PRIVATIZATION AND REGULATION OF THE SEAPORT INDUSTRY

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1. - INTRODUCTION

The relevance of seaports in the efficient working of an economy cannot be understated since all goods and passengers transported by sea require the use of, at least, two ports. In the majority of countries, most international trade (export/import), and in some cases also large shares of domestic trade, is done through maritime transport. For long-haul shipments, there are no alternative transport modes to ships, with the exception of high-value and small volume cargoes, for which air transport offers speed as its advantage.

Seaborne traffic depends on seaports for all its operations, since ports act as *interfaces* between maritime and inland modes of transport (railways, road or inland navigation). Therefore, in order to have an efficient maritime transport system, seaports must be guaranteed to work efficiently. The basic objective of a seaport is to provide a fast and safe transit of goods and passengers through its facilities, so that generalized costs for passengers (fare+time) and for shippers (tariffs+storage time) are minimized. Another role that some large seaports play is to serve as *hubs* for connection and transshipment, allowing cargoes on different long-haul routes to be served more efficiently by several ships.

The role of a modern seaport can be summarized in the following UNCTAD definition (*United Nations Conference on Trade and Development*): "Seaports are interfaces between several modes of transport, and thus they are centers for combined transport. Furthermore, they are multi-functional markets and industrial areas where goods are not only in transit, but they are also sorted, manufactured and distributed. As a matter of fact, seaports are multi-dimensional systems, which must be integrated within logistic chains to fulfil properly their functions. An efficient seaport requires, besides infrastructure, superstructure and equipment, adequate connections to other transport modes, a motivated management, and sufficiently qualified employees."

In the above definition, one of the main characteristics of seaports is stressed: a seaport is not merely an organization that provides a *single* service, but instead, seaports provide multiple activities. It is therefore interesting to study in detail all those taks, in order to evaluate the most efficient provision of these activities from an economic point of view. Moreover, since all port activities take place in a limited area, it is also relevant to study how they are coordinated, and what is the role that *port authorities* –or any other responsible institutions– must play in regulating seaports' infrastructure and activities.

In the last decades, we have witnessed profound changes in maritime transport, which have modified the balance between capital and labor at seaports. Ports are now increasingly becoming capital-intensive industries, while in the past they used to be labor-intensive. This change has generated an excess of employees in most ports around the world. The development of containerized transport is another factor that has significantly modified ports' operations. Containers have allowed large cost reductions in cargo handling, but they have also imposed new needs on ports in terms of equipment (gantry cranes, specialized terminals improved pavements, etc). On the other hand, economies of scale obtained by the transport of large quantities of containers and bulk cargoes have led to the building of

increasingly larger specialized ships that require substantial port investments in new infrastructures and equipment.

All these technical changes have generated a highly competitive environment in the seaport industry, especially between those large ports with the facilities to serve regular deep-sea traffic from liners. Modern ports no longer have a monopolistic position in the transport of goods to neighboring regions (*hinterlands*). The development of integrated transport chains has reduced transport costs to such an extent that it is now often preferable for a shipper to use a distant port instead of a closer one, provided that the former has better facilities and connections than the latter. Therefore, modern ports must be extremely competitive to be able to offer optimal combinations of time/price for those firms demanding their services.

Technological changes and a more competitive environment have induced a consideration of the role that the public sector must play in the running of seaports. Traditionally, in most countries ports have been owned and managed by public institutions. Public ownership in the seaport industry has usually been justified by the argument that seaports play a key role for national economies, and they have special characteristics that can easily provide the firms running port facilities with market power (expensive specialized assets, sunk costs, indivisibilities and economies of scale).

Moreover, in some countries seaports are regarded as focal points for regional development, and accordingly, they justify the outlay of subsidies from governments for the building and improvement of port facilities. As an example, seaports in North Europe (Antwerp, Rotterdam, Hamburg, etc) have long traditions of being linked with municipalities, even up to a point that in some cases it is difficult to disentangle port accounts from local public accounts.

However, even though the public sector has usually been present as port organizer, it is not evident that public organization of this industry is necessarily the best option. In particular, tighter public budgets and increasing fiscal needs have led many countries to seek private participation in seaports. Private firms' involvement in ports is not new for the provision of services, since many firms were already present in ports around the world, but it is quite innovative in the construction of port infrastructures. International experiences have shown that private participation in both these aspects (operations and infrastructure) has improved significantly the outcomes of some seaports. These experiences make a case for a revision of the traditional organization of seaports around the world, changes that will prepare ports for a more competitive market and less financial help from governments

This work offers a revision of the characteristics of all the different services provided by seaports, and describes the approaches used worldwide to introduce private participation in the industry. The challenge that modern ports now face is to design more adequate regulatory mechanisms to guarantee efficient outcomes in a context of tight public budgets, particularly in developing countries. There are no unique answers applicable to every port, therefore we try to provide a panoramic view of the feasible models a port can follow, and the best practices observed worldwide.

The structure of the paper is the following: section 2 presents a brief description of the economic characteristics of seaport activities. Section 3 describes the problems and challenges that traditional ports face in adapting to changes in maritime transport. In this section, we also examine the different aspects a concession contract – one of the basic instruments to introduce private participation in seaports – must cover. Some of the more innovative international experiences are also described here. Section 4 is devoted to analyzing regulatory mechanisms over the different tariffs that seaports charge their users, while section 5 discusses regulation affecting quality and safety. Section 6 contains definitions and characteristics of some performance indicators for seaports, which are useful for regulators to obtain information. Finally, section 7 examines the roles that the different institutions responsible for seaports must play in the new context of this industry.

2. - DESCRIPTION OF SEAPORTS' INFRASTRUCTURE AND SERVICES

2.1. - Economic analysis of seaports' activity

Defined in broad terms, a seaport can be considered a single organizational unit that provides a service to ships. However, when its internal workings are analyzed in detail, it is clear that there are *multiple* services being produced and demanded within a port area (services to ships, to cargo, and to passengers). Even for a type of service such as cargo handling, technologies can vary enormously depending on the type of cargo, up to the point that, for example, container loading can be regarded as a different service from bulk cargo handling. Therefore, instead of a single unit, a seaport is better characterized in economic terms by considering it to be a multi-product organization. Seaports offer many different services to ships, which in some cases can all be offered by a single company (small ports), but more often, are provided by independent firms working within the port area.

There are two basic characteristics that define the organization of seaports' activities. On one hand, the infrastructure where these activities are performed – berths, quays, storage areas, etc – is expensive to build (*see Box 1*) and exhibits a problem of indivisibility, i.e. it is not possible to enlarge a port in a continuous way. Port infrastructures must be built with determined minimum dimensions, and in general, their full design is strongly conditioned by the physical characteristics of the coast where the port is located.

Box 1. **Typical civil works unit costs for port infrastructure** (*)

Dredging (confined space restricted by existent berth requirements)	$ 7.5 / cu.m
Quayside (35m wide berth)	$ 54,000 / m
Container yard paving and infrastructure	$ 63.8 / sq.m
Open storage yard	$ 55 / sq.m
Sheds	$ 375 / sq.m

(*) 1997 data, for a 14 metre draft 500-600 m long berth.
Source: Drewry Shipping Consultants (1998)

On the other hand, due partly to high construction costs and partly to physical conditions, the available areas for performing seaport activities are generally very limited. This space limitation implies that the number of feasible operators that can provide services within a port area is, by definition, reduced. In particular, depending on the port's total size, in some small ports there will only be enough room for a single firm to provide some services. Market size plus physical restrictions are the factors that typically preclude the possibility of competition at some ports.

Since there are many aspects involved, it is useful to divide seaport activities between: (a) infrastructure, (b) services provided by the port, which require the use of the former, and (c) coordination between the different activities performed at ports. The main characteristics of these three elements are analyzed below.

2.2. - Description of seaports' infrastructure

The European Union uses an interesting definition of what is and what is not considered a port infrastructure (European Parliament, 1993). First, the *port area* is defined as a complex of berths, docks, and adjacent land where ships and cargoes are served. To reach that area, it is required to have infrastructures related to maritime access (channels, locks, aids to navigation, etc) and to land access (connections to roads, rail network, and inland navigation). *Figure 1* shows a scheme of the different types of infrastructures required by a port.

Therefore, the area where seaport activities takes place encompasses both the infrastructure within the port (berths, quays, docks, storage yards, etc) and the superstructure. Among the elements forming the superstructure, it is possible to distinguish between fixed assets built on the infrastructure (sheds, fuel tanks, office buildings, etc) and fixed and mobile equipment (cranes, van carriers, *trastainers*, etc).

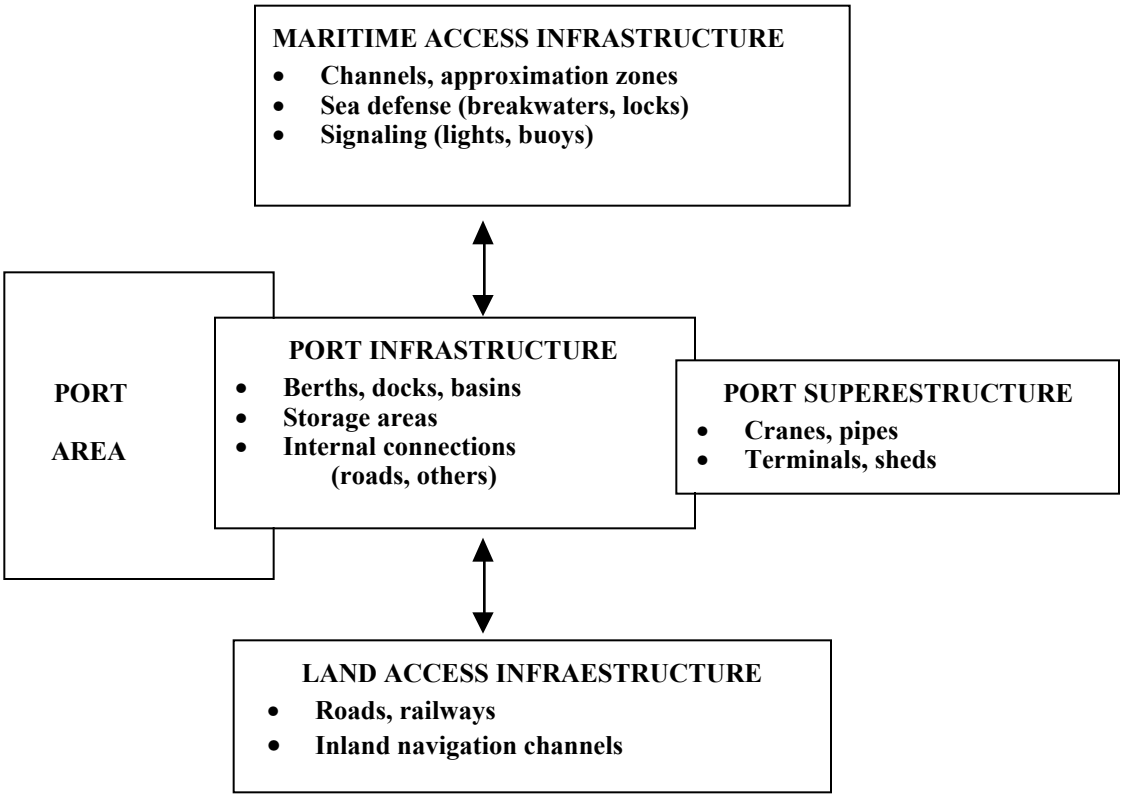
When discussing port infrastructure, it is convenient to define precisely those elements that are included and excluded. As it can be observed, there are infrastructures outside the port area, but these are essential for the use of a port (maritime and land accesses). In general, port authorities have responsibility over some of the maritime access infrastructures –breakwaters, lights, buoys – and all elements within the port area. Meanwhile, connections to land networks and the remaining forms of maritime access (channels, locks) are generally owned and maintained by the State or local government.

In almost all countries, port infrastructure has traditionally been designed and maintained directly by port authorities. Public funds were used to finance the building of new infrastructures, It was argued that these assets should be in the public sector, to avoid the risk of monopolization by private firms. However, there is at present a global trend toward

revising this model. In particular, there is a move toward increasing the participation of private capital in the building of infrastructure, generally through the use of concessions.

A seaport system based on concession contracts encourages private firms to become the agents making the required investments to build new infrastructure or enhance existing facilities. Concessions offer incentives to private investors, which are required because firms are in charge of infrastructure construction and must pay all costs. After a project is completed, they are granted the right to operate those facilities. Typically, concession contracts are offered for long term periods so that private firms are able to recover their investment costs. It is extremely important that concession contracts should be properly written, in order to determine the ownership and the rights of use over the infrastructure that is subject to concession.

***Figure 1*. Scheme of seaports' structure**



Given the importance of seaports for international trade, the objective of national seaports' systems should be to see the efficiency gains that private firms can achieve. Private participation in seaports can be used as a possible solution to the problems observed when a port is fully public (lack of incentives, excess of workers, etc). However, a system based on private operators providing port services must ensure that these agents are not left completely unregulated, otherwise tariffs may be raised excessively, or the quality of service lowered. An argument in favor of regulation concerns the impact that monopolistic behaviors could have over the rest of the economy, in terms of high tariffs that eventually

would be transferred to higher inflation rates through those goods directly or indirectly affected by port services.

2.3. - Description of port services

Besides the provision of basic infrastructure for the transfer of goods and passengers between sea and land, there are multiple services provided by different agents at ports, some of whom may even work outside the port area. These services cover all activities linked to the connection between port users and port, from the moment that a ship approaches a port until it ends all its operations. During this period, there are services provided to the ship, to passengers, to ships' crews and to cargoes (De Rus et al, 1994).

First, there is a group of services related to *berthing*, which include pilotage, towing and tying. All these services can be directly provided by port authorities, or they can be offered by private firms. Pilotage is defined as those operations required for a ship to enter and exit a port safely, and it usually implies the presence in the vessel's bridge (or at least a contact by radio) of an expert with sufficient knowledge of the zone to avoid risks. Pilots can be independent private agents in some ports, licensed by the port authority, while in other cases they are public employees. Towage is the operation of moving a ship using small powerful boats (named tugs) to steer it more easily. Again, it is possible to have private firms providing services for these operations, while in other ports tugs and their operators are directly hired by the port authority.

One of the more important services provided to cargo ships is what is generically labeled as *cargo handling*. This encompasses all activities related to the movement of cargo from/to ships and across port facilities. There is a historic separation between the operations of moving goods from ship's side until they are safely stored within the vessel (*stevedoring*), and those movements from berth to ship's side (*loading*), as a result of these operations traditionally being performed by different workers. Today, however, there are specialized firms that provide all these cargo handling services, using equipment such as cranes and surface transport elements.

