

0. TRANSPORT ECONOMICS (MPE_TREN)

Transport economics

- Transport Economics explores the efficient use of society's scarce resources for the movement of people and goods.
- Its numerous case studies illustrate the economic principles, discuss testable hypothesis, analyze econometric results, and examine each study's implications for public policy.

Course

1. Transport markets
2. Demand elasticity
3. Transport demand issues
4. Efficiency
5. Transport costs
6. Imperfect competition
7. Pricing
8. Regulation
9. Ownership
10. Subsidy
11. Transport and development
12. Transport appraisal
13. Demand forecasting

Empirical Project

- The major task will be to write an empirical project in transport economics.

Course Evaluation

- 50% - seminar's activity
- 50% - defense of empirical project

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1. TRANSPORT MARKETS

Market analysis

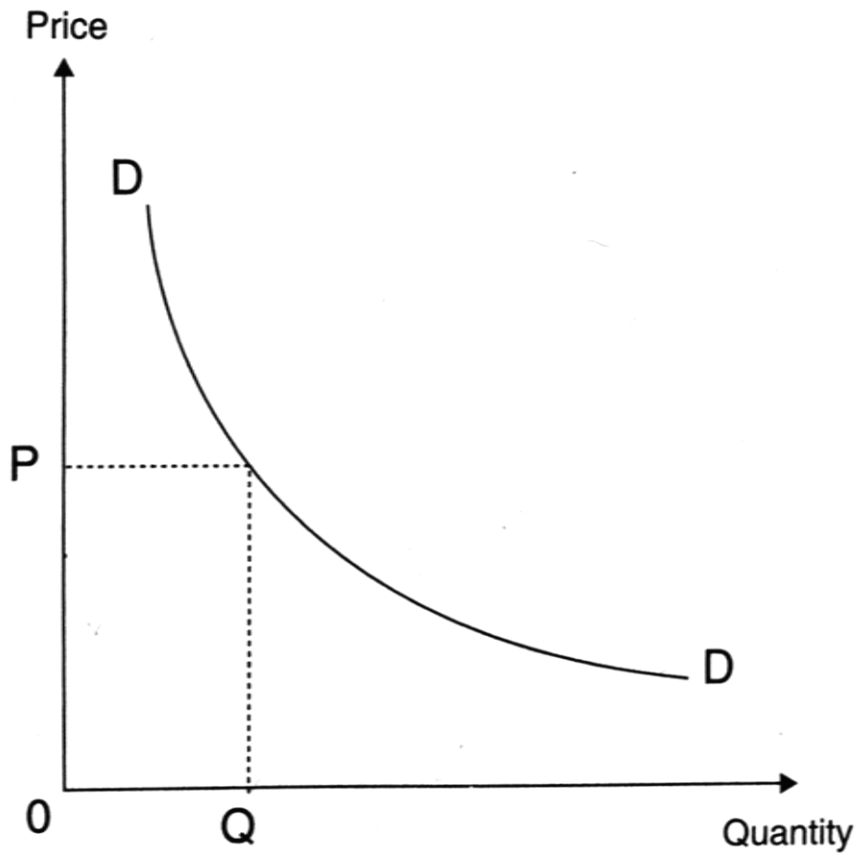
- Market demand and supply
- State regulation and intervention
- Ceteris paribus clause

The law of demand

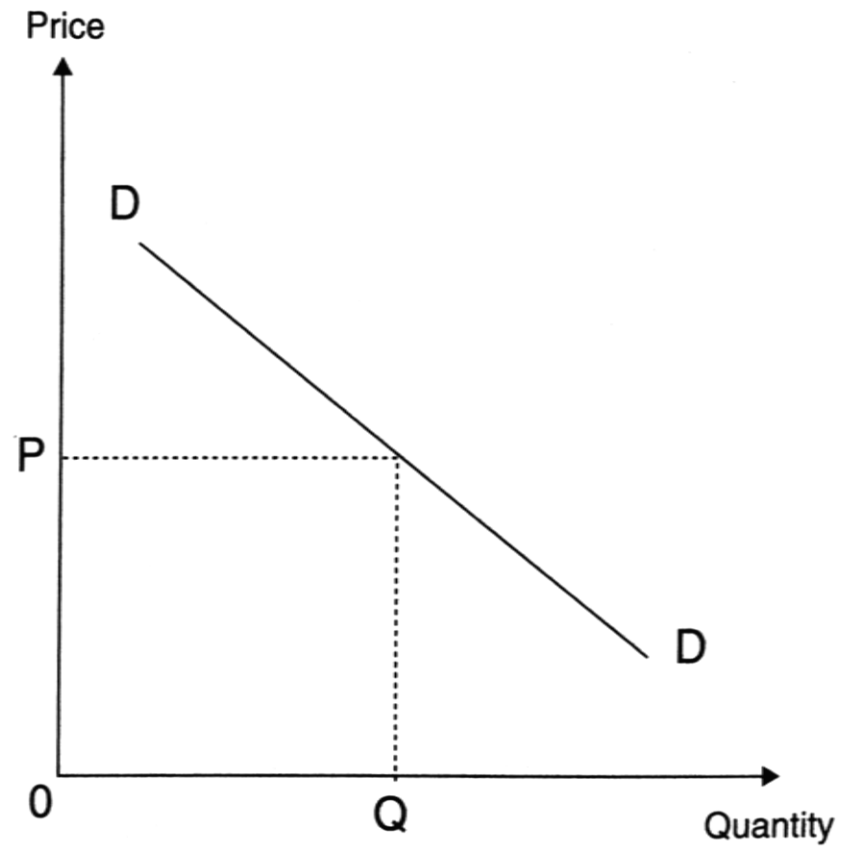
Law of demand states that, all else being constant, as the price of a product increases (↑), quantity demanded falls (↓)

Demand curves

Theoretical



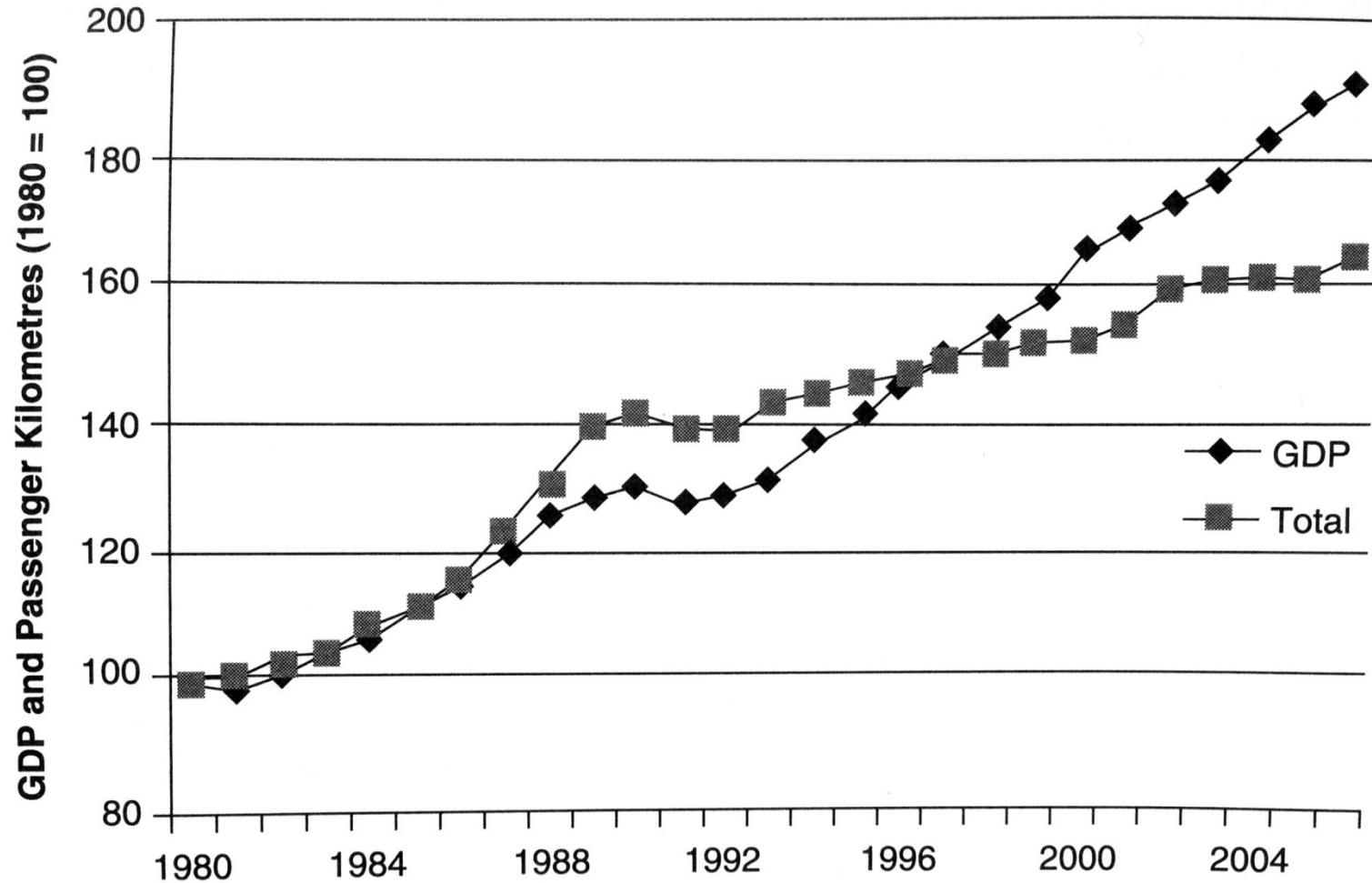
Simplified



Demand determinants

- Income ↑
- Price of substitutes ↑
- Price of complements ↓
- Fashion
- Expectations

Case 1: Impact of income on demand



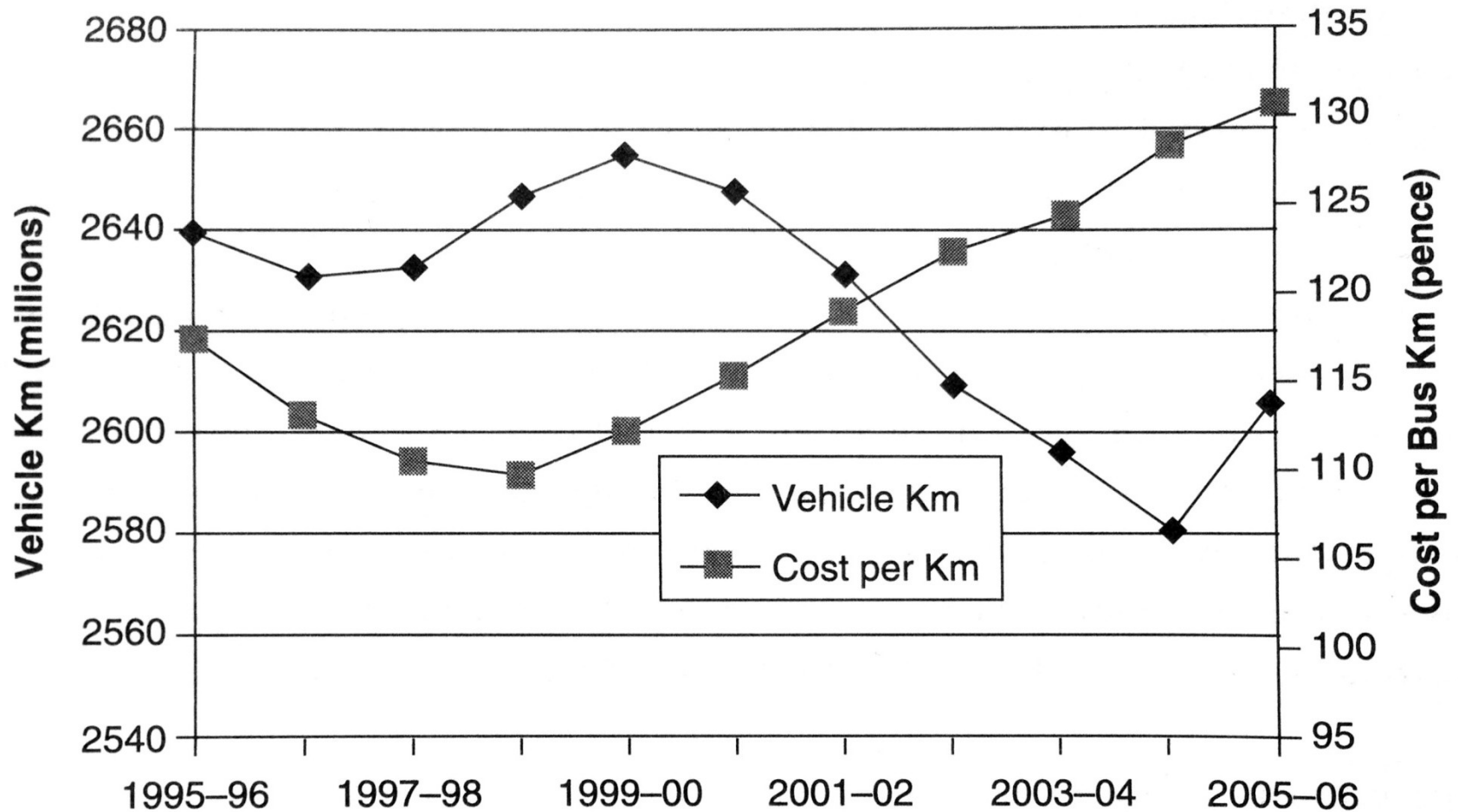
Theory of supply

The **law of supply** is a fundamental principle of economic theory which states that, all else equal, an increase in price results in an increase in quantity supplied

Supply determinants

- The cost of production
- Government policy
- The price of goods in joint supply
- Natural shocks
- Aims of producer

Case 2: British bus industry



Market workings

- Putting together demand and supply

2. TRANSPORT DEMAND ELASTICITY

Elasticity

Elasticity of demand is the responsiveness of demand to a change in one of its determinants

Price elasticity

Price elasticity of demand = Percentage Change
in Quantity Demanded/Percentage Change in
Price

Determinants of PE

- The number and closeness of alternative modes of travel (substitutes)
- Proportion of disposable income spent on the mode of travel
- Time dimension

Price elasticity of demand estimates of passenger transport

	<i>Elasticities</i>	
	<i>Peak</i>	<i>Off Peak</i>
Car	0.10–0.70	0.20–1.10
Bus	0.10–0.70	0.10–1.10
Railway	0.20–0.40	≤ 1.00
	<i>Leisure</i>	<i>Non-leisure</i>
Airlines	1.10–2.70	0.40–1.20
Railway	1.40–1.60	0.60–0.70

Source: Oum, *et al.* (1990)

Note: All the figures are negative

Price elasticities

N. Paulley et al. / Transport Policy 13 (2006) 295–306

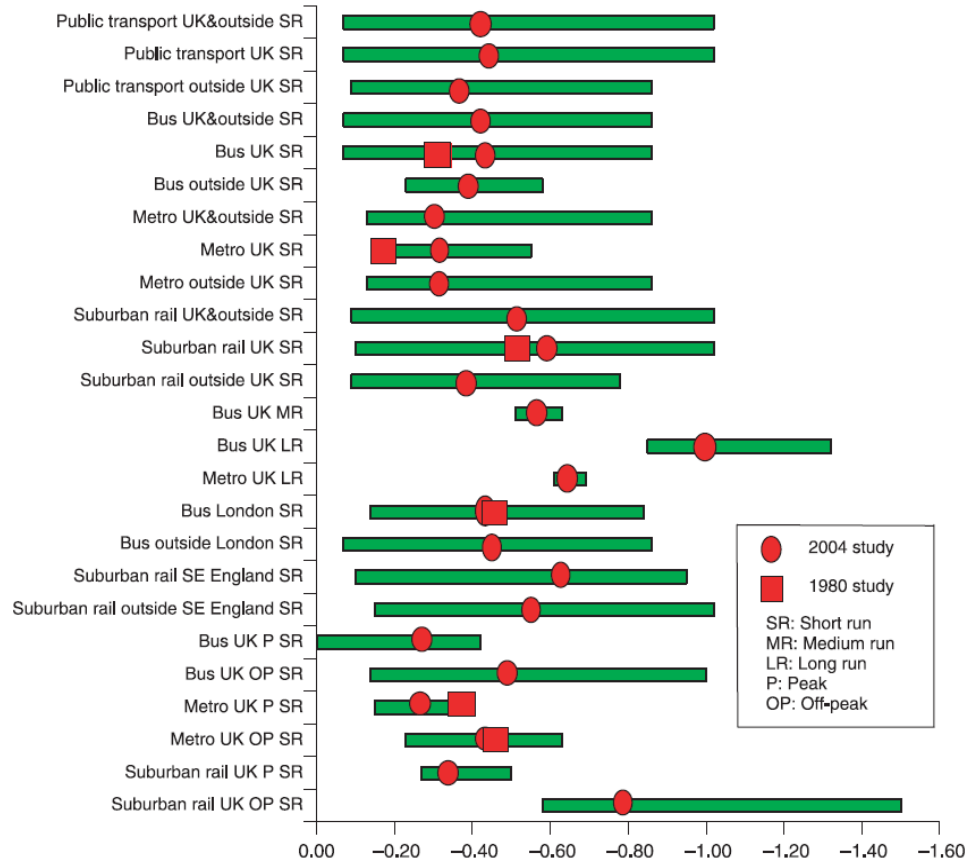


Fig. 1. Summary of mean values and ranges of fare elasticities.

