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. Costs
5. Efficiency
6. Competition
7. Ownership
8. Regulation
9. Subsidy
10. Pricing
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

- 25% - class attendance
- 25% - class activity
- 25% - written exam
- 25% - defense of an empirical project

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1. TRANSPORT MARKETS

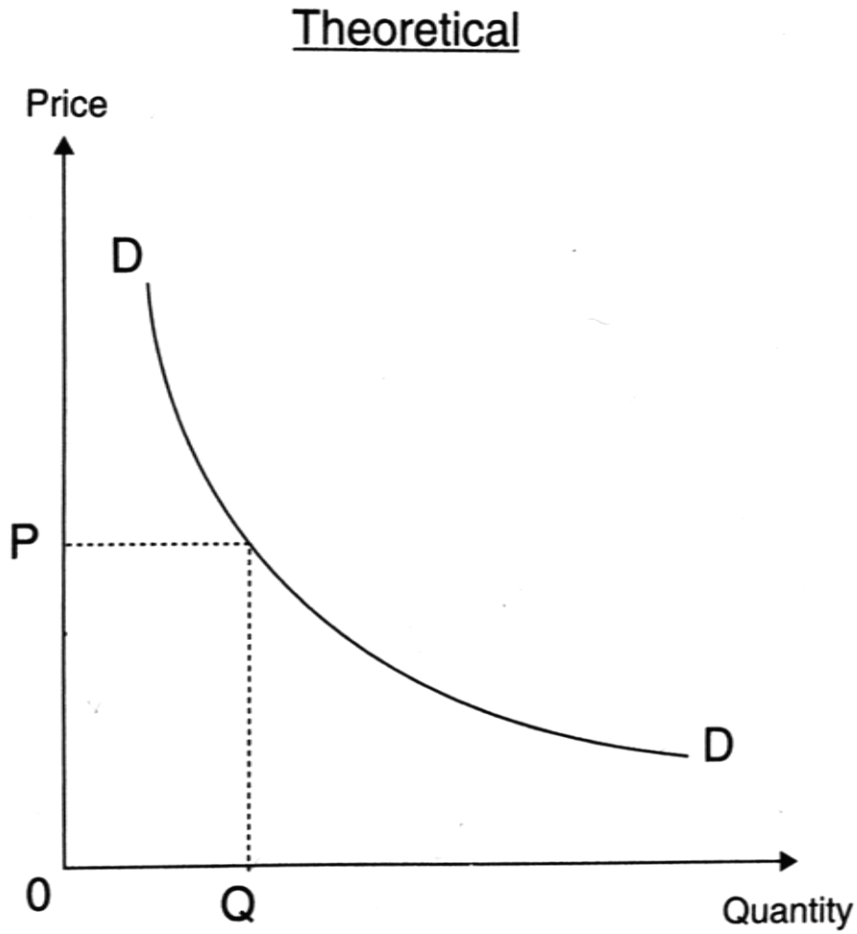
Market analysis

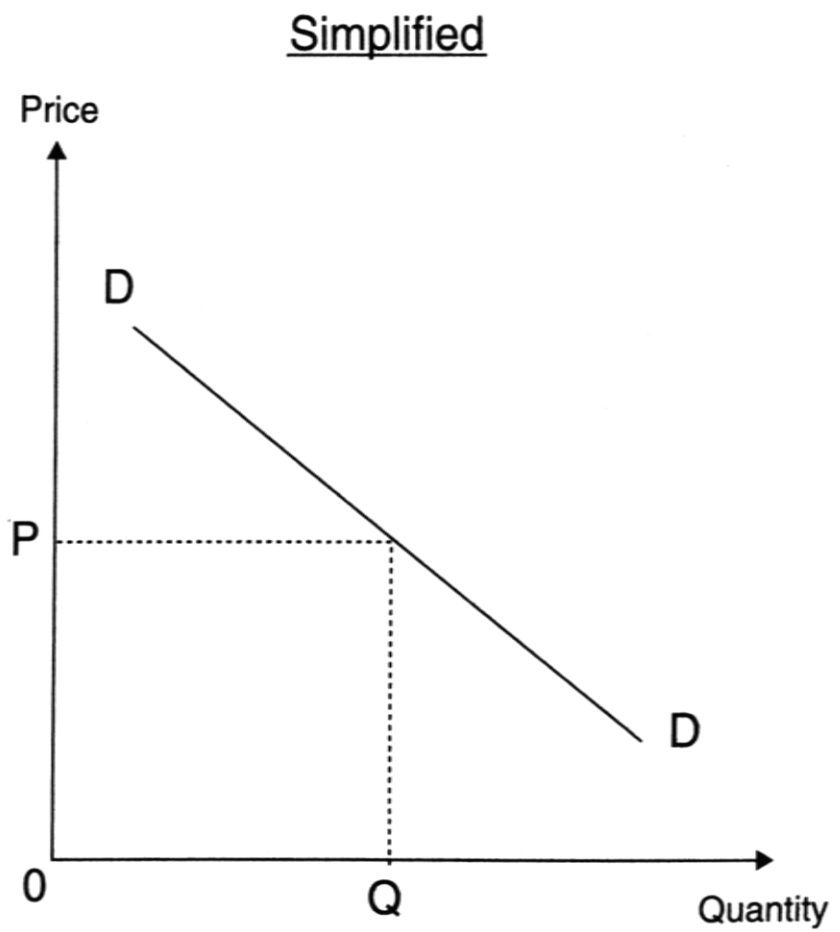
- Market demand and supply
- State regulation and intervention
- Ceteris paribus clause

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

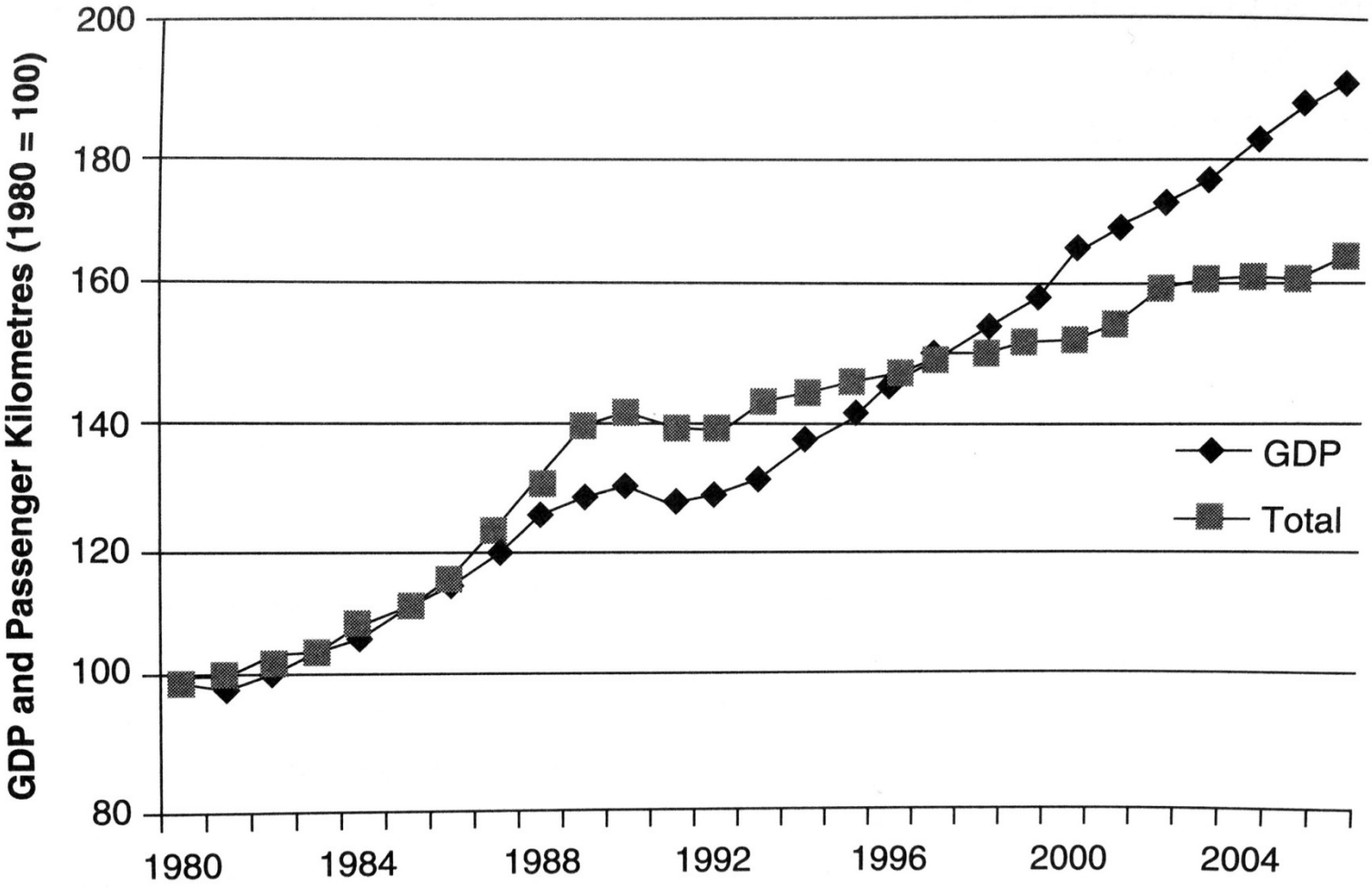




Demand determinants

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

Case 1: Impact of income on demand



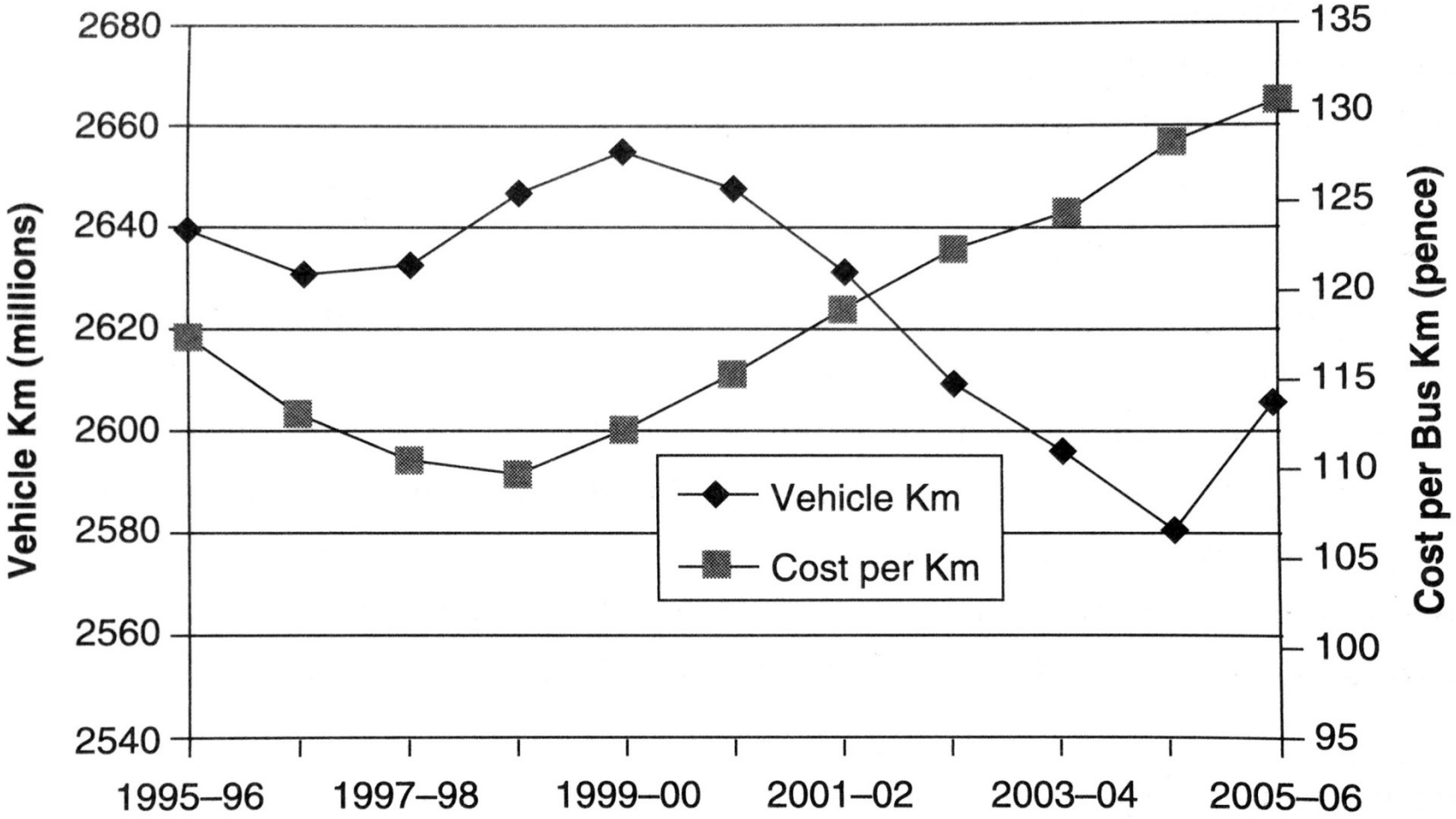
Theory of supply

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



Organization of Supply

- Integration or Fragmentation?
- Monopoly or Competition?
- Intervention or Liberalism?