The process of cargo handling varies according to the type of goods involved. There is a trend toward the specialization of firms according to the type of cargo, since the equipment required can then be specially designed to be highly cost-efficient. Thus, specialization leads to the formation of *terminals*, defined as specialized berths where all operations are mainly concentrated on a given type of cargo. Container terminals constitute the best example of this trend, since the handling of containers requires large gantry cranes, and land storage is relatively easy with adequate trucks and lifts, but it is highly space-consuming. All these factors make it more convenient for a firm to have a specially designed berth in order to handle containers more efficiently than general cargo berths.

Of the total cost involved in moving goods through a seaport, cargo handling charges are the most important (between 70% and 90% of total cost, approximately, depending on the

type of goods). Therefore, this is one of the services that must be supervised more closely by a regulator in order to ensure cost-efficient port operations.

Another type of service demanded by port users are those related to administrative paperwork and permits (sanitary certificates, import/export documents, taxes, etc). These are usually performed by specialized agents or *consignees*, who are hired by shipping companies to arrange in advance the paperwork and all matters related to the use of port facilities by a ship. Even before a ship calls at a port, consignees start working to arrange that all services required (handling, repairs, supplies, etc) are contracted for the ship and performed in the shortest feasible period.

It is essential for a modern port to have systems to minimize the burden of paperwork for port users, since delays originating in inefficiency in administrative procedures result in large economic losses to shippers, who do not receive their goods on expected dates and thus have to alter their productive plans, and to shipping companies, which have to keep their ships in ports for longer than necessary. In the European Union, there are some guidelines established to promote ports' investments in developing electronic data interchange systems (EDI). These systems are aimed at speeding up administrative paperwork and reducing waiting times for ships and land transport modes (trucks, railways) that deliver goods to/from ports (European Commission, 1997).

Finally, there is a series of other ancillary services performed by different agents and firms, working within or even outside the port area. In this group, all supplies to ships must be included, of which fuel and water are probably the most important. There are also services to crew members (medical, etc), and general common services such as cleaning, refuse collection, safety and the like. Some ports can also offer repair facilities to ships, which may involve the use of some special infrastructures.

In summary, there are many different services offered by a port. These services can be performed by a combination of public and private initiatives, and there are several models of ports indicating how private participation is introduced. A summary of all services described in this section is shown in *Box 2.* From the regulatory point of view, the provision of infrastructure and cargo handling are the more relevant services, since an efficiency in seaports is dependent on these two services. Other services can be provided by private firms working in more or less competitive conditions. The need for regulation is, therefore, not so strong for them.

Box 2. **Port services**

1. Infrastructure provision 2. Berthing services: • Pilotage • Towing•Tying 3. Cargo handling: • Stevedoring • Terminals • Storage • Freezing (fish, others)	4. Consignees: • Administrative paperwork for ships and cargo • Permits (sanitary, customs, etc) • Service hiring 5. Ancillary services: • Supplies • Repairs • Cleaning, refuse collection • Safety

2.4. - Coordination between seaports' activities: port authorities

There are many different activities being performed simultaneously within the limited space of port areas, with ships constantly entering, being serviced and exiting. Therefore, there is a need for an agent to act as a coordinator to ensure the proper use of common facilities, and to take care of safety and the general design of port facilities. In most seaports, this function is played by an organization called the *port authority*. These are generally public institutions, where local interests are represented, but this configuration is not unique, and it is possible to find examples of purely private port authorities.

There are several organizational modes for seaports, depending on the role that port authorities assume. These are usually labeled as *landlord port, tool port* and *services port* (Juhel, 1997):

- ***Landlord port***: In this model, port infrastructure is owned by the port authority, which is also in charge of its management. Meanwhile, remaining port services are provided by private firms that own the assets conforming to the port superstructure and all equipment required for service provision (cranes, vans, forklifts, etc). Examples of this type of port organization are Buenos Aires (Argentina) and Rotterdam (Netherlands). In general, this is the most common form of organization for large ports.

- ***Tool port***: As in the landlord model, port authorities are also the owners of infrastructure, but in this mode of organization, they also own the superstructure (buildings, etc) and the equipment (cranes, etc). Private firms provide services by renting port assets, through concessions or licenses. Examples of this category are Antwerp (Belgium) and Seattle (US).

- ***Services port***: In this model, port authorities are responsible for the port as a whole. They own the infra- and superstructures, and they also hire employees to provide services directly. The port of Singapore has usually been used as an example to illustrate this type of organization, since its port authority (PSA) is the owner of all assets and it provides all services. However, there are already advanced plans for PSA to introduce private participation and thus become a *tool* port.

If a connection between the type of port and ownership is to be established, it can be concluded that port authorities of the *landlord* and *tool* models are generally public, while the port operators are private firms. Therefore, these two types could be classified as mixed-ownership, since although the basic infrastructure is generally public, many elements of the port can be owned by operators. Meanwhile, *services* ports are more likely to be privately owned, where there is a single private firm operating the port as a single unit.

However, even though this is the general pattern, it is possible to find examples in the port industry where ownership and mode of organization do not follow the scheme above. Thus, for example, it is possible to find *services* ports that are fully public (Singapore, although this port is likely to be soon transformed as mentioned above), and *landlord* ports where infrastructure is privately owned. *Appendix 1* shows the type of ownership for the 50 largest world ports according to container traffic. In this ranking, it is possible to observe a trend in the seaport industry toward ports with mixed ownership, at least for large ports.

In principle, the role of port authorities should be exclusively confined to the provision of infrastructure and the coordination of port services. However, in many countries where there is no regulatory institution for seaports, port authorities perform many other tasks, such as investment planning and financing, or regulation of the tariffs that private operators charge to port users. *Box 3* shows a summary of all activities typically performed in practice by port authorities.

***Box 3.* Traditional functions of port authorities**

- Provision of infrastructure for maritime access
- Provision of infrastructure within the port area
- Strategic port planning
- Promotion and marketing
- Regulation and control of safety within the port
- Environmental protection
- Managing port assets (infra and superstructure)

Some port facilities have traditionally been regarded as public goods (lights, access channels, etc). However, a seaport considered as a whole does not exhibit public good characteristics due to the impossibility of excluding users and the unfeasibility of producing the same quantity of services to more users without increasing costs. Therefore, seaports are organizations that from an economic point of view do not necessarily have to be in the public sector. They can be run as commercial institutions.

On the other hand, many port activities are regarded in some countries as 'public services', in the sense that port users believe that these services should be available to any user – such as berthing services, or cargo handling – but there is no reason for the public sector to be obliged to provide them directly. Only in particular situations, as in the case of very small seaports serving isolated communities, is it possible to find conditions where public intervention would be required in order to guarantee the provision of port services, since the seaport would be vital for the community's basic welfare. However, even in this case, it is not strictly necessary that a public company should be providing port services, but instead they could be offered by subsidized private firms.

3. - SEAPORT INDUSTRY REGULATION

3.1. - Situation of seaports before privatization and liberalization

A traditional seaport, before the introduction of reforms reflecting changes in the maritime transport industry, could be described by the following:

- State or local government budgets are used to finance the building of most large infrastructure construction costs, but public budgets are becoming tighter.
- Port authority (generally public) finances the costs of maintenance and repairs for infrastructure.
- Port authority is financed partly with public funds, and the rest by port tariffs and fees from private firms operating in the port.
- There is an excess of employees working in the port, who have a high degree of unionization and strong positions at collective bargaining.
- Port efficiency in terms of tariffs and waiting times for ships is relatively poor.

Regarding infrastructure financing, we can find many different situations across the world (*see Box 4*). In particular, it is possible to identify a *municipal* model of port, such as those in North Europe (Netherlands, Belgium, Germany); a *state* model, such as those used in South Europe and South America, in which central governments control and finance all main ports; and a *private* model of port, where investment costs are paid by private firms or by port authorities from the resources obtained from charges to port users. This last model is more common in countries with a British tradition, which regards ports as commercial rather than public institutions.

Regarding the efficiency of seaports and the type of ownership, some authors point out that it is possible to find counter-examples in order to argue that there is in fact no relationship between efficiency and the type of port ownership. In the literature on seaport industry, the comparison between Singapore and Hong Kong is often mentioned. Both are highly efficient ports, with the former being completely public and the latter private. However, even though some remarkable exceptions do exist, it is common to find a gap between private and public seaports.

Therefore, even though each point mentioned above can be argued, we believe it to be a valid average representation of the state of the industry. This list of stylized facts does not pretend to reflect the exact situation of all seaports in the world, but only to pinpoint the main questions that those seaports that have started introducing reforms have already faced. All traditional seaports will surely have to respond to similar challenges in the near future. Changes that have occurred in the maritime transport industry are irreversible, and all world ports will be affected by them.

Box 4. Finances of port infrastructure across different countries

	Maritime Access Infrastructure	Port Area Infrastructure	Port Area Superstructure	Land Access Infrastructure
Argentina	P.A./Private	P.A.	Private	Most port authorities are responsible for roads and other transport connections within port areas. Connection to the hinterland is usually competence of governments. Regarding railways, responsibility can be national (Belgium), port authorities (Germany) or the railways concessionaire (Argentina). In the case of Hong Kong, private sector is responsible for transport infrastructures within the port area.
Belgium	State	Public	Private	
Cyprus	P.A.	P.A.	Concession	
Denmark	P.A.	P.A.	Private	
Finland	P.A.	P.A.	Private	
France	State/P.A.	Public/A. P.	Concession	
Germany	State	Public	Private	
Greece	State	Public/A. P.	Concession	
Hong Kong	P.A.	Private	Private	
Ireland	P.A.	P.A.	Concession	
Italy	State/P.A.	Public/A. P.	Concession	
Malta	State	P.A.	Concession	
Mexico	P.A.	P.A.	Private	
Netherlands	State	P.A.	Private	
Portugal	P.A.	P.A.	Concession	
Spain	P.A.	P.A.	Concession	
Sweden	P.A.	P.A.	Concession	
UK	P.A.	P.A.	Concession	
Venezuela	P.A.	P.A.	Private	

Sources: European Parliament (1993), ESPO (1996)

Notes: (1) P.A. = Port Authority (financed with own resources)
(2) Public: Financed by central, regional or municipal governments
(3) Concession: in cases indicated, superstructure is publicly owned but operated by private firms.
(4) This classification refers to main seaports of each country. In every case, it is possible that within the same country there may exist ports with other alternative modes of financing infrastructure than shown here.

Technological changes introduced in the last decades in the maritime transport sector can be summarized in two points: (1) containerization of cargo; and (2) development of larger and deeper specialized ships. These transformations have led to some new requirements for seaports to modernize their infrastructures and to buy new equipment in order to continue to be able to provide services to shipping companies.

Regarding the first change, it can be observed in the figures on the world traffic of containers. The fast growth of this mode of transport started in Europe, the US and Japan, but it is now spreading elsewhere. *Box 5* presents figures for different regions in the world, and it is remarkable to observe the spectacular growth rates of South America, Asia and

India, and in general, all developing countries. Four of the five largest world ports in terms of container traffic are located in Southeast Asia: Hong Kong, Singapore, Kaohsiung (Taiwan) and Pusan (South Korea).

Box 5. Container world regional traffic (million TEUS)

	1980	1986	1990	1995	Change 1980-1995
Southeast Asia	9.08	19.10	32.42	61.84	581%
Europe	11.49	17.76	23.25	33.06	188%
North America	9.92	13.42	16.49	21.85	120%
Caribbean/Central America	0.96	2.68	3.56	5.39	461%
South America	0.38	1.04	1.44	2.76	626%
Middle East	1.38	2.32	2.90	5.40	291%
India	0.26	1.08	1.83	3.17	1,119%
Australia	1.61	1.95	2.33	3.46	115%
Africa	1.27	1.74	2.42	4.66	267%
Total	36.35	61.09	86.64	141.59	290%

Source: Ocean Shipping Consultants (1996).

The changes in the types of ships used can be perceived by studying the increase in the size of ships performing long-haul services. There are now economies of scale evident in the use of larger specialized ships, which allows them to transport larger volumes of cargo at lower unit costs. This has led to spectacular rises in the capacity of ships, and at present, the last generations of container ships (Post-Panamax) oscillates between 5,000-6,000 TEUS[1] with a width of more than 16 containers abreast on deck and a draft of more than 12 meters (Hayuth and Hilling, 1992). For the transport of oil and other liquid cargoes, most of the world fleet of tankers is now above 300,000 GRT.[2]

These two ÔrevolutionsÕ in the maritime transport industry have forced seaports to start a fast renovation of their facilities, in order to be able to provide services to the new needs of shipping companies and, in particular, to a growing demand for container handling services. Seaports now face a more competitive situation than in the past, and so they must have the required facilities as well as low prices, or they risk losing traffic to rival ports. On the other hand, these companies are increasingly working with hub-and-spoke networks, therefore they demand the services of large ports that act as connection nodes (hubs) at which cargoes are transferred to smaller ships that perform services on a regional basis (feeder services).

[1] Twenty-foot Equivalent Unit: standard measure commonly used in the container industry.
[2]

3.2. - Forms of private participation at seaports and regulation needs

When choosing the best form to introduce private participation in the organization of port services, there are several alternatives depending on port size, initial conditions and the type of service considered. Among the different possibilities, the following can be mentioned:

- Selling the seaport as a whole (*full privatization*). Using this form, all assets and liabilities are transferred to the private sector, which can be justified by serious fiscal needs from the public sector.

- Transferring to the private sector parts of the seaport for their development by private operators (*Build, Operate and Own, BOO*). Short-term financial needs justify the use of this form of privatization.

- Introducing private participation in the port in order to build or renovate facilities required for service provision (*Build/Rehabilitate, Operate and Transfer, BOT or ROT*). In this case, the public sector does not lose ownership of the port infrastructure, and even those new facilities built by private firms are transferred to the public sector after a specified period of time. This is the case of classical concessions, which are discussed further in *section 3.3* below.

- Creating a new independent company, from the combination of efforts from two or more firms: *joint-ventures*. This type of agreement arises when two parties with common interests join forces. Thus, for example, in some cases a firm can supply technology and know-how, while another might have knowledge of market opportunities and customer contacts.

  These agreements are not exclusively signed between private firms. There are examples of collaboration between port authorities and private firms, as in the cases of Shanghai (China), Kelang (Malaysia), and other Asian ports with large investment projects, where port authorities have formed many joint-ventures to develop and operate new terminals. In other cases, collaboration may be found between several public firms, as in the example of the Singapore Port Authority with the authority of Dalian, to develop and operate a container terminal in the port of Dayaowan (China).

- *Leasing*: in some cases, port authorities simply rent port assets to be used by private operators during a fixed period, and thus they obtain income from contract fees. Contrary to concession contracts, in this case private firms are usually not required to make investments, therefore they only assume commercial risks. Some port facilities, such as storage buildings or cranes, are rented by operators under this scheme.

- *Licensing*: in this case the port authority allows operators to provide some services which only require relatively simple equipment, and thus assets are generally owned by private operators. Infrastructure is provided for these operators to use it, generally for

some specified fee, and in some cases they may also use some superstructure elements owned by the port authority. Stevedoring companies, pilots, tug operators or consignees can work under this type of agreement.

