NANYANG TECHNOLOGICAL UNIVERSITY

SEMESTER 2 EXAMINATION 2012-2013

MT2005 – PORT ECONOMICS

April/May 2013 **Time Allowed: 2½ hours**

INSTRUCTIONS

1. This paper contains **FOUR (4)** questions and comprises **TWO (2)** pages.
2. Answer **ALL** questions.
3. This is a Closed-Book Examination.
4. The questions do not carry equal marks.

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1. (a) Explain the concept of generalized cost in using port services from the demand perspective. Identify and briefly describe five major cost components for port users. Suggest and explain any three ways to reduce generalized cost in using cargo handling services provided by a multi-purpose terminal operator.

(20 Marks)

(b) Based on Q1(a) above, the multi-purpose terminal operator has reduced the generalized cost in using port services. What are the possible effects on another multi-purpose terminal operator located in the same port who is a keen competitor? Use an applicable economic concept for your illustration.

(15 Marks)

2. Explain public-private partnership (PPP) in port. (10 Marks)

3. (a) What is the main function of an inland port? Suggest some advantages of introducing an inland port in addition to the existing seaport.

(10 Marks)

(b) For the case of Port of Singapore, is it appropriate to implement the concept of inland port? State your opinions considering both positive and negative perspectives.

(15 Marks)

4. (a) What does Economies of Scale refer to? Describe the phenomenon of Economies of Scale by increasing vessel size in shipping companies.

(10 Marks)

(b) With the increasing vessel size to achieve Economies of Scale by shipping companies, suggest how should port operators be equipped to cope with such a trend.

(12 Marks)

(c) Define the term 'Port Rate' and 'Quay Crane Rate'. Also, state the relationship between the two terms with an example.

(8 Marks)

END OF PAPER

MT2005 Port Economics PYP 2013-14

1. The answer lies in one of the reference materials of this course, *"An interpretation of inter-container port relationships from the demand perspective"*.

(a) A list of cost components that are factored into the generalized cost of using a particular port, differentiated by those which can be readily quantified and those that are qualitative in nature, is shown in table below.

Qualitative in nature	Quantifiable in nature
Reliability	Terminal handling charges
Reputation	Port dues
Skill of employees	Pilotage and towage
Knowledge of employees	Storage costs
Understanding customer needs	Physical accessibility of hinterland
Ease of communication	Maritime access
Political stability	Terminal productivity
Social stability	Transit time for shipment
Availability of other supporting services	Port maintenance charges
	Connectivity to other ports
	Accident rate

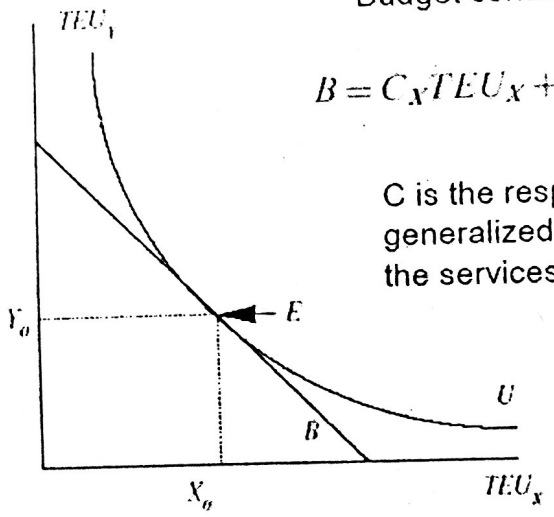
As for the ways to lower down the generalized cost, you can refer to the table below:

Table 4. List of factors that lower generalized cost per TEU for services of a port.

Quantifiable factors	Qualitative factors
1. Higher base cargo	1. Greater service reliability
2. Reduced charges for terminal handling and storage	2. Improved level of skill and knowledge of employees
3. Improved hinterland and maritime access	3. Enhanced reputation
4. Reduction in port charges (e.g. port dues, pilotage, towage and port maintenance charges)	4. Expanded scope and depth of other supporting services
5. Higher terminal productivity	5. Greater political and social stability
6. Faster transit time for shipment	
7. Better connectivity to other ports	

(b) Using indifference analysis propounded in microeconomic theory as a useful means to examine inter-container port competition and complementarity.