Cross price elasticity

Cross price elasticity = Percentage change in quantity demanded of service A / Percentage change in price of service B

Cross price elasticities intercity passenger transport demand in Canada, mid range values, Oum and Gillen (1983)

<i>Mode</i>	<i>Air</i>	<i>Bus</i>	<i>Rail</i>
Air	–	–0.015	0.025
Bus	–0.085	–	–0.340
Rail	0.295	–0.675	–

Source: Adapted from Oum *et al.* (1990)

Note (again) that quantity A is shown on the rows.

Estimates of cross-elasticities of transport demand

<i>Modes</i>	<i>Cross-elasticity</i>
Rail-Truck (freight)	-0.18 to +0.50
Truck-Rail (freight)	-0.62 to +0.84
Rail-Waterway (freight)	+0.15 to +0.20
Waterway-Rail (freight)	+0.61 to +0.86
Air-Bus (passenger)	-0.02 to -0.01
Bus-Air (passenger)	-0.12 to -0.05
Air-Rail (passenger)	+0.01 to +0.04
Rail-Air (passenger)	+0.08 to +0.51
Bus-Rail (passenger)	-0.47 to -0.21
Rail-Bus (passenger)	-1.18 to -0.17

Data source: Oum, et al. (1990)

Income elasticity

Income elasticity = Percentage change in quantity demanded / Percentage change in income

South East Britain income rail elasticities (2002)

<i>Area</i>	<i>Income elasticity</i>
South East to London	2.07
London to South East	1.90
South East Non London	0.89
Non London	0.11

Source: ATOC (2002)

Historical income and price elasticities

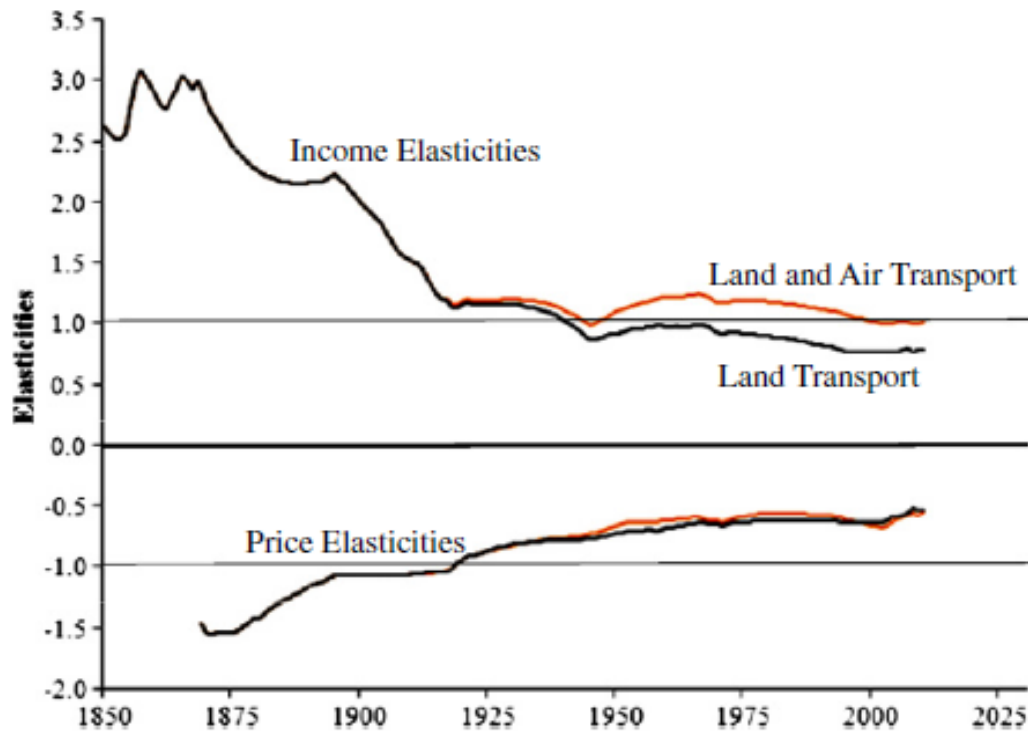


Fig. 5. Income and price elasticities for passenger transport demand, 1850–2010.

3. TRANSPORT DEMAND ISSUES

The Notion of Need

- There are some advocates of the idea that transport services, or at least some of them, should be allocated according to need rather than effective demand.
- The idea is that just as everyone in a civilized society is entitled to expect a certain standard of education, medical care, security and so on, so they are also entitled to enjoy a certain minimum standard of transport provision.

The problem of rural demand

- The provision of public transport services to satisfy demand in rural areas has always been problematic.
- Such services have high costs, but low revenues due to low load factors. They are uneconomic.
- However, the demand for these services is very real, as rural populations require them to get to work, to do their shopping, to access schools and medical care and for social reasons.

The problem of rural demand

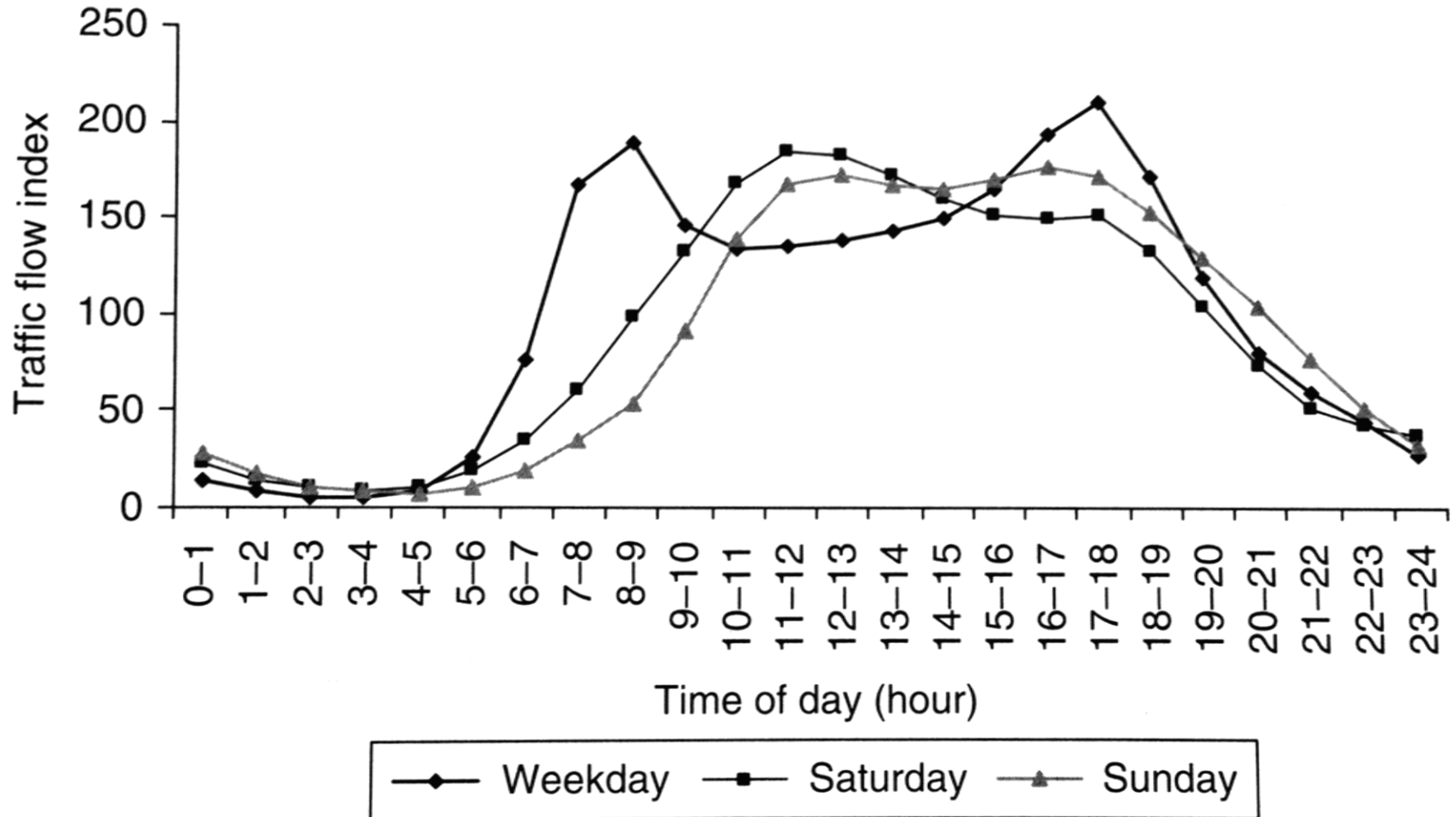
This problem has worsened in recent times for four main reasons:

1. Greater car usage
2. Growth of urban conurbations
3. Public services concentrated in urban centres
4. Population ageing

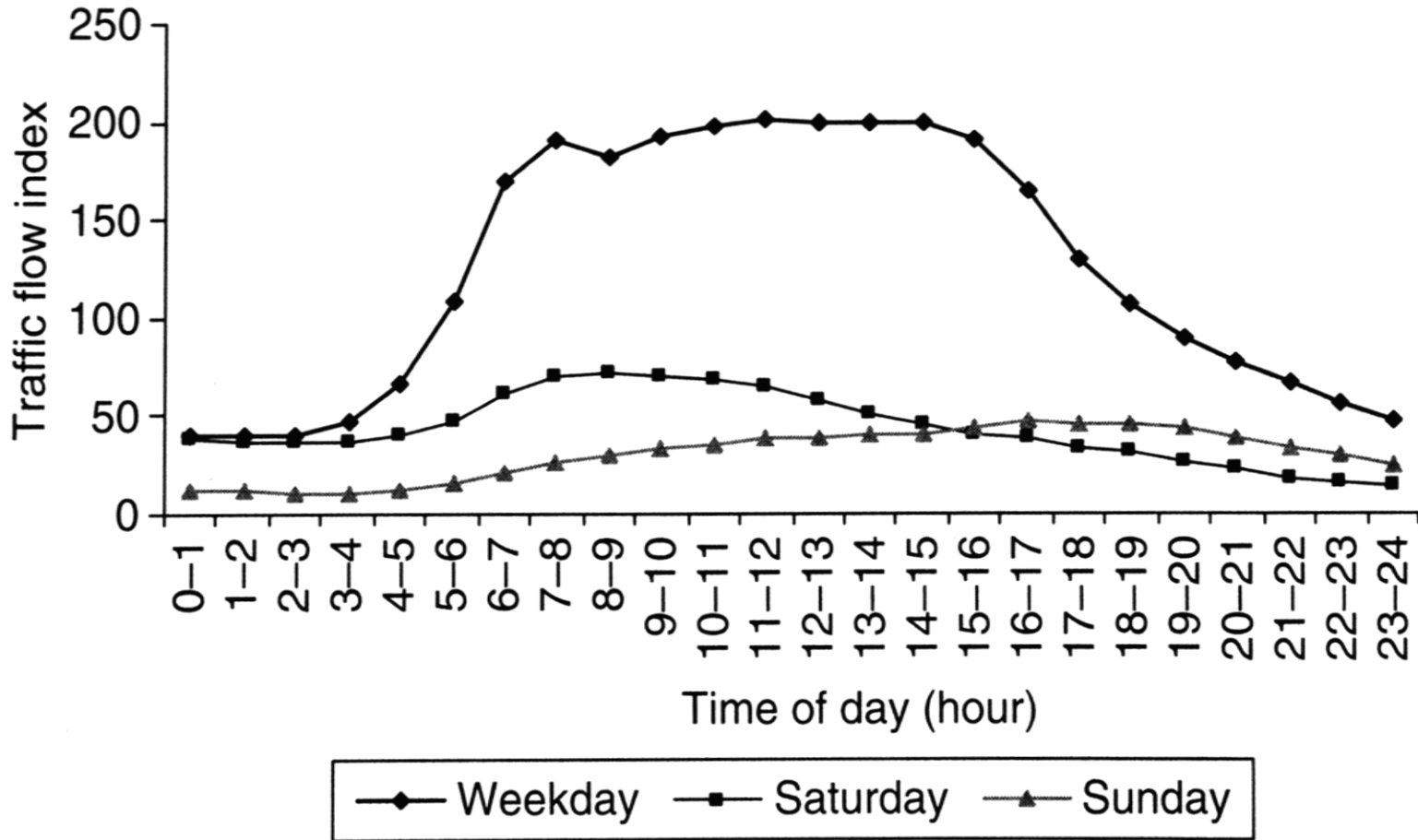
Problem of peak

- In economics it is usually assumed that demand is constant per unit of time
- In transport economics this assumption cannot be made as there are peaks in demand that occur on a regular basis

Distribution of traffic by time of the day, UK, 2004: Cars



Distribution of traffic by time of the day, UK, 2004: Goods vehicles



Valuation of time

- The importance of travel time in transport economics should now be apparent.
- Transport time savings are normally considered to be a major component of any scheme designed to improve transport efficiency.

Value of time

- A value of time can be inferred from logit model by looking at changes in the dependent variable that result from change in either time or costs difference.

Value of time

- There are differences between values of working times and non-working times.
- Also there are differences in the values of walking/waiting times and in-vehicle times.
- This has important consequences for design for public transport.

Demand for car

- While demand for cars is not a strictly transport matter, the importance of the automobile in travel behaviour, land use patterns and the environment makes it a matter of considerable interest to transport economist.

Demand for car

Two approaches to modelling demand for car ownership:

- Hedonic approach
- Product life cycle

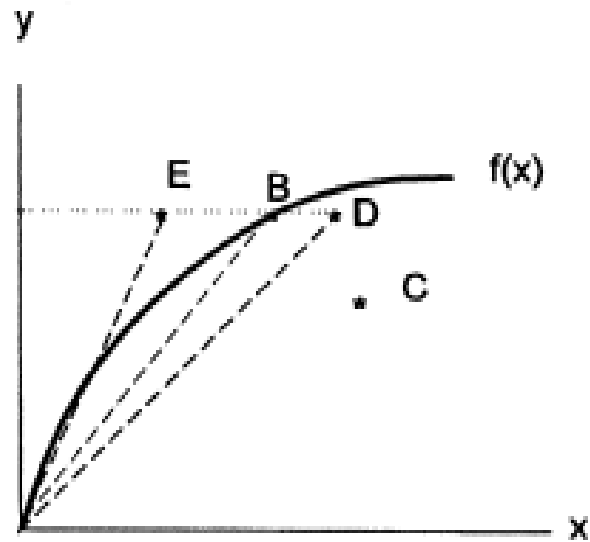
4. EFFICIENCY

Scarcity, choice and opportunity cost

- Any resource is scarce
- If individuals cannot have all that they want, then choices need to be made
- Opportunity cost is the next best alternative forgone

These three principles can be illustrated on production possibility frontier.

A Production Function as a Frontier



Efficiency

- The inputs/outputs ratio is the main base for assessing whether a given operation can be described as efficient or not.