- *Management contract:* a simple form of introducing private participation in a port is by contracting out the port management. In this situation, the port authority is the owner of infrastructure and port facilities, but decisions on its running are taken by a private firm which can provide a more commercial approach to operations. Both investment and commercial risks are in this case faced by the public sector, since managers do not invest their own capital in the port. The port of Bristol (UK) is an example of this type of contract, where facilities are owned by the local government, but the port is managed privately.

When choosing among the options in the list above to determine which is the best alternative for a particular port, the port objectives must be evaluated, and the constraints that the port authority faces must be considered. The type of service may determine the possible degree of private participation. A basic determinant would be to consider whether the service requires the exclusive use of a port's fixed assets:

a) Services that do not require an exclusive use of infrastructure or superstructure port facilities

Within this group, there are services such as pilotage, towing, consignees and the other ancillary services to ships and crew. In many ports, as a result of safety arguments, there is a tradition that some of these services be provided by the public sector. In particular, all berthing services are in most cases considered a 'public service obligation' – i.e. every port user has a right to be provided those services – and are therefore directly provided by port authorities to avoid the possibility of the service being disrupted.

Pilotage is a typical example of a compulsory service organized on a monopolistic basis in many ports. Pilotage is required for ships above some given capacity or length, and for dangerous cargoes. There are exemptions in most ports, such as for regular passenger services (ferries). The degree of public intervention in this service varies across countries. In some of them, pilots are civil servants, and thus they are subject to common state rules. In other cases, they are organized as independent agents more or less self-regulated by their own associations.

Regarding other berthing services (towage and tying), there are also diverse solutions among ports. Both are generally considered a 'public service obligation', and in practice are performed directly by port authorities or indirectly by licensed private operators. Towing services can be provided exclusively by a single firm, or in the case of large ports, it can be feasible to have several companies competing among themselves (De Rus et al, 1995). Some ports do not strictly control these services, and they only require some minimum conditions (technical capacity, safety and environmental standards, etc) for private

operators to have a license to operate. In this case, towage tariffs can be determined by market conditions and not fixed by the port authority.

Therefore, it is possible to conclude that this set of auxiliary services to ships and crew can work reasonably well through a system of licenses by which several operators are authorized to provide services within the port area. The activities of these operators can be regulated in terms of their prices and quality of services. In some cases, it is possible to have several operators competing among themselves (e.g. consignees of pilots). It would then not be required to have strict regulation on their charges, unless collusive practices are detected.

For other services, as in the case of towage, it can be more complicated to have more than a reduced number of operators, since their number will be limited by port size. In the case of medium/small ports, it is clear that there is a need to establish some limits on prices and conditions of service, in order to avoid market domination by a few firms who may try to exploit their position to extract rents from port users.

b) Services that require exclusive use of assets

These services require the use of one of the most scarce resources at seaports: space. Thus, within this group, we would include terminals for cargo handling, storage areas, repairing docks and fuel suppliers. It is more complicated to introduce private participation in these services, since operators need to use assets that are considered to be optimally owned by the port authority. Therefore, concession contracts need to be written carefully in order to reconcile private operators' interests with port authorities' objectives. At the same time, contracts must include incentives for private operators to maintain or enhance assets as required.

The number of operators for these services is by definition extremely limited, although it will vary according to port size. Similarly, the need to establish some regulation over charges and quality depends on what type of port is considered and how many alternative ports are close to it. Thus, for example, in the case of a port within a region with a highly competitive environment, the port authority or the institution in charge of regulation does not need to be extremely concerned about excessively high charges by private operators. In that situation, private firms must self-control their prices, in order to avoid the risk of losing market share in favor of competitors.

A possible characterization of the different sizes and degrees of development that a seaport can reach is presented in *Box 7*. Depending on port size, it is more or less required to have economic regulation of those ports where private operators use fixed assets. Broadly, we can distinguish two types of situations according to the degree of development reached by a seaport. First, there are those ports with a reduced market size – ports of types (1) and (2) – that do not require more than a general cargo terminal, which can serve all kinds of goods and containers, or in other cases, they can have one terminal specialized in dry-bulk goods.

For these ports, it is possible to consider the introduction of some form of competition among those firms that are willing to operate in the port. Thus, it is possible to establish a system of auctions where private firms bid for the right to operate the terminal. Once the bidding process is over and a single operator is chosen, it is necessary to have some regulation over the charges that this firm imposes on port users, since otherwise it would enjoy a monopoly position. Price-cap systems or a rate-of-return type of regulation would constitute alternative options to regulate the behavior of private operators, depending on the information and the experience that the regulatory institution might have on the type of service subject to regulation.

Box 7. Levels of port development

(1) Small local ports: They serve small communities and therefore through them passes all kinds of general cargo and containers, usually transported by relatively small ships *(short sea shipping)*. Facilities are basic: berths for general use with some storage areas nearby.

(2) Large local port: When traffic reaches a given level, it is profitable to invest in specific equipment, like for example a dry-bulk terminal, with berths able to serve deep-draught ships. It is also likely that some investments are dedicated to improve land access and to buy equipment to handle containers, although they would still be moved through general cargo berths.

(3) Large regional port: A seaport which handles a significant level of long-haul traffic starts requiring large investments in specialized terminals, as for example container terminals, or facilities specialized in some goods (coal, oil, wheat, etc). This type of ports have capacity to serve huge ships of more than 60,000 GRT, used in the long-haul bulk transport.

(4) Regional distribution centers: The largest world ports (e.g. Rotterdam, Hong Kong or Singapore) are a collection of highly specialized terminals that only serve particular traffics. These ports have excellent equipment for transport interchange between all modes (railways, road, inland navigation). The role of these ports is to act as hubs, where huge long-haul ships call at, mainly to make transshipment operations. From the hubs, smaller ships or other transport modes distribute cargoes to the region

Source: Stopford (1997)

However, this need for regulation is less strict if there is competition *between* ports. In cases where a region offers alternative ports to shipping companies, there is less need to regulate prices charged at the terminal, since the market mechanism would make the private operator keep prices low or lose traffic. On the contrary, if those alternative ports do not exist, the private operator enjoys some market power that must be controlled by regulation. As an illustrative case, users of the Mexican ports of Veracruz and Manzanillo have repeatedly complained about high tariffs, and they are asking for a regulatory institution to be created in order to limit the monopolistic position of terminal operators.

In the case of seaports of large size – types (3) and (4) – there exists a volume of traffic large enough (e.g. bigger than 100,000 TEUS) to allow for the existence of competition *within* the port. If a large port is divided into several independent terminals, it is possible to induce competition between operators for the traffic that calls at the port. In this way, regulation of prices is less of an issue, since if the market mechanism works reasonably well, private operators will restrain price rises themselves. However, some form of supervision would still be needed, since the situation is prone to collusion between competitors (due to the usually small number of parties involved).

As an example, the port of Buenos Aires (Argentina) was recently split into six different concessions to operate its terminals by independent companies. Although there were some initial problems and the market has eventually reduced the number of operators, there have been substantial improvements in port outcomes. Workers' productivity has risen from 800 tons in 1990 to 3,100 in 1997, and waiting time for containers has been reduced from 2.5 to 1.3 days during the same period.

Therefore, the conclusion derived from this analysis is that the introduction of private participation in the seaport industry appears as the more attractive option for ports trying to develop and adapt to the new conditions of the maritime transport market. Modern ports are in need of huge investments to enhance their facilities, in order to be able to provide those services demanded by shipping companies. Since in all countries it is increasingly difficult for governments to finance the required investments, the optimal solution is to try to attract private capital for investment in ports, and to also improve efficiency through the liberalization of port practices and the introduction of competition. The role of public sector institutions then changes from being direct providers of services to becoming regulators and supervisors.

The correct design of concession contracts for the collaboration between the public and private sectors is now the cornerstone of port systems. As discussed above, the existence of competition determines the need for the regulation of private operators, but even when competition is present and regulation not strictly required, there is still a need for port authorities to have some degree of control over the infrastructure assets that private firms are using. Given the relevance of concessions contracts, the next section is devoted to analyzing in detail the different aspects that they must cover.

To close this section, some figures are provided as indicators of what degree of competition is feasible between operators in different situations, in order to assess when regulation is required. It is difficult to establish threshold values valid for every port and type of cargo, but for containers there seems to exist some consensus among experts about the following figures (Kent and Hochstein, 1998):

Box 8. Threshold values to determine the type of competition, containers' traffic

Type of competition	Level of traffic (TEUS)
Intra-terminal	30.000
Inter-terminal	100.000
Inter-port	300.000

Source: Kent y Hochstein (1998)

The figures above show that if the volume of container traffic in a port is below 30,000 TEUS per year, it does not make sense to have several terminals and operators, since the market is extremely small. The best solution is to have a single operator and to regulate its charges. If traffic is above 30,000 TEUS but below 100,000, it is feasible to have several operators, possibly sharing a single terminal. Thus, the port would be in a situation of *intraterminal* competition, with various stevedoring companies providing cargo handling services to port users. These companies could make use of equipment owned by the port authority (cranes), or they could employ their own equipment, depending on their financial position.

If traffic is above 100,000 TEUS, the port has the possibility of opening different terminals, which can be operated by several companies, who in this case make use of separate berths and can manage them better. Competition is then easily implemented between terminals in this case. When a company serves all ships using a given berth, it is also possible for port authorities to make the private operator responsible for collecting port tariffs from users (charges for the general use of the port, different from the prices charged by the operator in concept of cargo handling) and transferring revenues to the port authority. In this range of traffic, it is also possible to provide incentives for private operators to finance projects for infrastructure enhancement, or even for the building of new facilities.

Finally, in a region where container traffic is above 300,000 per year, the market size allows for the existence of several alternative ports that can compete for traffic. In that case, we are likely to have *inter-port* competition, which again reduces the need for control over private operators' prices. However, even in this optimal case, it is still required to pay attention to a proper drafting of concession contracts, since private operators must be compelled to fulfil their obligations not only on service conditions and charges, but also on equipment maintenance, safety, quality of services, and all other matters which are costly for the concessionaire, and could be underprovided.

3.3. - Concession contract design

The different seaport services that can be offered by private operators are subject to various types of possible contracts. As discussed above, port size is one of the key variables in determining the type of private participation that can be chosen. For those ports with an insufficient demand to allow for the existence of several terminals, probably the best idea is to transfer the port as a whole to the private sector. If desired, it would be feasible to keep public ownership over the infrastructure, but the port could be run by a single operator

providing the infrastructure and cargo handling services (stevedoring, storage, etc) to port users. For the rest of the complementary services – berthing, etc – it could be possible for these to also be provided by the port operator, or if demand is sufficiently large, to open them to competition among different firms.

In the case of larger ports (landlord type), it is feasible to introduce private participation in more sophisticated forms. It is in these ports where infrastructure can be split into separate terminals, and thus generate competition within the own port. In general, in these ports some services could be provided by private firms operating under *licenses*, in particular, for those services that are easy to specify in a contract and do not involve the use of substantial elements of infrastructure. On the contrary, those private operators providing services that require the exclusive use of infra- or superstructure, must be subject to *concession* contracts, in which it is stipulated under which conditions a private operator can use assets, and what are its obligations.

License contracts are relatively easy to specify, since in general the required equipment to provide the service is owned by the operator. The role of the port authority or any other regulating institution is limited to imposing some minimum standards (e.g. professional qualification for pilots, or number and power of tugs for towing companies), and to establish some rules for service provision.

A concession contract is, by definition, more complex than a license, since it involves not only questions about service provision, but also about adequate maintenance of assets, investments to be made, and risk allocation between the regulator and concessionaire. All these aspects are discussed in detail below. Concession contracts can be regarded as an intermediate solution between public ownership and full privatization of a port. Private participation is introduced to achieve efficiency gains in the industry, and at the same time political concerns are safeguarded by not making society lose ownership of essential assets (Crampes and Estache, 1997). These contracts have been extensively used before in other industries involving expensive infrastructures (electricity, water, gas, transport), for collaboration between public and private sectors.

When designing a concession contract, there are several aspects that must be carefully tailored (Crampes and Estache, 1997; Thompson and Budin, 1997; Kerf et al, 1998): object of concession, exclusivity in the use of assets, concessionaire's obligations and payments, term of concession, penalties and fines, and risk allocation. The problem of excess of labor, common to almost all ports around the world, is also an element that must be considered when writing concession contracts. Another relevant feature is to carefully design the system to select the winner of the concession.

In this section, all these points are discussed in regard to seaports. The case of Argentina, a country that has deeply reformed its port system, is used to illustrate different points throughout the discussion, and the most relevant type of contract – the concession of a terminal – is used in the examples.

3.3.1. - Object of concession

The first question to be answered when drafting a concession contract is what is to be concessioned. Even though it might sound like a simple question, a concession contract must specify very precisely which are the assets that are to be transferred to the concessionaire, which are the services that the private operator must provide, which services must be left to the public sector, and which are subject to open competition with other firms. Thus, in the case of the concession contract for a terminal, the contract must describe in detail the limits between the infrastructure that is concessioned (berths, surfaces, inner access roads, etc) and what is not (e.g. general roads for intraport connections), in order to clearly establish what the concessionaire's responsibilities are in terms of maintenance, safety, etc.

The port authority, or the regulatory institution signing the contract, must guarantee that the assets are transferred to the concessionaire free from any other contractual obligations, and that they are available in the terms and times agreed upon. It is important to avoid delays in the transfer of assets, particularly delays owing to the negligence of the port authority in fulfilling the terms of the contract, since this might impede the concessionaire from starting its operations promptly.

A concession contract must define explicitly what services are to be provided by the concessionaire, and on what terms. As an example, the contract prepared for the concession of terminals at Puerto Nuevo (Buenos Aires) established that the concessionaire is the exclusive provider of the following services:

- Reception, deliverance, stevedoring and storage of cargo.
- Administrative control of cargo loaded and unloaded.
- Safe berthing and unberthing of ships.
- Berth use.
- Any other service to ships or to cargo that promotes efficiency and enhancement of the terminal.

In this example, the ambiguity of the last point is remarkable, since it opens a door for a concessionaire to interprete what has or has not been included, and thus to claim for itself the exclusive provision of some service which, in principle, the port authority did not plan to concede. This type of ambiguity should be carefully avoided in concession contracts, in order to avoid litigation problems with private operators.

3.3.2. - Exclusivity

On a concession contract, it must be specified what services are to be provided exclusively by the concessionaire, and for what other services open access must be guaranteed for other firms. For example, in the case of the concession contract of the port of Mar del Plata (Argentina), which is a small port that has been concessioned as a whole to a single company, it is explicitly stated that the berthing and other complementary services to ships

(energy and water supply) should be regarded as public services, and the concessionaire does not have a right to provide those services exclusively. The concessionaire is allowed to provide those services, but must also allow access to the port to any other company that might be interested in their provision. Alternatively, there is a list of services that are left exclusively to the port operator (cargo handling, issuing of permits for infrastructure use, marketing, intraport communication, etc).