Budget and Utility



Budget constraint:

$$B = C_X TEU_X + C_Y TEU_Y$$

C is the respective generalized cost of using the services of the port

Slope of budget line:

$$\frac{-C_X}{C_Y}$$

Utility function:

$$U = f(TEU_X, TEU_Y)$$

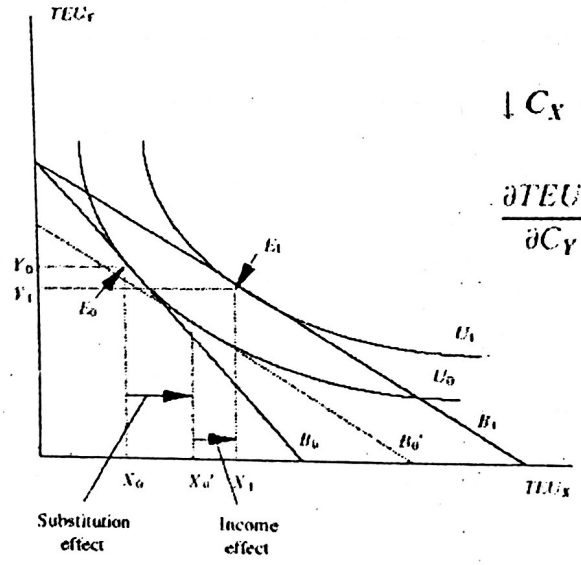
Marginal rate of substitution:

$$MRS_{XY} = -\frac{dTEU_Y}{dTEU_X}\bigg|_{U=\text{constant}}$$

Expenditure minimization or utility maximization condition: **MRS = Slope of budget line**

We need to discuss the case of gross substitutes and gross complements when the competitor port reduces its generalized costs.

Gross Substitutes



$$\downarrow C_X \Rightarrow \downarrow TEU_Y, \uparrow TEU_X.$$

$$\frac{\partial TEU_X}{\partial C_Y} \text{ and/or } \frac{\partial TEU_Y}{\partial C_X} > 0$$

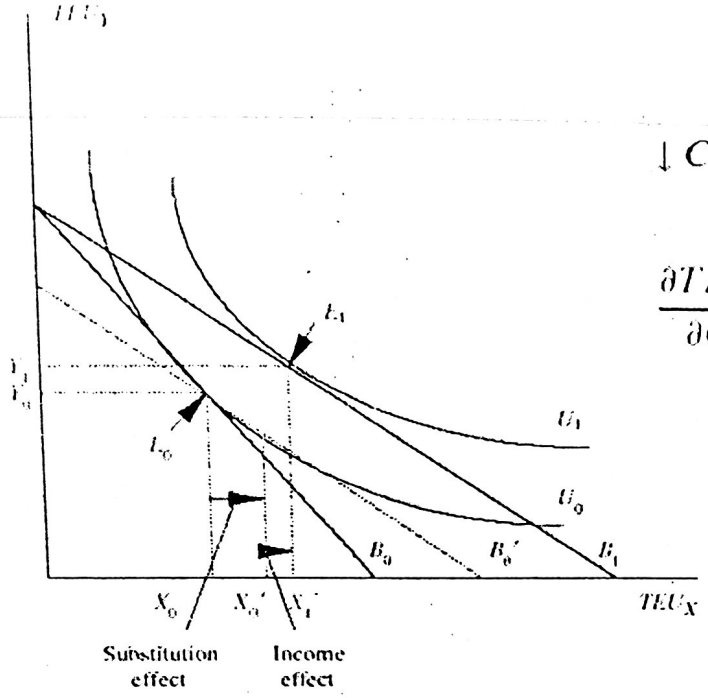
Real Industry Example

Maersk transferred part of its shipping traffic from Rotterdam to a new container terminal in Bremerhavanthat was opened in 2000.

Maersk cited poor service conditions at Rotterdam as the primary factor.