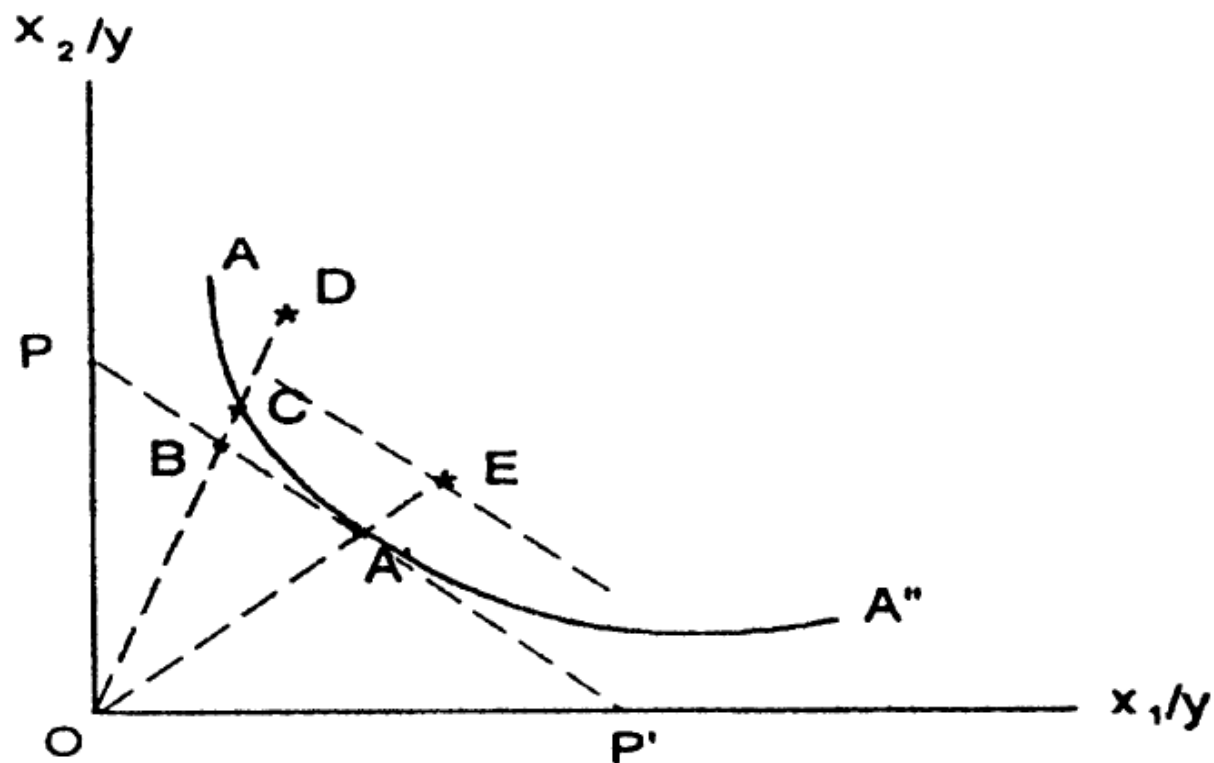
Technical, cost and allocative

Technical efficiency = minimum level of inputs to produce maximum level of outputs

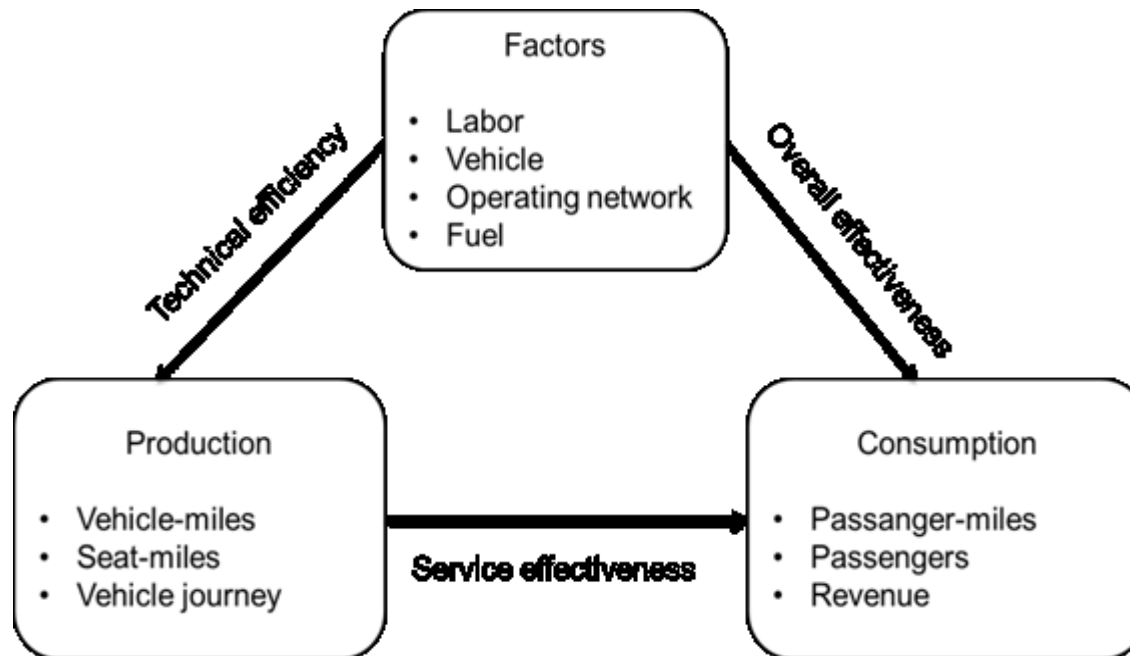
Cost efficiency = most cost efficient input minimization

Allocative efficiency = cost efficiency + right quantities

Technical and allocative efficiency



Service efficiency and effectiveness



DEA + Tobit

- DEA = non parametric method for the estimation of production functions. It is used to empirically measure productive efficiency.
- Tobit regression = to identify the determinants of DEA efficiency scores

Efficiency in railways – Driessen (2006)

Table 4.1 Descriptive statistics of the data

Variable	Symbol	Unit of measurement	Europe				Japan
			Mean	Min	Max	Standard deviation	Mean
Outputs							
Passengers kilometres	Fkm	Number of passenger kilometres (in millions)	19493	2104	74015	21607	182483
Freight kilometres	Fkm	Gross-hauled tonne-kilometres (in millions)	13583	1442	99914	18830	24288
Inputs							
Input of labour	L	Annual average number of staff	70425	6599	482269	87787	182483
Tracks	T	Total length of lines at the end of the year (in kilometres)	11238	2047	41718	11393	20198
Input of capital	C	Annual average number of rolling stock	55099	2992	438326	81061	48855

Dimensions:

Countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland

Period: 1990 -2001 (Denmark until 2000, Sweden until 1999)

Source: UIC (2003)

Efficiency in railways – Driessen (2006)

Table 4.2 DEA estimates of productive efficiency, Europe, 1990 to 2001^a

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	0.80	0.80	0.77	0.76	0.80	0.83	0.83	0.87	0.90	0.91	1.00	1.00
Belgium	1.00	1.00	0.99	0.96	1.00	0.96	0.95	0.96	0.96	0.95	0.97	0.94
Denmark	0.87	0.87	0.89	0.89	0.87	0.87	0.87	0.92	0.91	1.00	1.00	.
Finland	0.77	0.74	0.76	0.84	0.90	0.91	0.89	0.96	0.97	0.97	1.00	1.00
France	0.77	0.74	0.70	0.72	0.75	0.72	0.80	0.84	0.89	0.93	0.98	1.00
Germany	0.80	0.82	0.75	0.72	0.77	0.76	0.76	0.88	0.92	0.93	1.00	1.00
Italy	0.93	0.94	0.93	0.89	0.93	0.97	0.97	0.97	0.93	0.94	1.00	1.00
Netherlands	0.89	0.96	0.97	0.97	0.95	1.00	0.97	0.96	0.99	0.98	1.00	1.00
Norway	0.76	0.81	0.80	0.81	0.81	0.83	0.89	0.87	0.94	1.00	0.95	1.00
Portugal	0.67	0.68	0.68	0.84	0.88	0.90	0.89	0.89	0.88	0.74	0.91	0.95
Spain	0.51	0.50	0.52	0.59	0.59	0.64	0.68	0.75	0.82	0.88	0.93	1.00
Sweden	0.86	0.85	0.96	0.96	1.00	1.00	1.00	0.92	0.98	1.00	.	.
Switzerland	0.59	0.61	0.58	0.58	0.63	0.65	0.64	0.71	0.74	0.81	0.87	0.93

^a Variable Returns to Scale (VRS) efficiency scores

. = data not available

Source: CPB estimates

Efficiency in railways – Driessen (2006)

Variable	Symbol	Description
Table 5.1 Description of regression variables		
Dummy variables		
Institutional (or full) separation	VERT1	If variable is 1, then infrastructure and services are institutionally separated; 0 if this is not the case.
Accounting (or partial) separation	VERT2	If variable is 1, then infrastructure and services are separated on an accounting basis; 0 if this is not the case
Third party access	THIRD	If variable is 1, then legislation is transposed that allows third party access to competitors (either freight or passenger) and competition has evolved to a significant extent; 0 if this is not the case. ^a
Competitive tendering	TEND	If variable is 1, then competitive tendering is used to procure regional railway franchises; 0 if this is not the case.
Managerial independence from the government	INDP	If variable is 1, then legislation is transposed that assures independent management from the government of railway companies; 0, if this is not the case. ^b
Japan dummy	DUMJAP	If variable is 1, then country is Japan; 0, if this is not the case
Control variables		
Total area	AREA	Measured in 1000 square miles
Gross Domestic Product per capita	GDP	Measured in constant prices (2000) 1000 US dollars PPPs
Population density	POPDEN	Measured in population per square mile
Traffic structure	TSTRUC	measured by passenger kilometres / total traffic in kilometres
Traffic density	TDEN	Total traffic in kilometres (in millions) / total length of lines in kilometres

Efficiency in railways – Driessen (2006)

Table 5.4 Tobit regression results

Model	(1) Europe			(2) Europe + Japan		
Dependent variable						
DEA efficiency indices						
Independent variables	Coefficient estimate	(Standard error)	Marginal effect	Coefficient estimate	(Standard error)	Marginal effect
CONSTANT	0.5827	(0.0493) ***	0.4643	1.0987	(0.0651) ***	0.8746
VERT1	0.0447	(0.0231) *	0.0356	-0.0005	(0.0301)	-0.0004
VERT2	0.0225	(0.0213)	0.0179	0.0854	(0.0282) ***	0.0680
THIRD	-0.0812	(0.0311) ***	-0.0647	-0.0773	(0.0417) *	-0.0615
TEND	0.0826	(0.0346) **	0.0658	0.2641	(0.0461) ***	0.2102
INDP	-0.0691	(0.0181) ***	-0.0551	-0.1495	(0.0239) ***	-0.1190
TIME	0.0211	(0.0033) ***	0.0168	0.0162	(0.0040) ***	0.01290
AREA	0.0002	(0.0001)	0.0002	-0.0018	(0.0002) ***	-0.0014
POPDEN	-7.75×10^{-5}	(5.45×10^{-5})	-6.18×10^{-5}	5.39×10^{-5}	(7.22×10^{-5})	4.30×10^{-5}
GDP	0.0016	(0.0014)	0.0013	-0.0012	(0.0018)	-0.0010
TDEN	0.0776	(0.0118) ***	0.0618	0.0261	(0.0154) *	0.0208
TSTRUC	-0.1331	(0.0481) ***	-0.1061	-0.5422	(0.0636) ***	-0.4316
DUMJAP				0.3929	(0.1477) ***	0.3131
Log likelihood		127.13			93.1	
Adjusted R-squared		0.67			0.82	
Number of observations		153			165	

Notes: Asterisks (*), (**), (***) represents statistical significance from zero at the 10%, 5%, and 1% level respectively.

5. TRANSPORT COSTS

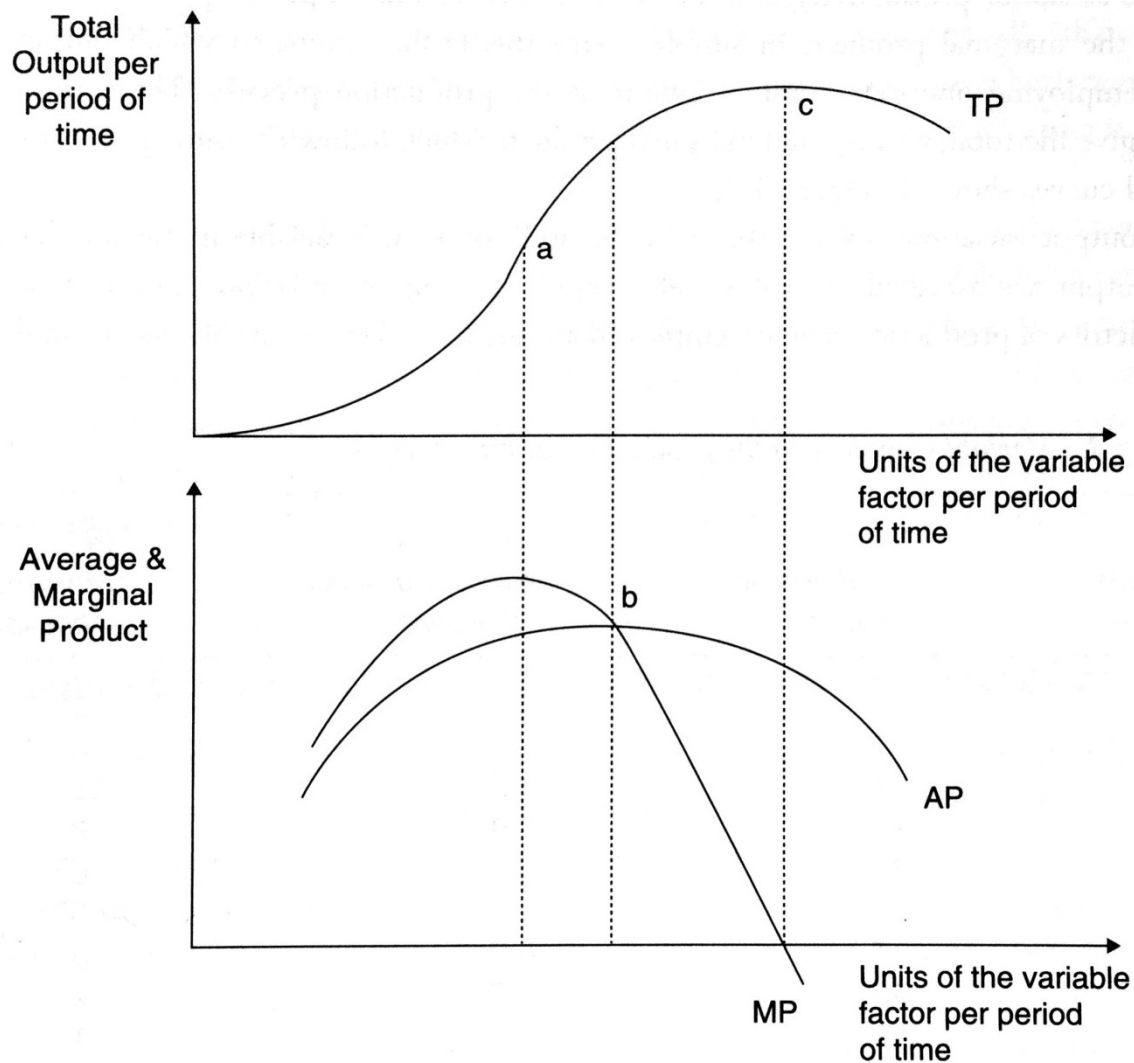
Introduction

- A major factor affecting supply is the cost of production
- Monetary costs + Time costs = Generalised costs of transport
- How to maintain downward pressure on public transport costs?

