Economics of Transportation

EE 382
Introduction

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Instructor: Ajarn Kaewkwan Tangtipongkul

Office: Room 458, 4th Floor

E-mail: kaewkwan@econ.tu.ac.th
kaewkwan471@gmail.com

GRADING

The final grade of the course will be based on the following items:

Mid-term exam	30
Paper and presentation	15
Article presentation	5
Class participation	5
Final exam	45

The scope of the subject

- **Transport economics** is a branch of economics that deals with the allocation of resources within the transport sector and has strong linkages with civil engineering

(source: http://en.wikipedia.org/wiki/transport_economics)

- Transport economists are interested in the economic problems of moving goods and people

Transport issues

- Congestion and the role of road pricing
- The impact on traffic on the environment
- The Organization of public transport services
- The rise of low-cost airlines
- The capacity of the rail network

The economic analysis of transport issues is at the micro level

- What determines the demand for a particular journey?
- What may happen to the level of congestion if a road pricing system is introduced?
- How can an airline operator charge passengers different prices for the same flight?
- What influences the level of competition within the bus sector?

Scarcity, Choice and Opportunity cost

- Individuals cannot have everything that they want because there is a finite limit on the resources that can be used to satisfy there ‘wants’
- Any resources is therefore **scare**

- If individuals cannot have all that they want, then choices need to be made, and put simply every choice involves a cost
- This will always be the next best alternative that could have had been selected when that choice was made
- This is known as the **opportunity cost** of that decision

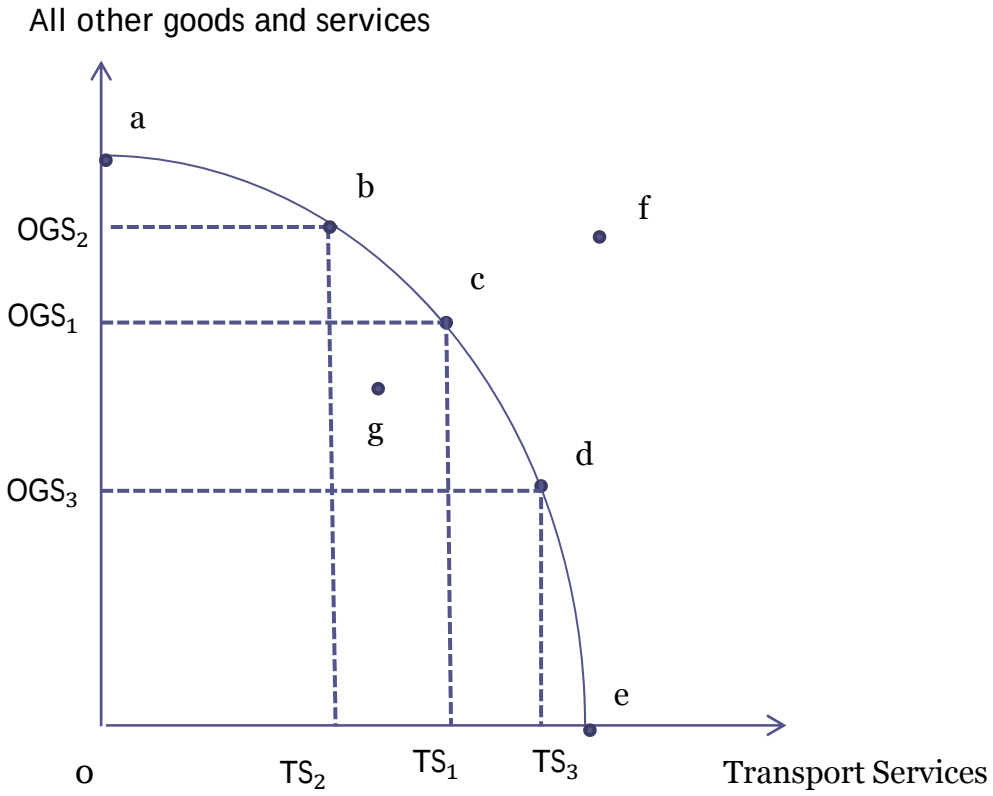
Example

If a particular society does not have sufficient resources to build both a new stretch of motorway and a new airport – a choice between the two

- If it chooses to build the motorway then the opportunity cost of the motorway is the airport that was not built

Opportunity cost – the next best alternative forgone

Production Possibility Frontier



The choice is between either transport services or all other goods and services

As resources are finite there is a maximum level or combination that can be produced

- As any economy cannot provide its citizens with all that they want, there is scarcity, a choice has to be made with regard to three basic questions
  - What to produce?
  - How to produce?
  - And for whom to produce it?