Regarding this question of exclusivity, the rule should be to guarantee an efficient provision of services to port users. For those services in which the presence of a competitor to the concessionaire could be positive, access should be allowed to any interested party. Meanwhile, those activities for which competition can result in a deterioration of services for users, exclusivity can be desirable. As an example, consider the case of a container terminal that is concessioned as a unit to a private operator, but other operators are allowed to enter to handle general cargo by using their own cranes. Even though competition in the general cargo segment could improve, it is probably preferable to avoid the interference with the container operations by allowing the single operator to perform exclusive all cargo loading services (general and containers).

For those services which involve some 'public service obligation' (i.e. provision of desirable but non-profitable services), in most cases it is preferable to have exclusivity and to have them provided by a single firm. If several operators are forced to offer those services, subsidies must be paid to all of them, which probably raises the administrative costs of controlling the system, which can be simplified by having only one operator.

In small ports, concessionaires must be offered some guarantees that they can recover their investment costs when the concession involves the building or rehabilitation of facilities. In order to do that, it is usual to include provisions in the contract to ensure that the concessionaire obtains some compensation in case that during the term of the concession, another facility is built within the port, which might reduce the level of traffic expected by the concessionaire. These provisions take the form of some minimum traffic guaranteed, or priority for the concessionaire in the bidding process for the building of new facilities.

3.3.3. - Obligations and payments

A concession contract must explicitly mention what the obligations of the concessionaire are, in terms of the level and quality of service. It also should specify clearly how charges to users are to be determined, who owns the revenue obtained from those charges, and what are the payments to be made between the parties.

The usual norm is that the concessionaire is obliged to pay a fixed annual fee (sometimes named *canon*) to the port authority or the institution responsible for the concession. It is possible to design a contract in which this fee is negative, i.e. the concessionaire receives a payment from the port authority, when the concessionaire's obligations include the provision of some service under the consideration of public service, and revenues from port users for that service do not cover costs.

Although not frequently observed, concessionaire's fees can sometimes be linked to the level of traffic served by the terminal or the infrastructure subject to concession (e.g. making it proportional to tons or TEUS handled), including a guaranteed minimum payment to the port authority. Concessions granted in the port of Buenos Aires have used this system of proportionality plus a minimum guaranteed payment.

In some cases, the concessionaire can be made responsible for collecting port dues charged on ships and cargo for the general use of the port, and then transferring the revenue to the port authority. When performing that task, the concessionaire acts simply as an agent for the port authority, since the level of those port dues is determined by the latter. Alternatively, the level of charges for the services provided by the concessionaire (cargo handling, storage, etc) is usually left in the hands of the operator, although it is subject to some form of external regulation. As discussed in the previous section, the need for regulation is more important for those small ports with a single terminal, and it decreases if there is intra- or inter-port competition.

Concession contracts in the seaport industry are usually associated with provisions for the building or rehabilitation of facilities (BOT or ROT type of contracts). In those cases, it must be well specified in the contract which are the completion and starting dates of the operation, and also very importantly, the moment in which the ownership of the assets is transferred to the port authority. There are also technical issues about infrastructure building (materials employed, methods, etc) that should not be left to be freely determined by the concessionaire, but specified in detail in the concession documents.

3.3.4. - Term

There are no universal rules about how long the life of a concession should be. Economic theory on regulation indicates that the longer the life-span, the more incentives the private concessionaire has to make adequate investments to enhance the assets, since profitability will be dependent on the state of the facilities. However, the longer the period between two concessions, the less information the regulator may have on cost and demand conditions. Therefore, there is a trade-off between incentives and information for regulating a concessionaire optimally.

Additionally, those concessions associated with large investments for rehabilitating existing ports or for building new facilities must allow for sufficiently long periods for operators to recover construction costs. In practice, concessions with large projects are usually longer that those with no investment requirements. The average term of concession contracts is for more than 15 years, and those with large projects can be around 25 years. Sometimes, there are also provisions for allowing operators to obtain the automatic renovation of concessions if they fulfill investment or rehabilitation plans. *Box 9* shows some examples of the terms of concessions for some contracts signed in ports around the world.

***Box 9*. Term of concession contracts in practice**

Port	Period (years)

Buenos Aires – Terminals 1-4 y 6	25
Buenos Aires –Terminal 5	18
Mar del Plata (Argentina)	15
Manzanillo (Panama)	20
Karachi (Pakistan)	20
Le Havre (France)	50
Kelang – Westport (Malaysia)	30
Manila – South Harbor (Philippines)	15
Santos (Brazil)	25
Maputo (Mozambique)	15

3.3.5. - Excess of labor

One of the common problems shared by many ports across the world is an excessive number of port workers, generated partly by unionization and partly by the technological changes introduced in cargo handling procedures. In a relatively short period of time, seaports' activity has been transformed from being labor-intensive to being capital-intensive, and that process has made a large number of employees redundant. The traditional public organization of seaports has exacerbated this problem, since port workers usually have a series of rights arising from their status as civil servants in some countries, and in general they enjoy significant social benefits that must be respected.

The process behind a port's transformation has to deal with this problem, since otherwise resistance from workers can blockade any reform. Port workers constitute in some countries strong pressure groups, which can have significant political influence (as in the case of Brazil, for example). Solutions include the provision of funds to offer redundancy compensations and anticipated retirement schemes for workers. These funds are generally partly financed through public budgets, but private operators are also required to share the financial burden resulting from the labor problem.

Concession contracts for terminals signed in different countries have searched for different solutions to this problem. As examples, in the case of Panama the port authority has offered unions to employ a fraction of the income generated by concession fees to redundancy programs. In Mexico, government and unions reached an agreement in which terminal operators have a right to negotiate only with the workers they employ in the terminal, instead of being forced to bargain with a single centralized port union (Brennan, 1995).

3.3.6. - Penalties and fines

In order to guarantee adequate compliance with the terms of a concession agreement, the contract must specify a series of penalties and fines that the concessionaire must pay to the port authority in case of faults. For example, if a private operator does not fulfil its

obligations in terms of investment requirements, or quality of service, the port authority might have the possibility of rising the fixed annual fees to the concessionaire.

For this mechanism to be valid, the port authority must regularly perform some inspection tasks, in order to verify if the concessionaire is providing the required services and keeping assets in the stipulated conditions. If a port authority is excessively permissive with faults from the concession, this might damage its reputation in front of other operators or for future concessions. Since concession contracts have long lives, it is important that port authorities are able to establish strong positions from the start of the concession. Additionally, the imposition of sanctions over one operator will usually have a demonstration effect over other operators within the same port, or in other ports regulated by the same institution.

3.3.7. - Risk allocation

One of the more complicated aspects to properly designing a concession contract refers to an adequate allocation of the different risks involved. As in any other sector where this type of contracts is being implemented, the ideal rule is to allocate each type of risk to the party that can take better actions to avoid it. In that way, all agents are provided with incentives to behave optimally. According to Kerf et al (1998), the following types of risk are involved in a concession contract:

- *Design/Construction risk:* this type of risk appears in those contracts that require the concessionaire to make investments on a building or rehabilitation project. Once construction starts, it is possible that the concessionaire will try to renegotiate the contract, on the argument that unforeseen circumstances have arisen or costs were wrongly estimated. In those cases, the concessionaire would try to obtain some financial help from the public sector to proceed with the project, or at least a reduction in the fees it has to pay to the port authority.

  On this point, the advice should be to study the origin of the forecasting errors. In those cases in which errors can be attributed to defective information or mistakes in the bidding process granting the concession, the government or the institution responsible for ports should assume responsibility and pay the concessionaire for the extra costs. A completely different situation arises if cost deviations are caused by poor estimates from the concessionaire. In that case, the position of the port authority should be strong and make the operator cover the extra cost, plus any penalty established in the contract if the building is not completed by the stipulated dates.

  For investments in new commonly built infrastructures, such as container terminals, there are international standard designs that allow for the estimation of reasonable costs and completion periods for berths of a given length and width, providing that normal subsoil conditions exist(Drewry Shipping Consultants, 1998). Therefore, this type of risk is relatively low for standard investments and should be allocated to builders. A different

situation arises if geographic conditions are not standard, or a project has very special characteristics, in which case the builder can be allowed to have some margin of error.

- *Operating cost risk:* Another source of risk is the existence of higher than foreseen costs to providing the service. Again, all excesses of costs that could have been reasonably predicted should be assumed by the concessionaire. If the bidding process was correctly designed, all bidders had the same information sets, and therefore must have carefully devised their cost estimations. Regarding this point, the bidding process must arrange for all candidates to have permits to inspect the involved infrastructure and to receive as much information as required. If this provision is made, any excess of costs discovered thereafter should be the responsibility of the concessionaire.

However, the possibility that some excess of costs can be caused by the port authority must also be considered, in which case the concessionaire should be allowed to renegotiate the contract or be compensated accordingly. For example, some cost rises could be due to delays in obtaining required permits, terminating existing contracts with other firms that have rights over elements included in the concession (e.g. occupied buildings), or disposing of obsolete assets which the port authority had agreed upon to remove. In all these cases, if delays imposed by the port authority on the concessionaire result in losses or higher costs, the latter should be able to receive compensation.

- *Revenue risk:* this is one of the more dangerous risks in the seaport industry, as in any other sector where the concession contract is valid for a long period. If demand forecasts used to compute the expected income flows are too optimistic, the concessionaire could eventually end up with much smaller revenues than expected, and can even go bankrupt. Regarding this type of risk, the general rule is to allocate it to the concessionaire, in order to provide incentives in the bidding process for candidates to properly estimate the expected demand levels. Furthermore, if regulations on charges allows the operator to lower them freely, this risk would be minimized by the concessionaire in case of low demand levels by reducing its charges in order to attract more traffic.

However, a strict application of this rule implies that in some cases an operator should be allowed to go bankrupt, since otherwise the system would lose its credibility. In that situation, the port authority must consider what the options are after the private operator ceases its service provision. In large ports, those services could be alternatively supplied by other operators, until a new bidding process is launched. But in the case of small ports, the port authority should be able to provide services directly, or to replace the operator quickly, since otherwise it can cause the port to suffer a long period of inactivity.

Another situation that should be carefully studied is whether the risk could be mitigated in some low demand situations by introducing flexibility in the regulation systems. In some cases, price limits imposed on concessionaires could result in too small revenue flows accruing to the operator, not allowing it to adequately recover its costs. If that is the case, and it is proved that the operator has not been negligent in letting its costs rise

excessively, the regulator should be more flexible and rescue the financially strained concessionaire.

Recently, a proposal has been launched from the academic arena (Engel, Fischer and Galetovic) offering a solution to the revenue risk of concession contracts. Even though the proposal has originally been advanced for other types of infrastructure (toll roads), it could be applied to the concession of terminals at seaports. The idea of Engel-Fischer-Galetovic is to make the term of the concession variable, so that it would depend on the level of demand effectively received. By this mechanism, in case demand is very small compared to its estimated values, the concession would be extended to a longer period, allowing the operator to recover investment costs more easily.

Alternatively, if demand is larger than expected, the concession could be terminated before its 'normal' expiring date, since the operator would have recovered its cost sooner than expected. Even though there is at present, as far as we know, no seaport in the world using a flexible-period concession contract like this, the proposal could be considered as an attractive alternative to mitigate the revenue risk involved in all terminal concessions with long terms.

- *Financial risks:* in developing countries, currencies are usually subject to wide oscillations in their valuations. Therefore, all seaport projects implemented in those countries are subject to exchange rate risks, especially for those with longer lives. However, there are relatively easy solutions to reducing this risk, such as nominating all monetary references of the contract in a hard currency, or buying insurance to cover it. Similarly, interest rates can also suffer large variations that might substantially alter operational or building costs. Even though both parties should cover for this privately, concession contracts may also include provisions on this point.

- *Environmental risks:* some of the circumstances that have to be considered when drafting a concession contract is the possibility of accidents within a port area or in its access zones, which can have disastrous effects for the port and adjacent areas (e.g. oil spills). In order for private operators to reduce those risks to a minimum, they should be strictly liable for any accident caused by negligence in maintaining adequate signaling devices, or not fulfilling required operations such as dredging. Even though the port authority should have subsidiary responsibility in compensating affected parties for those costs not covered by the concessionaire, it should supervise private operators to ensure that they are properly insured to cover their civil responsibilities.

In the construction phase, the concessionaire must be strictly supervised so that it takes care of any negative environmental effects that it might cause (e.g. dumping of dredging materials, impact over adjacent areas, etc). Those aspects should be included explicitly in the contract, in order to ensure a correct responsibility allocation.

3.3.8. - Selection process

One of the more important elements for a concession contract is the careful design of the selection process deciding which firm or consortium will be granted the concession. This process must pursue the objective of determining, in conditions of asymmetric information, which candidate can more efficiently run the assets that are the object of concession, and whether they have sufficient capacity to implement associated building/rehabilitation projects.

The usual practice is to design a selection process based on two consecutive phases:

Pre-qualification: in a first stage, those firms satisfying several criteria are selected to be evaluated on their proposals. Criteria considered in this phase ususally include experience in the seaport industry and some minimum financial capacity. By this pre-qualification, the number of candidates can be reduced to a small number, whose proposals for the particular project can be studied in great detail.

Generally, information required for this first stage is presented separately from the economic proposal (usually asked to be enclosed in different envelopes), and it is evaluated with objective rules. For example, in the case of the concession for the port of Mar del Plata (Argentina), the information about experience and financial capacity was condensed into a single index, and only those consortia above a certain minimum value were qualified for the next stage.

Concession award: in the second stage, the objective is to choose the proposal that is closest to the objectives pursued by the port authority. Thus, in general, the winning proposal is the one that offers a higher fee payment to the port authority (if financial needs is the basic reason behind concessioning port assets) or the one that offers lower charges to port users (if port efficiency is primarily sought). If the concession involves some investment projects, it is also possible to include some evaluation of what the best project is, or which has the lower cost. In the example of Mar del Plata, the solution was to summarize all three criteria again on a single index. The final decision was then taken on the basis of the information from this index, to which was added the first index calculated in the pre-qualification stage. Thus, this example constitutes one of the more sophisticated systems of firm selection, since it uses all the information provided by candidates.

In summary, the process of selecting a concessionaire must be designed according to the objectives of the government or port authority. The process should be as transparent as possible, and try to avoid allowing candidates to collude on their bids. In the case of the concessions for the terminals of the port of Buenos Aires (Argentina), the selection process was designed so that a candidate was only allowed to win one of the terminals, as a way to promote competition in the bidding process (not all terminals had the same characteristics, and therefore all bidders were supposed to tailor the bids to win the more attractive assets).

