ECONOMIC AND SOCIAL COMMISSION
FOR ASIA AND THE PACIFIC

KOREA MARITIME INSTITUTE

COMPARATIVE ANALYSIS OF PORT TARIFFS IN THE ESCAP REGION

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1. INTRODUCTION

1.1 Background to the study

Ports of the ESCAP region have long-established tariff structures. These are contained in published schedules, which vary in length from a few pages to more than one hundred. Some tariffs are extremely complex while others are relatively simple. There is, however, an increasing desire on the part of port users for greater transparency in the billing of port services. This highlights the need for more easily understandable and comparable tariff structures.

In 1989, as an initiative to improve transparency across the region, the ESCAP secretariat developed the ESCAP/UNDP Model Port Tariff Structure. During the last decade, however, competition among ports around the world has increased dramatically owing to many factors, such as continued containerization and development of intermodal transport. Within this commercial context, ports are increasingly required to review their competitive position against neighbouring ports. The commercial reality in the era of globalization is that customers require a balance of cost and service. However, relativity in port charges seems essential in ensuring that a port is competitive in all areas, including cost. Hence, a cost comparison can provide a valuable perspective.

In order to address these issues, the ESCAP secretariat undertook a comparative study of port tariffs across a significant number of ports in the region. The study was carried out as a joint project under the Memorandum of Understanding, which was signed in 1998, between ESCAP and the Korea Maritime Institute.

1.2 Study approach and scope

Any comparative study has to be based on a framework involving a number of assumptions. Therefore, it should be noted that the comparison does not represent all ports, but rather 21 ports in 17 countries across the region. The ports included were: Sydney (Australia); Shanghai, Tianjin (China); Hong Kong (Hong Kong, China); Chennai, Mumbai (India); Jakarta (Indonesia); Osaka, Yokohama (Japan); Port Klang (Malaysia); Yangon (Myanmar); Auckland (New Zealand); Karachi (Pakistan); Manila (Philippines); Busan (Republic of Korea); Singapore (Singapore); Colombo (Sri Lanka); Kaohsiung (Taiwan Province of China); Bangkok, Laem Chabang (Thailand); and Saigon Port (Viet Nam).

The basis of the comparative assessment is not a comparison against each other, but against the ESCAP/UNDP Model Port Tariff structure published in 1989. It is appropriate to place the comparisons against a recognized model that provides a useful framework for analysis.

The comparison of port tariffs, is based on two hypothetical types of container ship, namely 3,000 twenty-feet equivalent units (TEU) and 1,100 TEU ships. Although the cost comparison should not be considered a rating of cost in its own right, it provides a realistic snapshot of the outcomes arising from this approach.

A range of issues were identified from the study with regard to tariff setting models: costing approaches, the impact of exchange rates, capacity to adjust rates, the impact of privately operated ports and the price setting approach of ports and governments. These issues are discussed in the report.

This report is organized in five chapters including this introduction. Chapter 2 addresses the contextual issues relating to port pricing and outlines the ESCAP/UNDP Model Port Tariff Structure. Chapter 3 deals in detail with the comparative analysis of the approach to tariff structures. In Chapter 4, actual port tariff levels are compared among the ports of the region, based on the two hypothetical models. Chapter 5, in conclusion, also discusses a range of issues that emerged during the study, including expectations of tariffs, revision processes and suggestions for countries to consider in any review process they may adopt in relation to port tariff setting.

2. THE CONTEXT OF PORT PRICING

2.1 Pricing objectives

In formulating pricing policies and establishing tariffs, ports generally endeavour to incorporate the following pricing objectives:[1]

(a) *To promote the most efficient use of the facilities*: A principal objective of port pricing is to ensure that port facilities are used in the most efficient manner. The pricing system can influence the utilization of assets particularly when the demand for the services is price elastic. When demand for a service is inelastic, other measures, generally more authoritative than pricing, have to be found;

(b) *To retain the benefits resulting from investment within the country*: An objective of port pricing of particular interest for ports in developing countries is to establish charges at a level that tends to retain the benefits arising from port improvements within the country;

(c) *To recover sufficient revenue to meet financial objectives*: A third objective relates to building up financial reserves to prepare for unexpected falls in revenue or rises in costs. Nevertheless, the acceptable amount of the reserve may be limited, if other more important objectives, for instance the improvement of the utilization of assets, are to be achieved.

Other objectives of port pricing include minimizing total logistics costs from a national point of view; providing an incentive to port users to improve their facilities and services; and ensuring that the tariff is both practical and simple.

2.2 Pricing structure

2.2.1 Requirements of a good pricing structure

It is a complex procedure for a port to establish or change its pricing structure, and too frequent changes may be a source of confusion for port users. The pricing structure of a port, therefore, should be designed to last for many years achieving not only present pricing objectives but also future ones, although the level of each port charge may be modified as conditions change.

[1] For details, see United Nations Conference on Trade and Development, Port Pricing, 1975, pp. 9-10.

From the suppliers' point of view, any good pricing structure should satisfy at least three main general requirements. It should (a) allow a proper re-allocation of benefits, (b) facilitate the comparison between charges and costs, and (c) contribute to the improved utilization of facilities.

In addition, a good pricing system should be cheap to build up and operate. There is also an increasing desire on the part of port users for greater transparency in the billing of port services. This indicates the need for more easily understandable and comparable tariff structures. Consequently, a reasonable port tariff structure is simple and clear, and offers a comparable basis among ports. Thus, port users can assess the various kinds of service components and control the uncertainties in future business.

2.2.2 Basic approaches in establishing port tariff structure

Among the considerable number of factors that should be taken into consideration, a review of actual practices and expert literature[2] suggests that ports should take note of the following critical aspects:

(a) *Clarification of the relationship between port facilities and users*: Although identifying the users of port facilities is not usually easy, most of the payers can be identified under the current tariff system. Any port tariff structure should establish a clear framework for the relationship between the charges and the "who pays" factor and should provide fairness and flexibility;

(b) *Prevention of double payment*: To assist in understanding the relationship between port facilities and relevant charges, the tariff structure should provide a one-to-one relationship between facilities and port tariffs;

(c) *Price mechanisms to prevent congestion*: Facilities in which there is no cost input at all in the port areas should be exempt from charges. But congestion caused by 'free of charge' in the port may occur when traffic increases to such an extent that the level of traffic flow eventually becomes saturated. In that situation, congestion could be prevented by introducing congestion prevention charges;

(d) *Simplification of port tariffs*: It is a common phenomenon for ports to be faced with continuous confusion on port charges and, therefore, a constantly increasing demand for a simplification of the tariff structure. Approaches to achieve simplification include reducing the number of charges and/or reducing the number of variables in the basis for each charge.

[2] Literature review on port pricing is provided in annex II.

2.2.3 Types of port charges

As shown in table 2-1, port charges are generally divided into three broad categories, general tariffs, facility tariffs and service tariffs, each of which are subdivided into a series of individual charges.

(a) *Conservancy and port dues*

It is common to establish a charge to recover the cost incurred in providing the facilities and services which are necessary to ensure the safe navigation of vessels within the area under the port's jurisdiction. It may include dredging, the provision of breakwaters, training walls, navigational aids and harbour surveillance facilities, but usually excludes the costs of providing pilot and tow services which are charged by separate tariffs.

Conservancy is a port charge which is levied for the utilization of general nautical facilities in the approaches to the port (i.e., outside the port area), whereas port dues are levied for the services or utilization of facilities within the port, including channels, vessel traffic service, emergency fire services, breakwaters, pollution control and marine security.

Port dues on ships are based on the type and size of the vessels. The charging units would be the carrying capacity of the vessel measured in gross registered tonnage (GRT), net registered tonnage (NRT) and deadweight tonnage (DWT) or some combination of length, beam and draft, and the unit of differentiation should be the type of the vessel.

(b) *Wharfage*

Wharfage is normally a cargo-related charge to recover the costs associated with the provision of the basic infrastructure and superstructure of the port to facilitate the movement of cargo from shipside to hinterland and vice versa. It includes the costs of providing roadways, railways, quays, parking areas, transit shed facilities, police surveillance etc.

Similar to port dues, wharfage is charged by freight ton, metric ton, cubic metres or TEU, and its differentiation unit is the type of cargo.

(c) *Berth hire (dock or berth due)*

This is a charge, normally related to the ship, to recover the costs associated with the berthing of the vessel and for the use of the berth for a stated period of time. It may include expenditure on the provision, maintenance and operation of docks,

maintenance of dredged depths alongside and in the dock basin, fendering, provision of quays and facilities provided on the quay apron.

The charging unit of the berth due is meter-hours, computed as the length of the vessel multiplied by the hours that the vessel is at the berth. The unit of differentiation distinguishes among the berths by their characteristics, such as alongside depth, back-up area and cargo handling capacities.

(d) *Transit storage*

This is the charge to recover the costs of the storage of goods in transit sheds or areas. The temporary storage rates are usually set to minimize cargo dwell time and maximize throughput.

The charging unit is the amount of storage occupied multiplied by the period of storage measured in days. The storage can be differentiated based on the dwell time so as to charge higher rates for an extended period of storage. Separate tariffs can also be used to distinguish between open and closed storage and among different types of cargoes.

(e) *Pilotage*

Pilotage arises in two areas: the seaway gaining access to the river estuary and the port area itself. In many instances, the pilot service is compulsory.

The pilotage may be based on the GRT of the vessel or a charge per ship. In general, as the cost of providing pilot service does not vary for different sizes of vessels, it is appropriate to charge pilotage simply based on the vessel's port call. However, it can be differentiated by the location where the pilotage starts and ends.

(f) *Towage*

This service is usually optional. Occasionally, the towage tariff is included in another charge such as pilotage.

Towage is usually based either on the characteristics of the ship or the tugs performing the operation. Towing costs increase with the size of the tugboat used and the time of use. Therefore, the common practice is to charge a towage per hour and to differentiate based on the size of the tugboat used. However, in some cases it is charged as a fixed rate irrespective of the time taken for the operation and differentiated by the vessel's type and size.

(g) *Mooring/unmooring (berthing/unberthing)*

This is a specific tariff applied for berthing/unberthing and mooring operations.