Short run and long run

- Short run = at least one factor of production is fixed
- Long run = variations in output can be achieved through variation of all of the inputs

SR production, total, average and marginal product

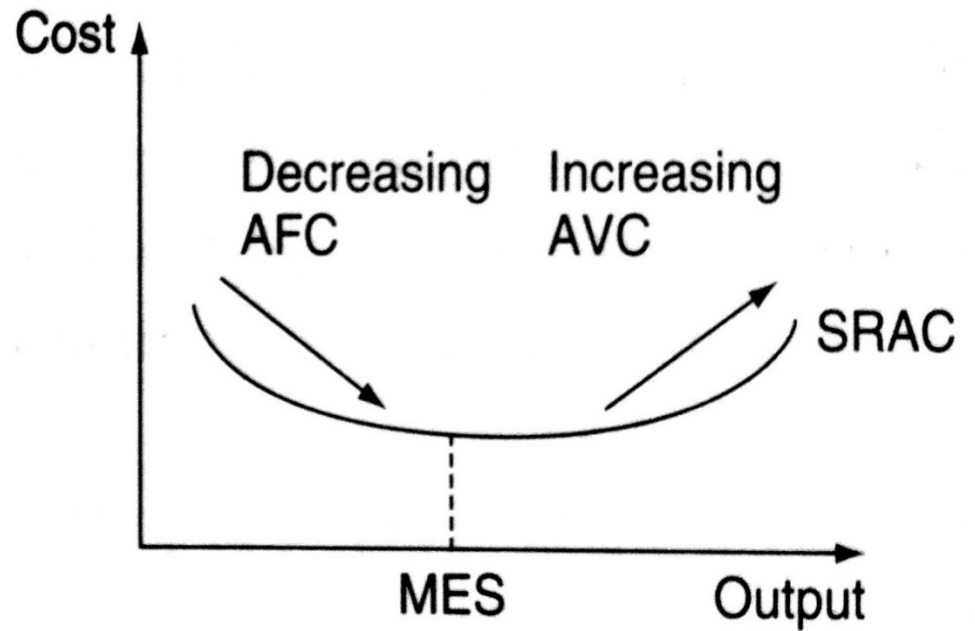
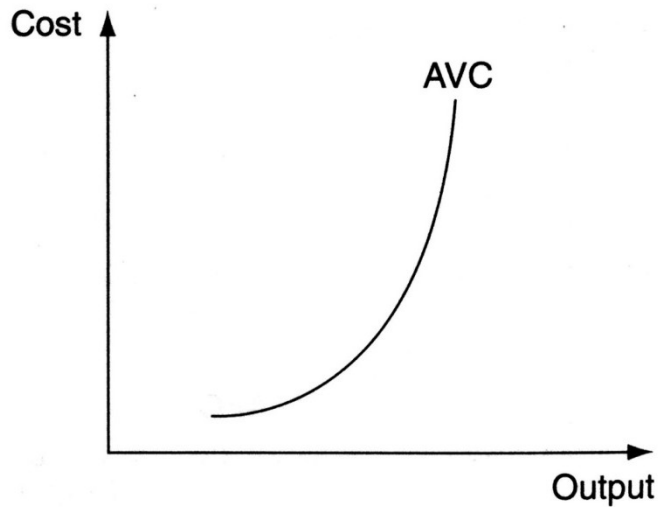
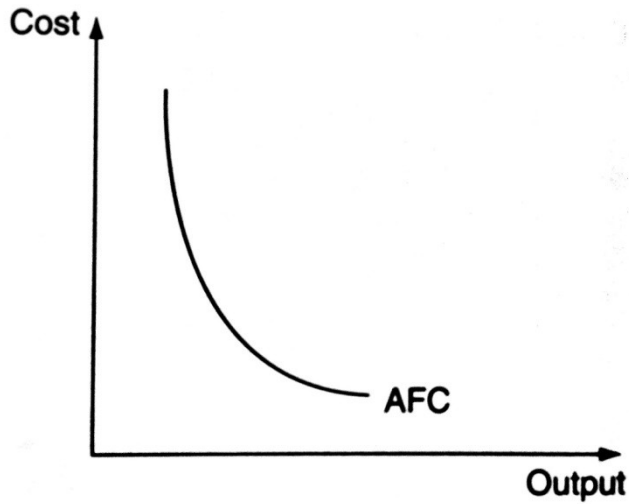


Case: Mode cost comparison

<i>Operating Cost</i>	<i>Airline</i>		<i>Ferry Operator</i>		<i>Bus Company</i>		<i>Railway Company</i>		<i>Parcels</i>	
	<i>British Airways</i>		<i>Caledonian Mac.</i>		<i>First Glasgow</i>		<i>Virgin West Coast</i>		<i>Parcelforce</i>	
	<i>2005/6</i>		<i>2005/6</i>		<i>2005/6</i>		<i>Value 2005/6</i>		<i>Value 2005/6</i>	
	<i>Value</i>	<i>%</i>	<i>Value</i>	<i>%</i>	<i>Value</i>	<i>%</i>	<i>Value</i>	<i>%</i>	<i>Value</i>	<i>%</i>
Labour Costs:	2346	30.0%	45.0	51.7%	45.4	69.2%	102.2	17.7%	5968	71.8%
Vehicle Costs:	1302	16.6%	18.0	20.7%	5.8	8.8%	171.7	29.8%	1392	16.7%
Infrastructure Costs:	0	0.0%	0.0	0.0%	0.0	0.0%	141.4	24.5%	0	0.0%
Fuel Costs:	1632	20.8%	9.5	10.9%	10.0	15.2%	15.6	2.7%	0	0.0%
Terminal Costs:	1514	19.3%	12.6	14.5%	0.0	0.0%	17.5	3.0%	530	6.4%
Other Overheads:	1034	13.2%	1.9	2.2%	4.4	6.7%	128.5	22.3%	426	5.1%
Totals:	7828	100%	87.0	100%	65.5	100%	576.9	100%	8316	100%
Fixed Inputs:	2816	36.0%	29.0	37.7%	5.8	8.8%	330.5	57.3%	1922	23.1%
Variable Inputs:	5012	64.0%	48.0	62.3%	59.7	91.2%	246.4	42.7%	6394	76.9%

Sources: Compiled from Company Annual Reports, 2005/6

The short run average cost curve

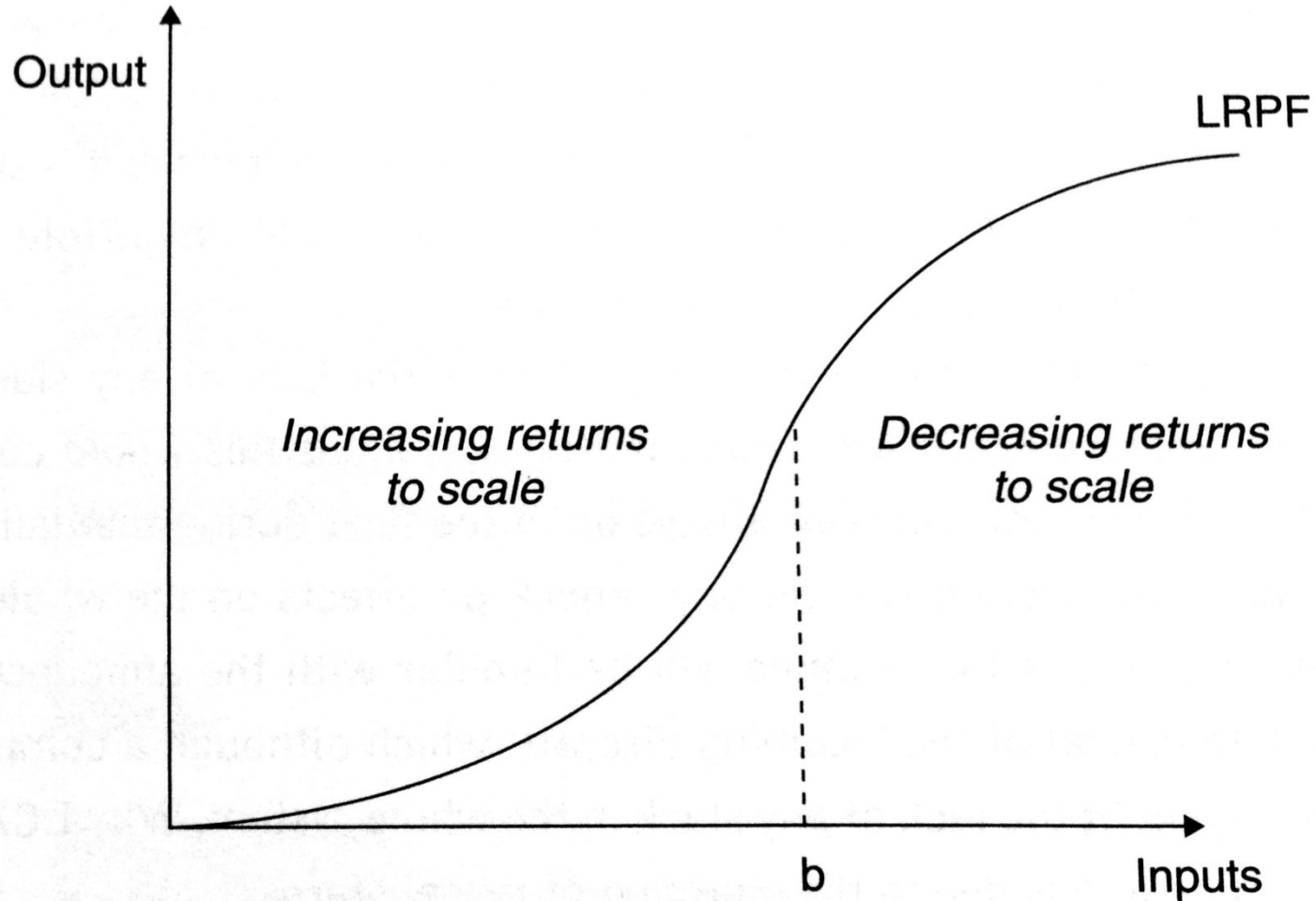


The importance of average cost in the business model of low-cost airlines

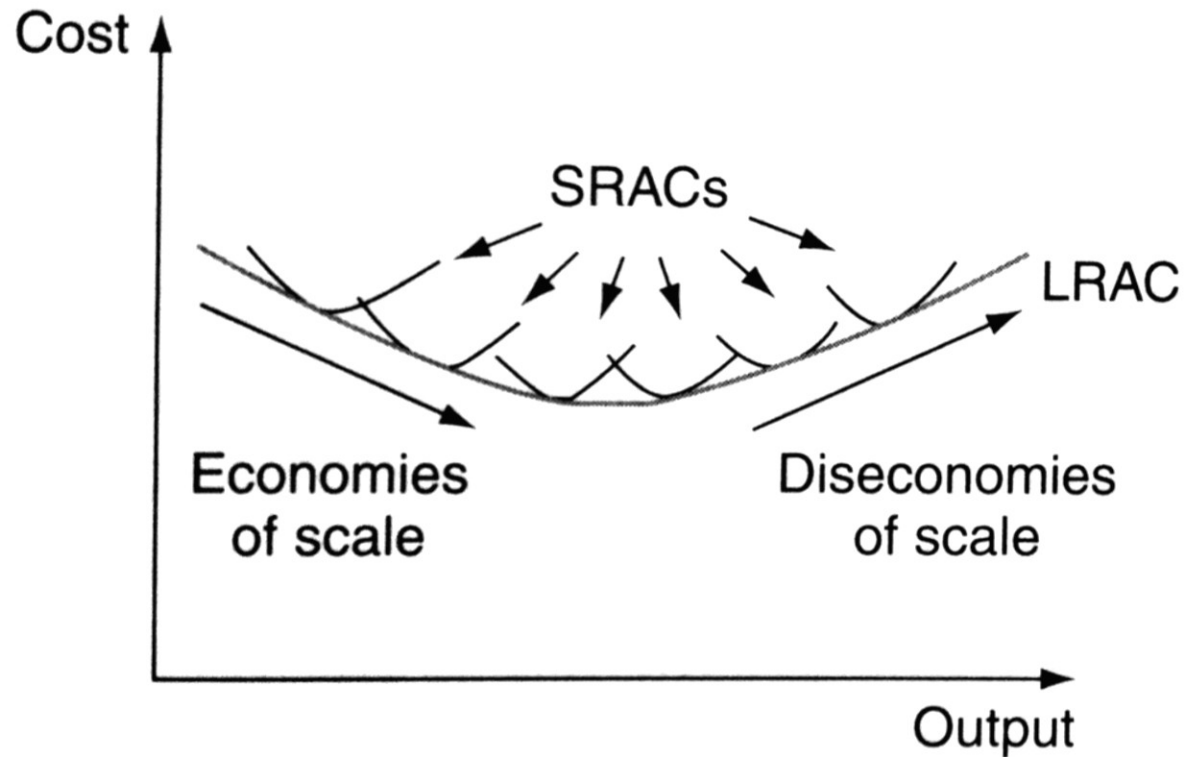
<i>Airline:</i>	<i>British Airways</i>		<i>easyJet</i>		<i>Ryanair</i>	
	<i>Actual</i>	<i>%</i>	<i>Actual</i>	<i>%</i>	<i>Actual</i>	<i>%</i>
Staff costs	2346.0	30%	75.2	11%	171.4	13%
Selling costs	449.0	6%	26.0	4%	13.9	1%
Aircraft costs	2446.0	31%	366.8	54%	590.1	45%
Fuel costs	1632.0	21%	165.9	25%	462.5	35%
Other costs	955.0	12%	42.2	6%	85.6	6%

Source: Adapted from the respective company accounts

The long run production function



The long run average cost curve



6. IMPERFECT COMPETITION

Perfect competition (assumption)

- Many buyers and sellers
- No barriers to entry or exit
- All firms are profit maximisers
- All consumers are utility maximizers
- Perfect information
- Homogenous product
- No economies of scale
- Non rivalry in consumption
- Absence of externalities
- No government intervention

Barriers to entry

- Firm size
- High sunk costs
- Product differentiation
- Legal protection
- Control of factors of production
- Exclusive dealership
- Branding

Disadvantages of monopoly

- Production inefficiencies
- Higher prices charged and lower output produced
- Reduction of consumer surplus and is regressive
- Net welfare loss
- X-efficiency
- The market no longer regulates itself

Advantages of monopoly

- A higher level of expenditure on R a D
- Market size – a natural monopoly
- Wasteful competition
- Hotellings law

Contestable markets

Baumol (1982) – it is unnecessary for the market to be in perfect competition in order to produce economically efficient results. It is enough to be a contestable market.

Contestable market = entry to the market is free and exit is costless

Case: Contestability in airlines

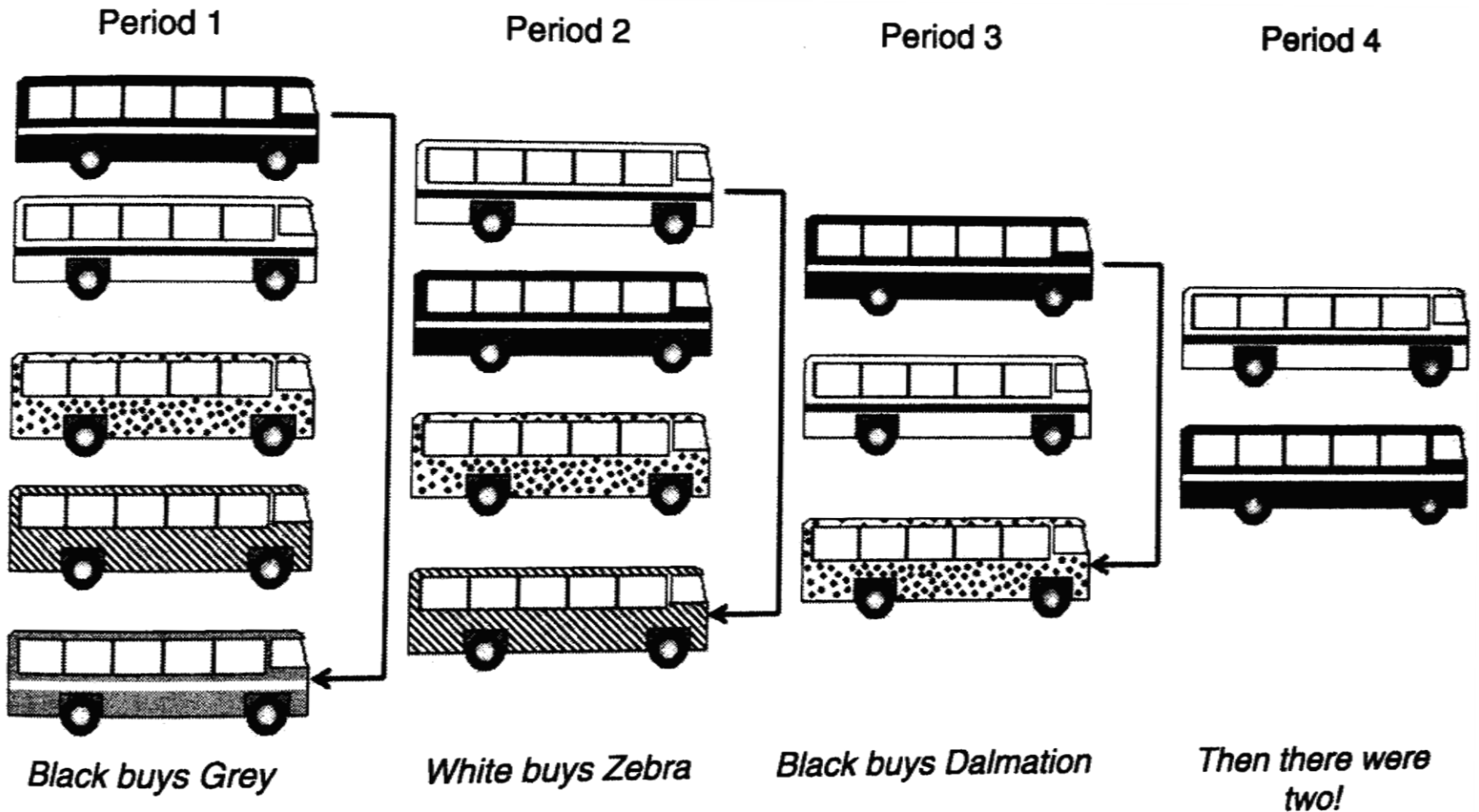
The sector is becoming more contestable because:

- Control over landing slots is lower
- The spread of information through Internet
- The frequent flyer initiative is on retreat
- The growth of LCA

Oligopoly

- Few sellers, many buyers
- Barriers to entry are significant
- Non price competition
- Product differentiation
- Tacit collusion

Downie competitive process



British bus industry - demand

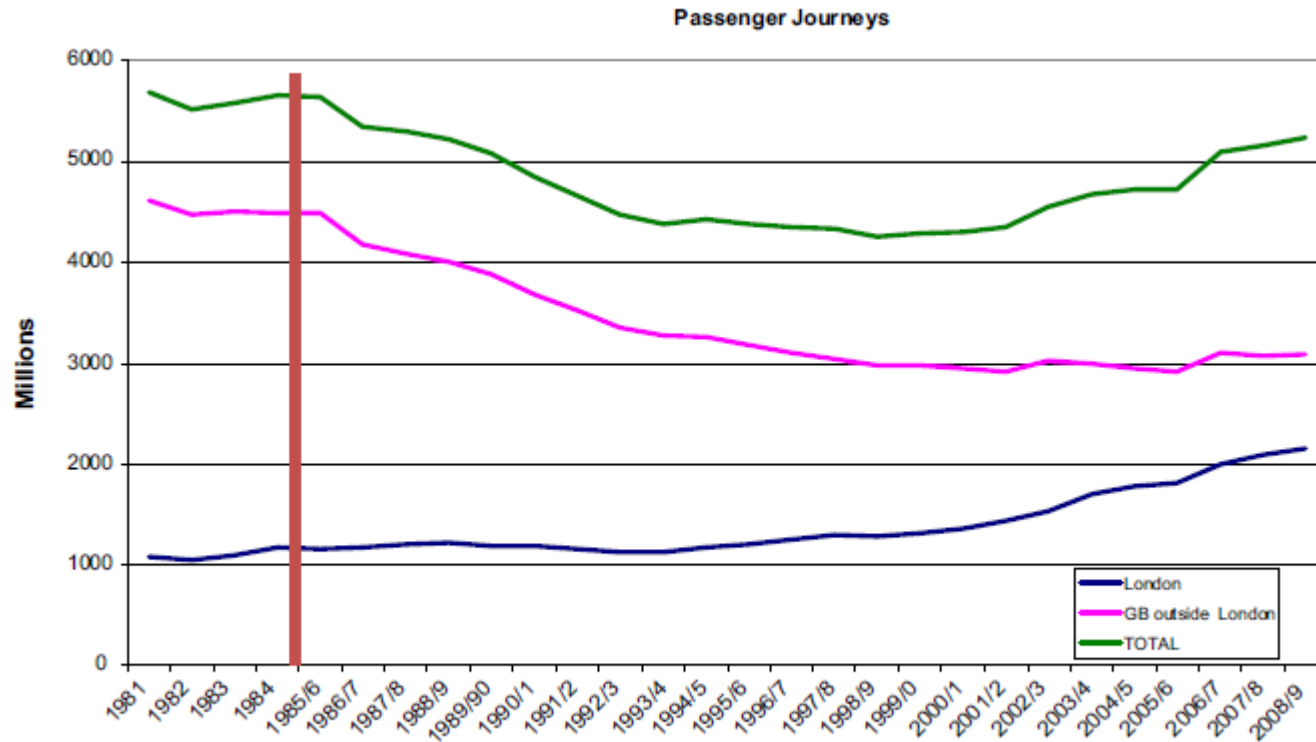


Fig. 1. Trends in local bus demand (passenger journeys, millions).

British bus industry - supply

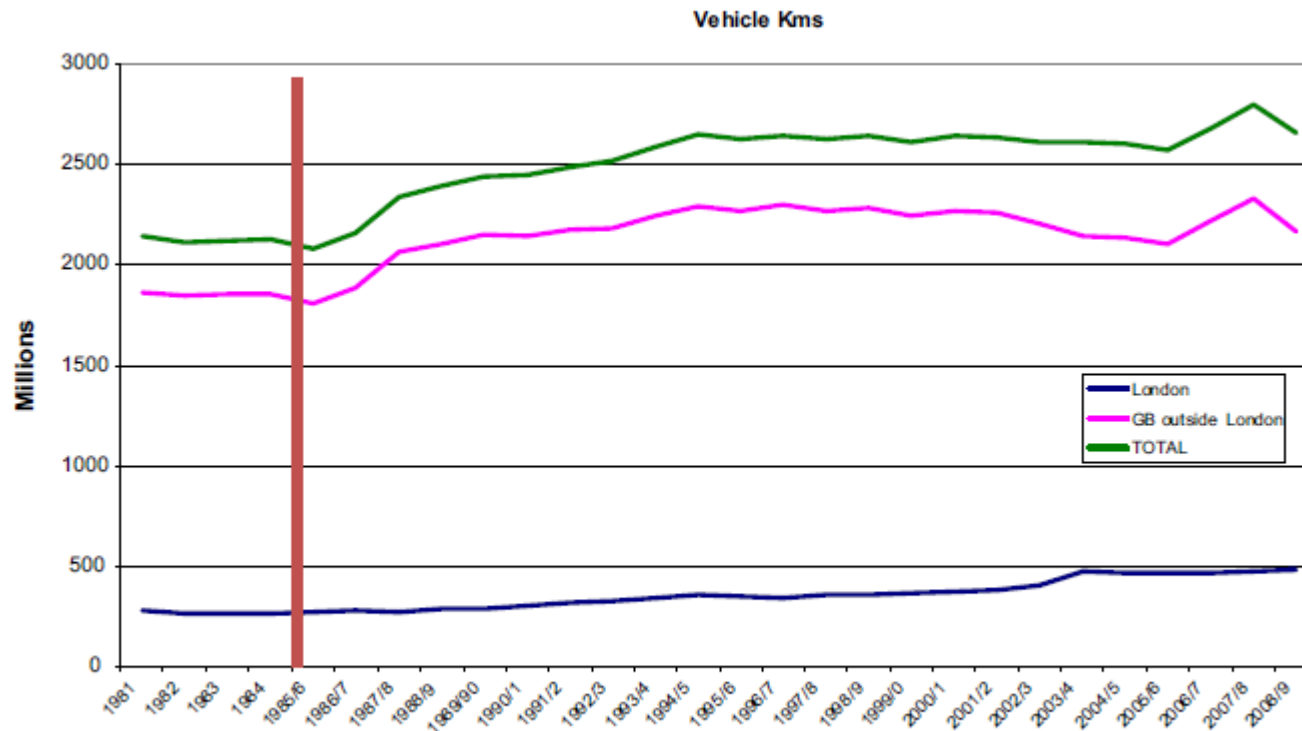


Fig. 2. Trends in local bus supply (vehicle kilometres, millions).

British bus industry – key changes

Table 1

Key changes in the local bus market since 1985/6.

	Outside London	London
Demand	-31%	+87%
Fares	+55%	+15%
Services	+20%	+78%
Costs	-20%	-28%
Subsidy	+5%	+84%

7. PRICING

Introduction

- Pricing is a vital component in the economics of transport
- The price determine who gets and who doesn't get a particular service, but also determines the distribution of rewards between the provider and the user
- The imperfect market structures are characterized by higher rewards for the providers

The principles of pricing

- In most cases, transport services are subsidised and/or regulated, however a basic understanding of pricing principles is needed
- In order to achieve economic efficiency, the price should equal the marginal cost
- In imperfect competition markets, it is possible to observe price discrimination, predatory pricing, price fixing and congestion pricing

Price discrimination

- Price discrimination refers to a situation where a company charges particular consumers a higher price than others for the same product for reasons unrelated to cost.
- The seller must possess a degree of market power, must be able to divide the market and market segments must have differing elasticities of demand.

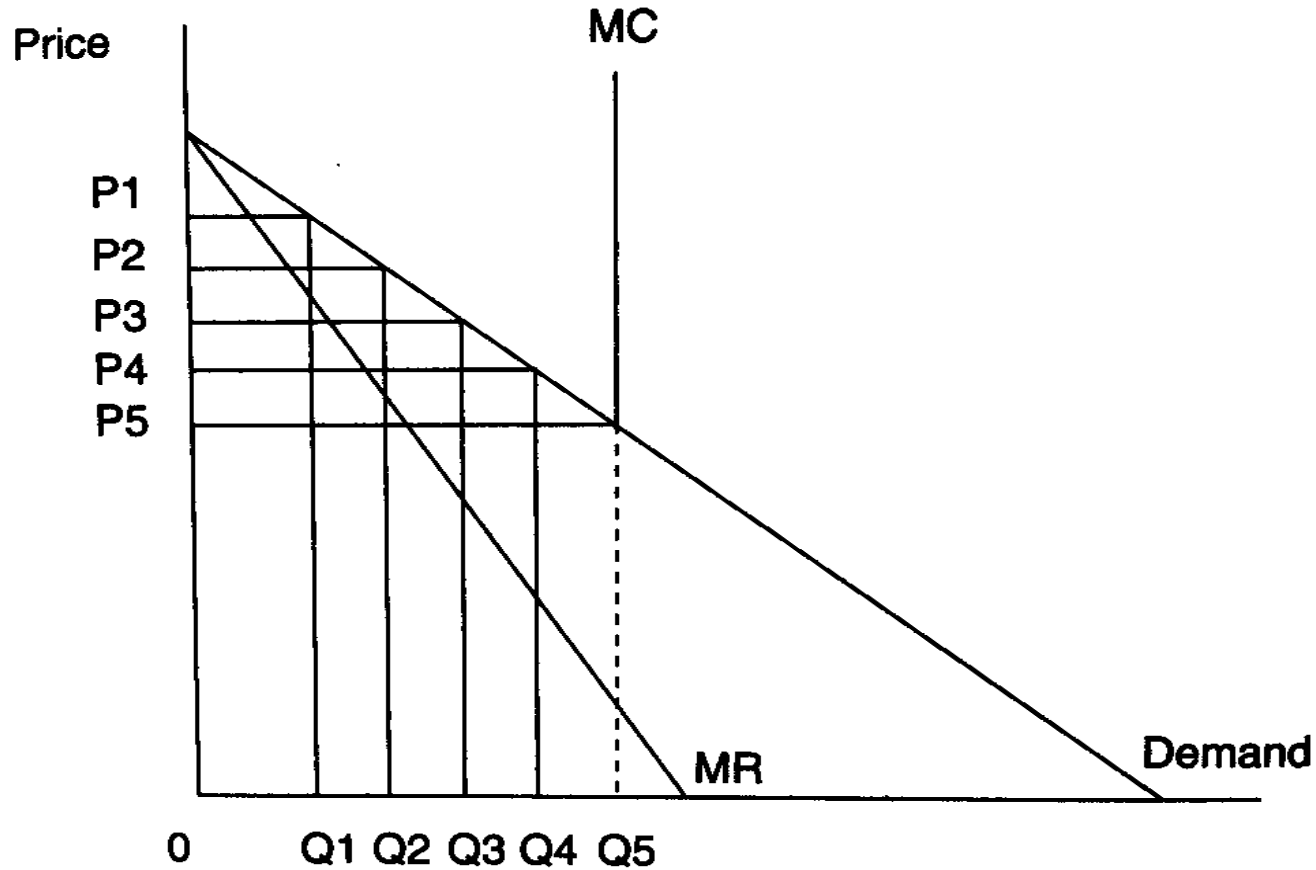
Perfect price discrimination

- To sell each unit (or ticket) separately, charging the highest price that each consumer is prepared to pay
- If this was achievable, the seller would obtain the entire consumer surplus from the consumer
- The seller must know the exact shape of each consumer's demand and charge each consumer the maximum price they are prepared to pay

Case: Sale of airline tickets

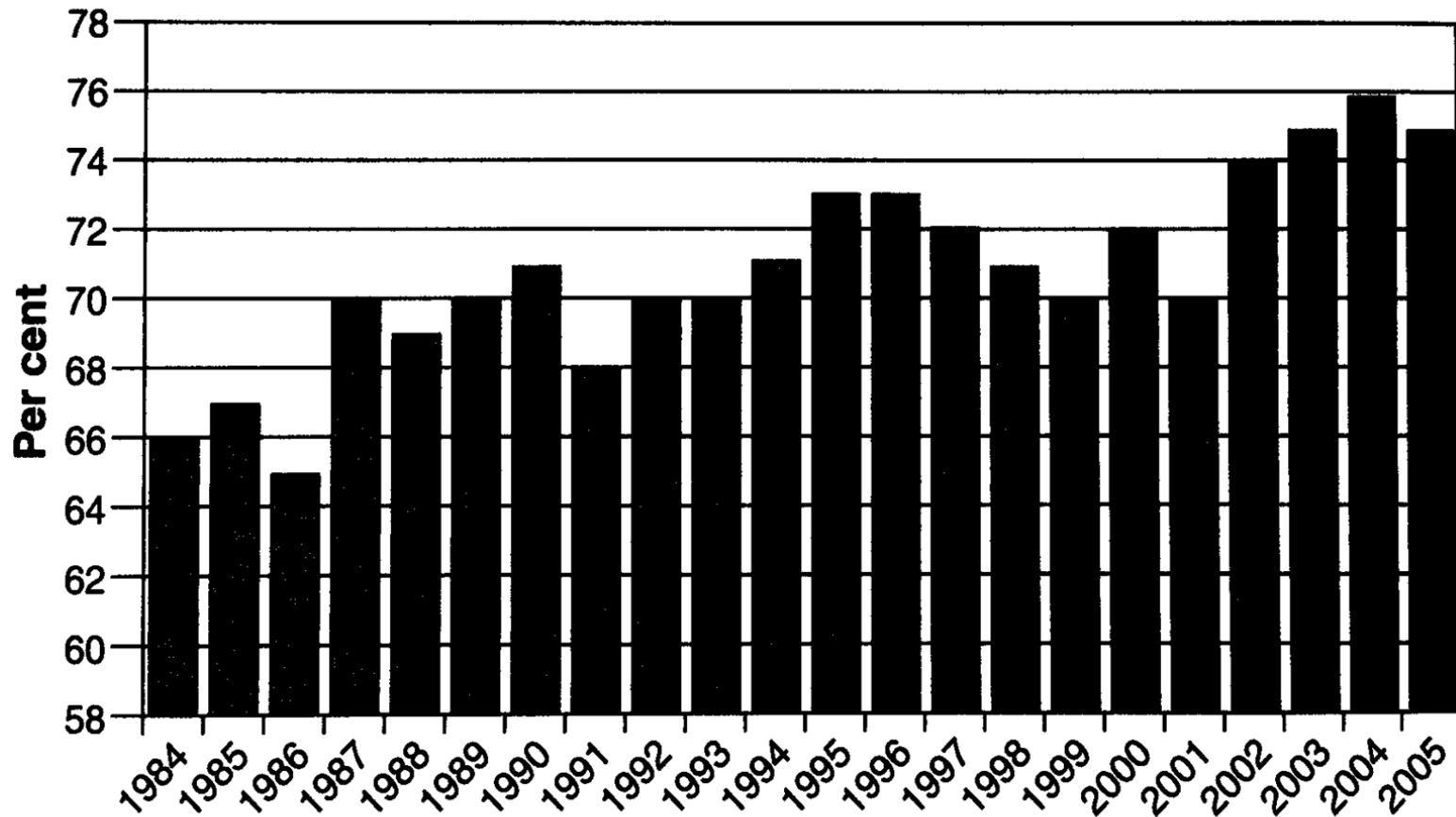
- On a typical airline flight there are three classes, namely First, Business and Economy.
- Figure on the next slide refers to travel in a particular class and the assumption is made that the marginal cost of one extra passenger is constant up to the point where the aircraft reaches full capacity
- At this point the MC curve becomes perfectly inelastic