3.3.9. - Re-negotiation of concession contracts

Finally, one relevant aspect that has to be considered when drafting a concession contract is that, in all probability, during the life of the contract some unpredicted circumstances may arise and force parties to re-negotiate. This statement is true for any kind of contract, but it is especially important in the case of concessions. This is due first to the long period of validity of the contract, which makes it unfeasible for any party to anticipate all possible contingencies. Unforeseen contingencies also occur because concession contracts are about expensive fixed assets, which cannot be easily removed and re-deployed on another location. Re-negotiation must then be studied, since in the case of disagreement, the owner of the asset is the agent that has rights over its use. If re-negotiation is not anticipated, the port authority can find itself in a weak position, allowing concessionaires to extract *ex-post* additional rents.

As an example, consider the case of a small port that is concessioned as a whole to a single operator. After the concession is granted and operations start, the concessionaire might try to renegotiate the contract and obtain better conditions by using the threat of stopping the provision of services to ships and blocking the use of assets by an alternative operator. If the concession contract does not contain provisions defining precisely who owns the assets and when they are able to be transferred between parties, the concessionaire could claim valid rights over the assets granted by the concession, and litigate against the port authority (hold-up problem). However, it the contract states clearly that the port authority owns the assets, in case of re-negotiations the concessionaire would never be in such a strong position, since, as owner, the port authority can always 'rescue' the assets and keep the port working.

Re-negotiation of a concession contract is probably the rule and not the exception, and should not be perceived as a failure. Since concession contracts are typically long-life documents, it is impossible that at the moment of drafting the contract the parties can foresee all possible future contingencies. Knowing this in advance, it is important to consider several future scenarios of conflicts, and ensure that some provisions are included to establish at least the basic rules for re-negotiations.

3.4. - Privatization and liberalization of seaports: international experiences

In general terms, the process of privatization and liberalization of the main seaports around the world has been characterized primarily by the use of concession contracts introducing private participation, rather than by selling seaports' assets to the private sector. Through this process of concessioning, port authorities reduce their functions and are transformed into landlords responsible for coordinating all activities performed at the port. Consequently, they receive all rents accruing from asset renting.

There are several patterns of privatization and de-regulation that the seaport industry is experiencing, depending on the region and the initial situation of the ports. In Europe the model seems to be the increasing introduction of private firms in the provision of port services, but in general, infrastructures are kept within the public sectors and, in some

countries, governments continue financing investment costs. However, there is a debate within the European Union on a plan to create a system of self-financing ports, which would not receive subsidies from governments (European Commission, 1997). The idea would be that port authorities should design port tariffs adequately in order to finance expansions of infrastructure, or seek private participation to finance infrastructure. In this region, limitation on the use of public funds is not mainly motivated by a lack of financial capacity from states, but on competitive considerations. It is argued that in order to have a single market where all ports compete on equal conditions, it is not fair that some states subsidize their facilities, while other seaports have to finance their facilities themselves.

The most radical reform in the European region has been introduced in the UK, where most ports have been fully privatized. In 1996, around 70% of all cargoes were handled exclusively by private institutions. The process started by privatizing the *Associated British Ports (ABP)*, an institution that had ownership of all former state ports. Subsequently, ports under a different legal status (*trust ports*) were transferred to the private sector. Results seem to be positive, since investment figures have risen and private operators are making substantial profits (Ferrer, 1997).

In Eastern Europe, with economies in transition, there is some ongoing reform of seaport systems, aimed at introducing private participation. Thus, some ports have been transformed into state companies participated in by workers, as in the case of the St. Petersburg port, where 51% of the port is owned by employees. Another example is the container terminal in the port of Vostochny, which is being operated by P&O Australia, SeaLand and a local Russian firm.

In some Asian countries, private participation in financing infrastructure building was already begun long ago, as in the cases of Japan and Hong Kong. In both these countries, infrastructure is built and operated by private firms under long-term concessions. In other countries in the Asian region (Korea, Philippines, Malaysia and China), shipping companies are also actively participating in the development of seaports (e.g. Maersk and P&O).

Latin America is one of the more dynamic regions in terms of seaport concessioning, the building of new facilities, and importantly, for the rehabilitation of existing ports. The model of mixed public/private financing of seaports is quite successful in countries of this region, due to three reasons. First, there is a strong need to seek capital to finance investments, since most governments are highly constrained in their budgets, due to debt servicing payments. Second, rapid economic growth is generating new traffic that demands new facilities and more efficient services. And third, fierce competition makes it necessary for ports to upgrade their facilities or risk being displaced by rivals.

Given the relevance of seaport reforms in Latin America, the rest of this section is devoted to describing three interesting cases: the experiences of Chile, Argentina and Brazil. Even though these particular countries are chosen, there are many others in the region that have already transformed their ports, or have advanced plans for that purpose. Other remarkable

experiences in this region are those of Mexico, Panama, Nicaragua, Costa Rica, Colombia and Peru. A brief description of the reform processes of all these countries, and also experiences from other world regions can be seen in *appendix 2*.

3.4.1. - Seaports' reform: the case of Chile

Chilean international trade is served by 38 seaports, of which 11 are publicly owned, and are organized by the public agency *Empresa Portuaria Chilena (Emporchi)*, while 27 belong to the private sector. Of this last, 11 are of private use (owned by mining and other companies), and 16 are privately owned but publicly used. *Box 10* shows the distribution of cargoes between the different ports. Overall, in 1997 Emporchi handled 94% of containerized cargo, 69% of general cargo, 18% of dry-bulk cargo and 11% of liquid-bulk cargo. In terms of total volume, the 11 public ports handled 37% of total tons that passed through Chilean ports (Tortello, 1998).

***Box 10*. Chilean ports. Distribution of cargoes by port type**

Port types	Containerized cargo		General cargo		Dry-bulk cargo		Liquid-bulk cargo		Total cargoes	
	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
Private [1]	1,702	0	194,501	2	12,394,187	49	6,870,439	75	**!Syntax Error,)**	38
Private [2]	427,347	6	2,900,055	29	8,247,183	33	1,334,878	14	**!Syntax Error,)**	25
Emporchi	6,375,130	94	6,804,283	69	4,481,230	18	987,764	11	**!Syntax Error,)**	37
Total	**!Syntax Error,)**	100	**!Syntax Error,)**	100	**!Syntax Error,)**	**!Syntax Error,)**	**!Syntax Error,)**	**!Syntax Error,)**	**!Syntax Error,)**	**!Syntax Error,)**

[1] Private ports for exclusive use by owners[2] Private ports for public use

Source: Own calculations using data from Tortello (1998).

In 1978, seaports in Chile were characterized by the split of cargo handling among two different groups of workers. Stevedoring operations were performed by specialized port workers, while loading/unloading operations were done by Emporchi employees. Both groups enjoyed some monopolistic positions. On the one hand, stevedores have strong limitations for their numbers to grow, since each worker was required to have some special license *(matricula)* to be able to provide stevedoring services. This practice transformed stevedores into monopolists for those services, which resulted in high tariffs and low productivity. On the other hand, Emporchi was by definition a public monopoly, working at the state level and its workers constituted an important pressure group.

In 1980, the government decided to change the status quo. Legal changes were introduced in 1981 by passing a new Seaports' General Law, which effectively eliminated the monopoly of Emporchi in cargo loading operations, allowing private participation in the industry for those services. Almost simultaneously, a different law abolished the system of licenses for stevedoring, allowing any worker to perform those services for shipping companies. The State made payments to compensate the 2,700 workers that lost their privileges and who were clearly opposed to any reform.

These regulatory changes permitted the significant entry of new private operators and a competitive market for cargo handling was established. The impact on costs was substantial: for general cargo, cost savings of $17.7 per handled ton were obtained, while for dry-bulk goods the savings were estimated in $1.43 per ton, and for liquid cargoes there were no improvements (Tortello, 1998). It is interesting to notice the differences in cost savings depending on the type of cargo, which can be justified by the presence of private participation in those ports specialized in bulk cargoes.

At the end of 1997, a law seeking to modernize State ports was passed, which sought to transform the Chilean port system and adapt it to the new needs of maritime transport. The law intended to introduce more private participation to achieve the objective of modernizing the ports. The law envisages to split Emporchi into 10 autonomous public companies, which will run the 11 state ports, from Arica in the north to Punta Arenas in the south. These new companies will act as port authorities, managing ports' infrastructure, and are not allowed to provide cargo handling or berthing services. The idea is that the new port authorities should contract all those services with private operators, through licenses and concessions.

Even though the division of Emporchi will not take place until January 1st 1999, the process of introducing private participation has already started. There are plans to grant BOT concessions for periods of 20-30 years for port terminals in all State ports. At the end of 1998 it is expected that concession contracts for terminals in the ports of San Antonio and Valparaiso will be signed. All those concession contracts will be left under the supervision of the new autonomous port authorities (Hall, 1997).

3.4.2. - Seaports' reform: the case of Argentina

The reform in Argentina also began with a revision of legislation, with significant changes being introduced in 1992. Among these changes, it is remarkable to observe the decentralization introduced by the elimination of the central public agency responsible for ports (*Administración General Portuaria, AGP*), and the transfer of ports to regional governments. Small ports were transferred to municipal governments, while the large port of Buenos Aires was split into three separate zones: *Dock Sud*, transferred to the province of Buenos Aires; *Puerto Sur*, which is still to be developed; and *Puerto Nuevo*, which remains in the hands of the central state.

Other characteristics of the reform process were the deregulation of all port services, including those related to berthing such as pilotage and towage, and the elimination of restrictive working practices. Most importantly, the reform has introduced significant private participation in building and operating port infrastructure. Given its special role within the maritime transport industry, special attention has been devoted to the development of container terminals, and the reform has attained large improvements in terms of the volume of traffic and productivity.

The port of Buenos Aires has been one of the more innovative world experiences in port reform. The State part of the infrastructure (*Puerto Nuevo*) was split into six terminals and concessioned for periods between 18-25 years. Initially, the proposed structure was to have 5 different operators, since terminals 1 and 2 were included in a single concession. As was mentioned above, the selection process was designed to avoid the concentration of terminals in the hands of a single operator, by forcing bidders to win at most only one terminal each.

In 1998, market conditions have changed the situation, and there are only two terminals competing in the container market (terminals 1-2 vs. 5) within *Puerto Nuevo*. Terminal 4 is relatively small and dedicated to general cargo, while terminal 3 is multi-purpose (general cargo, cars and passengers). Lastly, terminal 6 was forced to close down. Even though the reduction in the number of operators indicates that the process could have been better designed and was probably implemented too fast, its results in terms of port outcomes have been extremely positive, as can be observed in *Box 11*. For example, between 1991 and 1997, the volume of TEUS increased by 241%, and the productivity per worker has almost been multiplied by four.

Box 11. **Port of Buenos Aires indicators**

Indicator	1991	1997
Cargo (thousand ton)	4.000	8.500
Containers (thousand TEUS)	300	1.023
Capacity (thousand containers per year)	400	1.300
Cranes	3	13

Operations area (ha)	65	132
Productivity (ton per employee, annual)	800	3.100
Average container time at port (days)	2,5	1,3
Charges per container ($/TEU)	450	120

Source: Estache, Carbajo y De Rus (1998)

The success of seaport modernization in Argentina must be assessed by the increasing participation of private capital in the sector, but most importantly, by the changes that have been introduced in working practices. At the port of Buenos Aires, private firms have been providing stevedoring services since 1970, something that did not happen in any other port in the region. However, those companies never obtained strong results in terms of productivity, due to two different reasons. First, the institution responsible for seaport managment was not investing enough in infrastructure and equipment. And second, seaports' unions were very strong and kept a separation between stevedoring and loading services, similar to the case of Chile. Loading operations were the responsibility of AGP, while stevedores had such a power that the public agency could not install any new technology that would reduce labor requirements (Raciatti, 1998).

3.4.3. - Seaports' reform: the case of Brazil

The situation of the seaport industry in Brazil prior to the reforms introduced in 1993 can be characterized by problems of inefficiency, low productivity, an excess of bureaucracy and chronic under-investment. The results of combining all these problems were port tariffs between 3 and 6 times higher than international levels, long waiting times for using port facilities, and a deficient service provision, which translated into delays in goods deliverance and reception.

The process of reform started in 1990 with the dismantling of the public agency *Portobras*, and the decentralization of the system. In 1993 a law was passed to establish the general framework of the new reformed port system. This law grants autonomy to all seaports and it allows private participation in cargo handling services, a practice that was prohibited before that date. There was also a movement toward the liberalization of port tariffs, with the objective of promoting competition between ports at a regional level.

Reforms have faced strong resistance from port unions, which has been the main factor conditioning the process and delaying it. Even though solutions are being implemented to ease that opposition, today many ports still have large excesses of workers. There is now at each port an institution (OGMO, *Orgao Gestor de Mao-de-Obra*) formed of unions and port operators, which is in charge of managing the use and payment of temporary port workers.

There are plans to privatize 36 State ports, some of which are well advanced, especially for small ports (Itaji, Laguna, Cabedelo and Porto Velho). The main ports of the country (Santos, Rio Janeiro, Rio Grande) have been subject to important reforms, and substantial private participation has been introduced through concession of terminals. At the moment,

about 75% of infrastructure has been passed to the private sector through concessions. Productivity has increased, ship waiting times have decreased, and the port has become more competitive within the region. Disruptions due to labor stoppages and other problems have been reduced.

In addition, there are plans to make new investments of around $1 billion, many of which are already initiated. Part of these investments are oriented toward modernizing equipment for handling sugar cargoes – one of the main export products of the country at present – and container handling equipment.

Regarding the rest of public ports in the country, most of them are small, since the main export goods (iron ore, bauxite, sugar and forest products) use a limited number of facilities, which are privately owned in most cases. However, there is some potential for the development of some new hubs at regional level for containerized cargo. Two ports can be mentioned for that role: Rio Grande and Sepetiba. Both ports could in the near future attract cargoes with final destination to Argentina and Uruguay, and potentially become hub-ports for the Mercosur area. It is expected that competition for transhipment and final cargoes in the South East region of Brazil is going to increase, between these new emerging ports and the traditional facilities of Santos and Rio de Janeiro.

4. - PRICE REGULATION

4.1. - Port Tariffs

In seaport activity, there is a diversity of charges that the users of a port must pay for the services they receive and for the use of facilities. On the one hand, are port tariffs (or port dues), which are the charges on ships for the use of the general infrastructure of a port. These tariffs are imposed by port authorities, although they do not always collect revenues directly, a task that can be performed in some cases by concessionaires. Apart from infrastructure, port dues sometimes include charges for the use of compulsory berthing services (pilotage, towing), particularly in those ports where the port authority is in charge of those services. Another part of the total income received by port authorities stems from tariffs on all cargoes that pass through the port's facilities. These tariffs on cargo are paid partly by shipping companies, and the rest is directly charged to shippers.

Although port tariffs can constitute a relevant variable in the choice between ports by shipping companies and exporters/importers, its weight over the total cost that port users bear is relatively small. The more important part of the total bill is cargo handling (loading/unloading, stevedoring, storage, etc), as figures in *Box 12* show.