This tariff is charged simply by the vessel movement, but can be differentiated by the vessel's size measured in GRT, NRT or some combination of length, beam, and draft

(h) *Stevedorage*

Stevedorage costs should be directly related to the costs involved in handling commodities. Stevedoring companies in many ports are characterized by the high level of variable costs, for example, labour and a comparatively low level of fixed costs such as mobile plant, buildings. Therefore, in stevedoring operations the marginal costs and average costs may be identical.

The stevedoring charge is usually levied per freight ton, metric ton, cubic metres or TEU of cargoes. Stevedoring firms often reserve the right to calculate the charge on the volume or weight of the cargoes. It is common for all cargoes to be divided into groups according to various criteria and a uniform rate applied to each group.

(i) *Warehousing*

In most ports, there is a free period during which no charge is made for storage. Warehousing charges apply to goods that need to remain longer in the port and are, therefore, transported to special premises reserved for that purpose.

After the free period has expired, the tariff usually takes account of the length of stay of the goods in the storage place. In some cases, this charge per unit of time, usually the day, remains constant, regardless of how long cargo remains in storage after the given free period. However, in many cases, the charge per unit of time increases with the length of time spent in storage in order to discourage any abusive lengthy storage. This charge can be differentiated by type of storage, such as open, closed or frozen storage and by different types of cargo.

(j) *Other tariffs*

In addition to these specific tariffs, some ports levy other tariffs for services to the ship or to the cargo. These services may include fuel, water and electricity supply, labour supply, rent of equipment and cargo processing, such as weighing, marking and repacking.

Table 2-1 Different tariff categories

Categories	Type of charges	Changing units	Differentiation
General tariffs	• Conservancy, port dues	• Vessel GRT, NRT, length, beam, draft	• Type of vessel
	• Wharfage	• Freight or metric ton, cubic metre, TEU	• Type of commodity
Facilities tariffs	• Berth hire	• Metre-hour, berth-hour, berth-day	• Type of berth
	• Transit storage (short term)	• Day	• Open or closed storage, days in storage
Service tariffs	• Pilotage	• Vessel movement	• Location of pilotage starting/end
	• Towage	• Vessel movement	• Vessel GRT, NRT, length, beam, draft
	• Berthing/unberthing, mooring	• Vessel movement	• Vessel GRT, NRT, length, beam, draft
	• Stevedoring, wharf-handling, receiving/delivery	• Freight ton, metric ton, cubic metre, TEU, box	• Form of cargo
	• Equipment hire	• Half-hour, hour, shift, half-day	• Type of equipment
	• Cargo processing	• Freight ton, metric ton, cubic metre	• Form of cargo before and after
	• Warehousing (long term)	• Week, month	• Type of storage (open, closed, frozen)
	• Fuel, utilities	• Kg, metric ton, cubic metre	• Capacity provided

2.3 ESCAP/UNDP Model Port Tariff Structure[3]

At the request of member countries to provide countries in the region with a standard approach to port tariff setting, the ESCAP secretariat developed the ESCAP/UNDP Model Tariff Structure in 1989. The recommended structure was created after carrying out comprehensive research on ports internationally and conducting a number of expert group meetings to agree the approach.

The study included classification of service groups (including products); establishment of the nomenclature of port charges on shore and at sea; cost elements; and relationship between port charges and port facilities in recovering the costs.

Based on the data from the port tariff schedules supplied by 21 ports in the ESCAP region, the model tariff structure was developed to provide a common framework for the presentation of port prices. However, the task of actually determining prices within the structure was left to the decision of individual ports.

As shown in table 2-2, the ESCAP/UNDP Model Tariff Structure consists of the following four service groups:

(a) *Navigation*: The navigation group encompasses all services and facilities required for a vessel to move from the open sea (or from one location in a port) until it is stationary and secure in the port area. Reverse direction movements and activities are also included;

(b) *Berth*: The berth group encompasses all services and facilities available to a vessel owing to its location at that berth (or anchorage). This would include services which are fixed, that is available simultaneously at many locations in a port (for example, power), but not a service or facility which can effectively be utilized by another berth (for example, a crane on rail tracks serving two or three adjacent berths as opposed to a fixed crane);

(c) *Cargo operation*: The cargo operation group encompasses facilities and services utilized in the handling of cargo through the port. It includes stevedorage and wharf handling;

(d) *Other business*: The other business group encompasses all other port facilities and services which are not covered above. It is recognized that ports are involved in a very wide diversity of businesses and that there will be a significant number of entries in this group. In particular, it would cover property matters not directly related to a berth together with licensing, management services and consulting.

[3] ESCAP, ESCAP/UNDP Model Port Tariff Structure: Final Report, 1989.

Table 2-2 ESCAP/UNDP Model Port Tariff Structure

Service group	Component/ type of service	Charging system			
		Basis	Units	Payer	Recipient
Navigation	Conservancy	Size of ship	GRT	Shipping line	Port/Other responsible body
	Port dues	Size of ship	GRT	Shipping line	Port
	Pilotage	Size of ship Time	GRT Hours	Shipping line	Port/Pilotage Association
	Tug services	Tug time involved Size of ship	Number GRT	Shipping line	Port/ Tug owner
	Mooring/unmooring	Size of ship	GRT	Shipping line	Port
Berth	Berth hire	Time of ship alongside Size of ship	Hours GRT	Shipping line	Port
	Wharfage	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Consignee/ Consignor	Port
	Ancillary services	Amount consumed	Various	Shipping line	Port
Cargo operations	Stevedorage	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Shipping line	Provider of service
	Wharf handling	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Consignee/ Consignor	Provider of service
	Extra-movement	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Consignee/ Consignor	Provider of service
	Special cargo handling	Volume/weight/size of cargo Type of special handling	Unit Types	Shipping line	Provider of service
	Storage	Time	Tonnes/ TEU/㎥ Days	Consignee/ Consignor	Provider of service
	Packing/unpacking	Volume/weight/size of cargo	Tonnes/ TEU/㎥ Unit type	Shipping line	Provider of service
	Equipment/service/ facility hire	Hours of use by item	Hours	Stevedore	Equipment/ services owner
Other Business	Real estate licensing management services and consultancy etc.	Various	Various	Hirer	Port

Notes: GRT = gross registered tonnage

TEU = twenty-feet equivalent units

2.4 Port pricing approaches

Port tariff items can be divided into three groups: those related to the provision of services; those related to the provision of facilities; and general tariff items. Different groups of tariffs can be determined by different pricing approaches.

2.4.1 Cost-based pricing

Port tariffs related to the provision of services include pilotage, towage, berthing/unberthing, mooring, stevedoring, wharf-handling, receiving/delivery, cargo processing etc. These service tariffs are usually determined on the basis of the costs incurred in providing the services. Different prices, however, can be obtained different types of costs are taken into consideration.

(a) *Average cost pricing*

This pricing approach is based on average cost determined by adding the total fixed and variable costs and dividing this sum by the projected demand for the service. Port tariffs so derived have the advantage of assuring that the revenues collected will equal the total costs, assuming that the projected demand is realized. This approach gives priority to achieving an overall financial target, namely a stand-alone, non-subsidized price. For ports with a high proportion of fixed costs, increasing the throughput may significantly decrease the average or per unit cost.

A disadvantage of average cost pricing is that there is a tendency to set prices higher when demand is weak and lower prices when demand is strong. Furthermore, this approach excludes those clients that cannot afford to pay a given price, but might be able to pay a lower one, perhaps one based only on the variable cost.

(b) *Variable cost pricing*

Pricing based on the unit variable cost is determined by dividing the total variable costs by the projected demand for the services and the facilities. In general, this approach is only appropriate where variable costs are a large share of the total costs as in labour-intensive break-bulk cargo handling operations due to the use of casual labour.

Tariffs based only on variable costs have generally not been introduced, even though they encourage efficient use of port resources. The reason is that many port services and facilities have variable costs that are too small to serve as the basis for a tariff and to cover the port's expenditures. If a tariff is based on variable costs, the losses incurred need to be offset by other tariffs. However, the pricing based on variable

costs can achieve the operational objective of maximizing the use of services and the financial objective of covering the variable costs of these services.

(c) *Marginal cost pricing*

Pricing based on the unit marginal cost is determined by dividing the marginal costs by the projected marginal demand for the services.

The tariff based on the unit marginal cost requires that the relationship between variable costs and expected throughput demand be known for the period during which the price will prevail. Therefore, it is necessary to estimate the change in resource productivity as demand increases. This information is difficult and time-consuming to obtain. Change in variable costs over a long period of time must be correlated with variations in demand. These inherent problems have led to unit marginal costs not being used to set port tariffs, except where explicit surcharges have been introduced to cover overtime, a third shift, or holiday premiums for labour.

It may be useful to set the level of port charges of seasonal traffic on the basis of unit marginal costs because it is inefficient to provide additional capacity for these relatively short periods. Furthermore, there is a tariff ceiling, which is determined by the degree of congestion of the facilities, as users face much higher operating costs than the actual charge applied by the port authority.

Marginal cost pricing, however, has some problems. First, it is very difficult to estimate and distribute the marginal costs, particularly the estimation of the short-term and the long-term marginal costs, and the distribution of the marginal costs among the charge items. Second, marginal cost pricing should be based on competitive market principles. But the port industry is characterized by monopoly. Third, if a port authority suffers from a shortage of demand and makes operation losses amounting to the balance between the marginal costs and average costs, then compensation from other sources should be made.

For these reasons, marginal cost pricing has some limitations as a basic port pricing theory, even though it is economically efficient, flexible and the fairest pricing tool.

2.4.2 Performance-based pricing

The second group of port tariff items is related to the provision of facilities, such as berths and storing facilities. The main objective of these facilities tariffs is to promote efficient use of a facility focusing on performance, which is accomplished by using the facility at an optimal level. By so doing, it equates the interest of the supplier of the facility with its users, although calculation of optimal levels of utilization is not easy to carry out for all facilities.