Airline price discrimination



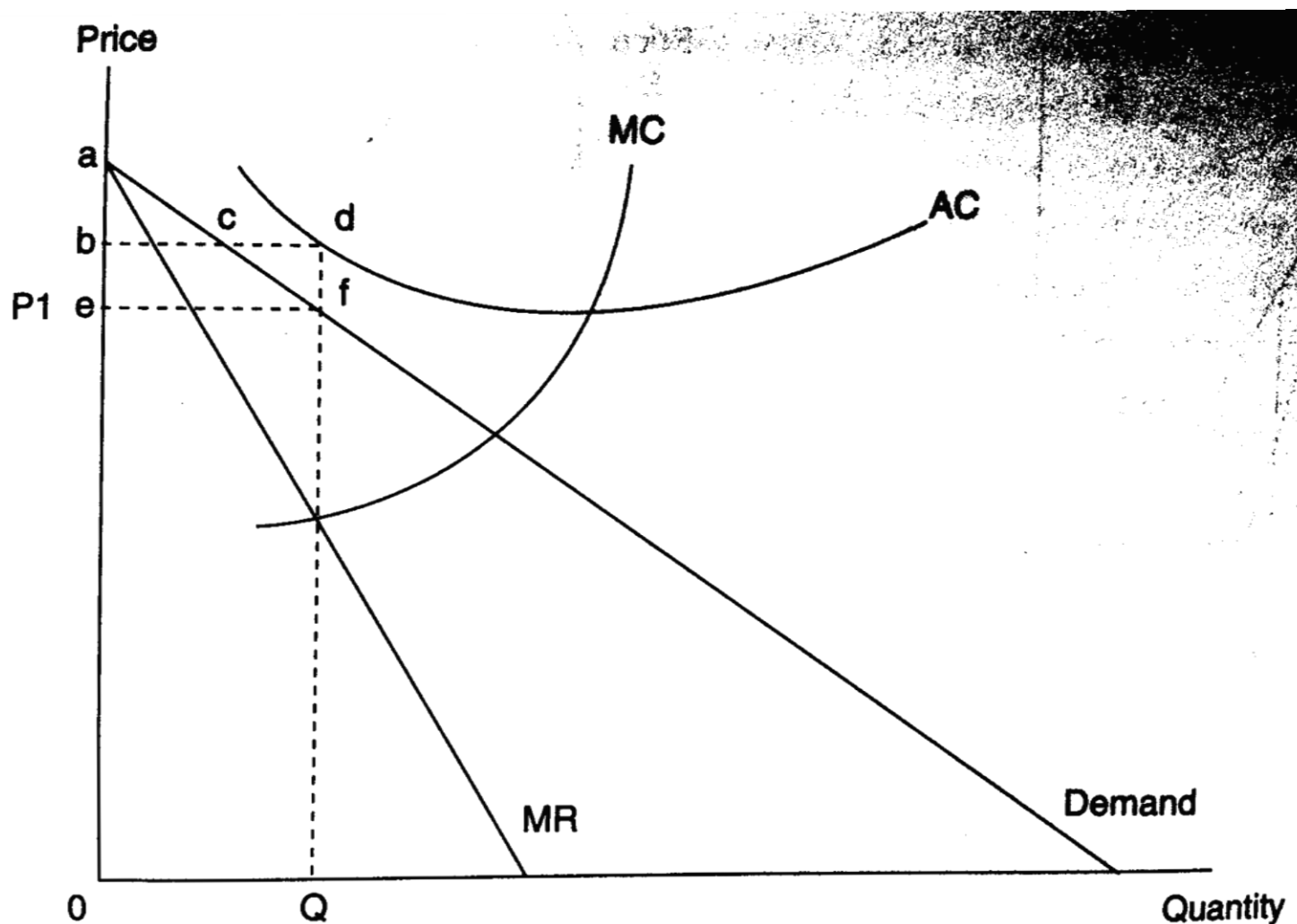
Yield management in the aviation

**Load factors for scheduled UK airlines, 1984–2005
(percentage of seats used)^a**



Source: Eddington Study Analysis of UK airline statistics 2005, Civil Aviation Authority.

Loss making operator and perfect price discrimination



Predatory pricing

- Predatory pricing occurs when a firm with market power reduces its price below cost in the short run so as to obtain abnormal profit in the long run.
- Predatory pricing is aimed at either achieving or maintaining a monopoly situation, with the price set so as to bankrupt competitors, „encourage“ them to merge or in fact collude.

Predatory pricing

- The consumer may benefit in the short run from lower prices, due lower competition such activity may not be in the public interest in the long run.
- In practise it can be very difficult to prove that such activity has taken place
- Predatory pricing is an appealing strategy in a segmented market

Price fixing

- Firms in oligopolistic markets such as the airline sector often face a dilemma as to whether to compete with each other or to collude
- Price fixing is a situation when oligopoly firms agree on the price they are going to sell their goods or services in order to remove price competitiveness and thus increase their profits

8. REGULATION

Introduction

- This presentation is concerned with control and specifically the control by relevant authorities on the levels and behaviour of transport users and operators under their control
- It concerns all areas of transport, whether that be public, private or freight

Government control

Government control of transport markets can be achieved through one of two measures:

- Regulation - control through direct command; i.e. telling operators what to do
- Ownership – the transport authority can own the assets and the means of production. The market is brought into public sector and thus it does not have to operate along market principles

Forms of regulation

- Specify the price to be charged
- Specify the maximum increase in price allowed
- Regulate the (final) price through the tax charged on the good or service
- Specify the rate of return (profit) to be gained
- Through introducing yardstick competition
- Specify a minimum frequency
- Limit market entry

The rationale for the regulation

- To overcome the market failure or imperfect/asymmetric information
- The market can no longer regulate itself
- To correct for externalities
- To ensure the quality of the service provided
- To provide a transport service where none existed before
- To improve efficiency within the industry

The drawbacks of economic regulation

- Limits free enterprise
- Inefficient, second best solution
- Assymetry of information
- The issue of regulatory capture
- Cumbersome regulatory procedures make avoidance of regulatory measures possible

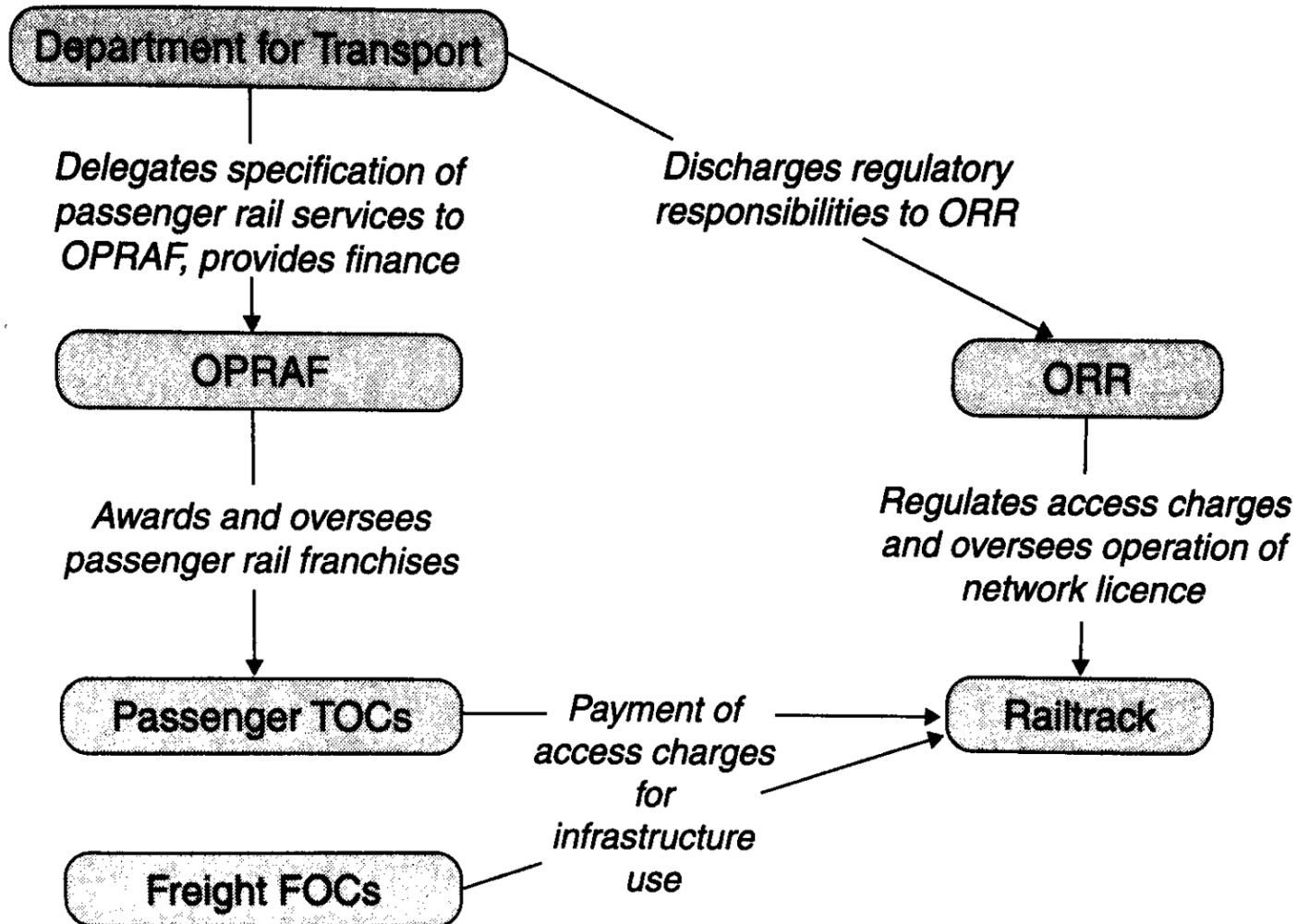
Case: Regulation of the British railway industry

- 1945 - 1994 – British Rail. Vertically and horizontally integrated single nationalized operator in the UK.
- 1994 - 1997 – British railway reform. British Rail divided into 104 separate companies with the main purpose to introduce competition at all levels of railway operation (train operating companies, rolling stock leasing companies, infrastructure maintenance and renewal companies).
- The majority of these companies were privatized

British infrastructure provider

- The one exception was the infrastructure provider, where it was considered that the advantages of having a single national network operator significantly outweighed the drawbacks of splitting the network up into separate geographical areas.
- This therefore left a monopoly provider of the infrastructure throughout the country
- This was organized into a company called Railtrack which was floated on the stock exchange
- All infrastructure access charges were to be at full cost
- As a result, the firm would return a profit and receive no direct subsidy except to assist the funding of railway investment
- The strong regulation was introduced to prevent the abuse of monopoly power

British rail industry regulatory structure 1997 - 2001



What went wrong?

- Railtrack investment needs, costs overruns on the major infrastructure projects
- Railtrack had effectively very little control over its own costs; loss of engineering expertise
- Broken rail at Hatfield (October 2000), resulting in a train derailment and four fatalities. Railtrack panicked and overreacted imposing severe speed limits on the network leading to widespread delays and chaos (2000 – 2001).
- Under the terms of track access agreements, Railtrack had to pay more than 500m GBP to train operating companies as a result of the disruption caused.
- This combined with major cost overruns led to bankruptcy of Railtrack in October 2001 and it was replaced by non-profit organization Network Rail.

British rail infrastructure provider – results

6

A. Bowman / Accounting Forum xxx (2014) xxx-xxx

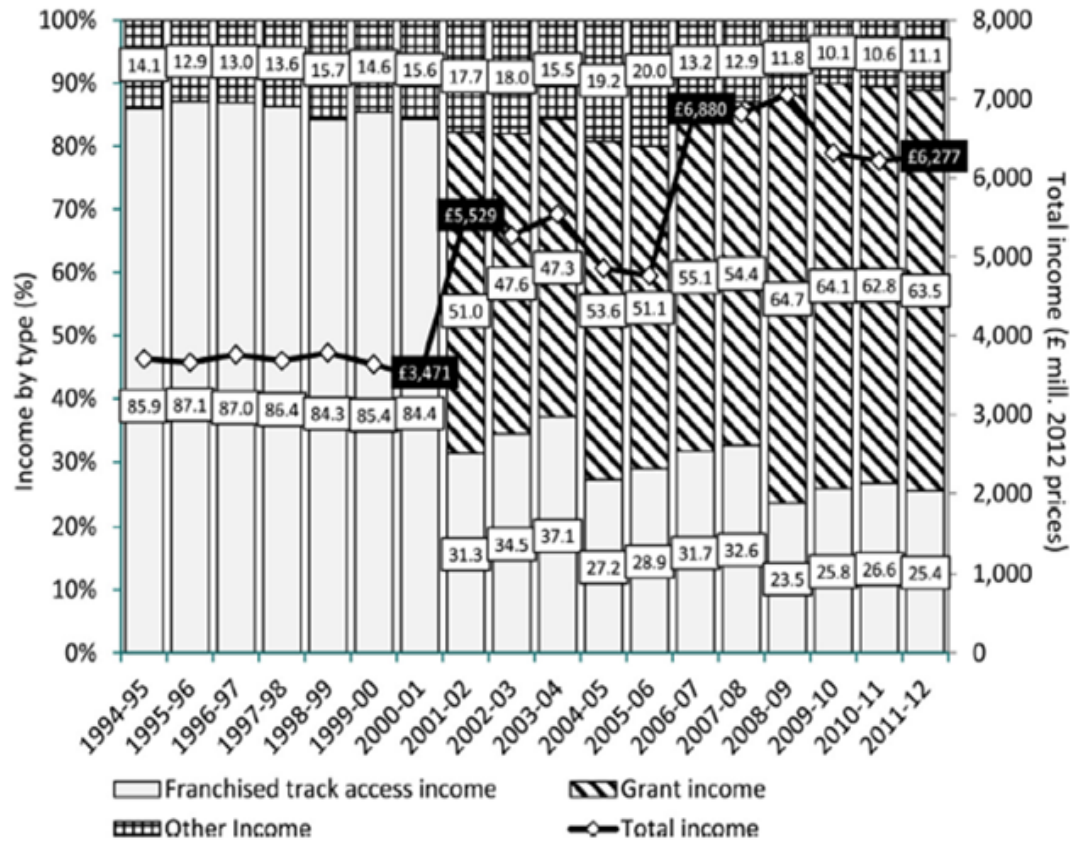


Fig. 2. Railtrack and Network Rail share of income by type 1994–2012. Source: Railtrack and Network Rail annual report and accounts, various years. Notes: Grants includes deferred grants and incentive adjustments.

9. OWNERSHIP

Reasons for public ownership

- Eradicate wasteful competition
- Military significance
- Public goods
- Essential to the economy
- A large employer
- Key industry
- High project development costs

Reasons for reform

- Increasing discontent with the model of public ownership
- Changing macroeconomic environment combined with social change
- The desire to introduce competition into the provision of transport services

Ownership forms

- Central government department
- Centralised provision
- The municipal department
- Delegate to third party
- PPP partnership
- Private enterprise

Efficiency of private and public railroad in Canada

The efficiency of public and private firms is usually compared in industries which have heavy regulation and limited competition. In this paper we present a case study in which the effects of property rights can be isolated from the effects of regulation on noncompetitive markets. We compare the postwar (1956 – 1975) productivity performance of the Canadian National (public) and Canadian Pacific Railroads (private). Contrary to the predictions of the property rights literature, we find no evidence of inferior performance by the government-owned railroad. We conclude that any tendency toward inefficiency resulting from public ownership has been overcome by the benefits of competition.

Caves, D. W. – Christensen, L. R. (1980): The Relative Efficiency of Public and Private Firms in a Competitive Environment: The Case of Canadian Railroads. *Journal of Political Economy*

Privatization of Canadian National

This article describes and analyzes the privatization of Canadian National Railway (CN), a large railroad privatization (1995). It uses data from 1990 to 2011 to compare CN's post-privatization operating performance with its pre-privatization performance. The overall results demonstrate that CN performed substantially better following privatization, both from an operational perspective and from a broader social welfare perspective. We find statistically significant increases over the long term (16 years following privatization) in sales, capital investment, assets, profit, profitability, productivity, dividends and corporate taxes paid. There was little change in the capital structure of CN and a significant decrease in employment. Using Canadian Pacific Railway as a basis for the counterfactual, we estimate that CN's privatization generated social welfare gains of approximately \$25 billion in 2011 Canadian dollars. The Canadian government received almost half of these gains, while CN's shareholders (most of whom were non-Canadian) captured the rest.

Boardman, A. E., Laurin, C., Moore, M. A., & Vining, A. R. (2013). Efficiency, profitability and welfare gains from the Canadian National Railway privatization. *Research in Transportation Business & Management*, 6, 19-30.