- This has led to the development of different economic systems or types of economies to answer these questions

The three market systems

- The command economy
- The free market
- The mixed market

A command economy

- the government decides what to produce, how it will be produced and who will receive the output
- The government also decides how the factors of production are employed
  - Land and raw materials, labor, and capital
- The state organises the factor of production to resolve
  - What and how to produce and distributes the resultant production on the basis of equity

A Free market economy

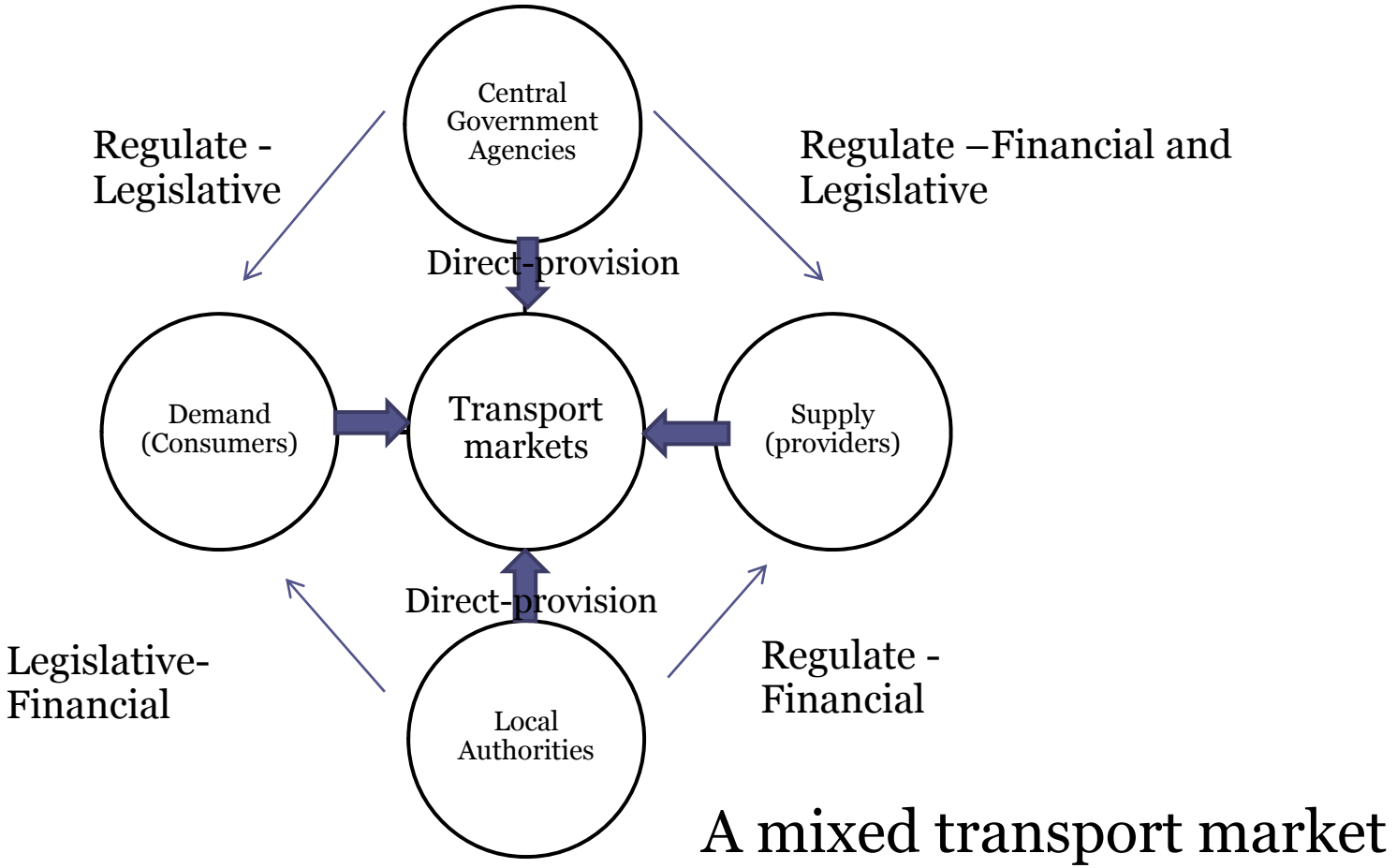
- In its most extreme form, a completely free market economy has no government input into the decision of what, how and for whom to produce
- Government's only function is to provide law and order
- Economic decisions are left purely to the market in the form of private buyers and sellers, with the **price mechanism** and the profit motive playing central roles in the operation of the whole economic system