Market workings

- Putting together demand and supply
- Incorporate market imperfections
- Adding government intervention and regulation

Readings for Lecture 2

Paulley, N., Balcombe, R., Mackett, R., Titheridge, H., Preston, J., Wardman, M., ... & White, P. (2006). The demand for public transport: The effects of fares, quality of service, income and car ownership. Transport Policy, 13(4), 295-306.

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 price elasticity

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

Price elasticity of demand estimates of passenger transport

	Elasticities	
	Peak	*Off Peak*
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
	Leisure	*Non-leisure*
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

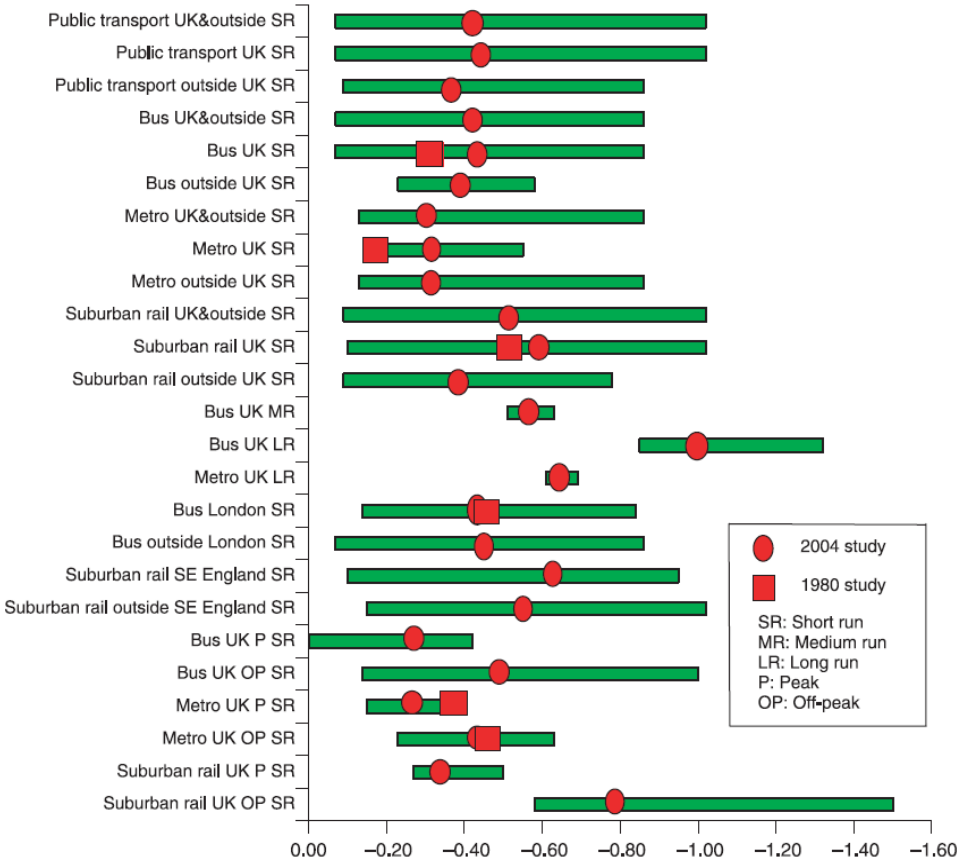


Fig. 1. Summary of mean values and ranges of fare elasticities.

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)

Mode	*Air*	*Bus*	*Rail*
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

Modes	*Cross-elasticity*
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)

Area	*Income elasticity*
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

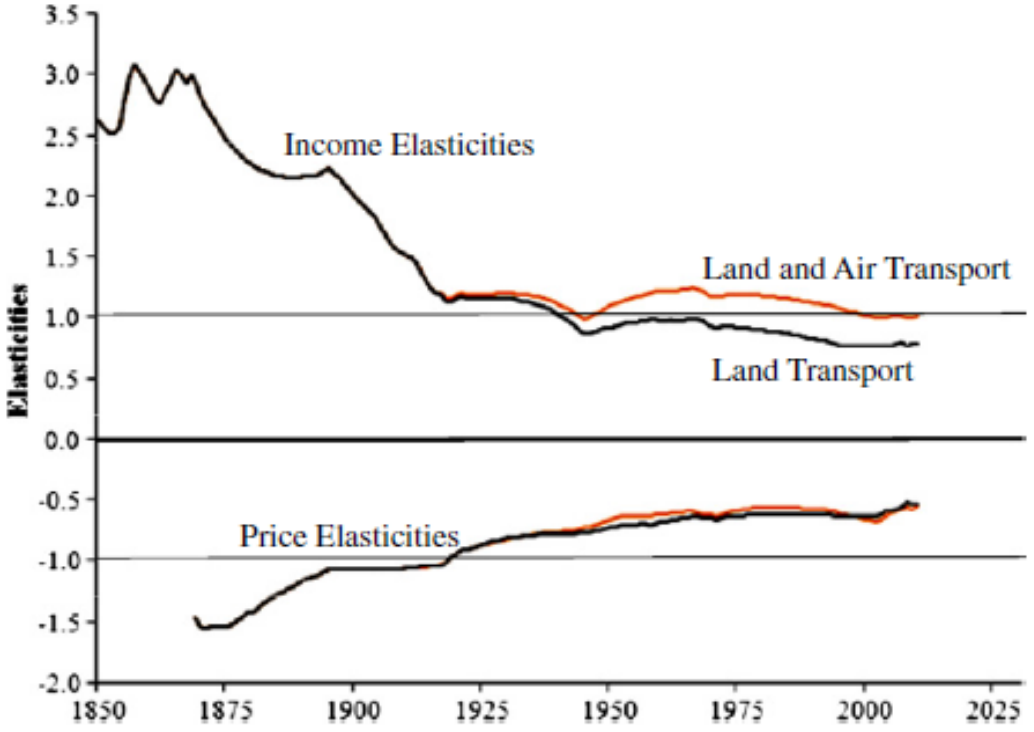


Fig. 5. Income and price elasticities for passenger transport demand, 1850–2010.

Fouquet, R. (2012). Trends in income and price elasticities of transport demand (1850–2010). *Energy Policy*, *50*, 62-71.

Readings for Lecture 3

- Buehler, R., & Pucher, J. (2012). Demand for public transport in Germany and the USA: an analysis of rider characteristics. *Transport Reviews*, *32*(5), 541-567.

3. TRANSPORT DEMAND ISSUES

1. 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:

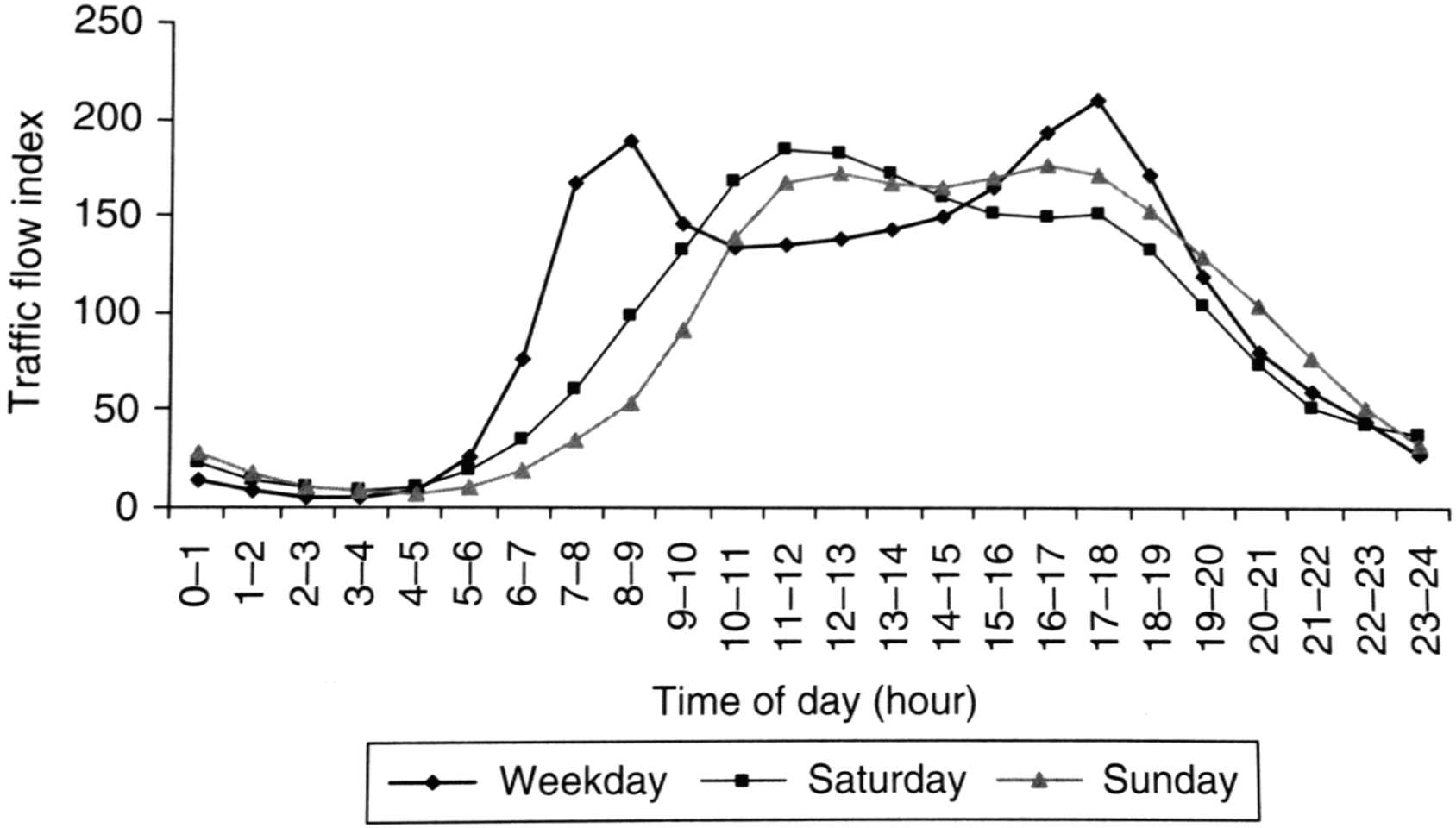
1. Greater car usage
2. Growth of urban conurbations
3. Public services co
4. ncentrated in urban centres
5. Population ageing

Suggested reading: *White, P. (2015). Report on public transport provision in rural and depopulated areas in the United Kingdom.*