There is a general opinion among experts on port industry that the elasticity of the demand for port services with respect to port tariffs is relatively small (Slack, 1985). For shipping companies, relevant factors when choosing a port are the general quality (equipment, waiting times and operating times, etc) and the existence of business opportunities (demand for cargo transport from exporters and importers). For the shipper, the important variables

would be the charges by cargo handling, the frequency of regular services (liners) and the existence of charter services from the port for special shipments.

***Box 12*. Relative weights of different port charges**

	Percentage over total bill
Port tariffs on the use of infrastructure	5% - 15%
Berthing services	2% - 5%
Cargo handling	70% - 90%
Consignees	3% - 6%

Source: Suykens (1996)

As a consequence of these behaviors, it can be concluded that port authorities can rise or lower port tariffs with a wide margin without affecting their demand levels. An exception would be the case of a region with fierce competition among ports with similar facilities and inland connections. In that case, it is possible that a slight variation in port tariffs could lead to traffic deviations, and thus render port tariffs as a strategic variable for competition.

In theory, an optimal rule for determining port tariffs for the use of port infrastructure should be to make users pay the marginal costs that they generate. But as with other industries where some infrastructure is publicly used (airports, roads, etc), marginal costs are very small, since they consist only of maintenance and repair expenses. These costs are small when compared with construction costs. Therefore there is a problem of cost recovery if the social optimal pricing rule is employed.

The classical solution to this problem was that the public sector paid for infrastructure costs, and thereafter, the users were charged only the marginal cost. The argument for the optimality of this system is that whether users pay full costs, it is possible that some of them would be driven out of the market, even if they are prepared to pay the marginal costs. But since the option of public sector help for seaports is not available in most countries, there is a need for new solutions to determine port charges. One possible alternative is to use the concept of *long-run marginal cost,* which keeps the idea of social optimality, and at the same time, achieves full cost recovery (for a more detailed exposition on this concept, see *appendix 3*).

Port tariffs are determined in practice by rule-of-thumb rules that do not necessarily relate to investment costs, nor to opportunity costs for the use of infrastructure. As a general rule,

port authorities seek real return rates on assets of around 8-12% during the economic life of the infrastructure (Drewry Shipping Consultants, 1998).

Tariffs charged on ships for the use of infrastructure are usually dependant on some capacity measure, such as the Gross Registered Tons (GRT) or some other alternative. At some ports with high demand levels, port tariffs on ships can be established on other criteria that better reflects the opportunity cost for the port authority of having a given ship use a piece of infrastructure (for example, at the port of Rotterdam, ship tariffs partly depend on their total length). It is also possible to impose extra charges for ships with special requirements, in terms of draught or other characteristics.

Regarding tariffs on cargo, port authorities usually discriminate among types of goods, following in some cases complex classification schemes (in the case of European ports, it is possible to find countries with lists of up to 56 different types of cargoes and charges). The origin of these systems of charges is the idea of extracting as much rent from users as possible (the old traditional ports' practice of charging 'what the market can bear'). Therefore prices are more or less related to the value of the goods passing through the port. However, there is a trend, at least observed in Europe, toward a reduction of tariffs on cargo in order to attract shippers, and a rise in tariffs on ships to balance port authorities total incomes.

In terms of regulatory needs, since most world ports are going to a landlord type of model and not to full privatization, there is in principle no need to impose regulation on these port prices. Nevertheless, in those cases of ports without competitors in their region it is possible that a regulator should supervise the level of charges on the use of infrastructure, since in such cases the ports enjoy a monopoly position. The need for regulation arises if the port authority is a either a private or a public institution, since in the latter case there is still a risk of capture by third parties, which can lead to a non-optimal tariff set by the port authority.

Meanwhile, there is a need for regulating charges on port users for complementary services (berthing, etc) in cases when these are provided by private operators without guaranteed competition. A system based on maximum prices is the usual rule employed in practice to regulate this type of service, since there are not significant problems in estimating their costs.

4.2. - Cargo handling charges

As mentioned above, cargo handling services are the most important for port users in terms of total charges. Therefore, since these charges significantly affect a port's competitive position, it is crucial that they should be closely related to the real costs of service provision. The process of privatization, introduction of competition and liberalization is aimed in great part to making these charges be determined according to market mechanisms, instead of set by public institutions, as traditionally was the case in most ports worldwide. However, the liberalization process does not always guarantee that market

mechanisms are going to prevail, and thus there is still a need for regulation in some cases, as those ports where competition is only feasible among one or a few operators.

In general, large ports tend to liberalize their cargo handling charges, so that private operators can set them freely. Competition within the port and between ports is a substitute for regulation in those cases, since operators must adapt their charges to market conditions. However, port authorities usually keep some form of control such as the setting of some maximum level of charges. The need for regulation is more strict in the cases of medium-size and small ports, since the size of the market only allows for a limited number of operators, a situation that can easily result in collusive practices among them.

The choice of maximum charge levels authorized to port operators should be studied in detail by port authorities or the regulatory institutions, since this is the basic instrument of regulation in altering the behavior of private operators. In practice, concession contracts signed between port authorities and private firms are usually not too precise on the system determining the authorized maximum charges. Generally, these contracts state that the private operator will be allowed to obtain an 'adequate rate of return' (as in the case of the concession contracts of Buenos Aires, Argentina), but without specifying further how this principle will be implemented in practice.

It is advisable that concession contracts should explicitly include the rules that a regulator is going to follow to determine the authorized charges for private seaport operations. Since it is known that these agents are going to adapt their behaviors to the type of regulation, and the effects of a regulation via 'price-cap' or 'rate-of-return' are not the same, the regulator must choose a system according to the information available, and its own objectives. Thus, for example, if it is intended that port operators should make substantial investments in equipment, it would be adequate to establish a rate-of-return type of regulation, since that will provide incentives for them to invest largely in capital assets.

Difficulties in evaluating the costs of concessionaires operating at ports can be in principle overcome by establishing some form of regulation based on comparisons between different operators (*yardstick competition*). This implies analyzing cargo handling charges among similair seaports in a given region, and to try to derive conclusions in terms of cost efficiency and charging practices. In general, for some types of cargo there are already some established international reference values that can be used by regulators to have an idea of the outcomes that should be expected from a private operator. Nevertheless, these reference values must be adapted according to local conditions (average wage levels, interest rates, etc). For some types of cargo, there may be much variability across ports, according to the type of technology and the age of the equipment employed for cargo handling.

As an example, for the case of containers, the price charge per TEU handled is an easy variable to obtain and can be used by a regulator after some adjusting for local conditions. The reference values can serve as a benchmark for the efficiency that a private operator

should be able to achieve, and therefore, this can be used as a limit for imposing some type of price-cap regulation.

4.3. - Concession fees

A relevant question when introducing private participation at seaports is to determine the payments that the operators must make to the port authority or the agent that owns the infrastructure assets (named concession fees or *canons*). Even if those fees do not directly affect port users, it is evident that the higher the payments that private operators make for the use of infrastructure, the more income that port authorities receive, and port tariffs can then be reduced accordingly. However, private operators will then try to pass their higher costs to users through their cargo handling charges, so a careful balance should be established by port authorities regarding those prices that it can directly control.

Box 13. **Comparison of container handling charges across world regions (1996)**

Region	Port	Price per loaded TEU ($)
North Europe	Antwerp	120
	Felixstowe	173
	Hamburg	182
	Rotterdam	156
	Zeebrugge	123
South Europe	Algeciras	193
	Barcelona	211
	La Spezia	240
	Marseilles	233
	Pireus	203
Asia	Pusan	175
	Kaohsiung	140
	Manila	118
	Singapore	117
North America	Halifax	168
	Los Angeles	256
Australia	Melbourne	199

Source: Drewry Shipping Consultants.

An advantage of this mixed-form of revenue for port authorities (from port tariffs and concession fees) is that part of the demand risk is left to the private operators, who then have correct incentives to provide efficient low-priced services in order to minimize that risk. Additionally, concession fees provide port authorities with a safe continuous cash-flow, and therefore they have the possibility of financing general port costs or even part of the facilities' construction/rehabilitation costs.

In European ports, revenues obtained from port tariffs are in general higher than revenues from concession fees, with these latter averaging 37% of total income received by port authorities. However, there are examples in other regions, as in the case of the port of

Baltimore (US), where more than half of total income is obtained from concession fees (58%), therefore indicating a higher presence of private operators (PDE, 1998).

There are no established procedures to determine the level of concession fees to be paid by private firms. An optimal rule should be to relate payments to the opportunity costs of the infrastructure and those superstructure elements that the concession might be associated with. For infrastructure, an approximation for the opportunity cost could be the market price of port adjacent land, although modified by the specific characteristics of the surface used by the concessionaire. Meanwhile, the opportunity costs of equipment granted by a concession are easier to estimate, since they would be equal to the price that they could reach in a rental market.

To the basic objective of concession fees reflecting opportunity costs, it is possible to add other aims, like, for example, sharing the risk of demand fluctuations between operator and port authority. This risk could be shared by making concessionaires' payments dependent on their level of activity, with some minimum payment guaranteed. Perhaps the optimal system to determine concession fees should be a mixed combination of opportunity costs and risk allocation objectives.

However, in practice port authorities are not often observed using any market criteria to determine the opportunity cost of assets. Concession fees are usually fixed payments per square meter used, which are revised periodically according to some criteria (some examples can be seen in *Box 14*). Fees are usually dependent on the service provided by the concessionaire, so that the price per square meter is different if the surface is used for container handling than if it is devoted to specialized storage areas. In some cases, fees depend on the volume of demand attended to by the operator, which therefore considers risk allocation. For example, in the case of the concessions of the port of Buenos Aires (Argentina), concessionaires pay according to the total volume of handled cargo, with a guaranteed minimum payment for the port authority.

Box 14. **Concession fees for different ports (1997)**

Port	Annual price per sq.m. ($)	Revision frequency	Revision mode
Baltimore	6.5	Annual	Variable
Bremerhaven	2.3	5 years	Price index
Bordeaux	4.5	Annual	Price index
La Spezia	5.7	Variable	Variable
Le Havre	3.8	Annual	Price index
Lisbon	15.0	Annual *	Price index
Oslo	61.5	Variable	Variable
Rotterdam	3.2	Variable	Variable

(*) It also charges a variable fee on volumes: $0.3 per Ton or $5.5 per container.

Source: PDE (1998)

5. - REGULATION ON QUALITY AND SAFETY

5.1. - Congestion problems

The waiting time of ships is one of the port characteristics that shipping companies value when choosing between alternative ports. The total time that a ship stays at a port is equal to the sum of the time employed to obtain the required services and supplies, and this time must be considered as a cost for port users. The 'generalized cost' paid by a ship using a port is equal to monetary charges (port tariffs+cargo handling charges+other services' prices) plus the time spent in the provision of services (*see Box 15*). Therefore, the shorter the waiting times, the lower the generalized cost of port use, and the more attractive the port is to users.

The first part of total ship waiting time is the time spent at the port maritime access zone waiting for a berth to be available. There are two possible scenarios. First, it is possible that the port suffers from no congestion problems, therefore the waiting time would be equal to zero. The second situation occurs in ports with congestion problems, which can result in relatively long waiting periods (several days).

> ***Box 15.*** **Concept of generalized cost**
>
> As in other transport modes, when analyzing the cost that users incur, we have to consider not only the monetary cost of the fare or tariff, but also the value of time spent to obtain the desired service. In the case of seaports, ships are charged by different concepts (use of infrastructure, berthing, cargo handling services, other supplies), but they also spend considerable lapses of time at port waiting to be served. In a broader definition, we should also include things like costs suffered from cargo damages or losses, but considering only prices and time, we can define the generalized cost for port users as:
>
> $$\textit{Generalized cost} = \textit{price} + \textit{time} \times \textit{value of time}$$
>
> $$= (\textit{port tariffs} + \textit{services' charges}) + t_{ship} \times V_{t\_ship}$$
>
> In the expression above, t_{ship} would be the total time spent by the ship in obtaining port services, since it enters the port until it exits, and V_{t_ship} would be the opportunity cost of the ship per unit of time (rent that is lost when the ship is not providing transport services).

In this latter situation, the long-term solution required is to enlarge the port's capacity, but in the short-term some demand rationing can be established through the use of port tariffs. A rise of these tariffs could induce some users to seek alternative facilities, therefore decreasing average waiting times and improving the welfare of the remaining users. However, during the period of construction of new infrastructures, the port authority should try to minimize the disruption for port users, since otherwise it is possible that some traffic segments will become permanently deviated toward rival ports. If congestion periods are not correctly managed, it is possible that investments in new facilities might result only in future excess capacity.

For those ports which are contracted out to be privately managed, or if they are fully privatized, a regulator should be concerned with guaranteeing that decisions on port capacity are taken sensibly. A private manager, in principle, will not have a long-term perspective on the running of the port if the management contract has a fixed term and no renovation is expected. Thus, if the performance of the port is measured by its financial results, a private manager could leave congestion problems unresolved, and simply obtain extra income from high port tariffs (which some users would be prepared to pay in the case of congestion).

5.2. - Quality of cargo handling services

The second relevant component of cargo ships' waiting time, and therefore of their generalized costs, is the time spent being loaded/unloaded, which an efficient port should try to minimize. Moreover, there are also safety procedures to be followed in order to avoid damage to cargo, which operators should follow. Therefore, regulation on private concessionaires should not be concerned only with prices, but also offer some provisions on the quality of service that must be included in concession contracts.

In principle, a private operator would be interested in cargo handling services being provided quickly and safely, in order for its clients to be satisfied. But it could be the case that a profit-oriented operator does not care excessively about safety and it only values speed (in case of terminals with high demand), or spends too much time servicing ships with expensive cargoes that are prepared to pay high charges, which raises costs for other clients with low-value cargo waiting to be serviced (*cream-skimming problem*).

In order to provide incentives for loading/unloading services to be provided as efficiently as possible, and to avoid situations such as the two examples above, it is possible to include in the concession contract some minimum standards on safety and servicing times to be achieved by concessionaires. For example, it could be possible to include a variable part on the concession fee, which could depend on ships' average waiting times. By using this instrument, the private operator would have incentives to service ships optimally, and to invest in the required equipment to reduce those waiting times as much as possible. Similarly, some penalties could be contemplated if some indicator on safety standards falls below a certain minimum (e.g. number of cargoes damaged or lost).

The quality of cargo handling services also involves some technical aspects like spending adequate amounts on the maintenance and repair of equipment. Periodical revisions must be performed on the equipment, to guarantee that the risks of accidents and disruptions are minimized. Since these revisions are costly but can improve the general efficiency of the port, some conditions should be explicitly included in the concession contract for the concessionaire. Other safety aspects that must be included in a well-designed contract include obligations for the concessionaire to maintain sufficient lighting in the terminals for night services, to have adequate ramps for passenger services, and to have separate facilities for cargo and passengers services.