A mixed market economy

- A market based system – one primarily (but not entirely) based upon the price mechanism, and one that uses a mix of public decisions of the state and the private decisions of the market to determine the outcome to the questions of what, how and for whom to produce

- Examples- health, education and many social services

Transport markets



A mixed transport market

Case study

Private and public sector roles in the provision of public transport in and around the Glasgow conurbation

- In Glasgow there are three main forms of public transport: the bus, the train, and the Glasgow underground

- All three operate through the price mechanism – a fare is charged for their use, the provision of each mode operates along very different economic principles

Bus Services

- Free market system – privately owned and operated companies decide which bus services they will operate

- Usually based upon providing a network of services that they believe will make them a profitable return

Rail services

- Glasgow has the largest suburban rail network in the UK outside of London
- Services provide based not on the profit motive, but rather on the basis of the public interest
- Transport Scotland determines the pattern of rail services to be provided and sets the fares to be charged
- Transport Scotland contracts a private sector operator- First Scotrail- to provide the services to the specified pattern and fare structure

Glasgow underground

- The public body, the Strathclyde Passenger Transport (SPT), act as both operator and principal funder of the system
- Provided on the basis of the public interest, hence passenger revenues fail to cover the cost of operation
- The economics of the whole venture however still need to add up, they the difference between costs and revenues are made up by subsidy

Questions for discussion

Pros and Cons on each mode of transportation

Air

Pros	Cons

Air

Pros

- Fast delivery
- This mode of transport is useful to deliver products with short lead time, fragile goods and products that are not bulky
- Products in high demand and in short supply may also airfreighted in order to meet customer demands

Cons

- Cost
- Flight delays and/or cancellations
- Custom and Excise restriction

Source: Serroukh (2011)

Rail

Pros	Cons

Rail

Pros	Cons
• Fast delivery • Capacity • Cost effective • Safe mode of transport • Reliable	• Subject to unforeseen delays • Reliance on rail freight operator's timetable • Suppliers/ customers are not always located near a rail freight depot and delivery to/from the depot can be costly and time consuming

Source: Serroukh (2011)

Road

Pros	Cons

Road

Pros

- Cost effective
- Fast delivery
- Ideal for short distances, national or mainland Europe
- Ideal for transportation perishables (e.g. fruit and vegetables)
- Easy to monitor location of goods
- Easy to communicate with driver
- Ideal for sending by courier shortage to customers

Cons

- Transport subject to traffic delays
- Transport subject to breakdown
- Goods susceptible to damage through careless driving
- Bad weather
- Driving regulations can cause delay

Source: Serroukh (2011)

Sea

Pros	Cons

Sea

Pros

- Ideal for transporting heavy and bulky goods
- Suitable for products with long lead times

Cons

- Longer lead/delivery times
- Bad weather
- Difficult to monitor exact location of goods in transit
- Customs and Excise restrictions
- Could be costly

Source: Serroukh (2011)

Pipeline

Pros	Cons

Pipeline

Pros

- Large volume transportation (E.g. 60 million liters per day)
- Excellent safety (E.g. fewer than 2 incidents per 10,000 kilometers of pipeline per year)
- Secure supply (unaffected by weather, operating 24/7/365)
- Cost efficiency for medium and long haul transportation, with no need for handling operations

  E.g. comparison purposes, the average cost per metric ton per 100 kilometers is:
  - Pipeline: €1.8 to € 2.1
  - Train (2,000 tons): €2.7
  - Truck (38 tons): €4.1

Cons

- Narrow specialization

Source: Societe Des Transports Petroliers Par Pipeline website

Multimodal Transportation

- The transportation of goods under a single contract, but performed with at least two different means of transport