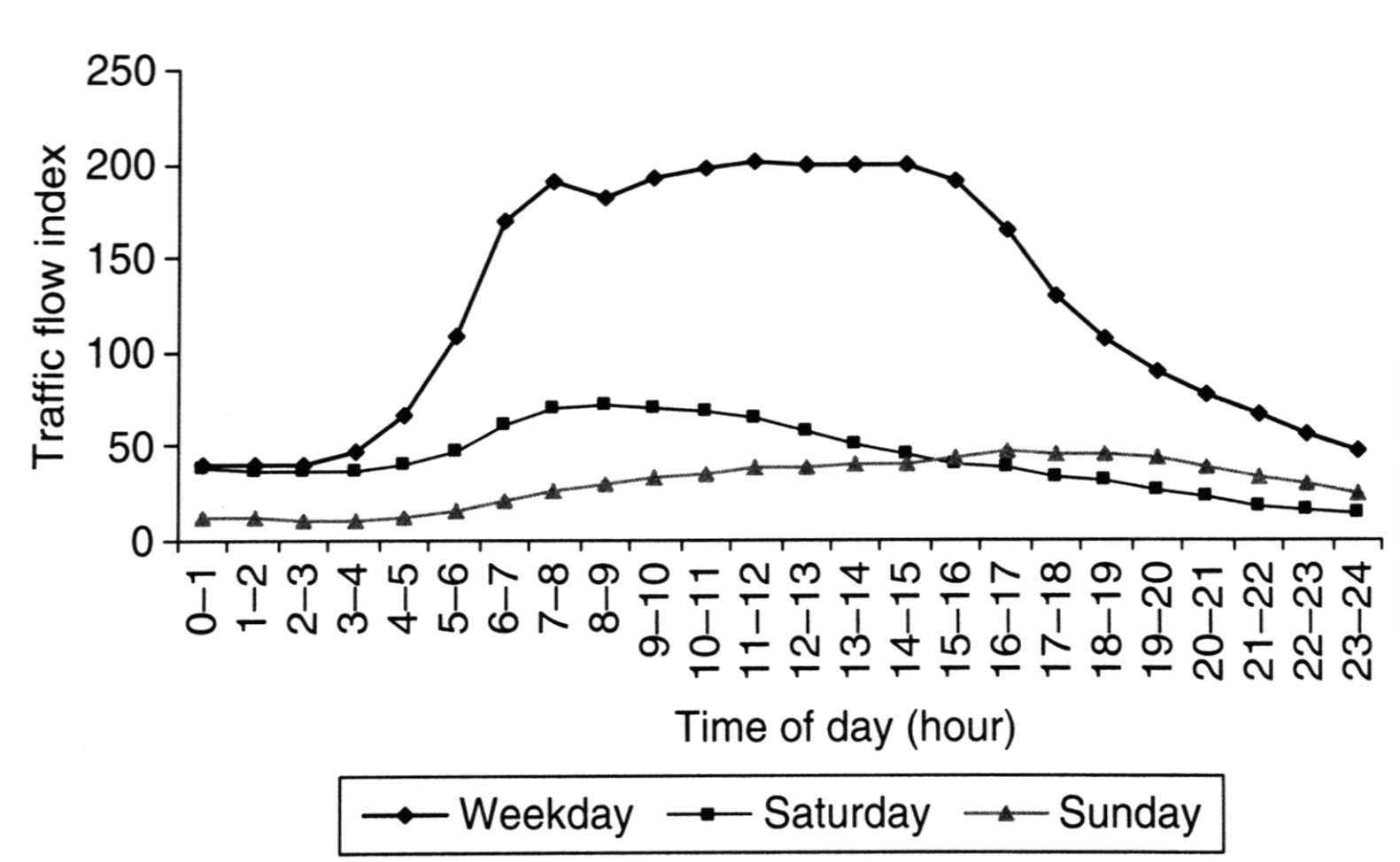
2. Problem of peak

- 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 tht 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



3. Valuation of time

- The importance of travel time in transport economics should now be apparent.
- Transport time savings re 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 differences between values of working times and non-working times.
- Also there are differences in the values of walking/waiting times and in-vehile times.
- This has important consequences for design fo public transport.
- Suggested reading: *Small, K. A. (2012). Valuation of travel time. Economics of transportation, 1(1), 2-14.*

4. 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 enviroment makes it a matter of considerable interest to transport economist.

Two approaches to modelling demand for car ownership:

- Hedonic approach
- Product life cycle

Is demand for car already saturated?

Suggested reading:

- Metz, D. (2013). Peak car and beyond: the fourth era of travel. *Transport Reviews*, *33*(3), 255-270.
- Buehler, R., Pucher, J., Gerike, R., & Götschi, T. (2017). Reducing car dependence in the heart of Europe: lessons from Germany, Austria, and Switzerland. *Transport Reviews*, *37*(1), 4-28.

Readings for Lecture 4

- Glaeser, E. L., & Kohlhase, J. E. (2004). Cities, regions and the decline of transport costs. *Papers in regional Science*, *83*(1), 197-228.

4. 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?

Cost categories

- Monetary costs; Time costs
- Infrastructure costs; Operators costs
- Enviromental costs; Accident costs

Costs classification

Fixed costs (FC) = costs that are the same irrespective of the level of output that is produced

Variable costs (VC) = costs that change as the level of output changes

Semi-variable costs (SVC) = costs that are fixed over a certain range of output, but then change once the upper limit of that range is reached

Case: Mode cost comparison

Operating Cost	*Airline*		*Ferry Operator*		*Bus Company*		*Railway Company*		*Parcels*	
	British Airways		*Caledonian Mac.*		*First Glasgow*		*Virgin West Coast*		*Parcelforce*	
	2005/6		*2005/6*		*2005/6*		*Value 2005/6*		*Value 2005/6*	
	Value	*%*	*Value*	*%*	*Value*	*%*	*Value*	*%*	*Value*	*%*
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 importance of cost structure in the business model of low-cost airlines

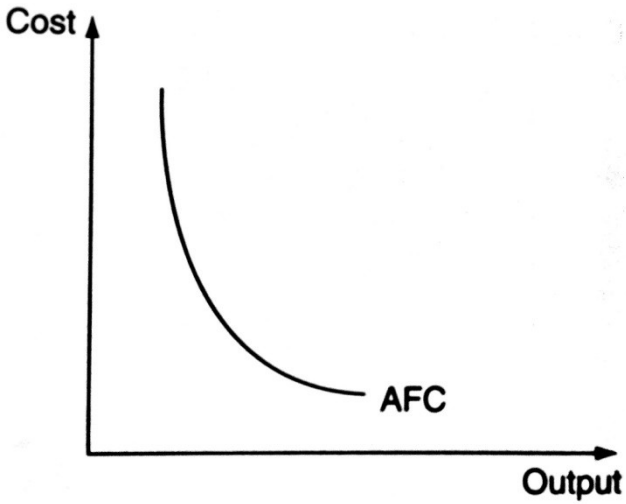
Airline:	*British Airways*		*easyJet*		*Ryanair*	
	Actual	*%*	*Actual*	*%*	*Actual*	*%*
Staff costs	2346.0	30%	75.2	11%	171.4	13%
Selling costs	449.0	6%	26.0	4%	13.9	1%
Aircraft costs	2446.0	31%	366.8	54%	590.1	45%
Fuel costs	1632.0	21%	165.9	25%	462.5	35%
Other costs	955.0	12%	42.2	6%	85.6	6%

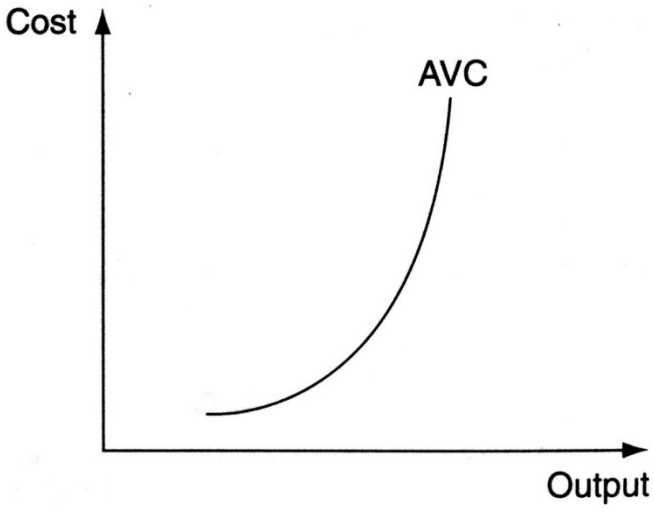
Source: Adapted from the respective company accounts

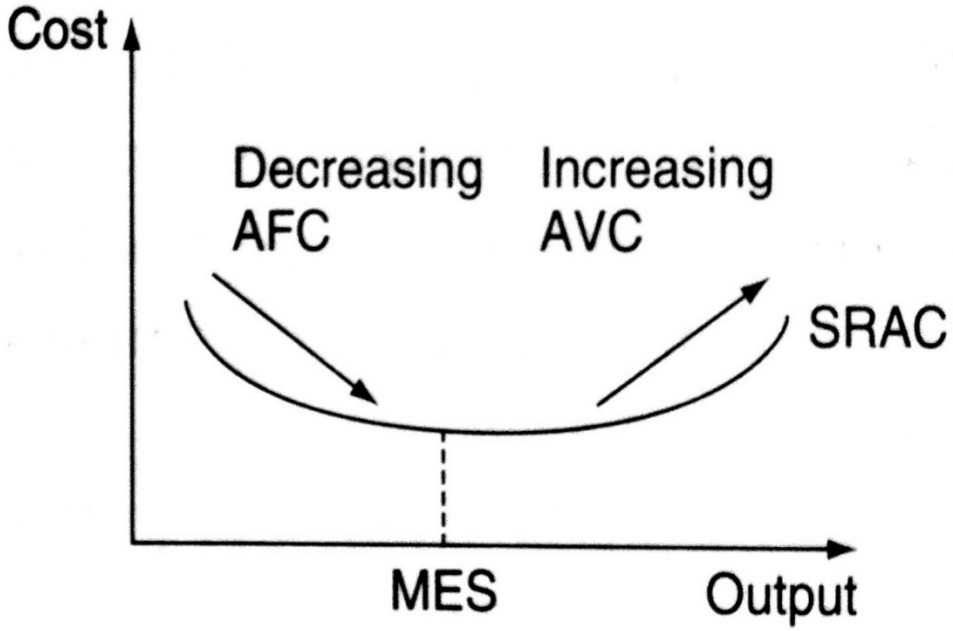
Short run and long run

- 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

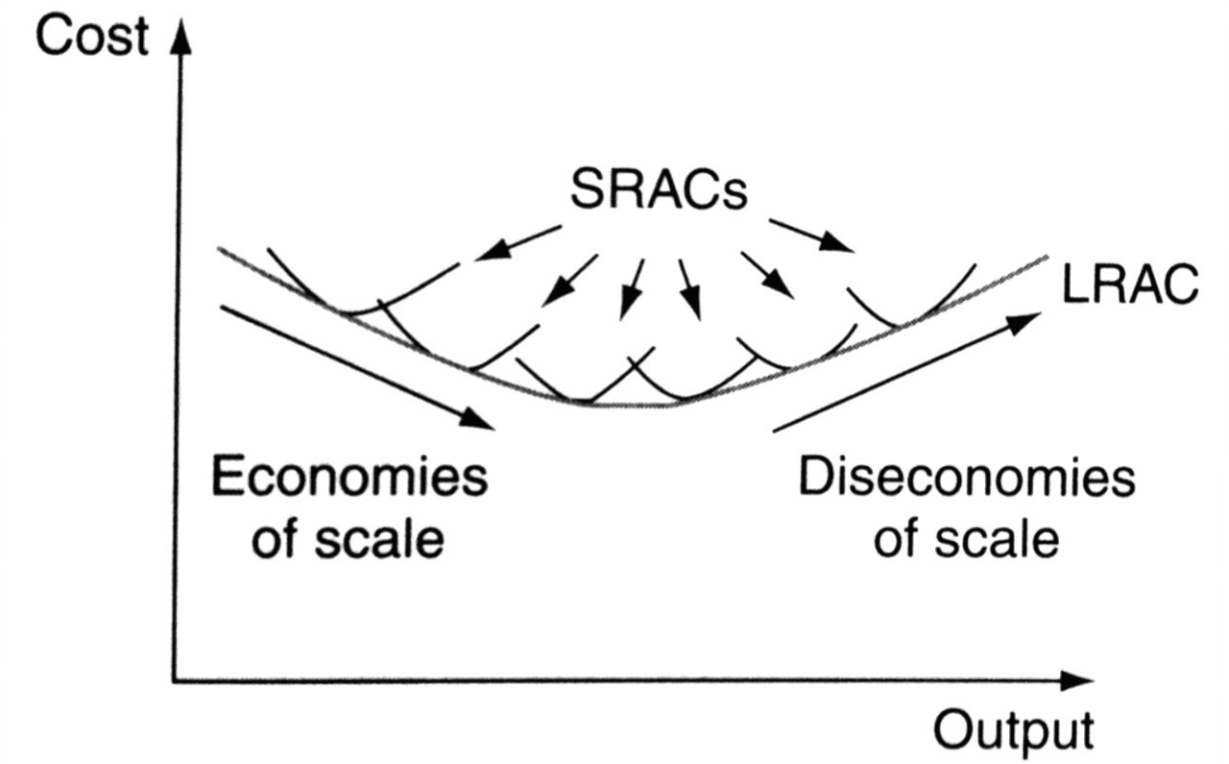
The short run average cost curve







The long run average cost curve



Economies of scale, scope and density

- If an equal proportionate increase in all outputs and route kilometers leads to the same proportionate increase in costs → **constant returns to scale**
- If an equal proportionate increase in all outputs holding route kilometers constant leads to the same proportionate increase in costs → **constant returns to density**
- If splitting the production of passenger and freight outputs and of infrastructure leads to increased costs → the railway is said to experience **economies of scope**

Nash, C. (2011). Competition and regulation in rail transport. *Handbook of Transport Economics.*

Readings for Lecture 5

- Smith, A. S., & Nash, C. (2014). Rail Efficiency: Cost research and its implications for policy.