Rough rules of performance-based pricing are: (a) increase the tariff when the level of utilization is above the optimum, and (b) decrease the tariff when the level of utilization is below the optimum. When levels of utilization are extremely high, congestion builds up, which makes using the facility very expensive in terms of delay costs. To avoid reaching this point, the tariff must escalate with the level of asset utilization or else during peak periods surcharges have to be introduced. When the level of utilization is well below the optimum level, priority should be given to building up trade, and performance-based pricing results in a price that covers only variable or marginal costs. This implies that the cost of the facility is also recovered through other tariffs, or perhaps a subsidy. However, the subsidy will encourage undesirable behaviour by users that may be difficult to correct in the future. Therefore, a minimum price, higher than that suggested by the variable or marginal cost, must be set to ensure efficient behaviour by users.

Performance-based pricing can also be applied to encourage users to follow efficient practices while occupying the facility. For instance, rebates from the published tariff can be offered to those ships that start to work, for example, one hour after berthing, and surcharges or fines can be applied to those that start after three hours, for example.

2.4.3 Value-based pricing

General tariff items in the third group, such as port dues and wharfage, can be better determined by the value added to the activities of the users by the services and facilities. The objective of value-based pricing is to generate enough revenues to cover all costs incurred in providing services and facilities, including those not covered through a variable cost based tariff for services.

The value added to users' activities is estimated through their willingness to pay for a service or a facility. In general, it is reasonable to expect that changes in tariffs levels have the same impact on all users.

Value-based pricing is a familiar feature of pricing policy within a service sector whose benefits are heterogeneous. For example, if the volume of cargo shipped through the port is divided into several groups with different price elasticities, each cargo group can be charged a different price according to the value of the service. The port may distinguish between those trades which the port wants to promote and those which are not of interest.

The effectiveness of value-based tariffs depends on how successfully the structure of the tariffs differentiates among potential users. Separate tariffs for containers, breakbulk, liquid bulk and dry bulk cargoes can be used to differentiate among

cargoes according to their value and price sensitivity. Differentiation can also be accomplished among different groups of port users within a tariff category.

2.4.4 Market-based pricing

An increasing number of port authorities are now using the technique of market pricing. Market pricing is essentially the practice of correlating the port tariffs to potential market demand and sensitivity in order primarily to maximize cash flow, attain good utilization of facilities, counter competition, stimulate market growth and improve profitability. Examples of market pricing include discounted tariffs for volume commitment, such as a 10 per cent discount on the published tariff on 100,000 tons annually, or lower tariffs in the less busy period to spread the traffic flow through the port.

In adopting market pricing, care must be taken to ensure that the full rate traffic is not diverted to the lower rate in an endeavour to generate a higher volume of business. Existing tariff levels, costs, competition, agreements with shipowners and market sensitivity should be carefully evaluated. For example, there is nothing to be gained by offering a 40 per cent off season discount for particular traffic if the market is insensitive to price. Finally, market pricing should be avoided if it leads to a tariff war. It may generate additional traffic, but the average rate will fall and there may be little prospect of increasing revenue.

3. COMPARISON OF PORT TARIFF STRUCTURES

3.1 Modification of the Model Port Tariff Structure for comparison

It is difficult to compare port tariffs among ports accurately because of diversity in their systems and regulations, the existence of pricing by long-standing agreements and the influence of the exchange rate. Furthermore, in some cases port charges, tariff levels and data are confidential and difficult to obtain.

In the current study overall systems of port tariff structures and types of charges have been surveyed through visiting ports in the ESCAP region and reviewing relevant literature. Port charges are defined as those used in the individual ports. Charging units and recipient and payer of port charges are also compared. The port tariff structure used for comparison is the ESCAP/UNDP Model Port Tariff Structure with slight modifications to allow for a more appropriate base for comparison. Nomenclatures for the same kind of port charges are unified for the purpose of comparing port tariffs. The use of a model makes a comparison achievable as any comparison against other approaches would be impossible to document because of the variation in approaches. The characteristics of the port tariff structures of individual ports or countries have been analysed. Alternative approaches to the simplification, standardization and unification were also identified.

As described in the previous chapter, the ESCAP/UNDP Model Port Tariff Structure consists of four service groups: navigation, berth, cargo operations and other business. However, after reviewing the data, slight modifications for the purpose of comparison have been made to the model by adding a 'lease group'. This consists of dedicated costs and rental charges in order to reflect the current trends in the operation of world container terminals that make extensive use of leasing charges. In addition, in the navigation service group, conservancy is consolidated into port dues,[4] and minor charges are grouped under ancillary services.

The new modified model tariff structure for comparison purposes is outlined in table 2-3.

[4] In the ESCAP/UNDP model, it was recommended that whenever possible the conservancy charge be incorporated into port dues.

Table 2-3 Model Port Tariff Structure – modified for comparison

Service group	Component/ type of service	Charging system			
		Basis	Units	Payer	Recipient
Navigation	Port dues	Size of ship	GRT	Shipping line	Port
	Pilotage	Size of ship Time	GRT Hours	Shipping line	Port/Pilotage Association
	Tug services	Tug time involved Size of ship	Number GRT	Shipping line	Port/ Tug owner
	Mooring/unmooring	Size of ship	GRT	Shipping line	Port
	Ancillary services	Various	Various	Shipping line	Port
Berth	Berth hire	Time of ship alongside Size of ship	Hours GRT	Shipping line	Port
	Wharfage	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Consignee/ Consignor	Port
	Ancillary services	Amount consumed	Various	Shipping line	Port
Cargo operations	Stevedorage	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Shipping line	Provider of service
	Wharf handling	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Consignee/ Consignor	Provider of service
	Extra-movement	Volume/weight/size of cargo	Tonnes/ TEU/㎥	Consignee/ Consignor	Provider of service
	Special cargo handling	Volume/weight/size of cargo Type of special handling	Unit Types	Shipping line	Provider of service
	Storage	Time	Tonnes/ TEU/㎥ Days	Consignee/ Consignor	Provider of service
	Packing/unpacking	Volume/weight/size of cargo	Tonnes/ TEU/㎥ Unit type	Shipping line	Provider of service
	Equipment/service/ facility hire	Hours of use by item	Hours	Stevedore	Equipment/ services owner
Other Business	Real estate,licensing, management services and consultancy etc.	Various	Various	Hirer	Port
Lease	Dedicated costs	Lease area	Various	Lessee	Port
	Rental charge	Lease area	Various	Lessee	Port

Notes: GRT = gross registered tonnage

TEU = twenty-feet equivalent units

3.2 Comparison of tariff structures

3.2.1 Navigation group

(a) *Port dues*

Port dues are levied in 18 out of 21 ports in the region included in this study. They are called harbour dues in some ports. The port of Sydney does not charge a port entrance fee in any type of charge. In Ho Chi Minh City, port dues are charged in the name of 'marine safety dues' and in Colombo as entering dues conservancy.

Light dues are charged in the following ports Colombo, Hong Kong, Port Klang, and Yangon while light and buoys dues are levied in the ports of Kaohsiung and Yokohama.

Conservancy is not levied in most of the ports in the region, with the exception of Yangon port, where conservancy is levied to the cargo as a port entrance fee. It is recommended to consolidate conservancy into port dues.

Tonnage is levied in the following ports: Kaohsiung, Osaka, Saigon Port, Shanghai, and Yokohama. It is recommended that tonnage charges be incorporated into port dues.

(b) *Pilotage*

Pilotage is levied in all 21 ports surveyed. However, in some ports of Australia, the Philippines and Singapore the pilot service is provided by the private sector. Pilot attendance/detention fee and premium for pilot officer are additionally charged in some ports.

(c) *Tug services*

A tug service charge is levied in most of the ports surveyed, except Chennai and Yangon. It is charged in the name of *towage* in the following ports of Auckland, Karachi, Mumbai, Sydney and in the name of tug hire in Kaohsiung and Shanghai. Tug boat assistance is additionally charged in some ports.

(d) *Mooring/unmooring*

It is called line handling in 12 ports out of 21 included in the study. It is not levied however, in the following ports: Auckland, Bangkok, Busan, Colombo, Jakarta, Laem Chabang, Manila, Port Kelang and Yangon.

Anchorage is charged in the following ports: Busan, Colombo, Hong Kong, Jakarta, Manila, Mumbai, Port Klang, Shanghai and Yokohama. In Jakarta port, anchorage means port dues. Berthing services are charged in the ports of Singapore and Yangon.

(e) *Ancillary services*

Fire and emergency services are charged only if those services are used. This charge is included in the tariff schedules of the ports of Bangkok, Colombo and Karachi.

3.2.2 Berth group

(a) *Berth hire*

Berth hire is charged under different names in different ports. The ports charging as berth hire include Auckland, Bangkok, Chennai, Laem Chabang and Mumbai. It is called dockage in the ports of Busan, Colombo, Hong Kong, Kaohsiung, Manila, Port Klang, Singapore and Yokohama. Berth hire is charged as hire of wharf in Saigon port, as berthage in Shanghai, and in the name of *facilities and services* in Sydney. In Jakarta port, it is levied in the name of wharfage/quay dues.

(b) *Wharfage*

It is usually levied on cargoes as port entrance fee. However, in the ports of Jakarta, Osaka, Saigon and Shanghai, wharfage is levied on ships entering the ports.

(c) *Ancillary services*

Ancillary services such as cleaning wharfs, water supply, telephone, garbage and security are included in the tariff schedules of some ports. They are charged only when used.

3.2.3 Cargo operation group

It is difficult to obtain data to assess and compare charges related to cargo operation. There are some discrepancies between general cargo berths and dedicated container terminals. Even in container terminals, the lease rate is dependent upon the individual agreements between port authority and users.

Stevedorage is charged in the ports of Hong Kong, Shanghai and Singapore. In Auckland this, plus wharf handling, is levied in the name of goods wharfage. Wharf handling is levied in Colombo.

As for equipment hire, hiring service is charged in Colombo port. In Mumbai port, mobile crane & equipment is charged, in addition to normal container freight charges, which leads to an abnormally high total port charge.

Storage is levied in most ports of the region. It is sometimes charged in the name of demurrage.

Packing/unpacking or vanning/devanning is charged in many ports of the region, including Colombo. Weighbridge is levied in some ports including Shanghai. Lift-on/lift-off is charged in Colombo, Shanghai and Singapore ports. It is often levied in the name of mounting/demounting. Off-dock container yard charge is levied in Busan port.