That is, relatively Cxis lower

Gross Complements



$$\downarrow C_X \Rightarrow \uparrow TEU_Y, \uparrow TEU_X$$

$$\frac{\partial TEU_X}{\partial C_Y} \text{ and/or } \frac{\partial TEU_Y}{\partial C_X} < 0$$

Hub and spoke, e.g. Singapore and Tanjung Priok
In hub, high level of connectivity in terms of shipping service frequency, number of shipping lines and ports-of-call (i.e. lower Cx) generates benefits for spokes

2. The answer lies in the topic, Port Policy Issue.

Sources of finance

- Investment policies include

  1) Sources of finance: public, private or public-private partnership (PPP)

  2) Market access control
- PPP is co-operation between public and private actors in which actors develop mutual products and/or services and in which risk, costs, and benefits are shared and mutual added value is created.
- Under a port PPP, a government institution enters a long-term contractual arrangement with a private operator for the delivery of port services.

PPP

- The operator takes responsibility for building infrastructure, financing the investment and then managing and maintaining this facility.
- The World Bank and the International Monetary Fund encourage developing countries to embrace the system of public private sector participation through schemes of financial assistance.
- E.g. Malaysian ports – Port Klang (West Ports) having Hutchison Port Holdings, Tanjung Pelepas having APM Terminals as private operators

3. (a) The answer lies in topic, Port Logistics.

Definition of Dry Port:

❑"A site located away from traditional land, air and coastal borders with the vision to facilitate and process international trade through strategic investment in multi-modal transportation assets and by promoting value added services as goods move through the supply chain" (Center for Transportation Research, University of Texas)

❑"A dry port is an inland intermodal terminal directly connected to seaport by rail where customers can leave/ pick up their units as if directly to a seaport" (Roso et al. 2009)

❑Main function is to act as an intermodal container transfer facility with value added services, e.g. interface between rail and truck for the transportation of containers to and from the seaport

❑Allows traditional loading and unloading operations at seaport to be moved inland

❑Provides a variety of value added services

❑Main features

❑Is an intermodal terminal

❑Is situated inland

❑Usually with rail connection to a seaport which scheduled and reliable services

❑Offer services that are available at freight terminals and at seaports, e.g. storage of containers, container maintenance, customs clearance, inspection, consolidation, forwarding, etc.

Advantages

☐Move the time consuming loading and unloading of containers inland, away from the congested seaport to improve port productivity

☐Speed up the flow of cargoes between vessels and land transportation networks, e.g. a high-capacity rail link system to the inland port

☐Close proximity to different stakeholders in the supply chain, e.g. shippers and consignees

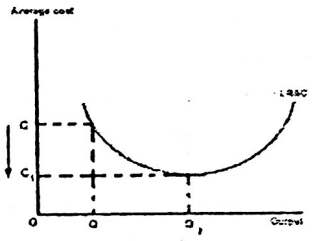
☐Free up land area at the seaport

☐Reduce air emission

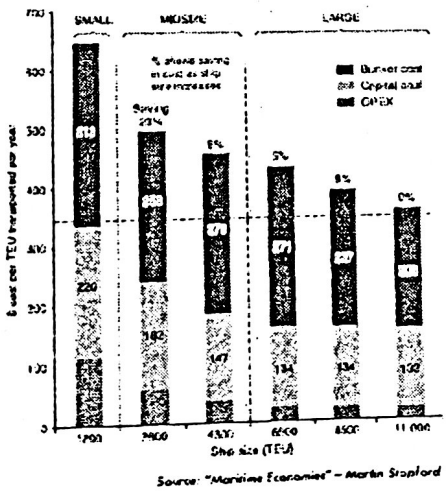
3(b) in my view, it's quite inappropriate strategy for Singapore to introduce the inland port. Singapore is quite restricted by its limited land resources. The fact that Singapore doesn't have hinterland thwarts its development in depth. Singapore may, if not necessarily, strengthen the commercial ties with Malaysia. And it's a great idea to situate the inland port in Malaysia whereby the port of Singapore could enhance its connectivity with hinterland customers. At the same time, Port of Singapore could shift the services, such as storage of containers, inland, which might "free up land area at the port".

