economic objection to allowing shippers to choose their own train operators or use their own trains
- Government regulations necessary to ensure safety standards
- Common carrier rail services suffer much higher fixed or inescapable costs leading to natural monopoly, which is limited by competition from other modes
- Due to economies of scale, pricing to recover costs could lead to divergence from MC pricing and hence welfare losses
- Problem most marked in case of infrastructure costs, particularly where certain services have spare capacity to meet peak demand or maintain service quality

Possible Pricing Solutions

- Base price on MC with resulting deficit being financed by government subsidy

- Base prices on full or average cost but this could be sustained only by protection from competition from other modes

- Adopt discriminatory pricing according to shippers' willingness to pay to cover the difference between average and marginal costs. This eliminates need for regulatory role of government as allocation of freight is determined by the market and long term investment planning can be made on grounds of profitability.

- Basis of discrimination is usually class of freight determined by value and the extent of competition from alternative modes of transport.

Critique of MC based Pricing

- Tenability of the assumption of "efficient production" i.e production at minimum costs

- If costs are not minimized, pricing based on these costs will not accurately represent the opportunity costs of the resources used, hence welfare distortions are inflated

- Receiving continual deficits will soften the budget constraint of the recipient firm; costs then become merely an accounting identity

Pricing in the Absence of Cost Minimization
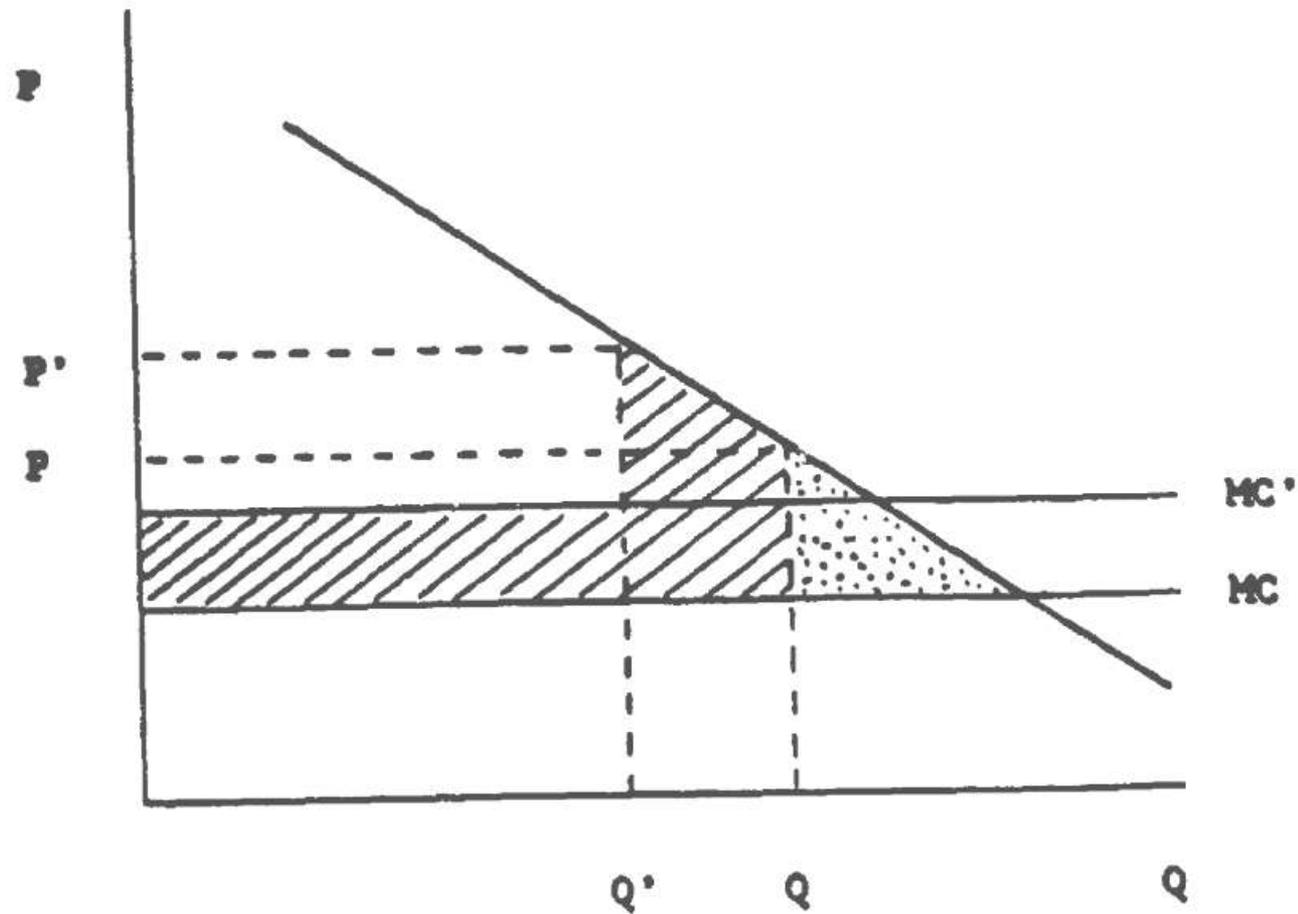
The Principal Agent Problem

- A problem of control
- Principal-Party which establishes the controls
- Agent-Party which operates under these controls and has access to private information
- Challenge: To design a "contract" which induces the agent to exert the optimal effort in sync with the objectives of the principal
- Minimizes loss of efficiency arising from information asymmetry

Hierarchy of Control in Public Sector

- Owner=Tax payers/citizens
- Government
- Enterprise
- Mangers
- Labour

- At each layer there is a principal and agent having distinct goals and information access
- This information asymmetry could give rise to inefficiency
- An optimal control mechanism between each layer could reduce the same

Five Interrelated Causes of Inefficiency in Public Sector Firms

- Goals of the enterprise or regulatory constraints on its operations

- The structure of the output market

- Control mechanism between government and enterprise

- Managerial incentive structure

- Conditions of employment of labour

THANK YOU