Collective charges are levied based on the terminal lease in most of the container terminals, including Busan, Hong Kong, Singapore and Yokohama ports.

3.3 Characteristics of port tariff structures by country

3.3.1 Australia - Sydney

Navigation service group

Tonnage rates are applied to vessels. Light dues are charged to vessels. Pilotage and mooring services etc. are specified in the group.

Berth group

Berth hire is charged under the title of ship's berth hire. Wharfage is charged as cargo berth hire.

3.3.2 China - Shanghai

Navigation service group

Tonnage due is charged for port dues based on NRT (0.71 yuan renminbi). Quarantine is charged per ship's visit (1,560 yuan renminbi). Line handling, pilotage, towage, launch hire and husbanding fee (agency fee) are specified in the navigation service group.

Berth group and cargo operation group

Tariffs of the public berths specify berthage, stevedorage (lump-sum charge) and special cargo handling etc.

In the private container terminals, stevedorage (contract rate), berthing fee, weighting, line handling, lift-on/lift-off, and storage charges are applied collectively based on contract.

3.3.3 Hong Kong, China - Hong Kong

Navigation group

Light due (HK$57/100NRT/Call) and anchorage due are levied separately. Mooring/unmooring, towage and pilotage are specified in the group.

Berth group

For the public cargo working area, berthing permit is charged to shipping lines. For the private container terminals, dockage is charged in line with or separately from stevedorage.

Port tariffs in the private container terminals are dependent upon the negotiation between the terminal operators and shipping lines. Port tariffs are charged collectively (through-put rate) as follows; terminal charge (stevedorage + marshalling yard fee + container yard charge + lashing fee + line handling + tally) plus storage, special cargo handling and extra movement if used.

3.3.4 India - Mumbai, Chennai

Navigation group

In Mumbai port, towage includes tug assistance and pilot boat charge. Anchorage fees are charged after 30 days from the day following the completion of anchoring.

Cargo operations group

Mobile cranes and equipment charge is charged additionally in Indian ports. This is one of the major reasons for the high port price in Indian ports. In Mumbai port dry dock charge is levied for docking and undocking.

3.3.5 Indonesia - Jakarta

Pilotage includes a premium for a pilot officer.

Anchorage dues could be combined into port dues, and wharfage/quay dues could be renamed as berth hire.

3.3.6 Japan – Yokohama and Osaka

Navigation group

In Japanese ports, port dues are applied to all entering vessels on the basis of GRT. Tonnage is additionally charged to the foreign vessels on the basis of NRT per voyage or year. Anchorage is charged after 48 hours if used.

Pilotage is charged according to bay and harbour districts.

In Yokohama port, mooring/unmooring charge (rope tying and untying) is levied.

Berth group

In Yokohama port, if dockage is charged, wharfage is exempted. Rental charges for use of land are levied per ㎡-month.

In Osaka port, wharfage is only applied to foreign vessels.

Cargo operations group

In Osaka and Yokohama ports, cargo operation charges are dependent upon the negotiation between the terminal operators and the shipping lines.

Harbour transportation services charges are levied for transporting cargo from aboard a berthed ship to inside transit shed/open storage yard per ton.

3.3.7 Malaysia - Port Klang

Berth group

Berthing charge is used for berth hire. Wharfage is levied differently for the foreign going ships and domestic trade ships.

3.3.8 Myanmar - Yangon

Navigation group

Pilotage is calculated using GRT and draft. Charges for pilot attendance and detention are included in the pilotage.

Port dues and light dues are charged for the ship's entrance using GRT. Berthing services charge is levied as mooring/unmooring charge.

Conservancy is levied as cargo's entrance charge.

Berth group

Berth hire is included in the berth group.

3.3.9 New Zealand - Auckland

The port tariff structure of Auckland port is the simplest in the region.

Navigation service group

All the navigation service charges are combined into a collective marine charge (port dues, pilotage, towage, linesmen charges) per GRT. A minimum charge ($1,735) is applied).

Vessel moves are levied for the dead ship's movement between berths or wharves on request.

Berth group

Berth hire (per GRT) includes a connection fee for one telephone. Other charges such as lay-up berthage after seven days, water, shore power and garbage collection (only in conventional ports) are included in this group.

Cargo operations group

The goods wharfage charge includes stevedorage and wharf handling charges for a full container load/REEFER, empty container, less than container load devanned on wharf and trans-shipment.

Facility charges (facilities fee, shed charge and reefer power supply per cargo working vessel) and demurrage/storage/trans-shipment charges, and weighbridge are levied besides goods wharfage.

3.3.10 Pakistan - Karachi

Navigation group

The pilotage fee includes pilot attendance fees. Tug service includes launch hire and is used as towage.

Cargo operation group

The group consists of the basic tariff (loading & unloading charges, terminal handling charges, special cargo handling, extra movement, storage charges), demurrage charges, parking charges, and issue of weighment certificate in detail.

3.3.11 Philippines – Manila

Navigation group

Anchorage dues are specified in the port tariff. However, they are not levied in practice.

Tug service and pilotage are supplied by the private sector and are not specified in the port tariff.

Berth group

Berth hire is charged in the title of dockage at berth per GRT per calendar day. The rate is applied differently to government ports and private ports.

Entrance/clearance for customs clearance and immigration, pier lighting and reefer charges are charged as miscellaneous charges.

Cargo operation

Stevedorage includes the loading and unloading, lashing/unlashing, lifting and closing of hatch covers.

3.3.12 Republic of Korea - Busan

Navigation group

In Busan port, anchorage dues are additionally charged for the ship's staying at anchorage in gross tonnage.

Berth group

Dockage is used as berth hire. Wharfage is levied for the cargo passing from navigation aids in the channel to cargo handling and storage facilities. This means that wharfage covers its own function, plus port dues for cargo.

Cargo operation group

Off-dock container yard charge is levied for the container cargo on condition that 60 per cent of the container throughput of a liner shipping company is regarded as being processed in the off-clock container yard.

3.3.13 Singapore

The port tariff structure of Singapore Port is nearly identified to Port Tariff Structure Standards.

Navigation group

Tug and pilotage services are provided by the private sector and their charges are not included in the port tariff.

Berth group

Berth hire is charged in the title of dockage on the basis of length overall of vessel-hours.

Mooring/unmooring is levied as berthing/unberthing services per berthing or unberthing. Lashing/unlashing charge is levied per container (S$3).

Cargo operations group

Stevedorage consists of the basic rate, rehandling charge, lift on/off charge etc.

Storage charge is subdivided as follows: full/empty/trans-shipment and period.

3.3.14 Sri Lanka – Colombo

The port tariff structure of Colombo port is subdivided in detail, especially in stevedorage related charges.

Navigation group

For port dues, entering dues and overhour dues and light dues are charged separately.

Pilotage consists of pilotage payable on each arrival and professional pilot fees on the basis of 30,000 DWT.

Anchorage is charged from the fifth day of using anchorage for port entry.

Berth Group

Berth hire is charged per 100 gross tonnage as dockage. A rental charge for occupying a berth at a wharf is levied after one hour from completion of discharging/unloading.

Cargo operations group

Harbour tonnage dues are levied on the ship in addition to stevedorage for the laden containers discharged/loaded.

Movement of container is charged for the movement of containers from ship to marshalling yard. Lifting-on/lifting-off is charged as mounting & de-mounting containers.

Hiring services consists of hire of forklift truck & cranes and other equipment.

Stevedorage-related charges are subdivided to a very detailled level. It would be possible to assist users by simplifying them.

3.3.15 Taiwan Province of China – Kaohsiung

Container terminals are leased to the liner shipping companies and the public entity in Kaohsiung

Navigation group

A tonnage due is charged to shipping companies as port dues on the basis of NRT (NT$6.0). Buoyage is also charged to shipping lines.

Pilotage is charged based on the draft (per foot) and tonnage (per 500 GRT).

Wharfage is charged to a consignee for the use of water facilities and navigation aids.

Berth group

Berth hire is charged in the name of dockage.

Private container terminal

Container terminal charges are applied collectively to container cargoes as an agreement tariff (stevedorage + marshalling yard fee + container yard charge + lashing fee + line handling + tally + gate fee) in addition to over-storage and extra movement if used.

3.3.16 Thailand - Laem Chabang

The port tariff structure of Laem Chabang port is subdivided into great detail, especially in stevedorage-related charges (wharf handling and extra-movement). Hire of equipment and admission fee for gate and Customs office are levied additionally.

Navigation group

Pilotage service is provided by the private sector and is not specified in the port tariff. Pilotage includes a pilot transportation fee.

Berth group

Berth hire is levied per 100 GRT/hour and includes rope boat service (mooring/unmooring).

Cargo operations group

Marine survey service is separately charged.

Container cargo operation charges are subdivided into many items. Equipment hire for crane and truck and admission fee for vehicle and equipment for gate entry and in Customs area are charged additionally.

3.3.17 Viet Nam – Saigon Port

Navigation group

For port dues, maritime safety dues (0.209-0.282US$/GRT) and tonnage dues (0.1 US$/GRT) are charged separately. They are characterized by the offer of a rebate of 30 per cent, 50 per cent or 80 per cent based on the conditions.

Berth group

Wharfage is charged to vessels, cargoes and passengers. These three groups could be classified as berth hire, wharfage and passenger fee respectively.

Cargo operations group

Container in lighterage is charged for the movement of containers in lighterage.

Hire of labour, means and equipment is levied for the hire of skilled/unskilled labour, crane and barge etc., and truck and forklift.

Other business group

A clearance fee is charged for the vessel entering/leaving the port on the basis of GRT.

3.4 Port pricing approaches and systems by country

3.4.1 Port pricing approaches by country

Reviewing port pricing approaches by country (based on the sample ports) in the ESCAP region reveals that most of countries adopt the principle of cost-based pricing. Some of the countries, however, place more emphasis on market-based pricing including examples of performance-based pricing based upon market size and competition.

Hong Kong, China

The cost-based approach is employed, but port pricing is likely to be influenced politically by the Shippers' Association etc. The government is only responsible for the investment in navigation channels. There is no clear expressed criteria for the cost recovery.

India

The cost-based approach is adopted, and performance-based and value-based approaches are followed.