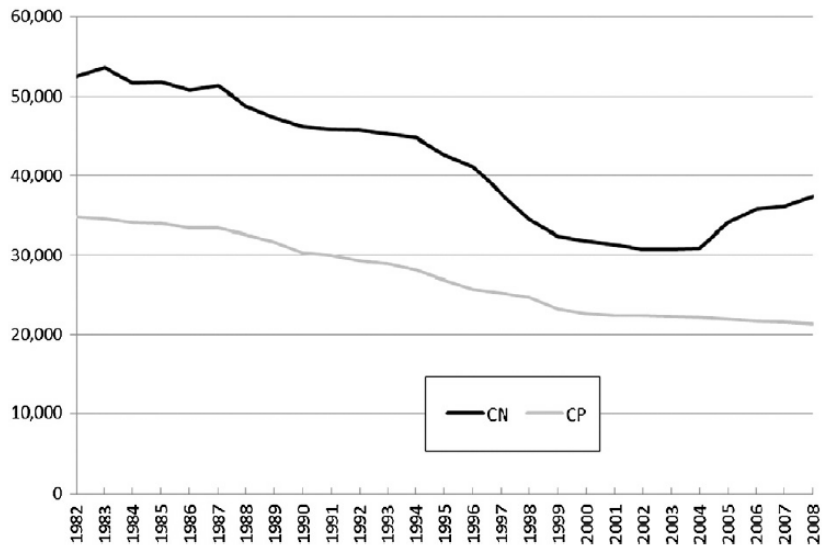


Fig. 1. CN and CP Canadian track operated (kilometres).

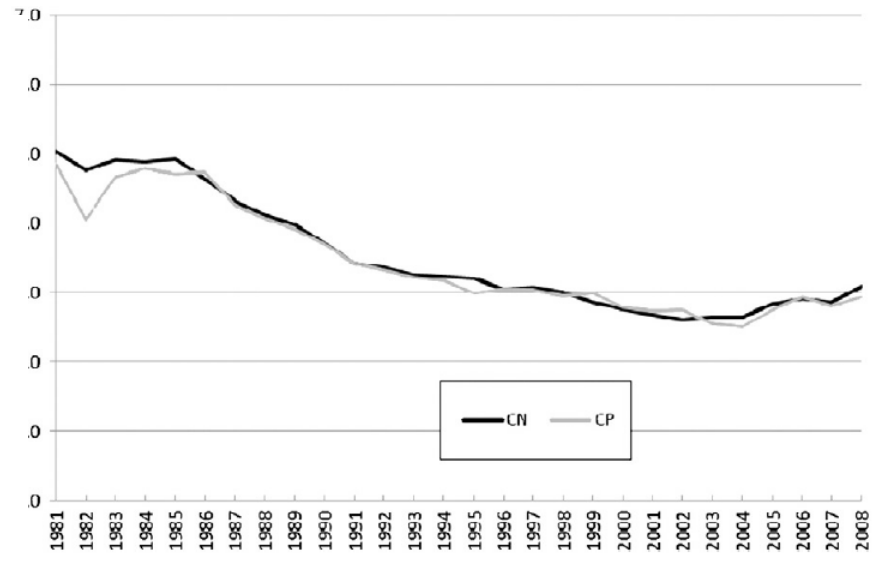


Fig. 2. CN and CP freight prices per revenue tonne-kilometres in Canada (2011\$).

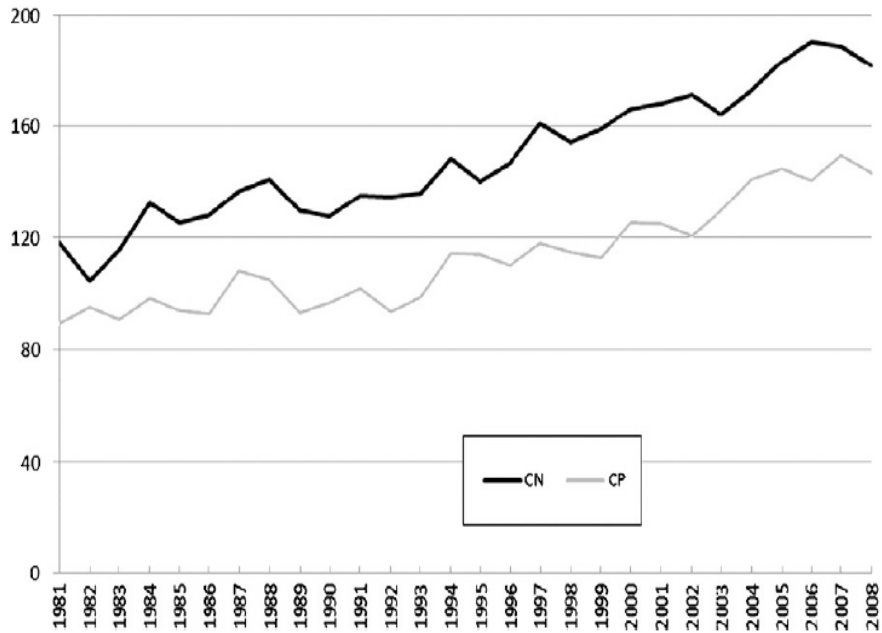


Fig. 3. CN and CP freight output in Canada (millions of revenue tonne-kilometres).

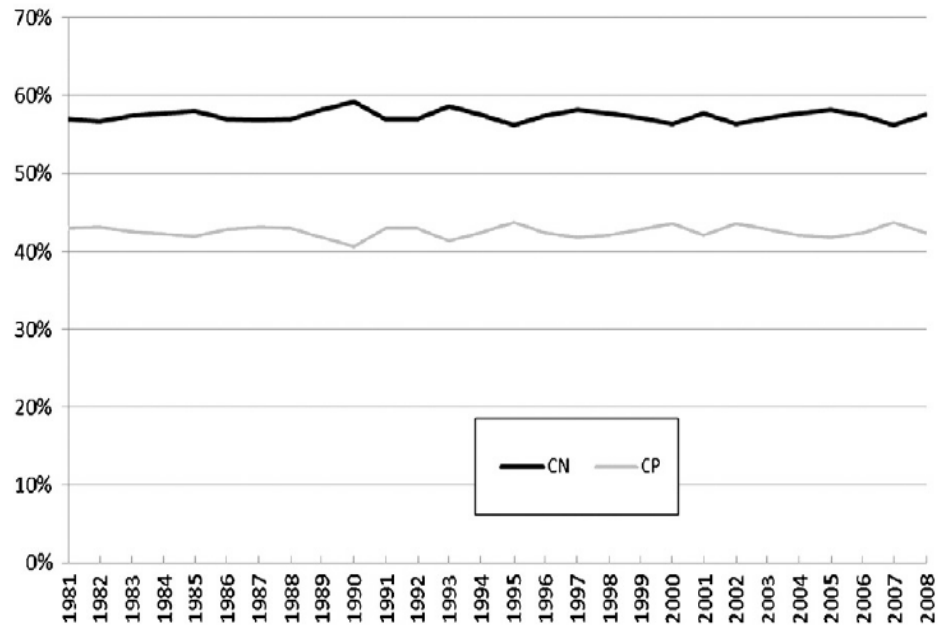


Fig. 4. CN and CP market shares in freight in Canada.

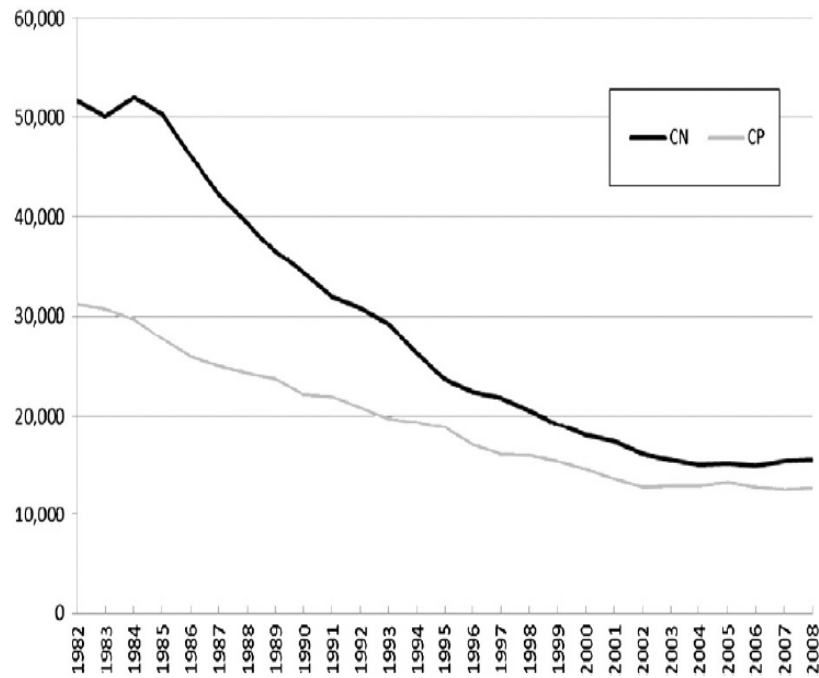


Fig. 5. CN and CP rail employment in Canada.

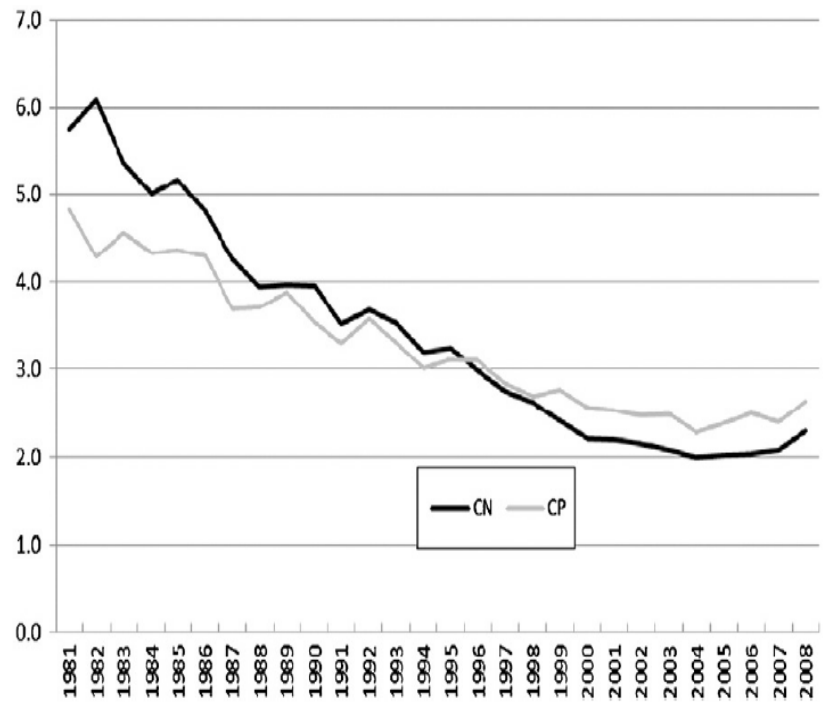


Fig. 6. CN and CP average total costs per revenue tonne-kilometre (2011\$).

10. SUBSIDY

Introduction

Subsidy plays a vital role in the operation of transport markets, because they are made up of a combination of market forces and the actions of transport planning authorities, with subsidy playing the pivotal role in reconciling these two forces in the actual market place

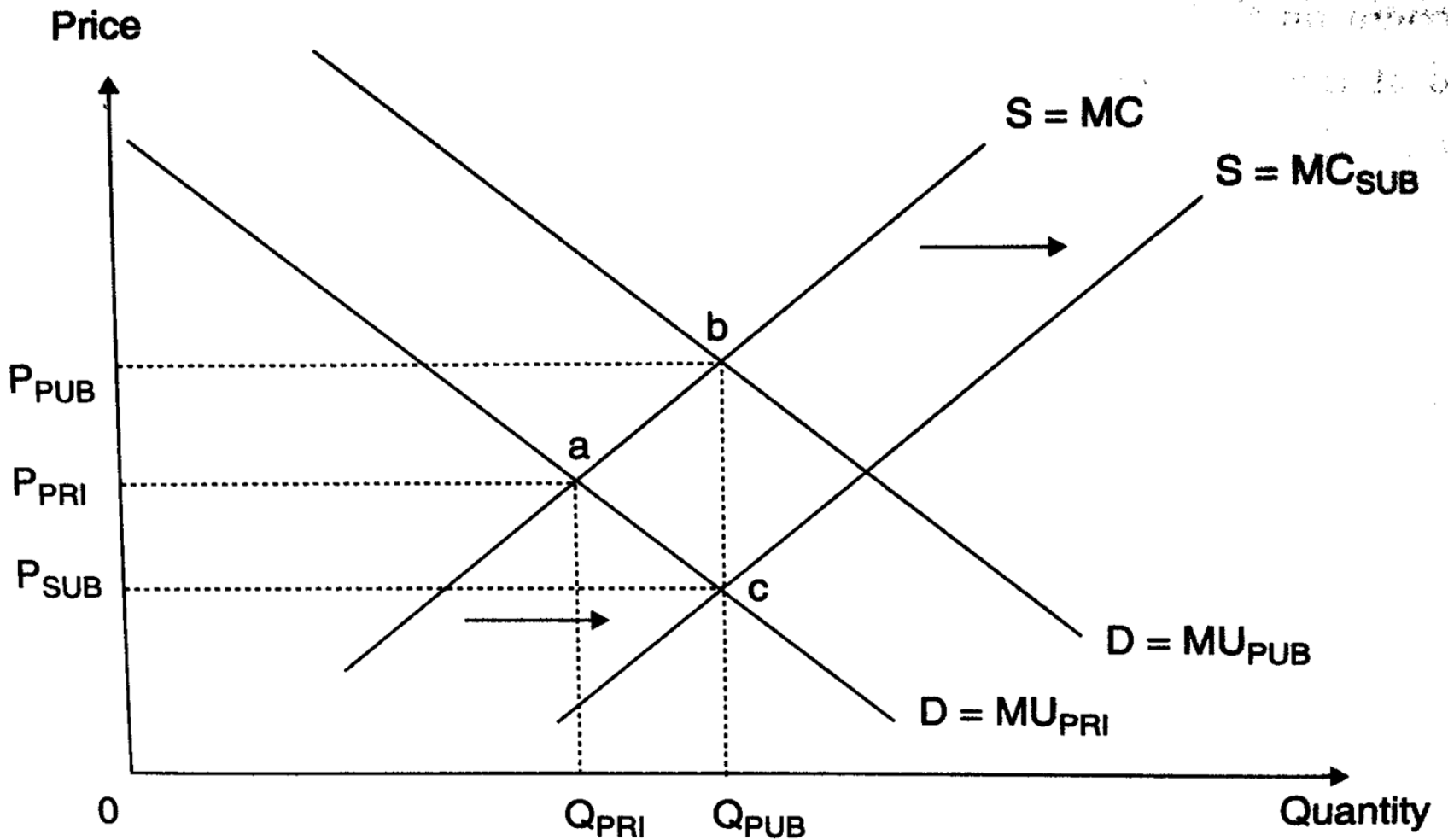
Subsidy or payment for public service?

- The payment of subsidy is closely related to aspects of regulation
- With the general move away from transport provision through traditional forms of public ownership towards far more private sector involvement, many argue that there is no longer a subsidy but rather a payment for the performance of a contract for providing a service
- The issue is further complicated by the fact, that paying transport subsidies has also a very strong political dimension

The rationale for subsidisation

- In support of land use efficient modes of transport
- To lessen the impact of environmentally unfriendly modes of transport
- To support economic development or regeneration of an area
- To support socially necessary services

Subsidy to operators to correct for under-consumption (supply side measure)



Demand side measures

- Far more straightforward
- Used to correct for a demand side market failure
- Specific groups and individuals are targeted to receive the subsidy
- In effect the individual is given a concession (a reduced fare) to use a service

Drawbacks of paying subsidy

- It is always a second best solution
- Can lead to inefficient operation
- The winners curse syndrom
- Subsidise a service that doesnt actually need a subsidy

Cross-subsidization

Cross-subsidization occurs where the profits of one route or service are used to pay for the losses on another route or service.