5. 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.

Efficiency

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

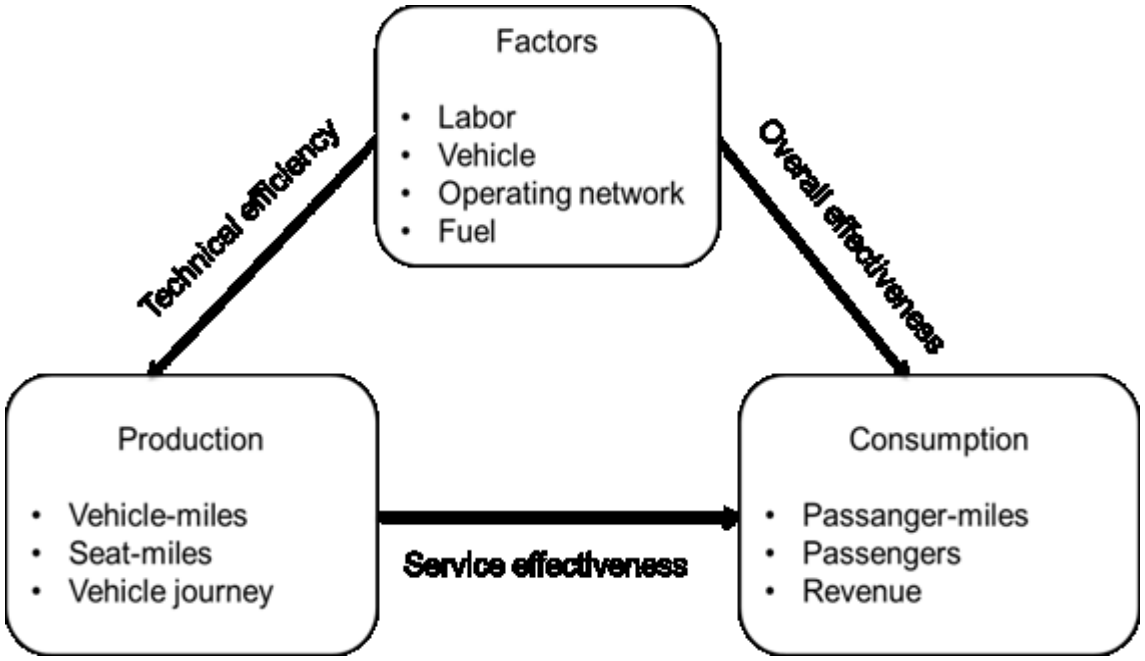
Technical, cost and allocative efficiency

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

Cost efficiency = most cost efficient input minimization

Allocative efficiency = cost effcieincy + right quantities

Service efficiency and effectiveness



DEA + Tobit

- DEA (data envelopment analysis) = 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

Case study in railways efficiency

Driessen, G., Lijesen, M., & Mulder, M. (2006). *The impact of competition on productive efficiency in European railways* (No. 71). CPB Netherlands Bureau for Economic Policy Analysis.

Contents

Outputs and inputs

Table 4.1 Descriptive statistics of the data

			Europe				Japan
Variable	Symbol	Unit of measurement	Mean	Min	Max	Standard deviation	Mean
Outputs							
Passengers kilometres	Pkm	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)

Driessen, G., Lijesen, M., & Mulder, M. (2006). *The impact of competition on productive efficiency in European railways* (No. 71). CPB Netherlands Bureau for Economic Policy Analysis.

Efficiency scores - DEA

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

Source: Driessen et al. (2006)

Efficiency determinants

Table 5.1 Description of regression variables

Variable	Symbol	Description
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 is1, 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

Source: Driessen et al. (2006)

Efficiency determinants – regression

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.

Source: Driessen et al. (2006)

Readings for Lecture 6

- Nash, C., Crozet, Y., Nilsson, J. E., & Link, H. (2016). Liberalisation of passenger rail services. *CERRE Report*.

6. 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 rivarly in consumption
- Absense of externalities
- No governemnt 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 unneccessary 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

Competition on x for the market

- **Competition on the market** = this occurs where there is no restriction on entry. Operators are competing directly against each other.

- **Competition for the market** = where entry to the network is restricted, it is possible to organize competition for the exclusive right to service individual routes

European rail

Competition on the market:

- Praha – Ostrava; Praha – Brno
- Wien – Salzburg; Roma – Milano
- Stockholm - Goteborg

Competition for the market:

- British franchising
- Germany regional traffic
- Many others

See: Nash, C., Crozet, Y., Nilsson, J. E., & Link, H. (2016). Liberalisation of passenger rail services. *CERRE Report*.

British bus reform

- Local buses in Britain, outside London, were 'deregulated' in 1986 (**competition on the market**)
- By contrast, in London, the 1984 London Regional Transport Act introduced a system of comprehensive tendering (**competition for the market**)
- This paper examines the long term impacts of these changes.

J. Preston, T. Almutairi / Research in Transportation Economics 39 (2013) 208–214

British bus industry - demand

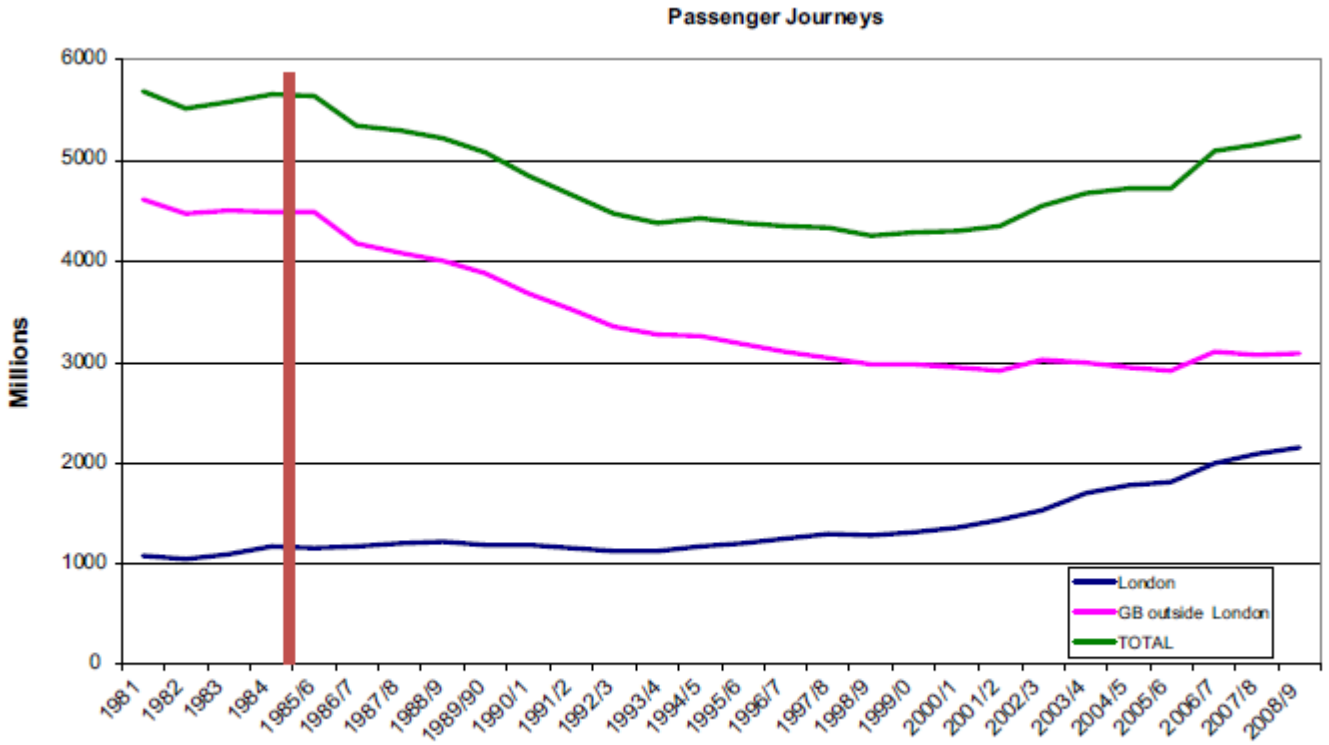


Fig. 1. Trends in local bus demand (passenger journeys, millions).

British bus industry - supply

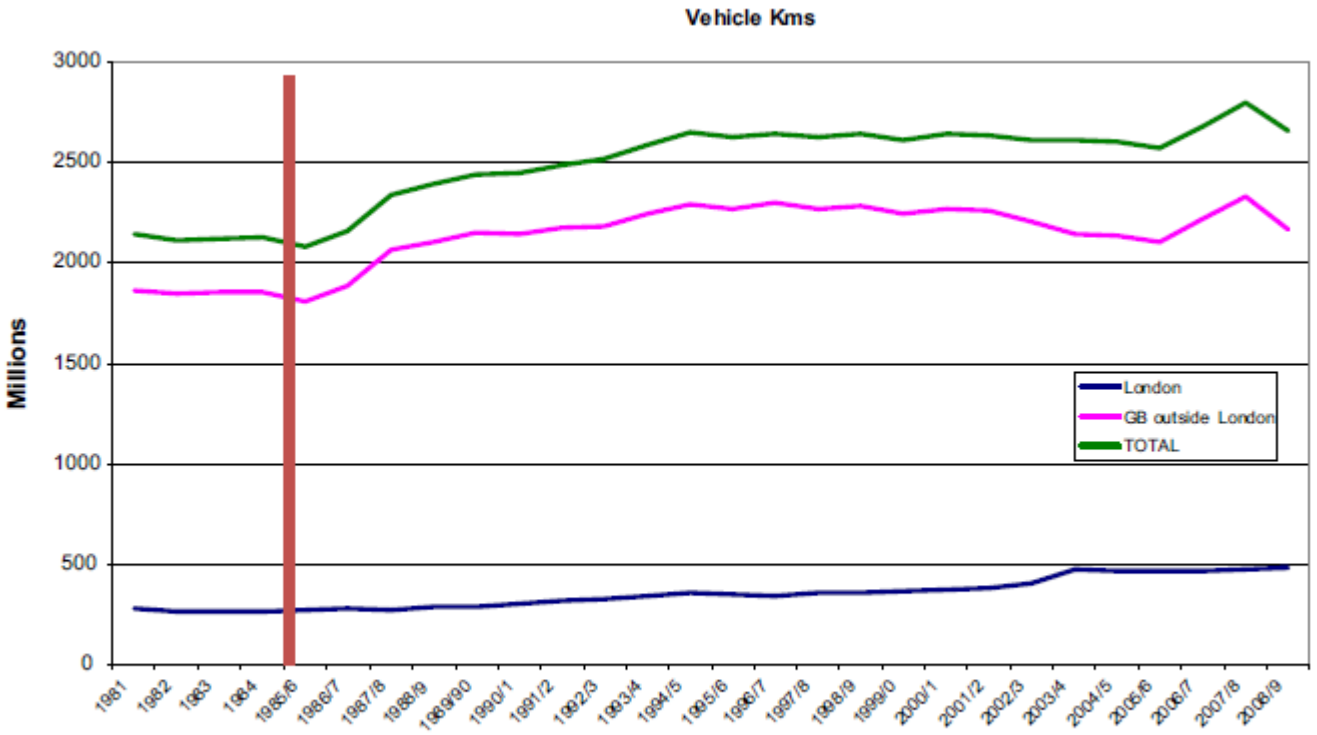


Fig. 2. Trends in local bus supply (vehicle kilometres, millions).

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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%

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Readings for Lecture 7

- Preston, J., & Robins, D. (2013). Evaluating the long term impacts of transport policy: The case of passenger rail privatisation. *Research in Transportation Economics*, *39*(1), 14-20.

7. OWNERSHIP

Introduction

- Due to many market imperfections, transport markets usually cannot be left entirely to market forces to resolve economic transport issues.
- In most cases, therefore, they need some form of external intervention in order to correct for market failures

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

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 privatization

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

Rail privatization in Britain – success or failure?