5.3. - General port safety

A high density of vessel traffic in the access zones of a port and within its area increase the risk of collision between ships. There is also a higher risk of a ship stranding, especially in stormy conditions. Given the negative externalities that maritime accidents cause on other port users, and the potential environmental consequences, regulation on general port safety and quality of services related to ships' movements must be strict, and compliance closely monitored.

Regarding pilotage practices, in general all ports make their use compulsory by vessels above some level of capacity or dimensions, and by those ships transporting dangerous cargo. When pilotage is imposed, a technical expert with a knowledge of port characteristics (pilot) should be on the ship as it is entering or exiting, or at least the captain must follow instructions by radio.

In those cases in which pilotage services are not directly provided by the port authority, but instead, are offered by independent agents, this activity must somehow be controlled by the port regulator. First, there must be some economic regulation on the tariffs that pilots charge for their services to shipping companies, particularly in those cases where it is not guaranteed that competition among several agents is sufficient. Second, technical capacity must be ensured by requiring pilots to demonstrate their ability to perform the required tasks. A system of licenses can be used to regulate these safety aspects. In addition, it is also recommendable to oblige pilots to have some minimum standards on their equipment (boats, radios, etc).

Pilots are the agents that determine the number and power of tug boats that a vessel requires to perform movements to enter and exit the port. Therefore, there is a risk of collusion between pilots and towing firms, so that users may be forced to buy extra services that are not necessary. On this point, it is convenient for ports to have clear regulations on the minimum requirements for towage services available to all port users (De Rus et al, 1995).

Regarding berthing services (safe tying of vessels to berths), in those ports where they are provided by private firms, port authorities should also provide some regulations to guarantee that safe procedures are correctly followed. There are experiences in ports where insufficiently tied ships have drifted within the port area, causing accidents. This problem is especially serious for tankers, since sudden unberthings when delivering or receiving supplies can lead to dangerous spills in port waters.

Finally, port authorities must always have emergency plans in case of accidents, and port workers must be trained on evacuation procedures. Concessionaires should be obliged by their contracts to fulfil some minimum standard safety requirements in their buildings and superstructure elements: emergency exits, fire-fighting devices, signs, etc.

6. - PERFORMANCE INDICATORS

In order to evaluate the outcomes that a seaport obtains, there are several types of indicators that can be used. These indexes are useful if they can be easily computed from available information (from port authorities and concessionaires), they can be updated regularly in order to study the evolution of the port over time, and they have some regional benchmarks against which they can be contrasted. Using these indicators, a regulator can assess the performance of a port, and evaluate if the results that concessionaires reach are satisfactory.

Since there are many indexes that can be computed from ports' information, it is useful to classify the possible indicators into three separate groups, according to the aspects that they aim to measure:

- *Physical indicators*
- *Factor productivity indicators*
- *Economic and financial indicators*

6.1. - Physical indicators

The type of information that this set of indicators tries to measure is conceptually very simple. The idea is to measure how much cargo is moved by a port, and how fast ships are serviced and how quickly cargo is transferred to other transport modes. Therefore, the basic indicators are mainly referred to time measures, and also indirectly, to the total volume of traffic that the port receives.

The most commonly used indicators of this type in the seaport industry are:

- ***Ship turn-round time***: this is the total time that a vessel spends at a port, from when it enters until it exits. This turn-round time can then be divided into two parts: time at berth and time outside. If a port does not have this kind of detailed information for all vessels, it is always possible to compute some average turn-round time by dividing some estimated total vessel stays over the number of vessels calling at the port during a particular period.

- ***Waiting rate***: using the two types of times described above, the waiting rate would be the time in the port but outside the berth, divided by time at berth. This index provides information about the existence of congestion problems at the port. A high value indicates that ships must spend a significant part of their time at port waiting for a berth space to be available.

- ***Berth occupancy rate***: represents the percentage of total available time that berths are in use by ships. This is a useful indicator for obtaining an estimate of the level of a port's activity. However, it must be complemented with additional information like the turn-round time, since although a high value for the berth occupancy rate would be

positive (it would indicate that a port is busy most of its time), this will only be true if the turn-round time is reduced. Otherwise, this could be regarded as an extremely inefficient port, whose users spend too much time berthed but not serviced.

- ***Working time over time at berth***: this is another complementary indicator to those above regarding a port's efficiency. A value close to one indicates that during most of the time spent by a ship at the port, it is being serviced. Meanwhile, a small value for the index would reveal that the ship is idle most of the time that it is berthed (with the corresponding opportunity cost). If detailed information is available, it could also be interesting to know the distribution of the remaining time (Time at berth – Working time). Some ports have records on the idle times due to rain, strikes, equipment failure or other reasons.

Since most factors affecting this list of indicators depend on the type of ship and transported cargo, it is difficult to provide benchmark values that can be considered valid for every ship and port. A feasible solution to make comparisons from those indexes is to compute them separately by vessel type: bulk-carriers, containers and general cargo. For example, for the waiting rate, the best values observed in the world are 5% for container ships and 20% for bulk-carriers. These are obtained in the large ports that work as regional hub centers (Rotterdam, Antwerp, Felixstowe or Singapore).

Another interesting performance indicator – from the point of view of shippers that export/import goods – is the time required for cargo to pass through the port:

- ***Cargo dwell-time****:* it is the time elapsed since cargo is unloaded from a ship until it exits the port, or the reverse operation. It is usually measured in days, and naturally, the smaller the value of the index, the higher the port's efficiency.

A high value for this latter indicator would reflect the existence of problems in the management of cargo, and although it would be extremely interesting to have knowledge of the causes of a long stay for shipments at a port, it is usually difficult to have that detail of information. The best practices are generally obtained in the container market, where large ports exhibit values around 4.7 days. Meanwhile, for general cargo the dwell times are longer, and they average 7-12 days.

Causes of delay can be due to the poor performance of administrative services, like customs or sanitary inspections, but they could also originate through bad coordination between ship and land modes of transport arrivals'. The presence of delays that increase the cargo dwell time can be disastrous for some kinds of goods, like fruits and vegetables, or fish.

Finally, other types of indicators that could be included in the physical group would be those related to safety concerns, like the number of accidents or incidents suffered by ships at a port. In order to be accurate, it is preferable that these indicators be expressed in relative terms to an exposure-to-risk variable, like the total number of ship movements to and from the port. In order to evaluate the commitment of concessionaires to safety, it is

possible to evaluate the amount of investments on safety over total expenditures, or over some volume of cargo handling.

6.2. - Factor productivity indicators

In addition to those physical indicators providing information on ports' efficiency, it is important to have some knowledge of the productivity of labor and capital, since in cases when low port's efficiency is detected, it is possible to identify the reasons causing it. Some simple indicators to measure productivity are:

- ***Tons per worker-hour or per gang-hour***: these measures are aimed at measuring labor productivity, but when making comparisons across ports, it must be ensured that conditions are similar, since, for example, the size of a gang can vary between two ports. Similarly, when comparing workers' productivity, this should be done only on equivalent types of cargo. Moreover, the information would have to be complemented with some indexes on the state and type of equipment employed, since labor productivity varies according to a port's capital stock.

- ***Tons per crane-hour***: this simple indicator evaluates the productivity of one of the main elements of equipment for cargo loading/unloading. In order to make comparisons across ports, again some homogeneity on the type of cranes should be guaranteed. For the case of containers, it is possible to compare ports more easily, since both cranes and cargoes are basically homogeneous. For that type of cargo, instead of tons it is preferable to use TEUS as the unit of reference.

- ***Tons per berthing location or per linear meter:*** these indicators try to provide a measure of the efficiency of a port in the use of its basic infrastructure in providing services to ships.

- ***Tons per ship-day***: this indicator gives an idea of the total productivity of a port in cargo handling. A reduced value for the index will indicate a low efficiency in the port, and the imposition of longer times over ships.

6.3. - Economic and financial indicators

Lastly, there is a third group of indicators that can be calculated to provide a complete picture of a port's situation to those institutions in charge of regulation. The objective of all these indexes is to reflect port finances and level of charges to users:

- ***Operating surplus over GRT/NRT*** [3] or ***operating surplus over handled ton***

- ***Total income (expenditure) over GRT/NRT or ton.***

[3] Gross Registered Tons (GRT) or Net (NRT).

- ***Charge per TEU***: a usual index to evaluate the efficiency of a port, regarding container traffic, is to check what is the total charge per handled TEU. This is becoming an international reference benchmark, though it is recognized that local conditions over some particular costs (e.g. labor) might vary considerably. Therefore, it is recommendable to use this indicator on a regional basis. Overall, the best practices around the world indicate that this index can have its minimum around $120-$180 (*see Box 13 above*)

7. - REGULATORY INSTITUTIONS

The new competitive environment of the port industry requires a revision of the roles that public institutions in charge of this sector (ministries, public agencies and port authorities) must play. Traditional port institutions suffer in many countries from serious problems relating to an excess of bureaucracy and lack of incentives. Many agencies in charge of seaports do not have clear plans about what their objectives are, or these are so vague that they cannot be implemented in practice to yield any positive outcomes (*see Box 16*). In order to solve these problems, four types of strategies have been followed across the world: commercialization, liberalization, privatization and modernization (Hochstein, 1997).

Commercialization refers to those changes aimed at making port institutions work independently from political interference, and to develop rapid responses to market circumstances, such as a private firm does. In order to achieve this, it is a necessary condition for seaports to be run under similar laws to those regulating private businesses, and free from the slow systems of controls required by public administration.

Box 16. **Problems of traditional seaports' institutions**

- Political pressures
- Excess of bureaucracy
- Hierarchies' rigidities
- Lack of clear plans and objectives
- Poor management techniques
- Poor marketing strategies
- Lack of funds for investment
- Excess of personnel
- Lack of incentives

Source: Hochstein (1996)

Additionally, it is desirable that the structure of the seaports' system is as decentralized as possible, in order for decisions on a port to be taken by an agency with sufficient knowledge of the problems and the local conditions, and not by a centralized agency. Thus, many countries are starting to decentralize their seaport systems and transform their port authorities into private societies with the ability to issue bonds or equities that can be traded such as those of private companies.

Liberalization seeks to reduce monopolistic situations within seaports. It is based on allowing the free entry of new private operators, which can then compete in some cases with transformed formerly public firms. Privatization, on the other hand, is oriented toward selling those former public firms to private agents, in order to eliminate subsidies, improve efficiency, and make users pay the full costs of services. A partial or complete transfer of assets can be chosen, according to the type of service considered, and the political consideration of the asset involved (e.g. infrastructure is not generally sold to the private sector, but only granted temporarily for its use).

Lastly, modernization of seaport administration implies that it is possible to improve institutions in charge of seaports, by introducing changes in the incentives managers have to perform their tasks as skillfully as possible. Ports' commercial and marketing strategies have to be changed for ports to be able to survive in highly competitive frameworks. The use of information technologies (implementation of electronic systems to interchange data) should be a priority for all ports in order to modernize their operations.

During the last decades, there has been a general process leading to the transformation of seaports worldwide, which is changing ports from being entities completely controlled by governments to becoming mixed private-public organizations, or even becoming fully transferred to private hands. As pointed out by Hoffman (1998), this reform is probably more positive for developing rather than developed countries, since ports in the former are in serious need of investments for development and renovation, and governments suffer from a lack of resources. However, transforming ports in developing countries is more complicated, due to the fact that seaports' institutions are generally more prone to political control and corruption. Port workers also have more power in those countries to block or delay the required reforms (as in the case of Brazil, as described above), since they are one of the loser groups in this process.

Even though the reform of seaports implies that governments should quit this industry, there is still a need for some public intervention at two levels. First, the process of reform must be promoted and directed from the government, in order to define what the objectives the new reformed system intends to pursue. Second, after private participation is introduced at seaports, there is a need for regulation of new private operators. As has been discussed throughout this paper, competition can be used as a substitute for regulation, but competition will not always be feasible for all ports and types of services.

This new task of regulation can in principle be assumed by any of the existing institutions with responsibility over seaports, but ideally, an independent agency would be a better solution. An independent regulator must be able to avoid political interference from governments, as well as avoid 'capture' by private operators.

An optimal seaport system should allocate tasks between institutions in the following way:

- First, the **Ministry** or **government department** in charge of ports must reduce its role in order to provide the adequate legal environment for the reform of seaports. A general

law establishing the framework in which the industry must work is a necessary condition for a reform to be successful. Legislation must be passed to remove ancient norms in most countries regarding prohibitions on private firms operating in seaports. Similarly, labor practices are usually very rigid in traditional ports, since they were designed to be very protective of workers' rights as was required by circumstances in the past. Today, they hamper the development of modern ports. In addition to the reform of general legislation on ports, another pre-requisite that a government must provide is the existence of anti-trust institutions. Since a modern system of ports is based ultimately on concessions and competition between operators, cases of collusion and monopolization are likely to appear.

- **Regulator**: some agency or institution should be allocated the task of supervising the process of privatization and liberalization, in order for the reform not to be a mere transformation from public monopolies to private ones. The regulator should try to combine the social objectives pursued through reform (improved cost efficiency, low charges) with the private interests of the new concessionaires (profits, security). The fundamental instrument of that phase must be a correct drafting of concession contracts, in which all aspects discussed in section 3.3 should be considered. Once the reform of the system is completed, a regulator should endeavor to supervise the enforcement of contracts, and to solve the possible disputes that might arise.

  Ideally, for a regulator to perform all these tasks correctly, it should be independent from the government. However, in practice, it is rarely observed that one of these 'perfect regulators' is instructed to take care of seaports' systems (in contrast to other industries, like electricity, railways or telecommunications, where at least in some developed countries some independent regulators have been used). In the seaport industry, regulation is in some cases performed by central public agencies, and in others, is left in the hands of port authorities. For example, the reform in Argentina did not include the existence of this type of institution. In the case of Mexico, there are petitions for some independent regulator to be created as a result of alleged monopolistic practices by operators at the terminals of Veracruz and Manzanillo (Sutter, 1997).

- **Port authority**: its role should be much smaller than it used to be in the past. In particular, in a modern port, the tasks of a port authority should only be to manage the public common infrastructure, to guarantee the existence of minimum safety conditions in the port area, and to take care of environmental aspects. It can also be in charge of promoting private participation in as many services and investment projects as possible. However, if there are elements of infrastructure for which there are no private interests (e.g. external breakwaters, dredging of common zones), the port authority should ensure that these are not abandoned. In some cases, it could assume those tasks directly, while in others it could contract them to subsidized private firms.

There is a debate in the seaport industry about what should be the ideal character of port authorities. These institutions have traditionally been public in most ports, but there are also

examples of some private port authorities, although privatization processes around the world have rarely reached port authorities. Only the UK has gone as far as privatizing even these institutions, as well as the former *British Transport Docks Board,* which was transformed into a purely private firm (*Associated British Ports plc*). There are other examples in which port authorities have introduced some private participation by issuing equities, like in the case of Mexico.