Malaysia

The port tariff has not been adjusted in Malaysia since 1963. Principles of port pricing in Malaysia are not clear, but it is possible that pricing approaches based on cost-based pricing will be taken if the port tariff is revised in the future.

Myanmar

In container terminals, the cost-based approach occupies about 70 per cent, the performance-based about 25 per cent, and other approaches about 5 per cent in port pricing.

Republic of Korea

Four kinds of approaches are adopted in port pricing in the ports of the Republic of Korea. About 42 per cent of port costs was reflected in port prices in 1996.

Port pricing is carried out predominantly based on cost. It was found, however, that costs are not recovered completely in port pricing.

Singapore

Four kinds of port pricing approaches are basically applied in Singapore. PSA Corporation adopts a market-based approach in that shipping companies are offered special offers according to the long-term contracts.

Taiwan Province of China

Cost-based and performance-based approaches are dominant in the Taiwanese ports. Trade promotion is also a major consideration in port pricing.

Thailand

The cost-based approach is the principle, but the target rate of cost recovery is not 100 per cent.

Viet Nam

It was found through interviews that the cost-based approach occupies 60 per cent, market-based 20 per cent and performance-based and value-based 10 per cent respectively in port pricing. The Viet Nam National Pricing Committee is responsible for managing prices in Viet Nam. Most sectors are free from the Committee's control, but the port sector.

3.4.2 Procedure and timing for port tariff revision

(a) Revision procedure

Generally, the personnel of the responsible departments first review the costs for the facilities and services to produce a tariff revision draft and to discuss the possible problems with the revision. Approval from the related government organizations

should be obtained, as required, before finally implementing the port tariff revision. An outline of the process in various countries follows.

Hong Kong, China

Port tariff levels are reviewed every year; a revision draft is reported to the government; approval is sought from the Parliament; port tariff revision is executed.

Malaysia

A cost review of port facilities and services is conducted; market sensitiveness is reviewed; opinions are collected from related parties; approval from the government (Ministry of Transport) is sought.

Myanmar

Port authorities recognize the necessity of tariff revision: a prepared revision draft is submitted to the Ministry of Transport; approval from the Parliament through the Trade Commission is obtained; port tariff revision is executed.

Singapore

There is a practical management review of port tariff levels; the revision draft is reported to the senior management; approval from the Ministry of Communications, Information and Transport through the MPAS Board is sought; the revision is discussed with shipping companies; port tariff revision is executed.

Taiwan Province of China

Local port authorities recognize the necessity for tariff revision: approval from the Ministry of Transport is obtained; the revision is discussed with related parties; port tariff revision is executed.

Viet Nam

At the practical level, the Viet Nam National Shipping Lines (VINALINES) and the Viet Nam National Maritime Bureau (VINAMARINE) produce a revision draft and submit it to the Viet Nam National Pricing Committee; approval is sought from the committee instead of Parliament; port tariff revision is executed.

(b) Revision Periods

Revision or adjustment periods are not definite and are perceived as likely to be shorter in the future. For many countries the target period is one year. Port tariffs are also revised irregularly according to the market situation.

Hong Kong, China

Every year port tariff levels are reviewed.

India

Port tariffs used to be revised every three years, but currently it is two years. In future the port tariff is expected to be revised every year.

Republic of Korea

Port tariffs are revised every two or three years.

Singapore

Every year port tariff levels are reviewed. Recently in 1996 port dues were discounted at a 20 percent rate.

Taiwan Province of China

In Kaohsiung port, port tariffs were revised in 1998. Port tariff levels were on an upward trend until 1998, thereafter the trend was reversed.

Thailand

Laem Chabang Port tariffs were revised in 1992 and Bangkok Port tariffs were revised in 1996.

3.4.3 Reasons for revising port tariffs

One of the major reasons given for port tariff revision is the cost push factor. In some countries the revision is used as a marketing tool to attract ships.

Hong Kong, China

Basically the cost-push factor is the reason, but political influences from the Shippers' Association are other factors.

India

Inflation, increasing fuel costs, port workers wage, exchange loss etc. are some of the reasons for a revision.

Myanmar

Cost push was the major factor in the 1990 revision and inflation including energy prices, in the 1998 adjustments.

Singapore

Port dues have been discounted at a 20 per cent rate as a promotion tool since 1996.

Taiwan Province of China

Deficit from port operations, inflation, market development and strengthening competitiveness were the reasons for revision.

Thailand

Cost push, change of cargo composition rate as cost distribution factor, and change of payer of the tariff caused a revision of port tariffs.

Viet Nam

Inflation was the prime cause.

3.4.4 Incentive systems of port tariff by country

An incentive policy that discounts or exempts port tariffs to strengthen competitiveness is not so prevalent because port tariffs are characterized by public control. Most countries, however, employ some incentives as a policy measure. For private sector operating ports, tariffs are regulated using only upper limit tariffs.

Hong Kong, China

Container terminal operators are responsible for the port pricing of their own income (cargo handling, berth hire etc.). Port dues, which the Hong Kong Government Marine Department is responsible for levying, are not discounted. The port revenues of the Marine Department are totally returned to the Hong Kong Government.

India

A volume discount is applied to total service volume.

Malaysia

Port tariffs are compulsory. For the private firms port tariffs can be discounted, but not over-charged.

Myanmar

No discount and incentive rates are applied in port tariffs.

Singapore

For the trans-shipment cargoes, the Port of Singapore Authority (PSA) Corporation is independently responsible for pricing. Port dues have been discounted at a 20 per cent rate since 1996.

Taiwan Province of China

Stevedorage can be discounted by 20 per cent, G/C rental charge by 30 per cent and trans-shipment, charge by 50 per cent. But port tariffs can be over-charged.

Thailand

The trans-shipment cargoes through Laem Chabang port can be discounted for port marketing purposes, but not over-charged.

3.4.5 Laws and regulations governing port tariffs by country

The regulatory bodies of port tariffs are generally port authorities. Port tariffs are likely to be controlled by laws and regulation legislated by parliaments.

India

Major Port Trust Act for major ports trusts, and Indian Port Act for the other ports.

Malaysia

The Port Authority Act and Acts of Parliament.

Myanmar

No special laws or regulations.

Taiwan Province of China

Port Act

Thailand

Port Act

Viet Nam

Two laws related to port tariff regulations are: 137 Decision of Prime Minister (27/4/1992) on Controlling Prices; and Inter-ministerial Circular on the Control of Port Tariff (02/TTLB, 12/4/1993).

4. COMPARISON OF ACTUAL PORT TARIFF LEVELS

4.1 Methodology

The comparison of port tariffs between ports is a difficult task owing to many factors such as the diversity of tariff systems; differences in legal charges, regulations and other miscellaneous factors; confidentiality of tariff data in dedicated terminals; and the reality that tariff levels are often determined based upon individual negotiations between the port authority and users. Another difficulty in comparing port tariffs is the different currencies by which port tariffs are charged in individual ports.

Therefore some simplifications are required to compare different port tariffs on the same basis and in the same measure. First, two hypothetical containerships are created so that total costs in ports accruing to each of the hypothetical ships can be compared. Cost data were collected from ports in a standardized form based on the modified ESCAP/UNDP Model Port Tariff Structure. Port tariff levels were surveyed and calculated in local currencies and converted into United States dollars for comparison.

4.2 Hypothetical ships and cargo throughput assumptions

Two hypothetical containerships were created, the detailed specification including assumptions on cargo exchange/throughput described below.

(1) Hypothetical Ship I (3,000 TEU class)

- Standard specification: 40,000 G/T, 22,322 N/T, 43,600 DWT, 252 metres in length
- 3,000 TEU capacity, draft of 9.5 metres
- 1,000 TEU exchange in each port (loading and unloading 500 TEU each): assumed throughput profile is given in table 4-1 based on the actual case of the port of Busan
- Seven days of dwell time, including free time
- Berthing time: 16 hours

Table 4-1 Container throughput profile for 3,000 TEU hypothetical ship

		Import	Export	Trans-shipment	Total
20F	Full	67	72	37	176
	Empty	9	9	5	24
	Subtotal	76	81	42	200
40F	Full	135	144	74	353
	Empty	18	20	10	47
	Subtotal	153	164	84	400
Total	Full	337	360	186	882
	Empty	44	49	25	118
	Subtotal	381	409	211	1,000

(2) Hypothetical Ship II (1,100 TEU class)

- Standard specifications: 9,800 G/T, 5,469 N/T, 13,000 DWT, 147 metres in length
- 1,100 TEU capacity, draft of 8.3 metres
- 600 TEU exchange in each port (loading and unloading 300 TEU each): assumed throughput profile is given in table 4-2 based on the actual case of the port of Busan
- Seven days of dwell time, including free time
- Berthing time : 10 hours

Table 4-2 Container throughput profile for 1,100 TEU hypothetical ship

		Import	Export	Trans-shipment	Total
20F	Full	101	108	56	265
	Empty	13	14	7	35
	Subtotal	114	122	63	300
40F	Full	50	54	28	133
	Empty	7	7	4	17
	Subtotal	57	61	32	150
Total	Full	202	216	112	530
	Empty	27	29	15	70
	Subtotal	229	245	126	600

4.3 Comparison of port tariff levels and competitiveness

4.3.1 Purchasing Power Parity

For an international comparison, port tariff levels estimated in local currencies of individual countries should be converted to an internationally comparable measure. Conversion to United States dollar terms based on exchange rates is frequently used in various international comparisons.

However, there are some drawbacks to using exchange rates to convert local currency values to a common currency when making international comparisons. First, exchange rates fluctuate and sometimes change abruptly according to changes in interest rates or because of speculations against a currency. This volatility of exchange rates may produce a misleading result. Particularly, when the comparison is made for a certain period of time, this approach may not provide a steady picture, although it can be overcome to some extent by using average exchange rates over the period.

A second drawback of using exchange rates for conversion is that exchange rates do not reflect the relative prices of goods and services produced in the countries, so they do not provide consistent estimates for comparison. A way to overcome this shortcoming is to use a conversion rate that reflects how many goods the local currency buys within the country instead of how many dollars it will buy in the exchange market. This is known as purchasing power parity.