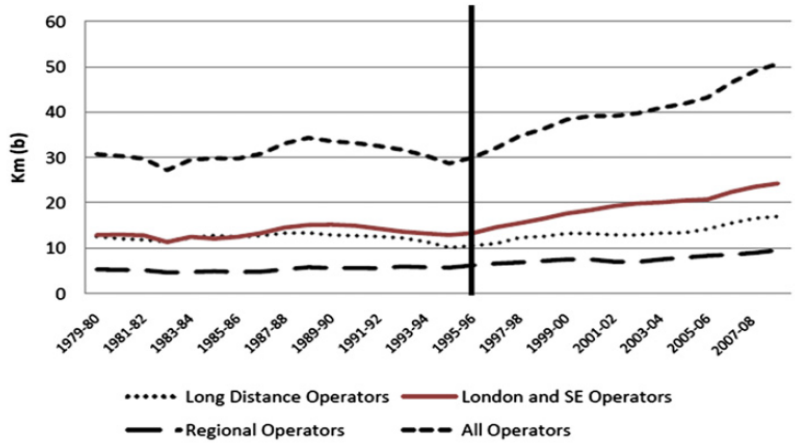


Fig. 1. Passenger kilometres by sector.

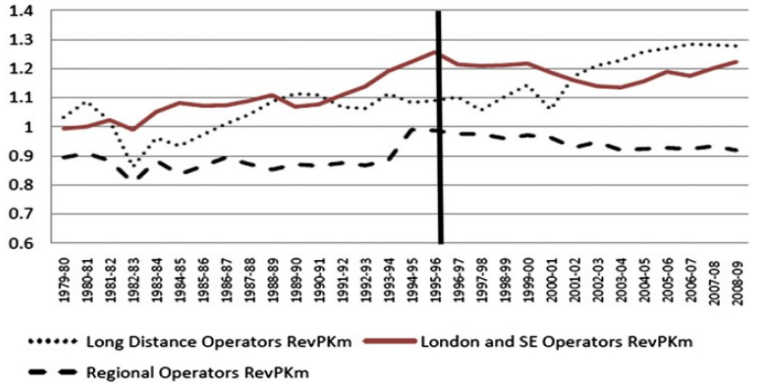


Fig. 2. Real revenue per passenger km (£ per 10 km, 2008 prices).

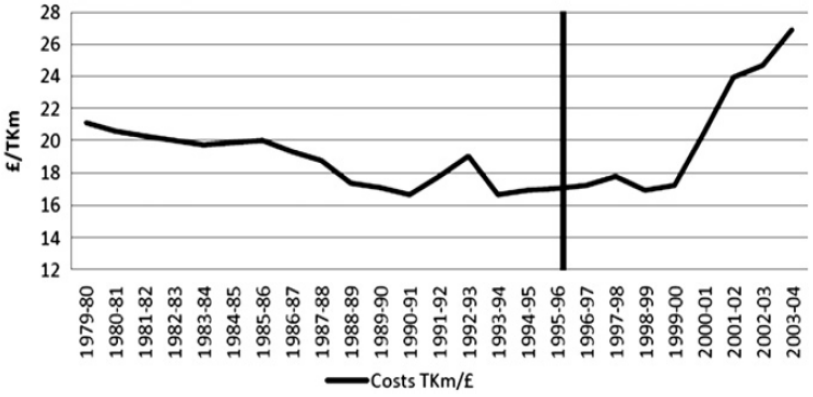


Fig. 4. Total costs per train km (£, 2008 prices). Source: Smith (2006).

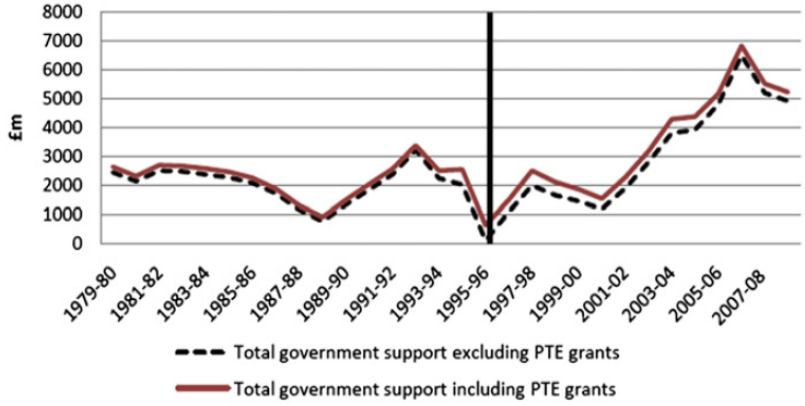


Fig. 5. Total government support to the rail industry (£ million, 2008 prices).

Preston, J., & Robins, D. (2013). Evaluating the long term impacts of transport policy: The case of passenger rail privatisation. *Research in Transportation Economics*, *39*(1), 14-20.

Rail privatization in Britain – success or failure?

Table 1
Forecasting model parameters.

Coefficient	Value	*t*-statistic
α	2.923	17.106
β	−5.690	−2.817
γ	0.0024	7.093
δ	3.68762E-07	3.614
θ	−0.092	−8.575
μ	−0.051	−3.117
ρ	−0.063	−3.283
Adjusted R^2	0.983	
Durbin–Watson	1.453	

$$\text{Ln PKM}_t = \alpha + \beta\text{RPKM}_t + \gamma\text{TKM}_t + \delta\text{GDP}_t + \theta\text{PRIV} + \mu\text{HAT} + \rho\text{STRIKE} \quad (1)$$

where PKM_t = Passenger Kilometres in year t, RPKM_t = Real Revenue per Passenger Kilometre in year t, TKM_t = Train Kilometres in year t, GDP_t = Real Gross Domestic Product in year t, PRIV = Privatisation Dummy Variable (1992/3 to 2005/6), HAT = Hatfield Dummy Variable (2000/1 to 2006/7) and STRIKE = Strikes Dummy Variable (1982/3 and 1991/2). The estimated coefficients of equation (1), using data from 1979/80 to 2008/9, and some diagnostic statistics are given in Table 1.

Preston, J., & Robins, D. (2013). Evaluating the long term impacts of transport policy: The case of passenger rail privatisation. *Research in Transportation Economics*, *39*(1), 14-20.

Canada (1980): Public ownership does not matter?

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 Enviroment: The Case of Canadian Railroads. *Journal of Political Economy*

Canada (2013): Ownership does matter?

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.

Canada: Output

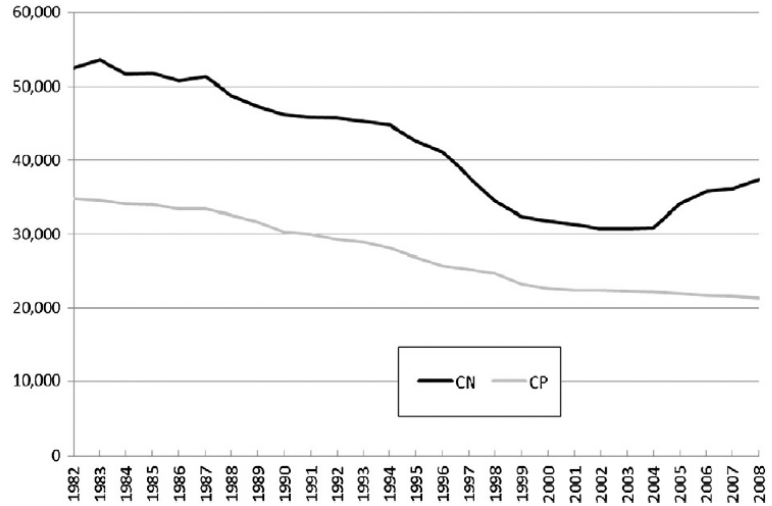


Fig. 1. CN and CP Canadian track operated (kilometres).

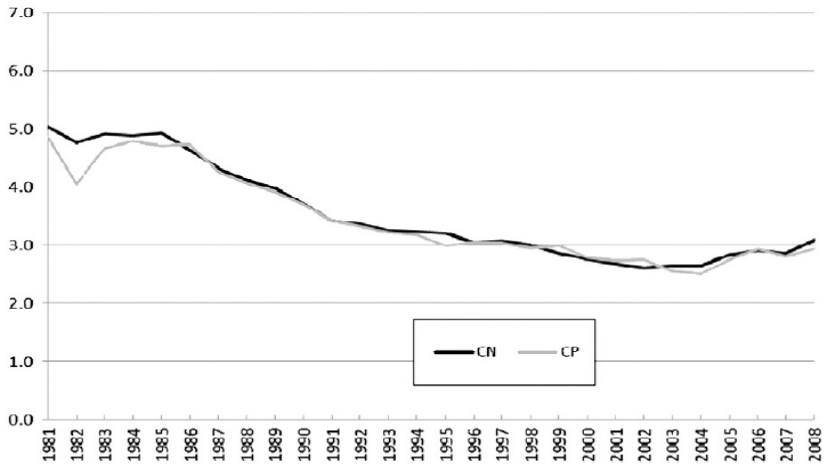


Fig. 2. CN and CP freight prices per revenue tonne-kilometres in Canada (2011$).

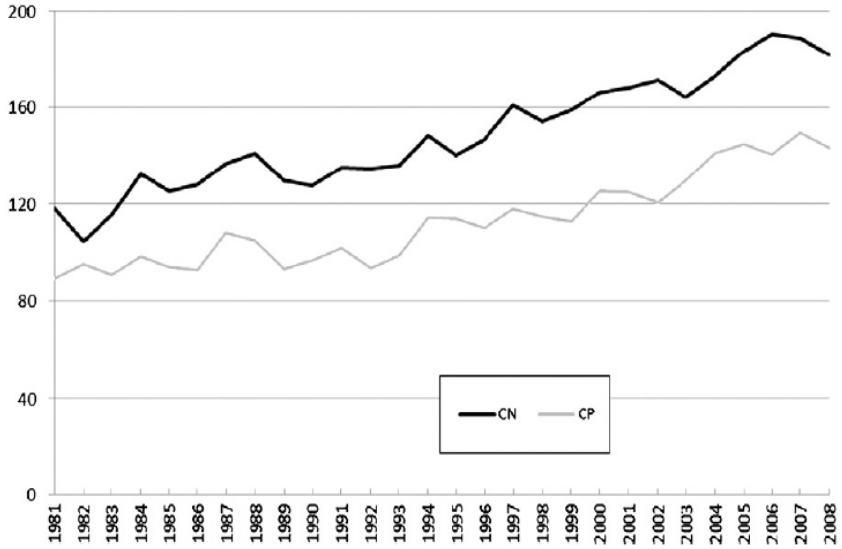


Fig. 3. CN and CP freight output in Canada (millions of revenue tonne-kilometres).

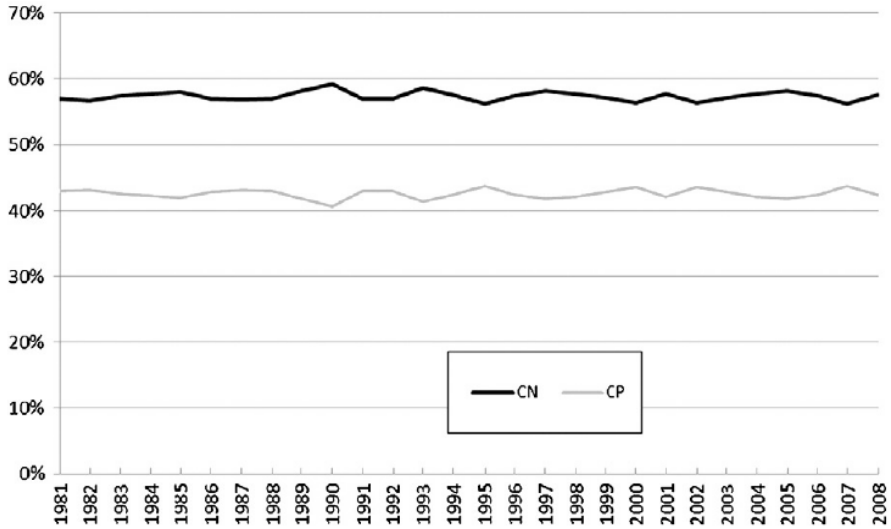


Fig. 4. CN and CP market shares in freight in Canada.