The Global picture

- Transport requires infrastructure as well as vessels, planes and vehicles, to move goods and people around the globe

GDP and merchandise trade by region, 2005-07 (annual percent change at constant prices)

	GDP			Exports			Imports		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
World	3.3	3.7	3.4	6.5	8.5	5.5	6.5	8	5.5
North America	3.1	3	2.3	6	8.5	5.5	6.5	6	2.5
USA	3.1	2.9	2.2	7	10.5	7	5.5	5.5	1
South and Central America	5.6	6	6.3	8	4	5	14	15	20
Europe	1.9	2.9	2.8	4	7.5	3.5	4.5	7.5	3.5
EU (27)	1.8	3	2.7	4.5	7.5	3	4	7	3
Commonwealth of Independent States	6.7	7.5	8.4	3.5	6	6	18	21.5	18
Africa and Middle East	5.6	5.5	5.5	4.5	1.5	0.5	14.5	6.5	12.5
Asia	4.2	4.7	4.7	11	13	11.5	8	8.5	8.5
China	10.4	11.1	11.4	25	22	19.5	11.5	16.5	13.5
Japan	1.9	2.4	2.1	5	10	9	2.5	2.5	1
India	9.0	9.7	9.1	21.5	11	10.5	28.5	9.5	13
Newly industrialized economies(4)	4.9	5.5	5.6	8	12.5	8.5	5	8.5	7

World seaborne trade by types of cargo and country groups, annual, 1985-2011 (Metric tons in millions)

CARGO TYPE	Year						
	1985	1990	1995	2000	2005	2010	2011
Crude Oil loaded	1049	1287	1532	1605	1857	1787.68	1762.37
Petroleum products and gas loaded	410	468	518	558	565	983.75	1033.51
Dry cargo loaded	1895	2253	2601	3821	4687	5637.47	5951.86
Total goods loaded	3330	4008	4651	5984	7109	8408.90	8747.74
Crude Oil unloaded	1128	1315	1550	1633	1854	1933.23	1907.03
Petroleum products and gas unloaded	367	466	508	513	573	979.18	1038.62
Dry cargo unloaded	1938	2365	2685	4097	4696	5531.42	5823.65
Total goods unloaded	3433	4126	4743	6242	7122	8443.83	8769.30

Source:UNCTAD, UNCTADstat

The world's largest container ports

Rank	Port, Country	Volume 2010 (million-TEUS)	Volume 2011 (million-TEUS)
1	Shanghai, China	29.07	31.74
2	Singapore, Singapore	28.43	29.94
3	Hong Kong, China	23.70	24.38
4	Shenzhen, China	22.51	22.57
5	Busan, South Korea	14.18	16.17
6	Ningbo-Zhoushan, China	13.14	14.72
7	Guangzhou Harbor, China	12.55	14.26
8	Qingdao, China	12.01	13.02
9	Jebel Ali, Dubai, United Arab Emirates	11.60	13.01
10	Rotterdam, Netherlands	11.14	11.88

Source: World Shipping Council website

What is TEU?

- The Twenty-foot equivalent unit (TEU)
- Often used to describe the capacity of container ships and container terminals
- A standard-sized metal box which can be transferred between different modes of transportation, such as ships, trains, and trucks

Transport at the National Level

A major component of the national output and accounts for a large part of national expenditure in most developed countries

Examples:

- >14.5% of national expenditure in Great Britain

Weekly household expenditure in Great Britain (2001/2002)

Average weekly expenditure all households (pounds)	
Food & non-alcoholic drinks	41.80
Alcoholic drink, tobacco & narcotics	11.40
Clothing and footwear	22.90
Housing, fuel and power	35.90
Household goods & services	30.50
Health	4.50
Transport	57.80
Communication	10.40
Recreation and culture	54.10
Education	5.60
Restaurants and hotels	33.40
Miscellaneous goods and services	30.70
Other expenditure items	59.50
Total	398.30

US passenger transport by mode (2007)

Mode of passenger transport	Passenger-miles (millions)	Percent
Highway-total	4,884,557	88.79
Passenger vehicles, motorcycles	4,520,810	82.18
Trucks	222,836	4.05
Buses	162,908	2.96
Air carriers	583,689	10.61
Rail- total	30,972	0.56
Transit	16,118	0.29
Commuter	9,473	0.17
Intercity/Amtrak	5,381	0.10
All other modes (e.g. ferryboats)	2,091	0.04

Source: Button, K. (2010).