Purchasing power parities (PPPs) are the rates of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries. Because PPPs provide approximations of the real purchasing power of specific currencies, they are very often used as key statistical tools for international comparisons. However, it should be noted that PPPs are not a perfect substitute for exchange rates in making international comparisons. In fact, they are complementary in that PPP based comparisons are useful in specific situations, such as when comparing output levels or productivity levels between countries, while exchange rate based comparisons are more appropriate in others.[5]

In this study, both nominal exchange rates[6] and PPPs are applied to convert the port tariff levels of local currencies into the United States dollar term.

[5] http://www1.oecd.org/std/ppp/pppfaq.htm
[6] Average exchange rates during the first three quarters of 1999.

Table 4-3 Economic indicators of individual countries

Country	Population (million)	GNP (billion US$)	GNP per capita (US$)	GNP (PPP)	PPP	Exchange rate	
						1997	1999
Australia	19	382.7	20,142	362	1.4	1.3439	1.5484
China	1227	1055.4	860	3770	1.9	8.2898	8.2782
Hong Kong, China	7	163.8	23,400	158	8.4	7.7421	7.7534
India	962	357.4	372	1599	8.8	36.313	42.925
Indonesia	200	221.5	1,108	679	893.9	2909.4	8076.0
Japan	126	4812.1	38,191	3076	167	120.99	117.03
Malaysia	22	98.2	4,464	168	1.6	2.8132	3.800
Myanmar	44	23.0	523	-	1.4	6.2418	6.305
New Zealand	4	59.5	14,875	59	1.5	1.5083	1.8672
Pakistan	128	64.6	505	202	12	40.158	46.000
Philippines	74	88.4	1,195	270	9.4	29.471	38.643
Republic of Korea	46	485.2	10,548	618	673.7	951.29	1192.6
Singapore	3	101.8	33,933	91	1.6	1.4848	1.7020
Sri Lanka	19	14.8	779	46	19.3	58.995	69.949
Taiwan Province of China	21	263	12,345	465	15.54	28.703	28.703
Thailand	61	165.8	2,718	393	11.9	31.364	37.518
Viet Nam	77	24	312	122	2,359.3	11,085	13,912

Source: http://www.worldbank.org; International Monetary Fund, *International Financial Statistics*, 2000.

Notes: Exchange rates are ratios of local currencies to the United States dollar.

GNP = gross national product PPP = purchasing power parity

4.3.2 Comparison of total port costs

A survey was undertaken to estimate nominal port tariff levels of individual ports. In the questionnaire for the survey, respondents were asked to provide their current port tariff schedules. The approach adopted in the study and the two hypothetical container ships with detailed specifications were explained in the questionnaire to assist the respondents in providing information and data as accurately as possible. Then, the respondents were asked to fill in the tables provided for each of the hypothetical ships with the estimates of individual port tariff items in local currency, as grouped in the modified ESCAP/UNDP Model Port Tariff Structure. The survey questionnaire is provided in annex I.

The local currency amounts were converted to United States dollar terms using nominal exchange rates as well as exchange rates based on PPP. Total port costs that would be paid by the hypothetical ships (or their cargoes) were compared among the regional ports surveyed.

The total port costs the 3,000 TEU and 1,100 TEU hypothetical container ships are summarized in tables 4-4 and table 4-5 respectively.

In terms of the total port costs based on nominal exchange rates, the 3,000 TEU class hypothetical container ship costs least in the port of Manila, among 21 ports included in the analysis. The port of Yokohama appears to be the highest, costing more than six times the costs of Manila, as charged in nominal United States dollar terms. The costs of the ports of Hong Kong, Singapore, Sydney, Yangon are more than three times as high as the port of Manila.

When PPP rates are applied, however, the tariff level of Osaka port is the lowest among the regional ports. The port of Yangon is ranked as the highest cost port in the region, while it is considered as one of the lowest cost ports in terms of nominal United States dollar terms.

In most of the developing country ports in the region, port tariff levels based on PPP rates are relatively higher than those based on nominal exchange rates, as can be seen in Shanghai, Tianjin (China); Mumbai, Madras (India); Jakarta (Indonesia); Yangon (Myanmar); Karachi (Pakistan); Manila (Philippines); Colombo (Sri Lanka); Bangkok, Laem Chabang (Thailand); and Saigon (Viet Nam). This implies that the ports of the developing countries levy higher port tariff levels than those that would be appropriate under their price levels. It is not a surprising result in view of the fact that in developing countries, price levels are generally low and purchasing power is higher than exchange rates indicate.

On the other hand, in the countries where price levels are high and local currencies have low purchasing power, the port tariff levels based on PPP tend to be lower than those based on nominal exchange rates.

It is interesting to note that Port Klang in Malaysia and the ports of Bangkok and Laem Chabang in Thailand show comparatively low levels of port tariffs among the ports of the region in both cases where PPP rates and nominal exchange rates are applied. It was also found that in some countries, including India, Japan, Myanmar, Pakistan, Sri Lanka and Taiwan Province of China, port tariff levels are relatively high regardless of the approach applied compared with other countries in the region.

The total port costs for the 1,100 TEU hypothetical containership shows very similar results to those of the 3,000 TEU ship.

Table 4-4 Comparison of port tariff levels (3,000 TEU class ship)

Country	Port	Nominal exchange rate		Purchasing power parity	
		Tariff (US$)	Manila=100 (Rank)	Tariff (US$)	Osaka=100 (Rank)
Australia	Sydney	181,991	351 (18)	201,282	198 (9)
China	Shanghai	84,033	162 (8)	366,129	361 (15)
	Tianjin	75,706	146 (5)	329,848	325 (13)
Hong Kong, China	Hong Kong	205,000	395 (20)	189,221	187 (6)
India	Mumbai	92,429	178 (9)	450,857	444 (16)
	Madras	93,663	181 (12)	456,877	450 (17)
Indonesia	Jakarta	77,819	150 (6)	703,060	693 (20)
Japan	Osaka	144,746	279 (16)	101,435	100 (1)
	Yokohama	359,882	694 (21)	252,198	249 (12)
Malaysia	Port Klang	68,928	133 (4)	163,703	161 (2)
Myanmar	Yangon	189,935	366 (19)	855,384	843 (21)
New Zealand	Auckland	132,250	255 (15)	164,625	162 (4)
Pakistan	Karachi	92,883	179 (11)	356,052	351 (14)
Philippines	Manila	51,848	100 (1)	213,145	210 (10)
Republic of Korea	Busan	92,535	178 (10)	163,809	161 (3)
Singapore	Singapore	157,459	304 (17)	167,497	165 (5)
Sri Lanka	Colombo	132,149	255 (14)	478,948	472 (18)
Taiwan Province of China	Kaohsiung	123,926	239 (13)	228,896	226 (11)
Thailand	Bangkok	63,424	122 (2)	199,961	197 (7)
	Laem Chabang	63,769	123 (3)	201,049	198 (8)
Viet Nam	Saigon Port	81,836	158 (7)	482,562	476 (19)

Table 4-5 Comparison of port tariff levels (1,100 TEU class ship)

Country	Port	Nominal exchange rate		Purchasing power parity	
		Tariff (US$)	Manila=100 (Rank)	Tariff (US$)	Osaka=100 (Rank)
Australia	Sydney	115,143	355 (19)	127,348	195 (9)
China	Shanghai	44,054	136 (7)	191,942	294 (15)
	Tianjin	40,120	124 (4)	174,801	268 (13)
Hong Kong, China	Hong Kong	129,026	398 (20)	119,095	183 (8)
India	Mumbai	45,873	141 (8)	223,763	343 (16)
	Chennai	50,187	155 (11)	244,806	376 (18)
Indonesia	Jakarta	48,509	150 (9)	438,258	672 (20)
Japan	Osaka	93,031	287 (16)	65,194	100 (1)
	Yokohama	226,229	697 (21)	158,536	243 (12)
Malaysia	Port Klang	43,353	134 (6)	102,962	158 (4)
Myanmar	Yangon	107,168	330 (18)	482,637	740 (21)
New Zealand	Auckland	69,638	215 (13)	86,685	133 (2)
Pakistan	Karachi	49,587	153 (10)	190,084	292 (14)
Philippines	Manila	32,437	100 (1)	133,347	205 (10)
Republic of Korea	Busan	54,993	170 (12)	97,351	149 (3)
Singapore	Singapore	99,419	306 (17)	105,757	162 (5)
Sri Lanka	Colombo	82,781	255 (15)	300,023	460 (19)
Taiwan Province of China	Kaohsiung	78,808	243 (14)	145,562	223 (11)
Thailand	Bangkok	34,163	105 (2)	107,708	165 (6)
	Laem Chabang	36,619	113 (3)	115,451	177 (8)
Viet Nam	Saigon Port	40,818	126 (5)	240,693	369 (18)

5. CONCLUSION AND ISSUES RAISED

This study attempted to compare port tariff systems adopted in the ports of the ESCAP region in terms of tariff structure as well as actual tariff levels. One of the advantages of tariff comparisons is that it can show if tariffs are reasonably in line with neighbouring competitors. Tariff comparisons also provide useful marketing information in this increasingly competitive environment of port operation and management. During the course of the study, however, difficulties and shortcomings were posed and some important issues were raised for further review and analysis.

5.1 Model tariff structure

This study utilizes as a comparison base the ESCAP/UNDP Model Port Tariff Structure developed in 1989. The survey results reveal that many ports in the region have fairly simplified port tariff structures, which are similar to the ESCAP model. In some ports of the region, however, tariff items are divided in too much detail, particularly for charges included in the cargo operations group. Nomenclatures of port tariff schedules are not the same across the ports surveyed.

A sound pricing system should be clearly understandable and comparable between one port and another. If port charges are calculated on comparable bases, users will be able to assess the amount of the various charges more accurately, and so reduce the uncertainty in their estimates. Ports also have an interest in adopting comparable bases for calculating charges, since it will be easier for them to evaluate their competitiveness with regard to other ports. It is also desirable to explain clearly each charge specifying which services are included and which are excluded.

Transparency and comparability of port tariffs could be achieved by adopting a common tariff structure among ports, simplified through the consolidation of similar charges.