Canada: Employment and costs

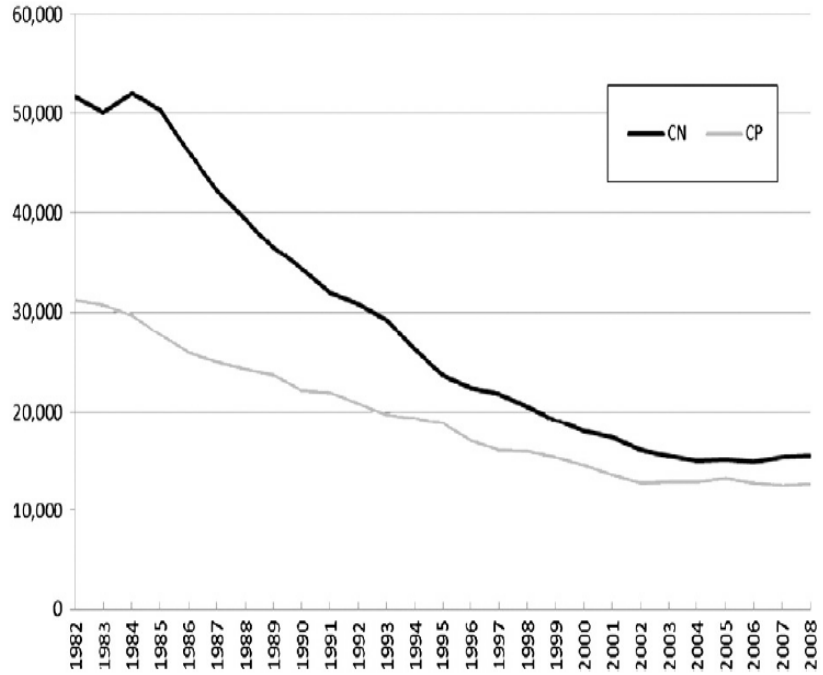


Fig. 5. CN and CP rail employment in Canada.

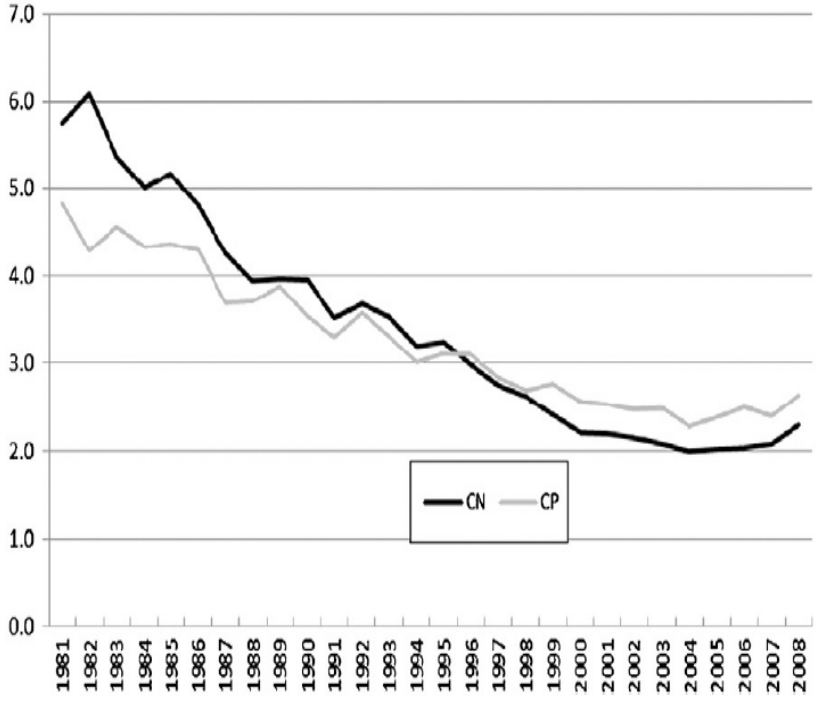


Fig. 6. CN and CP average total costs per revenue tonne-kilometre (2011$).

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.

Readings for Lecture 8

Reform of the Railway Sector and its Achievements - Network Industries Quarterly - Vol 18 - No 4 (December 2016)

8. REGULATION

Introduction

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

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 markt failure or imperfect/assymetric 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 exsited 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

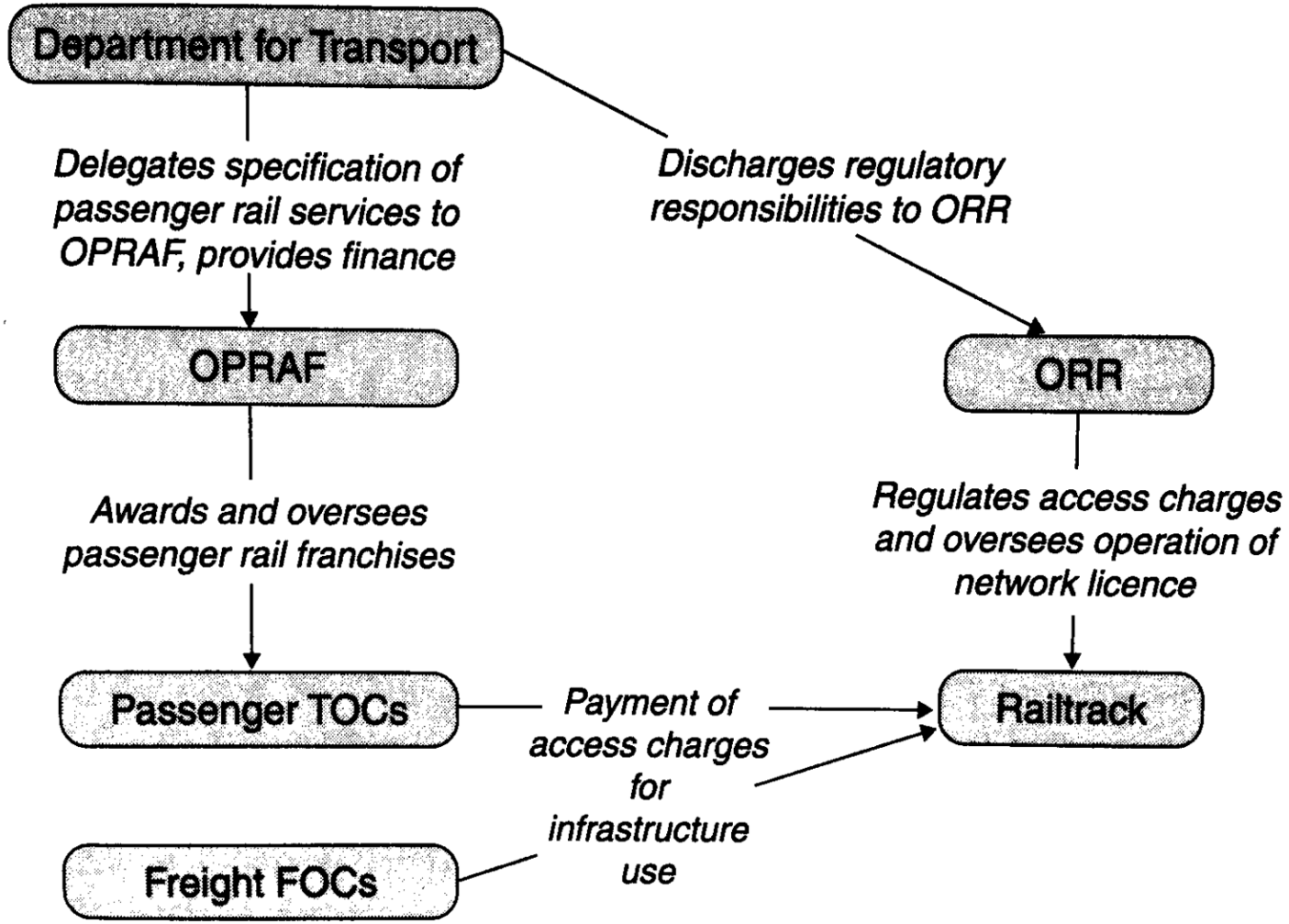
Case: Regulaton of the British railway industry

- 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 amd 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

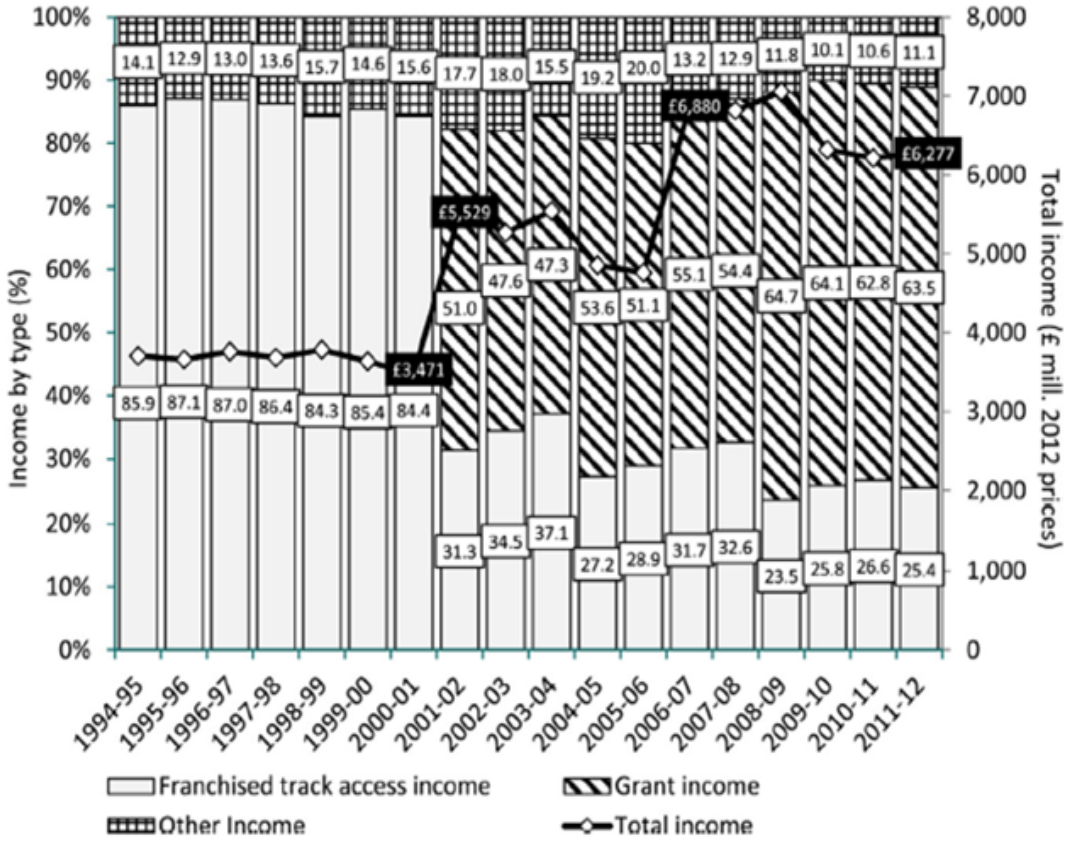


Fig. 2. *Railtrack and Network Rail share of income by type 1994–2012.* Source: Railtrack and Network Rail annual report and accounts, various years. Notes: Grants includes deferred grants and incentive adjustments.

Readings for Lecture 9

- Crössmann, K., & Mause, K. (2015). Rail subsidisation in the European Union: An issue beyond left and right?. *Comparative European Politics*, *13*(4), 471-492.