Local transport

Urban transport

- Traffic congestion problems
- Public transport use and levels of car ownership

Indicators of public transport competitiveness in various cities where public transport (PT) market share grew between 1995 and 2001

		London*	Madrid	Vienna	Singapore	Hong Kong	Paris
Market share of motorised and mechanised journeys by PT (%)	1995	23.9	27.2	43.2	44.2	71.8	27.1
	2001	26.8	30.2	46.6	45.7	73.9	27.5
Annual number of journeys on public transport per inhabitant*	90-95	345	250	490	480	545	260
	96-01	390	290	495	485	525	310
Average annual investment (% of GDP)	1995	1.13	0.88	1.07	0.44	0.37	0.45
	2001	0.64	0.81	0.62	0.84	1.00	0.32
Length of reserved routes (km/millions of inhabitants)	1995	172	84.5	174	22.5	17.5	149.5
	2001	176	92.5	185	29.5	22.5	151.5
PT speed (in km/h)	1995	31.3	28.5	24.9	27.0	26.4	31.6
	2001	34.6	30.7	27.0	28.6	26.0	30.9
PT vehicle x km/hectare per inhabitant	1995	145	67.5	87	110	146	71.5
	2001	157	85	106	112	172	84
PT vehicle x km per hectare	1995	7,850	4,500	5,850	10,300	46,700	3,400
	2001	8.650	4,750	7,100	11,500	49,200	3,400

* traffic including non-residents

Indicators of public transport competitiveness for Eastern European and Far Eastern cities where public transport (PT) market share is 50% or higher

	Singapore	Prague	Budapest	Moscow	Warsaw	Hong Kong
Market share of motorised and mechanised journeys by PT (%)	45.7	54.2	55.9	63.6	64.0	73.9
Number of cars for every 1,000 inhabitants	125	535	330	190	380	50
Parking spaces/jobs in the CBD	165	45	95	30	60	25*
PT place x km per inhabitant	14,300	16,100	11,100	17,400	8,900	16,100
PT place x km per hectare (in thousands)	1.460	705	515	2,800	460	4.620
Length of reserved routes (km/million inhabitants)	29.5	235	197	40	178	22.5
Proportion of PT rail services as a% of place x km	40	72.5	64.5	84	46	31.5
PT commercial speed (km/h)	28.6	28.6	21.2	36.6	23.1	26.0
PT speed door-to-door (km/h)	13.3	16.2	13.1	21.0	-	12.0

* excluding car parks of firms and retail businesses

Rural transport

- Has its origins and destination outside of urban areas
- Involves movement between cities and non-city areas
- Example – the movement of agricultural products, tourism etc.

Emerging Trends

- The established industrial world the long-term trend, despite periodic downturns in the business cycle
- The liberalization of Eastern Europe, coupled with the new political geography that is emerging is posing problems as well as offering opportunities, for the countries in the region
- Economic development in the low-income countries in Africa, Asia, and South and Central America then transport will inevitably change

Car ownership per 1000 population in selection countries (2006)

Country	Car ownership	Country	Car ownership
USA	765	Greece	329
Luxembourg	686	South Korea	293
Malaysia	641	Israel	263
Australia	619	Hungary	262
Italy	566	Poland	261
Canada	563	South Africa	146
Japan	543	Mexico	138
Norway	494	India	12
Belgium	484	China	10
Spain	471	Pakistan	8
UK	426	Bangladesh	2
Netherlands	417	Ethiopia	1
Denmark	408		

Source: United Nations

Durable goods for 1,000 households (2006 or most recent prior year)

	China		India	
	Urban	Rural	Urban	Rural
Automobiles	4.3		4	0.7
Bicycles	117.6	98.4	51.9	57.2
Cameras	48	3.7		
Computers	47.2			
Microwave ovens	50.6			
Motorcycles	20.4	44.6	28.3	7.9
Refridgerators	91.8	22.5	30.8	4.8
Telephones	93.3	64.1		
Mobile telephones	137.4	89.4	70.4	27.5
Televisions	137.4	89.4	70.4	27.5
Video disc players	70.2		8.2	1.7
Washing machines	96.8	43	12.5	0.9

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