Following trial implementations of the ESCAP model tariff to four ports in the region, it was reported that the ESCAP model could be easily adopted for use in any regional port and existing charges could be mapped directly to the four service groups in the model structure. Assistance could be provided to the governments and port authorities in the region that might wish to adopt the ESCAP model to simplify their port tariff structure through related advisory services.

5.2 Comparison of port tariff levels

The underlying assumption for tariff comparisons is that the charges being compared are for the same services and ports being compared are competing for the same traffic, which is, in fact, not realistic. Services that are provided for the same tariff item may differ from one port to another. The quality of service may not be comparable and the cost of providing services may be different among ports because the mix of labour and capital employed in providing the services may not be the same. The traffic that will bear port charges may also differ among ports, and the ability to pay the charges may be different depending on competitiveness.

This study attempts to tackle this limitation by creating two hypothetical ships carrying container cargoes and by making a common assumption on the number of containers to be loaded and unloaded in each port. However, this approach also poses unrealistic scenarios and still ignores differences in service quality that may impact on the total costs of port users.

Therefore, the result of the tariff level comparison should not be considered a rating of ports in terms of tariff level. The ratings produced by the analysis indicate the relativity of tariff levels based on two different conversion ratios, namely average exchange rates and purchasing power parity.

Nevertheless, it can be inferred from the results of the tariff level comparison that there exist wide gaps in port tariff levels across the ports in the region. The highest tariff level could be more than seven times higher than the lowest.

The great disparities may be due to differences in the cost of providing port services, which may occur because of lack of cost control, ineffective labour management, and/or institutional inefficiencies such as rigid dock labour schemes creating chronic over-staffing, restrictive work practices, and high wages. Further analysis to identify the main causes of the differences could help governments and port authorities to place themselves in a more price competitive position.

5.3 Trigger model for tariff revision

Ports are also increasingly required to be financially viable and sustainable. For the majority of public and even private sector ports in the region, however, price changes require government approval. The revision of port tariffs can, therefore, be a lengthy process. This results in infrequent yet substantial price increases. This in itself can be problematic for port users and a disincentive to potential private sector investors who would like to ensure an appropriate revenue stream.

An approach to assisting ports more effectively to keep pace with changing cost structures could be the development of a trigger mechanism in which predefined cost indicators such as inflation indices, can be used as the basis for future tariff adjustments. Through this approach, ports would be able to adjust prices to reflect changing costs without resorting to government approval. Port users, who would like to avoid significant and abrupt price increases, could also benefit from the trigger mechanism.

However, port tariffs are not always determined purely on the basis of costs. As discussed in chapter 2, different groups of tariff items can be determined based on different pricing factors: costs, performance, value of the service and market. Adjusting tariffs according to the cost increase therefore may not be enough for ports to keep financially viable and sustainable. In particular, private sector port operators wish to ensure an appropriate revenue stream. In this case, the real income level of the port operators could be maintained by adjusting tariffs taking into account the increase in real gross domestic product.

As a trial attempt to address this issue, a set of port tariff setting models has been developed on the basis of cost recovery. A trigger model for the port tariff revision has also developed in a very simple form. These models are presented in annexes III and IV. These models could be further elaborated to assist the government and port authorities in the region to make pricing decisions in a more effective manner.

ANNEX I PORT TARIFF SURVEY QUESTIONNAIRE

- Please provide the "Port Tariff" currently applied.
- Please fill out the table for the following two hypothetical container ships in local currency in 1999.
  - If a port charge currently charged at the terminal is not included in the list provided in the table, please provide information of the port charge by filling out the type, charging party, paying party, rates and basis in local currency in 1999.

1. Hypothetical Ship (3,000 TEU class)

❑ Basic assumptions

- Containership: 40,000 G/T, 22,322 NT, 43,600 DWT, Length: 252m, 3,052 TEU, Draft 9.5m
- Throughput handled: 1,000 TEU (loading 500 TEU, unloading 500 TEU) for full containers
- FEU : TEU = 2 : 1 = 200 FEU : 100 TEU (based on the real practice in the region)
- Yard storage period: 7 days (including free time)
- Berthing time: 16 hours
- Ship's stay in port during daytime (no surcharge)
- For your reference in the (amount) column, the port charges in 1993 are given

❑ Note

- Conservancy: Utilization of general nautical facilities in the approaches to the port (i.e., outside the port area)

- Port dues: Utilization of general nautical facilities within the port including channels, vessel traffic service, emergency fire services, breakwaters, pollution control, marine security
- Pilotage: Provision of pilot includes all matters ancillary to the provision of the pilot, including labour, craft, shoreside facilities etc.
- Tug service: Provision of tugs
- Mooring/Unmooring: Securing a vessel and subsequent release
- (i) Berth hire (=time of ship alongside size of ship) (ii) Wharfage (=volume/weight/size of cargo)
    - Items (i) and (ii) cover the use of the berth and all associated fixtures, facilities and services including berth/anchorage, fendering, channel depth, workers facilities, rail facilities, roads, fencing, lighting, stacking area, pollution control
- Ancillary service: Provision of various services at berth, for example, cleaning, water, electricity, telephone, garbage, security
- Stevedorage: Handling of cargo from ship to wharf or from wharf to ship
- Wharf handling: Handling of cargo from wharf to road/rail or vice versa either directly or through a transit shed
- Extra movement: Handling, restacking, and sorting
- Special cargo handling: Handling of cargo requiring special attention by reefers, over-height etc.
- Storage: Storage of cargo beyond basic time period
- Packing/Unpacking: Packing or unpacking of containers or unit loads
- Equipment/Service/Facility hire: Use of equipment, facilities and services for various cargo operations described above not provided as standard. It also includes use of transit sheds, stacking areas and other facilities when they are not uniquely associated with an individual berth

Questionnaire

Service group	Type of service		Charging party	Paying party	Rate		Amount
					Basis	Unit	
Navigation	Conservancy						
	Port dues						
	Pilotage						
	Tug service						
	Mooring/Unmooring						
	Others						
Berth	Berth hire						
	Wharfage						
	Ancillary service						
	Others						
Cargo operation	Stevedorage						
	Wharf handling						
	Extra movement						
	Special cargo handling						
	Storage						
	Packing/Unpacking						
	Equipment/Service /Facility Hire						
	Others						
Other business	Real estate						
	Licensing						
	Management service and consultancy						
	Others						

2. Hypothetical Ship (1,100 TEU class)

- **Basic assumptions**

  - Containership: 9,800 G/T, 13,000 DWT, Overall length: 147m, Capacity: 1,100 TEU, Draught Max.: 8.3m, Depth Moulded: 11.2m, Breadth: 22.7m
  - Throughput handled: 600 TEUs (loading 300 TEU, unloading 300 TEU) for full containers
  - FEU : TEU = 1 : 2 = 75 FEU : 150 TEU (based on the real practice in the region)
  - Yard storage period: 7 days (including free time)
  - Berthing time: 10 hours
  - Ship's stay in port during daytime (no surcharge)

▫ Questionnaire

Service group	Type of service		Charging party	Paying party	Rate		Amount
					Basis	Unit	
Navigation	Conservancy						
	Port dues						
	Pilotage						
	Tug service						
	Mooring/Unmooring						
	Others						
Berth	Berth hire						
	Wharfage						
	Ancillary service						
	Others						
Cargo operation	Stevedorage						
	Wharf handling						
	Extra movement						
	Special cargo handling						
	Storage						
	Packing/Unpacking						
	Equipment/Service /Facility Hire						
	Others						
Other business	Real estate						
	Licensing						
	Management service and consultancy						
	Others						

ANNEX II LITERATURE ON PORT PRICING

1. "Charging for Port Facilities" by I. G. Heggie

Elasticity of port demand differs greatly according to the type of cargo, type of vessel, characteristics of the port, hinterland conditions etc. For example, oil and iron ore are cargoes that are required in industrial areas located near the port. Therefore, these cargoes have to use a specific port and thus can be categorized as fixed cargo. On the other hand, other cargoes can be handled at ports that contribute to lowering the total cost, which includes inland transportation cost, ocean-borne transport cost, port cost etc. Therefore, these cargoes are categorized as variable cargo.

Port pricing based on marginal cost theory is recommended for variable cargo, whereas average cost pricing is desirable for fixed cargo because demand is not price elastic. Therefore, this article suggests that port pricing be based on cost factors.

Port costs can be divided into two sectors: capital costs and operation costs:

- Capital costs, which are required in constructing port facilities, generally cover depreciation costs and interest costs. The interest cost factor should be included in port costs as a fixed cost;

- Operation costs, which accrue in maintaining and operating the port facilities, consist of dredging costs, maintenance costs, labour costs for operation, and are characterized by both fixed and variable costs.

Amortization payments of capital costs are dependent upon the annual amortization payments based on marginal costs. Basic information for the economic life of assets and assets valuation should be given in advance.

The article suggests that designated replacement costs should be used as a base of assets valuation at present, and that wharfage be based on the amortization payments of a newly built wharf. It can be proved by a mathematical formula that it is simpler to find the service unit for which actual net replacement costs accrued annually than amortization costs based on a ship's size.

The article suggests that the economic life of assets be based on the expected physical life span, and that marginal social opportunity costs for all the resources mobilized in constructing port facilities be reflected in port tariffs.

A port pricing formula taking into account the annual replacement costs can be described as follows:

$$d = \frac{R_o}{V_o}\left[\frac{1-(1+r)/(1+R)}{1-(1+r)/(1+R)^t}\right]\cdot\frac{1}{(1+r)(1+R)}$$

Where d = the due;

R_o = the real replacement cost of the asset in year o;

V_o = the volume of traffic serviced in year o (measured in nrt or freight tons etc.);

r = the rate of growth of the service provided by the asset;

R = the discount rate;

t = the physical life of the asset.

One of the critical considerations is how to allocate the replacement costs of assets in port pricing, that is to say, how to reconcile the cost centre and revenue centre. For example, berth costs should be distributed between the berth hire and wharfage. But berth hire generally depends upon the ship's GRT, NRT or length overall, whereas wharfage depends upon cargo tons. Therefore, berth costs should be allocated based on reasonable criteria.

2. Port Pricing and Investment Policy by E. Bennathan and A. A. Walters

One of the conclusions in this publication is that port pricing should be based on short marginal cost for the port facilities that are used in supplying one unit of port service. This theory is applicable under the free economy system. It is somewhat of an abstract concept, but is necessary for the efficient management of port facilities.