9. 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

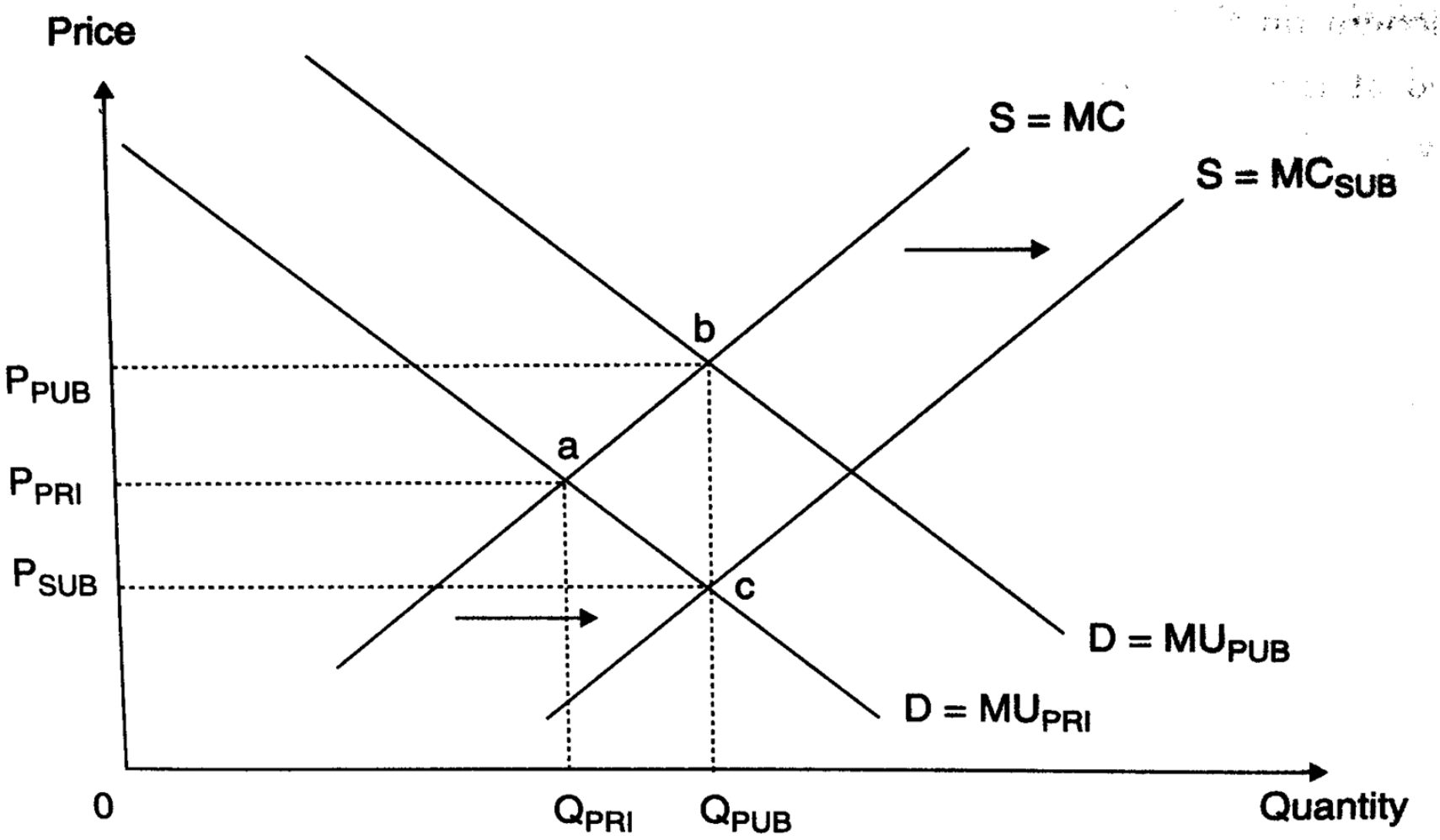
Subsidy or payment for public service?

- 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 towads far more private sector involment, 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 enviromentally 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:

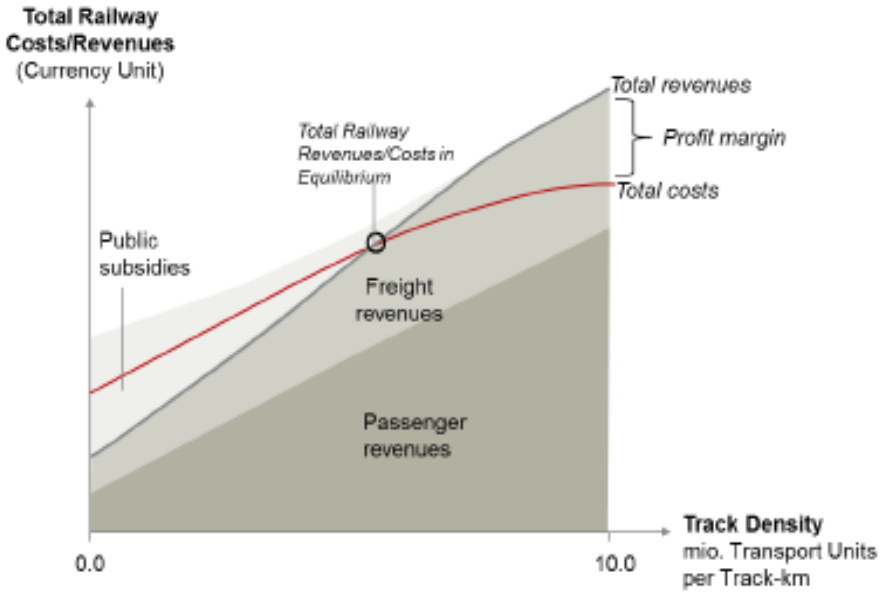
- Hides true costs of providing a particual service
- Users of profitable routes are penalized
- There are better instruments to ensure provision of services

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

Readings for Lecture 10

- Alexandersson, G., & Hultén, S. (2006). Predatory bidding in competitive tenders: A Swedish case study. *European Journal of Law and Economics*, *22*(1), 73-94.

10. 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.

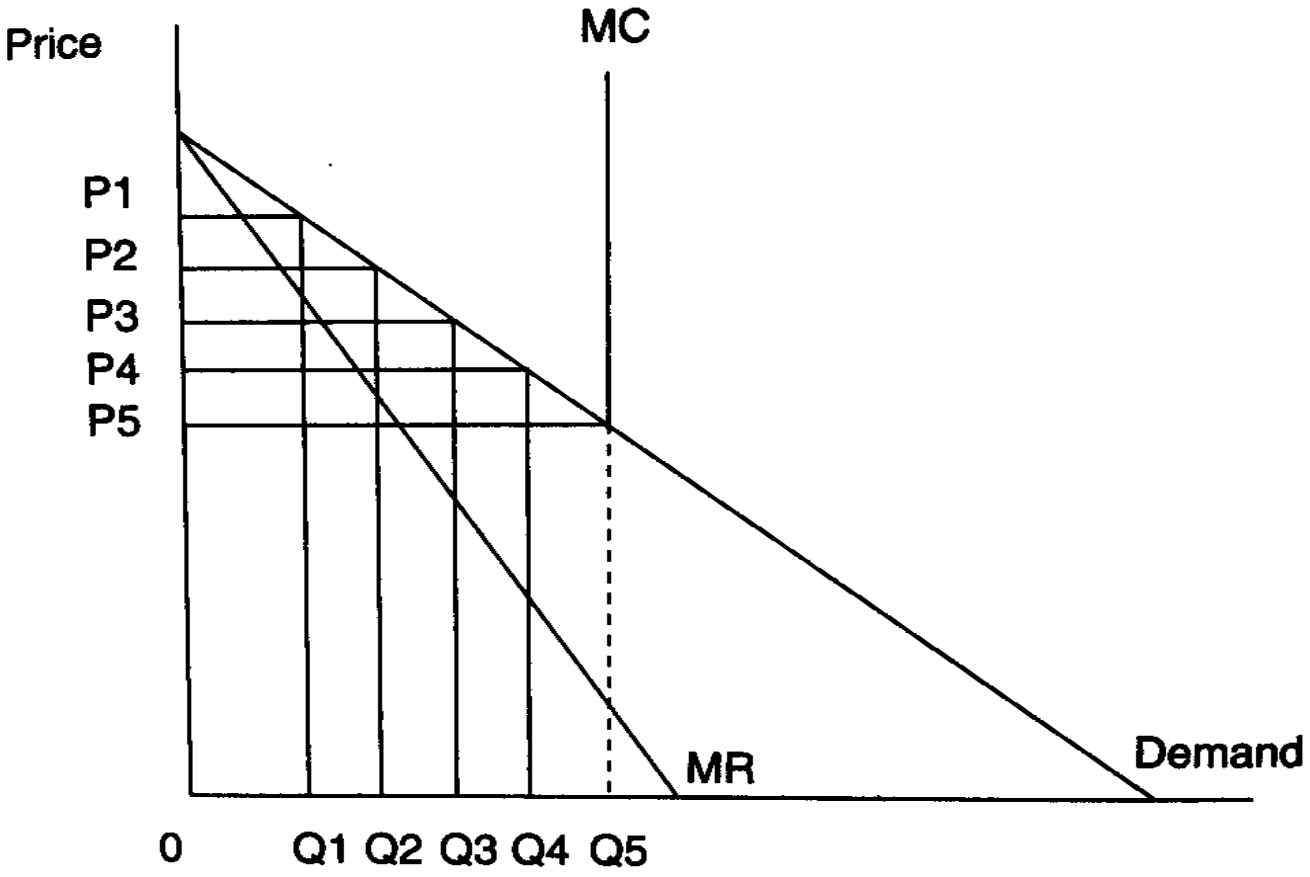
Perfect price discrimination

- To sell each unit (or ticket) seperately, 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