4. (a)

- Economies of Scale (EOS)
  - In Microeconomics, EOS refers to the cost advantages that a company can obtain due to expansion
  - In shipping industry, it refers to the decrease in unit cost, e.g. per TEU/ per ton as the scale of output increases, e.g. an increase in the vessel size
  - Operating cost:
    - Insurance and maintenance costs likely to increase in line with vessel size
    - Administration, stores and consumables, manning costs do not increase as much as vessel size increases
  - Capital cost:
    - Big vessel costs less per TEU slot
    - Saving diminishes as vessel gets bigger
  - Bunker cost:
    - Bunker consumption in tons per TEU decreases as vessel size increases
    - Saving diminishes as vessel gets bigger

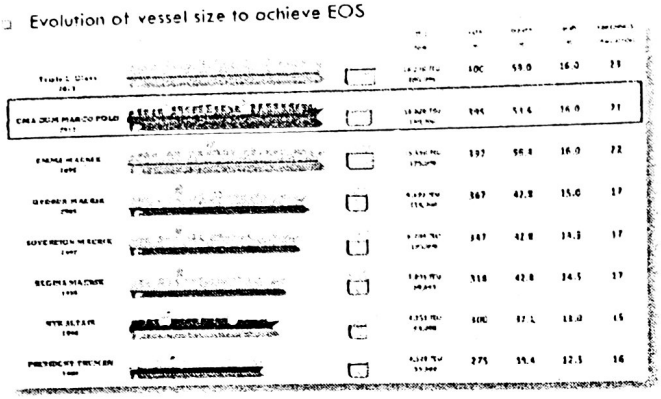


- Economies of Scale (EOS)
  - EOS in terms of cost per TEU decreases with vessel size:
    - ~$648 per TEU for 1,200TEU
    - ~$498 per TEU for 2,600TEU
    - ~$360 per TEU for 11,000TEU
  - So 11,000TEU almost halves the cost of that for 1,200TEU
  - The degree of saving, however, decreases as vessel size increases



Source: "Maritime Economics" – Martin Stopford

- Evolution of vessel size to achieve EOS

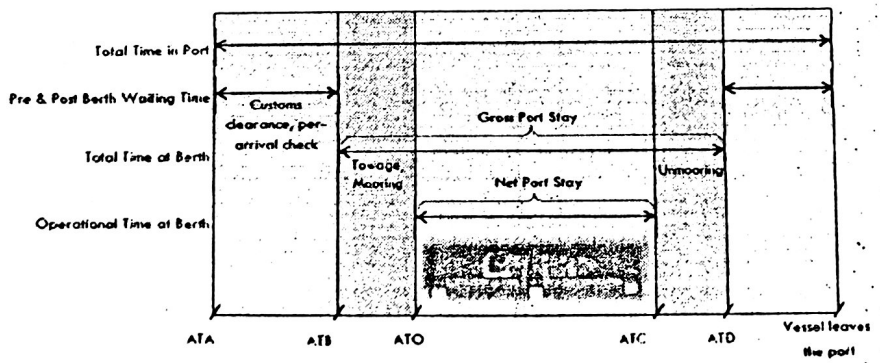


4 (b)

- Major shipping dynamics that would influence port performance
  - Key vessel particulars
    - LOA
    - Beam/ breadth
    - Water draft
    - Air draft
  - Port users' requirements
    - Port rate
    - Turnaround time
    - Vessel stowage plan
  - Government regulations
    - Underkeel clearance (UKC)
    - Berthing clearance

4 (c)

- Port Rate
  - The total no. of containers handled on a vessel during its port stay, i.e. the duration of berthing hours at the port
  - Total no. of containers handled exclude restow, uncontainerized cargoes (UC) and hatch cover movements
  - Unit: move per hour (mph)



- QC Rate
  - The total no. of containers handled on a vessel with a total operating time operated by a no. of QC
  - $\sum$ no. of container handled on vessel / $\sum$ QC operating time
  - Unit: move per hour (mph)

Port Rate & QC Rate (Example)

- Port rate will increase if more QCs are assigned to the operations
- However, port rate is not equal to the sum of individual QC rate since start time and completion time of each QC may be different
  - QC 1 started at 21.1300 and ended at 21.1900 with 300 moves
  - QC 2 started at 21.1500 and ended at 21.2100 with 300 moves
  - Sum of QC rate = 100mph; port rate = 75mph