It has often been used in the past to reduce the level of total subsidy

Drawbacks:

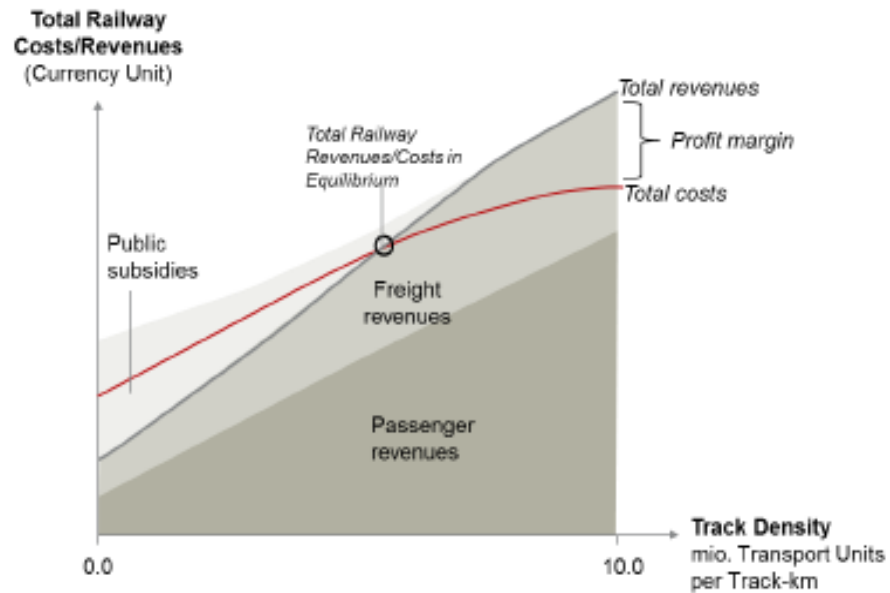
- Hides true costs of providing a particular service
- Users of profitable routes are penalized
- There are better instruments to ensure provision of services

Methods of paying subsidy

- Deficit subsidy
- Net cost contract
- Full cost contract
- Design, Built, Operate and Maintain (DBOM)

Economies of density and subsidy in railways

Figure 2: Simplified Representation of Costs/Revenues of a Railway System



Source: civity Management Consultants figure based on Swier

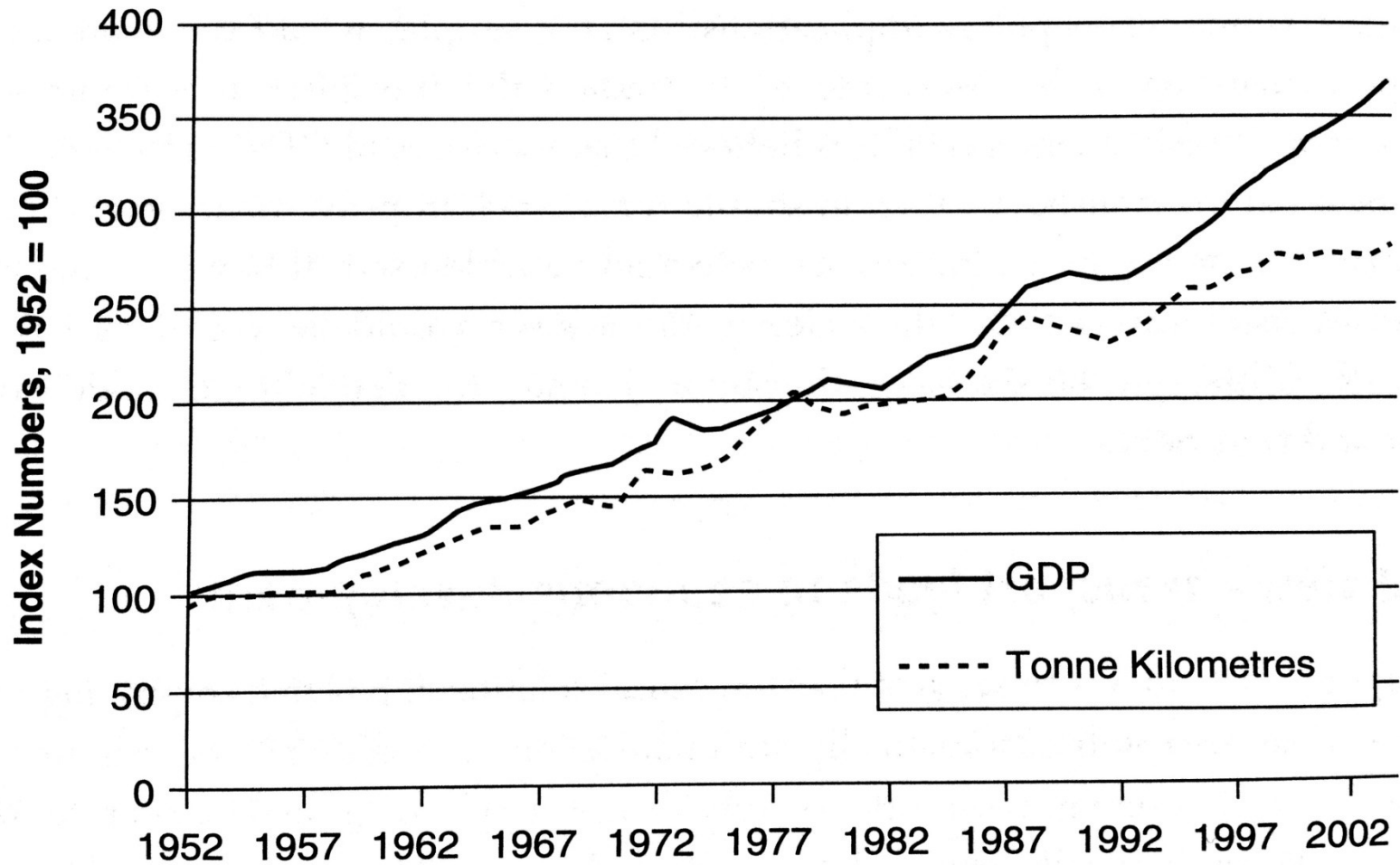
Note: Transport Units = Passenger km + ton km

11. TRANSPORT AND DEVELOPMENT

Learning Outcomes

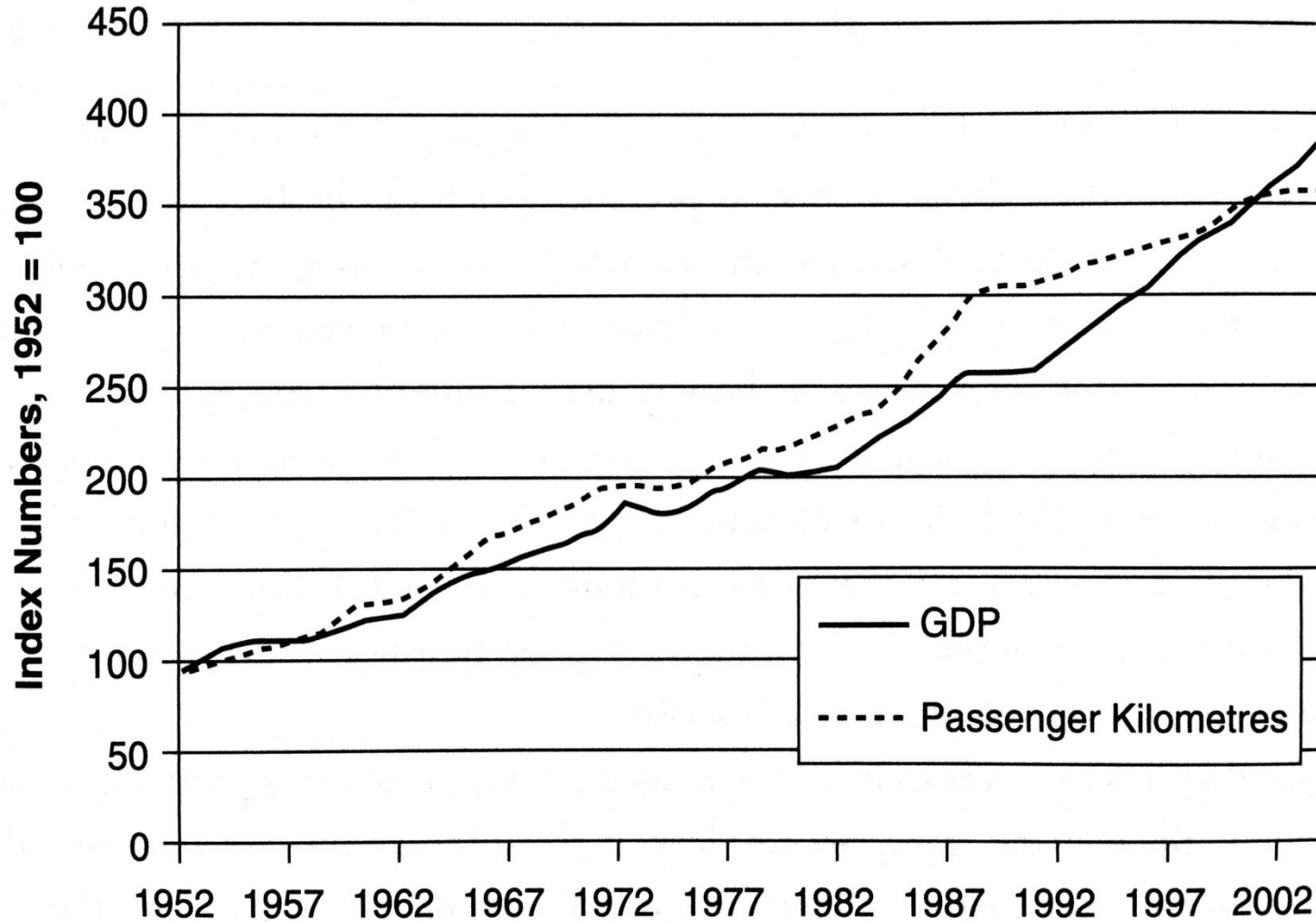
- The link between economic development and transport
- Causation: demand led and supply led effects
- Impact of transport on economic growth
- Transport role in the local economy
- The link between transport and wider social development issues

Economic and transport growth



Freight transport and real GDP, Great Britain

Economic and transport growth



Passengerkilometers travelled and real GDP, Great Britain

Direction of causation?

- The association between transport volumes and GDP has long been recognized, there remains real question over the direction of causation
- Is it that as income rise, more goods are demanded and transported?
- The alterantive hypothesis is that advances in freight transport will result in reduced transport costs an it will lead to more goods produced

Supply led view – transport leads to economic development

To adopt a supply led model is to suggest that the casual relationship is that improving the transport infrastructure of an area will automatically stimulate economic activity. This would occur for a number of reasons:

- Widening of markets, increased production and multiplier effects
- Indirect effects on employment in construction and operation

Demand led models – economic development drives demand for transport

- Contrasting with the supply led view is the alternative idea that transport provision is invariably a response to a basic demand, hence the casual relationship is that economic development leads to a demand for better transport facilities
- Without a basic demand for an area's goods and services, then irrespective of the quality of the transport infrastructure this will never stimulate that demand

Synthesis

- There is no clear answer to the direction of causation and the two are closely associated
- Under a supply led view improving transport services and/or upgrading the infrastructure is a necessary and sufficient condition for improved transport to lead to economic development
- Under a demand led view, however, it is a necessary but not sufficient condition, i.e. the only condition required. There has to also be a basic derived demand for transport services in order for transport developments to then facilitate economic development.

Empirical evidence (examples)

Fogel (1964) – Railroads and economic growth

Purvis (1985) – highway development and economic growth

Aschauer (1989) – elasticity of aggregated output with respect to infrastructure spending

Harmatuck (1997) – return on infrastructure investment will decline as maintenance expenditure goes up

Rodriguez-Pose (2004) – impact of European transport investment on economic development (almost zero)

Decoupling transport from GDP

- There is a very close association between freight and passenger traffic and GDP
- This has now become a major problem, due to negative impact of transport on the environment
- Decoupling = GDP can continue to grow without being associated with the growth of traffic
- Is decoupling achievable?

Transport and local economy

- The role of transport in the local economy → the extent to which the multiplier effect is allowed to function at the local level from any external injection
- The better physical links within the local economy → the easier it is for the benefits to have a full impact
- Physical separation of production and consumption

Location

- Many theorists suggest that firms of similar nature will tend to be located near to each other for various reasons.
- Examples: Silicon Valley, Moravian Manchester
.....
- Improved transport links to create industrial clusters?
- The local economy, transport and housing market

12. TRANSPORT APPRAISAL

Learning Outcomes

- Understand why we appraise
- Understand main methods of appraisal
- Have an appreciation of how these methods vary across Europe
- Be able to critique some of the key assumptions on which appraisal is based

Transport investment

- Transport investment involves expenditure on particular project in situation of limited resources.
- The task is to choose the project that brings maximum return

Appraisal

- Appraisal is a way of predicting how much utility we as society will derive from the expenditure on one project compared to another, by predicting the utility that will arise from each
- It is fundamental to realise that, inherent in appraisal there is some kind of prediction or forecasting required

Cost benefit analysis (CBA)

- CBA estimates and totals up the equivalent money value of the benefits and costs to establish whether they are worthwhile.
- The result of CBA is a number; this shows the ratio of benefits to costs.
- The basis of CBA is that a monetary value needs to be allocated to all benefits and costs

How does CBA work?

- Choose options
- Choose length of time
- Use a predictive model
- Calculate time savings
- Take away benefits from cost to find out whether benefits exceed costs and, if so, by how much

Key elements of CBA

- Project appraisal period
- The benefits that are assessed
- Forecasting and modelling
- Present value
- Values of time
- Accident valuation
- Operating costs
- Revenue
- Discounting

Criticism and problems with CBA

- Valuing time savings
- Discount rate and length of time of project appraisal
- What does NPV show us?
- Equity and distributional effects
- Project pricing – optimism and inaccuracy

Costs and benefits of high speed rail

Costs	Benefits
Capital costs	Revenue
Operating costs	Time savings (beyond those recovered in higher prices)
External costs	Release of capacity on existing rail routes
Loss of tax revenue (from traffic diverted from road to rail)	Diversion from other modes – reduced congestion, accidents and environmental costs
Opportunity cost of public sector funds	Induced traffic
	Wider economic benefits

CBA of HSR in Spain

CBA of high-speed rail in Spain (billions of 2010 euros)

	Madrid–Seville	Madrid–Barcelona
Costs	6.8	12.4
Benefits	4.5	7.2
Of which time savings	1.6	2.8
Generated traffic	0.8	1.1
Costs saved on other modes	1.9	2.9
External costs saved	0.2	0.4
Net present value	−2.3	−5.3

Source: [de Rus \(2012\)](#).

CBA of HSR in Britain

1998 Appraisal of HS1 (£m 1997 NPVs).

User benefits – international services	1800
User benefits – domestic services	1000
Road congestion	30
Environmental benefits	90
Regeneration	500
Total benefit	3420
Costs to government	1990
Net present value	1430
Benefit cost ratio (all benefits)	1.72
Benefit cost ratio (excluding regeneration benefits)	1.5

Source: [National Audit Office \(2001\)](#).

Note: At the current exchange rate (January, 2015) £1 equals 1.3344 euros.

CBA of proposed HSR in Britain

Appraisal of HS2: present value of costs and benefits over 60 years (£b 2011 prices).

	Phase 1 Oct 2013	Full network Oct 2013
Transport benefits (business)	16,921	40,529
Transport benefits (other)	7673	19,323
Other quantifiable benefits	407	788
Indirect taxes (loss to govt)	-1208	-2912
Net transport benefits	23,793	57,727
Wider economic impacts	4341	13,293
Total costs	29,919	62,606
Revenues	13,243	31,111
Net cost to government	16,676	31,495
Benefit cost ratio (Inc. WEIs)	1.7	2.3

Source: DfT (2013).

13. TRANSPORT FORECASTING

Learning Outcomes (1)

- Alternative approaches to generating a forecasts of demand for existing, new or improved services
- Issues surrounding asking people how they or the public would react to new or improved transport services and the problems taht will occur
- Methods for identifying and projecting demand for existing services when no major changes are expected

Learning Outcomes (2)

- Methods for identifying and projecting seasonal change
- Methods for forecasting demand when significant change is expected in the economic and social environment
- Methods for forecasting the impact of new or improved services in a competitive environment

Aim

- In order to assess if the provision of a new or improved transport service makes economic sense we need to have some idea of how public will respond, both immediately and in the far distant future
- Forecasting is about collecting information from all relevant sources and analysing it in a consistent structured fashion.

General approaches

There are three approaches to forecasting demand:

1. Qualitative: Surveys and Sampling
2. Time series analysis
3. Econometric techniques

Qualitative Methods

- Qualitative Forecasting Methods are based on surveys of either potential customers or experts
- The major problem is identifying who to ask

Time series analysis

In time series analysis we seek to identify the three elements:

1. The Trend
2. Seasonal or Cyclical Factors
3. The unusual (sometimes termed the stochastic factor or noise)

Econometric methods

The modelling process involves 6 stages:

1. Understanding the Problem
2. Obtaining the Data
3. Specifying the Model
4. Estimating the specified Model
5. Validating the Model
6. Simulation/Forecasting

The gravity model

The model that predicts the level of transport between two locations to be dependent upon their respective population sizes and the distance between them

Econometric demand models

The demand for particular mode (road, rail, air) will be determined by income, price, journey times, frequency and comparative quality

Modelling choice

- It is often the case that we are more concerned with forecasting the share of existing traffic than the growth of that traffic
- Logit models