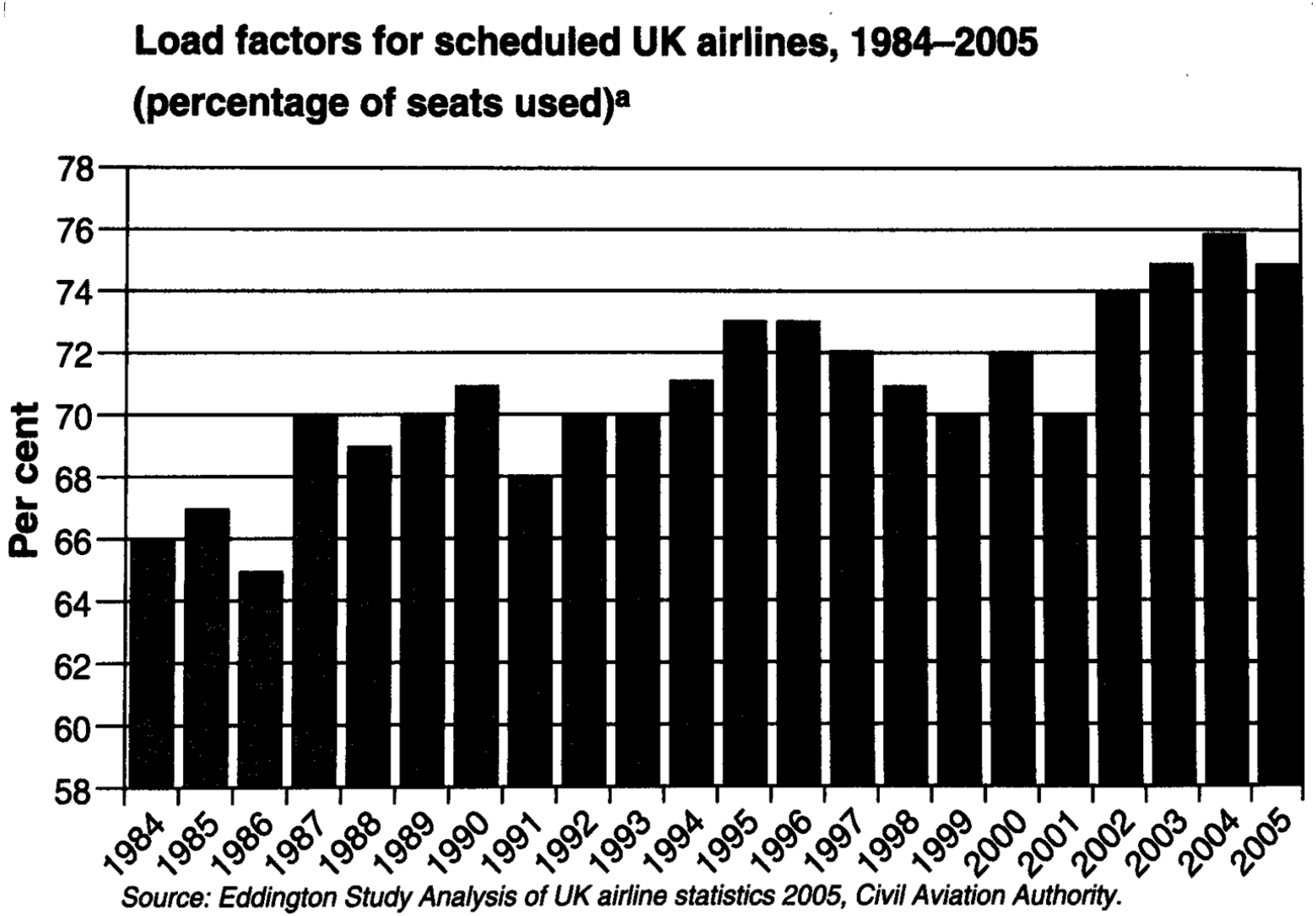
Case: Sale of airline tickets

- 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

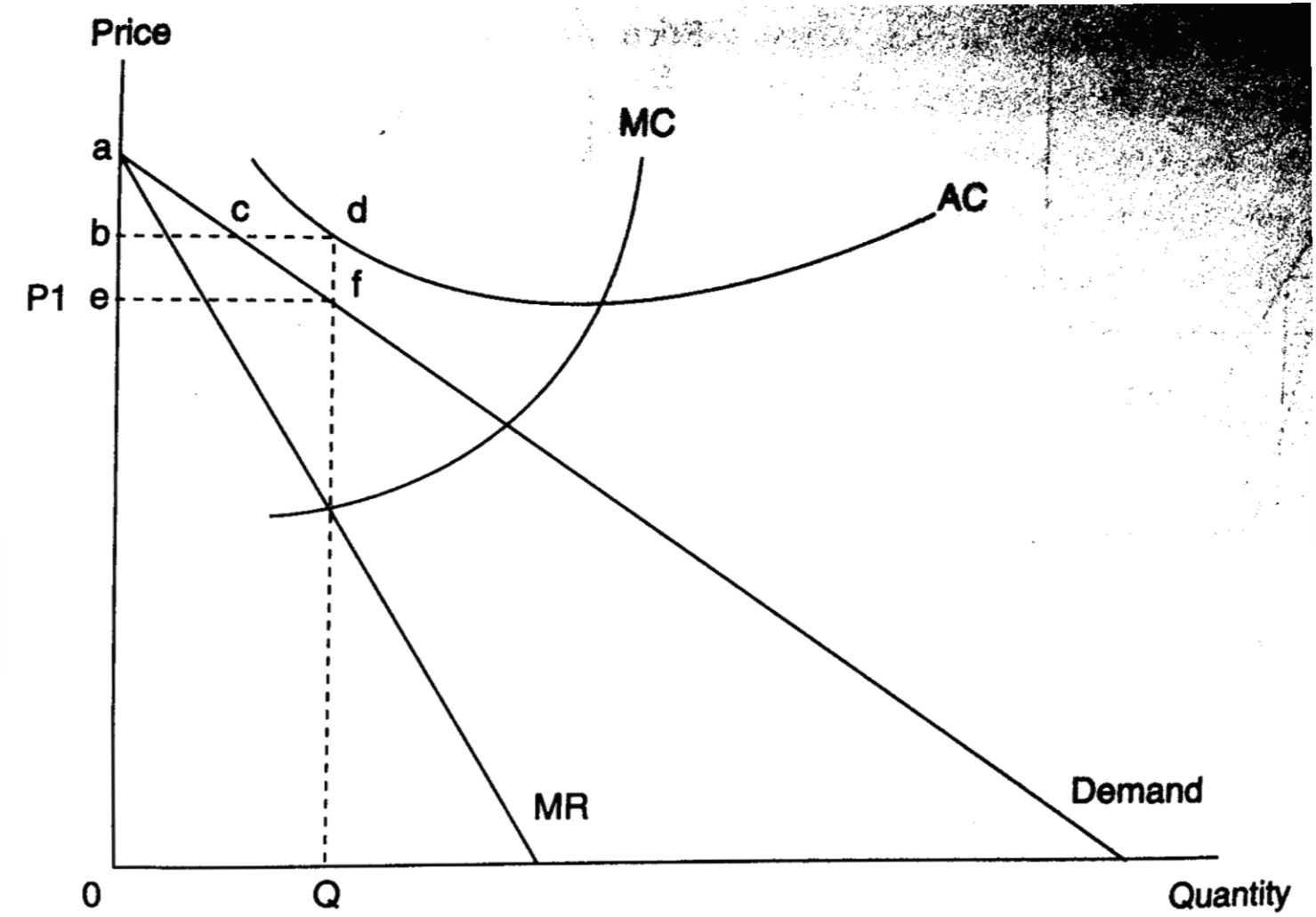
Airline price discrimination



Yield management in the aviation



Loss making operator and perfect price discrimination



Predatory pricing

- Predatory pricing occurs when a firm with maket 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 remov price competitiveness and thus increase their profits

Readings for Lecture 11

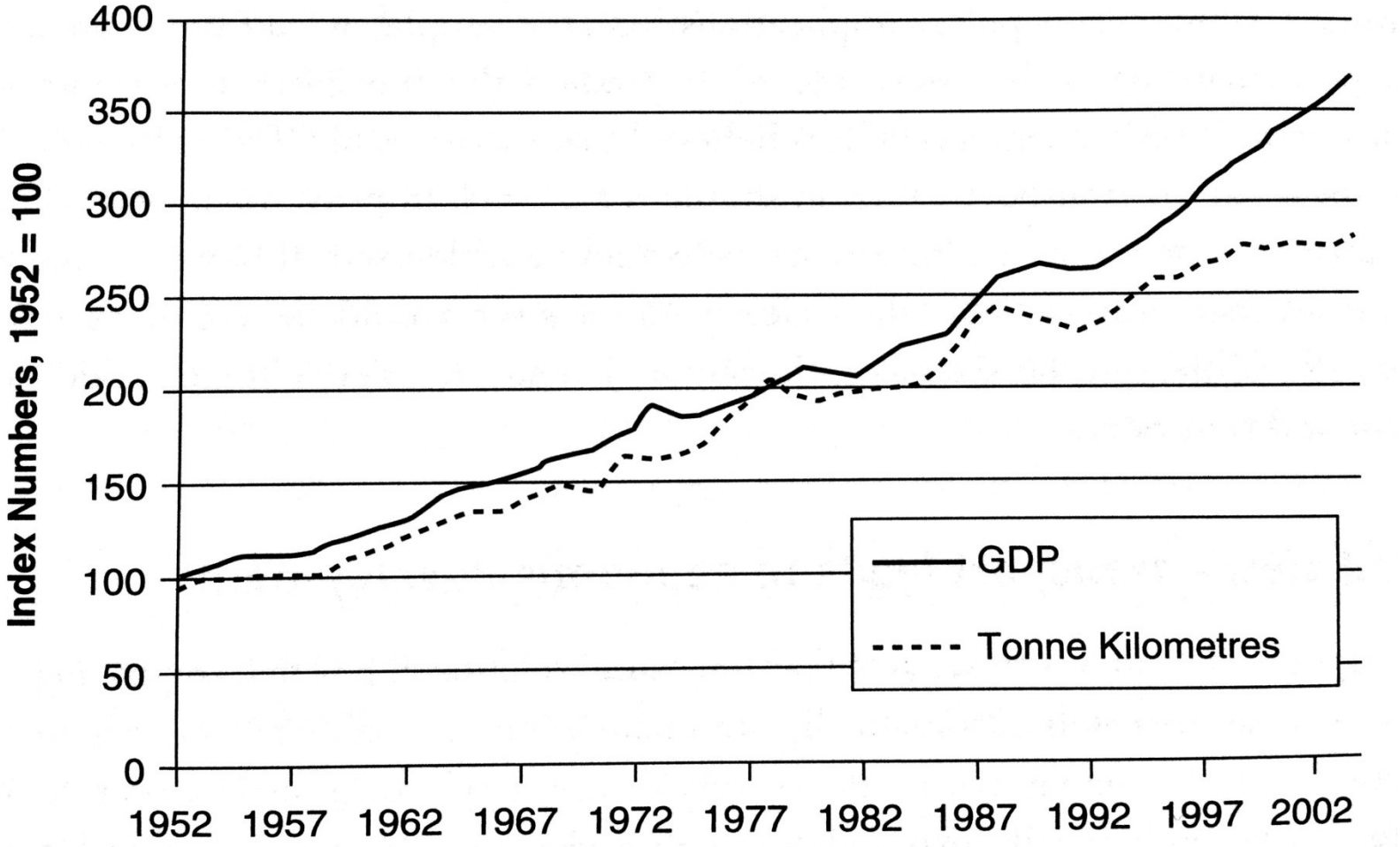
- Vickerman, R. (2015). High-speed rail and regional development: the case of intermediate stations. *Journal of Transport Geography*, *42*, 157-165.

11. TRANSPORT AND DEVELOPMENT

Learning Outcomes

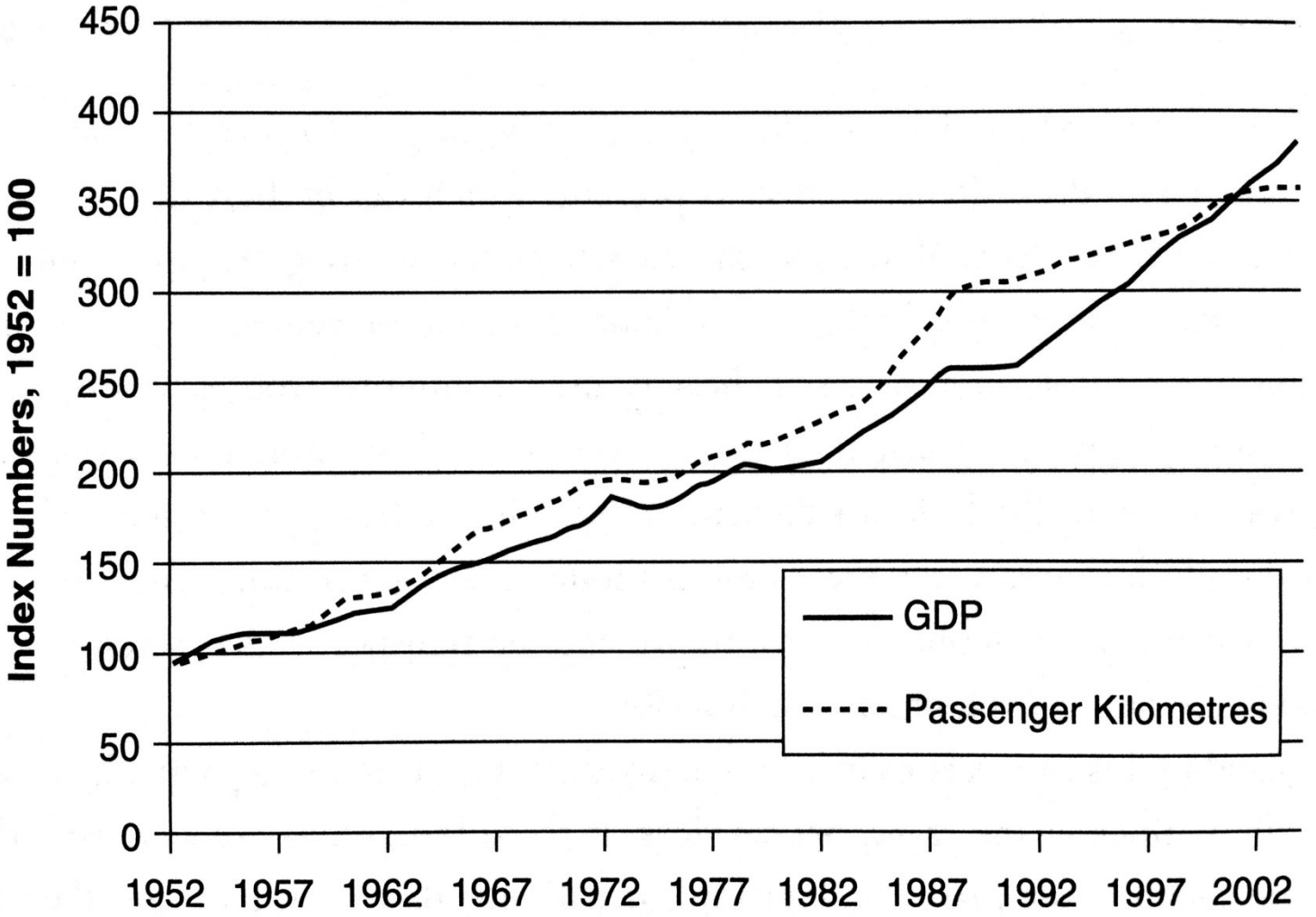
- The link between economic development and transport
- Causation: demand led and supply led effects
- Impact of transport on economic growth
- Transport role in the local economy
- The link between transport and wider social development issues

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 a invaraibly 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 stimulae that demand

Synthesis

- There is no clear answer to the direction of causation and the two are closely assosiated
- Under a supply led view improving transport services and/or upgrading the infrastructure is a necessary and sufficient condition for imporved trasnport 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 rder 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 maintanance 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 enviroment
- 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 inustrial clusters?
- The local economy, transport and housing market

Readings for Lecture 12

- Nash, C. (2015). When to invest in high speed rail. *Journal of Rail Transport Planning & Management*, *5*(1), 12-22.

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 asumption on whcih 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 predicitng 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 whetjer they rae 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

Nash (2015)

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.

Nash (2015)

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).

Nash (2015)

Readings for Lecture 13

- Guirao, B., & Campa, J. L. (2014). The construction of a HSR network using a ranking methodology to prioritise corridors. *Land Use Policy*, *38*, 290-299.

13. TRANSPORT FORECASTING

Learning Outcomes (1)

- Alternative approaches to generating a forecats 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 envrioment
- Methods for forecasting the impact of new or improved services in a competitive enviroment

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 identyfying 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 tranport 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, joureny 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