The authors assert that it is most important to find a criterion for facilities tariffs such as berth hire and port dues. They suggest that it should be ship's length

Limitations of the theory

The port pricing method suggested in this publication is purely theory oriented, and has rarely been applied to real pricing cases.

It is impossible to estimate the marginal costs. As they rely on a competitive market, they cannot be applied freely to the public facilities, such as port facilities.

The publication indicates that government subsidy policies are likely to have negative effects rather than positive effects.

3. "The Economics of Port Pricing" by K. J. Button

Ports possess a public utility element and thus marginal cost pricing theory can be applied in determining the cost to be paid by the users.

In fact, the users of a public utility should be charged the marginal social opportunity cost (MSOC) of the resources that they use. This approach is a price mechanism which gives priority to those who are prepared to pay the full costs, including all external costs, of using the services provided by a port.

If port charges are above MSOC, total port capacity will be sub optimally utilized. It will encourage ships to divert to other, possibly less efficient, ports that are cheaper.

It is assumed that a port exists which offers a range of identical berths to vessels, each berth being equally attractive to potential users. The actual marginal financial costs to the port authority of handling each ship is considered identical and charges are assumed to reflect these direct short-term costs incurred by the port authority in operating a berth.

In any time period, there will be a sufficient number of potential users. Thus, a demand curve reflecting their desire to use the port facilities at different levels of price can be drawn. This demand curve will be negatively sloped to reflect the fact that some ships will be willing to pay more to use a berth than others.

Factors such as the availability of similar alternative facilities at adjacent ports and the future commitments of ships will influence the slope of this curve.

If the number of berths available and the demand for them match, then there will not be problems in berth allocation. In most cases, however, the actual supply of berths is limited relative to the demand for them. Therefore, where the supply of facilities is limited, excess demand occurs, resulting in ship congestion.

In such circumstances, some vessels, if a berth is assured at a definite charge, will either divert to other ports or reorganize sailings. In such cases, the probability demand curve which reflects the influence of the probability of not being able to dock immediately and adjustment of charges is located below the demand curve.

To alleviate port congestion, a higher charge must be levied. When the optimum congestion charge is levied, there is no excess demand and the probability demand curve becomes identical to the actual demand curve, reaching a balance.

The revenue collected by the port authority in excess of short-run marginal costs incurred in handling ships can be used for future port investment. When capacity is increased to that level where no congestion supplement needs to be added into MSOC, the port is of optimum size.

However, it will not be so easy for the port authority to devise the ideal MSOC pricing policy owing to fluctuating demands, inadequate information, administrative problems etc. Although it is very difficult to find, within a short-term period, a demand curve and a probable demand curve which are in line with the financial objectives of the port authority, this theory suggests that the probable demand curve is inside the actual demand curve. Therefore, where excess demand occurs, it is more advantageous to apply the MSOC pricing policy than the conventional analysis method.

4. "Port Charging Practices" by B. J. Thomas

This paper provides an analysis of the merits and demerits of various theories on port stevedoring charges.

(a) Commodity rate method

Commodity classification is based on the cargo-handling characteristics of the commodity in question. A cost analysis is conducted on the cargo by applying the average stevedoring cost in the stevedoring tariff. This practice has resulted in some complex tariff structures because cargo types, stevedoring methods and input elements are diverse.

According to this method, the commodity rate is calculated on the basis of costs. A fixed rate is levied per work unit of each commodity. Therefore after a certain period, the rates have to be adjusted to reflect the market situation.

In such cases, even if productivity increases and cost reduces, it acts as an incentive to improve productivity for the stevedoring companies because a fixed rate is applied. However, from the dockworker's viewpoint, it is not a good method to enhance productivity because even if they improve productivity, they still receive a fixed wage. To sum up, this method has a complex tariff structure and is not a sufficient incentive for enhancing productivity.

(b) Cost-plus method

The cost-plus method is widely used. The charges applied guarantee the direct cost from stevedoring and overhead costs. Cost is reduced with improved productivity and a certain level of bonus is paid to labour.

However, if productivity improves, direct cost decreases and profit automatically is reduced. In addition, the investment in equipment is not compensated and thus provides no incentive for productivity improvement.

(c) Sliding scales method

This method considers the average stevedore's costs and fixed profit, and compares them with a predetermined productivity to arrive at the initial rate. Productivity fluctuation is reviewed on a regular basis during the contract period, and it is linked to the rate.

It contributes to improving productivity because the shipowner and stevedore jointly assumes responsibility for production fluctuation by sharing the burden of cost reduction resulting from productivity improvement.

However, there is the difficulty of predetermining in-depth the cost and productivity.

(d) Consolidated system

A consolidated rate for each commodity is predetermined that incorporates numerous costs associated with various stages of stevedoring. This is then quoted as a single rate per stevedoring unit.

If the rate is determined wrongly, the stevedore may incur losses, so strict pre-investigation is required for rate determination. This method allows for a simple and easy application of the rate.

5. Usage Pricing for Public Marine Terminal Facilities by MARAD (U.S. Department of Transportation Maritime Administration)

This publication provides the formula for calculating port charges under the concept that port charges have to be determined so as to recover costs.

First, depreciation, maintenance cost, taxes and insurance fees, terminal operating cost, general administration cost etc. were calculated in order to determine the port operation cost. Second, the imputed cost for the port is estimated and calculated.

Third, costs apart from the costs mentioned above are estimated and calculated. Fourth, total revenues can be calculated by adding the above three costings.

Revenues from port facilities charges, except for wharfage should be calculated first. This requires the calculation of berth hire, wharf preferential charges, storage and other port charges.

In order to estimate wharfage, sums of all the port revenues except for wharfage should be deducted from the target revenue and this value should be divided by total cargo throughput volume of the port. This produces wharfage per unit cargo.

The publication is a useful guide in port pricing. However, it has two defects. It does not take into account the full cost of private sector terminal leases, which constitute a substantial part of port charges, and it does not deal with port charges for the water facilities.

ANNEX IV TRIGGERMODEL FOR TARIFF REVISION

When the cost analysis is finished, one might suppose that relating the cost data to tariffs would be the next logical step. But if the port charges of nearby ports are not so high rather lower than those of one's own port, then the cost data will not work satisfactorily as tariff guidelines. This is particularly true nowadays as the services provided by the ports are under severe competition.

It has, so far, been assumed that cost retrieval is a natural process. The increase in port charges in proportion to price increases is a critical process. A remarkable example of a tariff increase is found in the United States of America, where the port authorities were forced after 1970 to increase the port price. Ports in the United States did not change their berth hire and wharfage between 1948 and 1966. But port authorities increased their port charges shortly after 1970, supporting the rationale that the tariff level should be kept in line with the price increase. One advantage of this solution may be that it has sometimes been found very effective in detering the sharp increases in the port tariff.

Apart from these basic propositions, the following factors should be considered in adjusting and revising port tariff levels:

(a) Port tariffs, with reference to fluctuating price levels, should be increased at regular intervals;

(b) The rate of port price increase should be kept as low as possible at short time intervals;

(c) The port authorities need to gain full understanding for the increase from the users, and are consequently under an obligation to give rational and righteous reasoning for the increase.

1. Introduction

If a port tariff model is set suitably for a port and a port tariff level decided, then the port tariff level should be amended based on the change of economic situation each year.

Generally, the price index reflects normal economic fluctuations. Port authorities, as service providers, can maintain real port price per cargo or ship by making port tariff levels respond to the price index.

It goes, however, without saying that, if current charges are already kept too low, or if the port policy is to gain some commercial profit in the long run, there is a need to increase the real price strategically and gradually. In this case, the increase in real GDP should be considered as the maximum increase rate for port prices. For example, a stevedoring company can expect to increase their own port charge (stevedorage) taking into account the rate of increase of real GDP.

But a port charge item may consist of more than one service. For example, on-board stevedorage is made up of T/S charge, shifting charge and cargo handling charge. If the cargo composition rate of the stevedoring company is changed for a particular year, the real income of the company may not be maintained in spite of applying the price index.

It would be reasonable to introduce the port tariff change model so that the real income of the service provider (whether it be public or private sector) is maintained instead of applying the price level by charge item.

2. Model

The port tariff change model can be set as follows.

The average income of a port during fiscal year t is given by:

$$UP_t = \frac{R_t}{T_t}$$

UP_t: unit income earned by all related service providers for all services during the fiscal year t

R_t: total income earned by all related service providers during the fiscal year t

T_t: estimated traffic volume for the related service during the fiscal year t

The maximum unit price of all the normal services provided by a specific service provider is therefore:

$$MUP_t = CPI_t * \sum_{s=1}^{n} \left[UP_{s,b} * \frac{T_{s,t}}{T_t} \right]$$

MUP_t: the maximum unit price provided by the service provider of related charges during the fiscal year t

CPI_t: consumer price index in fiscal year t

b : base year

$UP_{s,b}$: unit income by service provider related to the service category p during the beginning year. In other words, the following must hold true: the UP in $/GT) that all regulated entities derive from regulated prices charged for the provision of, or in connection with, regulated services provided by that regular service provider in connection with channel service category p during the base year calculated in accordance with the following formula:

$$UP_{s,b} = \frac{R_{s,b}}{T_{s,b}}$$

$R_{s,b}$: The total revenue that all regulated entities derive from regulated prices charged for the provision of, or in connection with, regulated services provided by that regulated service provider in connection with service category s during the base year

$T_{s,b}$: the expected traffic volume of related service category S during fiscal year t. $T_{s,t}$ > fiscal year t. $T_{s,b}$ ->base year

T_t : the traffic demand during fiscal year t such as stevedoring quantity, tonnage of ship arrivals)

$\sum_{s=1}^{n}$: the sum of all service categories

If the real income of the service provider is allowed to be increased, then the final model in the system is given by

$$MUP_t = CPI_t * \sum_{s=1}^{n}\left[UP_{s,b} * \frac{T_{s,t}}{T_t}\right] * IRGDP_t$$

It is important $IRGDP_t$: increase in real GDP during the base year to note that the ultimate decision to allow real GDP increases is the responsibility of the port authorities.

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