Arguments in favor and against private port authorities are similar to the debates regarding the privatization of any public agency. In the case of seaports, Goss (1990) discusses the need for the existence of a coordinating institution within ports, and shows the advantages and disadvantages of a public port authority. On one hand, as advantages, it is pointed out that it is required to have an agent who takes care of those infrastructures or other elements that *do* have the characteristics of public goods (costs are not increased by marginal users, and it is impossible to avoid having some agents derive some utility from the good, even without paying for it).

It is a known fact that public goods, if left to be self-organized by a group of agents, can easily end up being underprovided. Typical examples of this type of goods are access channels – once built and dredged, the marginal ship imposes a cost equal to zero –breakwaters, buoys, lights and other aids to navigation. Even though all these elements have characteristics of public goods, the number of users of a port is relatively small so as to allow for the existence of some control mechanism to oblige all users to finance the good. If that becomes possible, a private port authority could obtain the same outcomes as a public institution.

Another type of argument in favor of a public port authority would be for a more efficient control of the negative externalities that can be generated to third parties that do not make any use of the port. A public port authority would defend the interest of these parties better, since in principle, its objective will be to defend general social interests, and not only those of port users. As an example of these externalities, environmental effects can be cited. A seaport generates some residuals from its activities, or imposes some risks of oil spills and other accidents, which can seriously affect the city or region where the port is located. In principle, a public port authority could deal with these problems better than a private one.

Among the disadvantages of a public port authority, is that it does not face any type of market discipline. In addition, its level of bureaucratization will be predictably high. This type of institution is by definition relatively slow, since it must follow all the established procedures to guarantee adequate public control of its accounts. Those procedures preclude public port authorities from reacting to business opportunities as quickly as a private institution. In some cases, it is possible that a public port authority might not be allowed to obtain financial resources in the market (e.g. by issuing debt), which would limit its ability to implement large infrastructure projects.

Finally, when analyzing the roles and tasks of a port institution, a question arises concerning the degree of centralization that is optimal. The ownership and control of a port

can be one of three types: central or national, regional and municipal. Seaports under national responsibility have the advantage of benefiting from the central planning of investments, and so for some large projects, it is possible that the port can be helped by other national ports. However, these ports do not have flexibility in the organization of their operations, since this will be organized by the central agency. Examples of this type of organization can be found in Spain and the Philippines.

Regional ports depend on states or regional governments. They have the advantage of having more flexibility than national ports, but on some occasions, competition among seaports within the same country can generate an excess of capacity for port facilities. Examples of this model are New Zealand and United States.

Lastly, municipal ports such as Rotterdam are better prepared to react to local conditions, and thus they are more flexible than others in making changes and adapting to variations in demand or other needs. However, the port's interests are sometimes tied to the general priorities of the city (Hochstein, 1996).

The degree of a seaports' decentralization in a given country can often depend on its size, the number of ports it has, and its legal tradition. Remarkably, in most countries in the Latin America region, there is an evident trend toward decentralization, promoted by national governments. This is observed in Argentina, Brazil, Colombia, Mexico and Venezuela, where the general laws regarding ports are providing a higher degree of autonomy to port authorities.

8. - APPENDIX 1: TYPE OF OWNERSHIP OF MAIN 50 WORLD PORTS (1997)

Port	TEUS thous.	Public	Mixed	Private	Port	TEUS thous.	Public	Mixed	Private
1 Hong Kong	14,539		♦		26 Seattle	1,476		♦	
2 Singapore	14,135	●			27 Gloa Tauro	1,449		♦	
3 Kaohsiung	5,693		♦		28 Manila	1,358		♦	
4 Rotterdam	5,445		♦		29 Hampton R.	1,232		♦	
5 Pusan	5,234		♦		30 Osaka	1,200		♦	
6 Long Beach	3,505		♦		31 Le Havre	1,185		♦	
7 Hamburg	3,370		♦		32 Genoa	1,180		♦	
8 Los Angeles	3,000		♦		33 Tacoma	1,159		♦	
9 Antwerp	2,969		♦		34 Charleston	1,151	●		
10 Dubai	2,600		♦		35 Bangkok	1,099		♦	
11 Shangai	2,527	●			36 L.Chabang	1,036		♦	
12 N.York/N.J.	2,457		♦		37 Melbourne	1,029		♦	
13 Tokyo	2,383		♦		38 Durban	984	●		
14 Yokohama	2,328		♦		39 Barcelona	972		♦	
15 Felixstowe	2,251			◊	40 Tianjin	935	●		
16 Keelung	1,981		♦		41 Jeddah	921		♦	
17 Kobe	1,944		♦		42 Southampton	891			◊
18 San Juan	1,781		♦		43 Montreal	870		♦	
19 Bremen	1,526		♦		44 Taichung	842		♦	
20 Colombo	1,687	●			45 Valencia	810		♦	
21 Kelang	1,684			◊	46 Santos	829		♦	
22 T. Priok	1,671		♦		47 Sharjah	815		♦	
23 Algeciras	1,538		♦		48 Houston	798		♦	
24 Oakland	1,531		♦		49 Sidney	765		♦	
25 Nagoya	1,498		♦		50 Miami	761		♦	

SOURCE: **CASS (1996)**

9. - APPENDIX 2: SEAPORTS' PRIVATIZATION – INTERNATIONAL EXPERIENCES

Africa	
Kenya	*Hutchinson Port Holdings* (HPH) signed in 1996 a contract to manage and operate the container terminal at Mombassa. This is considered as a first step towards further introduction of private participation at the port.
Morocco	Seaports' reform is in the agenda of the government, and it is considering allowing private capital into ports. First stage has been the transformation of the public agency *Régie d´Acconage du Port de Casablanca (RAPC)* into a new autonomous public corporation. This change is aimed to improve the efficiency of 11 ports, starting by Casablanca and Mohammedia. A project financed by the World Bank has led to a cargo handling productivity increase of 25%, and the average dwell time of containers at the port was reduced a 40%.
Senegal	The port of Dakar is being transformed into a landlord type of organization. Stevedoring services have been transferred to the private sector.
America	
Bahamas	The first phase of its modernization project had an objective of capacity provision for container traffic (400,000 TEUS). Now it is trying to start competing against Miami and other Caribbean ports.
Colombia	Seaport laws authorized 25 private ports to handle only specific cargoes. A new general law was passed in 1991, allowing these ports to work on any type of cargo from that date onwards. The central public company in charge of state ports organization (COLPUERTOS) has started to be dismantled. The objective is to introduce competition between the main ports of the country: Buenaventura, Barranquilla, Cartagena y Santa Marta. Privatization of the port of Cartagena was initiated after 1991, and since then it has improved its efficiency. The container terminal at that port (COTECAR) has plans for enlargement of its capacity up to 500,000 TEUS/year.
Costa Rica	Stevedoring services at the ports of Limón and Moin is performed by private firms. However, at the port of Caldera those services are still under public organization (Alvarado, 1998).
El Salvador	The state port of Acajutla is starting its reform process, with plans to introduce private participation.
Guatemala	Stevedoring services at the ports of Quetzal and Barrios has been transferred to the private sector. The process of privatization of those services at the port of Santo Tomás de Castilla has also been initiated (Alvarado, 1998).
Honduras	The program for the general reform of the transport sector include plans to privatize seaports. At the moment, full privatization of all ports is being considered, with the exception of Puerto Cortés, which is the main port of the country. The idea is to keep this last port under public control, but to introduce private participation at terminals (Juhel, 1994). However, private firms have been already authorized to operate stevedoring services at Puerto Cortés (Alvarado, 1998).

Mexico	The new 1992 seaports' general law has redefined the role of the State in the industry. The government is relinquishing port administration, terminal operation and provision of other port services. Privatization started with 26 projects, including the cargo terminals at the ports of Lázaro Cadenas, Manzanillo, Altamira and Veracruz. The bidding process of seven small ports (Acapulco, Topolobampo, Mazatlan, Puerto Vallarta, Guaymas, Ensenda and Campeche) did follow. The objective is to reach a system of *landlord* type of ports. It is planned that port authorities (API) at each port will manage those publicly owned assets that will be concessioned to them. The decentralization program aims to end up with 22 APIs running the main ports of the country. These APIs are allowed to have private participation by issuing equity.
Nicaragua	Stevedoring services at ports of San Juan del Sur and Puerto Cabezas are performed by the public sector. However, authorities at the ports of Sandino, Bluff, Arlen, Rama and Corinto are starting to concessioning those services to private firms organized by port workers (Alvarado, 1998).
Panama	It is intended to partly transfer those ports controlled by the State public agency *Autoridad Portuaria Nacional (APN)* to the private sector. Thus, the ports of Balboa and Cristobal were privatized in 1996 and are now run by P*anama Ports Company*, a subsidiary of *Hutchinson Port Holdings*. On the other hand, there are plans for an international consortium to invest $600 million on a project for the construction and operation of a container terminal on the Atlantic side of the Channel at Telfers Island.
Uruguay	The general seaports' law passed in 1992 introduced significant reforms in the ports' activity. The main reform was to make more flexible the use of labor at ports. There are plans to grant a concession of the only container terminal of the country to the shipping company *Maersk*. This proposal is somehow risky since the concessionaire should be strictly supervised not to discriminate at the terminal against some rival shipping companies that may compete for import/export traffic. However, this same company has a concession at the Spanish port of Algeciras for a transshipment terminal, and no problems have been reported so far. There is a difference between both cases though, since at Algeciras there are other independent alternative terminals.
Venezuela	Port reform was initiated in 1991, by dismantling the public agency in control of seaports (*Instituto Nacional de Puertos, INP*). In 1992 the transfer or responsibilities from INP to the eight port authorities now in charge of ports was completed. These port authorities now have the task of introducing private participation through concession of container terminals. The new system specifically limits the possibility of any public sector institution (national, regional or municipal governments) can provide services at ports. The first ports to introduce private participation were Caracas and Puerto Cabello (Juhel, 1994).

	Asia
China	Shanghai's port authority and the private firm *Hutchinson Whampoa Ltd.* formed in 1993 a joint-venture to create the company *Shanghai Container Terminals Ltd. (SCT)*, that owns and operates the container terminals at the port. During its first year in operation, SCT handled 25% more containers than in the previous year, and productivity was increased in more than 30%. There are investment plans of $673 million, to be completed by 1999. Moreover, SCT has preferential rights for the development of container terminals at other ports. Hutchinson Whampoa is also involved in the development of the Yantian port, a locations that is intended to become one of the four China's hubs, together with Dalian's Daiyo Bay, Beilun and a port in the Fujian province. The parties that are more interested in the development of Chinese ports are shipping companies with regular services in the region and private investors based at Hong Kong (Peters, 1995). For example, Maersk has a preferential agreement as the main user at the port of Yantian, and P&O has made significant investments in the container terminal at Shekou and in the development of the Tianjin port.
Philippines	One of the first concessions in the Asian region was the *Manila International Container Terminal (MICT)*, granted in 1988 to a consortium of private firms. The terminal was concessioned for a 25-year term, and it has had a positive impact on the terminal productivity, since ship turn-round time was reduced a 60%. The concession contract includes a minimum income level guaranteed for the government, and it involves investments for $54 million. There are plans to enlarge further the capacity of Manila with a fifth berth that would permit the port to handle more than 1 million TEUS/year. Regarding other ports, *Asian Terminals Inc. (ATI)*, a joint-venture formed by *P&O* and the local firm *7-R Port Services*, has a 15-year contract with the Philippines Port Authority to operate the South Harbor of Manila (Peters, 1995). *HPH* has won a bid to develop and operate a container terminal at the American naval base of *Subic Bay,* for a 25 year-term.
India	The *Indian Ports Association (IPA)* is opening doors to private participation at seaports, though the process is very slow. The only relevant plans are to grant 3-year BOT contracts to private operators.
Malaysia	Privatization was initiated in 1986 at the port of Kelang, when the container operations were granted for 21 years to the joint-venture *Kelang Container Terminal* (KCT), formed by the port authority and private investors. In 1992, a second privatization phase was launched, by concessioning the rest of the port's infrastructure to another private company *(Kelang Port Management*, KPM). Although the port authority does not have participation at KPM, it possesses a golden share to keep control over essential issues. The KPM container terminal thus competes with the KCT terminal within the port of Kelang (an example of inter-port competiton). There is a project to develop new facilities at Westport, located also in Kelang. The initial plan was designed by the government to reduce congestion at existent facilities, and te intention was to finance it with public funds. But eventually it was concessioned to a private consortium *(Kelang Multi-Terminal Consortium, KMTC)* with a 30-year term contract. It is planned that these new facilities developed by KMTC will compete against those of KCT and KPM, reinforcing even more the competitive framework of the Kelang port.

Sources: Juhel (1994), Peters (1995), Hall (1997), Webster y Cohen (1997), Alvarado (1998).

APPENDIX 3: CONCEPT OF LONG-RUN MARGINAL COST

The concept of long-run marginal cost is not an exclusive idea for the seaport industry. On the contrary, it has been applied before by other industries which share the characteristic of involving expensive infrastructure elements, as in roads or public utilities (water, gas, etc). The problem that all these industries face is that they require significant investments to build the infrastructure, which constitute large sunk costs, while thereafter the marginal costs of operation are relatively small. If the social optimal pricing rule is applied in order to promote the use of the infrastructure –price equal to marginal cost– it is impossible for private companies even to recover their investment costs (see Loudon, 1984; Hanke and Davis, 1973; Saunders et al, 1977).

With the aim of seeking a second-best alternative which can keep the objective of reduced prices to avoid excluding potential users, the long-run marginal cost (LRMC) is defined as the sum of short-run marginal cost (SRMC) plus the marginal cost of capacity (MCC):

$$LRMC = SRMC + MCC \qquad [A.1]$$

For the case of seaports, the marginal cost of capacity (MCC) would be the additional cost of infrastructure required to attend one more unit above the maximum installed port's capacity. It is evident that for the case of ports with excess of capacity, each additional user does not require new infrastructure, so in that case MCC = 0 and the long-run and short-run marginal costs are equal, where the latter cost is formed only of maintenance and infrastructure repairing costs. Meanwhile, for the case of a port with congestion problems, the marginal cost of capacity has a positive value, and therefore LRMC > SRMC.

The idea of long-run marginal cost is that if users pay that price for the use of the port, the port authority would be able not only to cover the operating costs, but also to finance the infrastructure construction costs. Therefore, the problem posed above by the short-run marginal cost pricing rule would be solved.

However, there are some difficulties when implementing long-run marginal cost pricing in practice –common to other industries– and these are: (1) the infrastructure cannot be enlarged in a continuous way (there are indivisibilities derived from the minimum size that a berth can have, or the general configuration of the port); and (2) the infrastructure assets have a long economic life. If the rule of setting price equal to long-run marginal cost is directly applied, port tariffs could oscillate widely between years, since those users that call at the port in periods of capacity enlargement would then be paying for some assets that are to be used also in the long-term.

In practice, a solution is to use some formula to distribute the cost of construction and its associated financing cost (payment of interests on loans) during the economic life of the asset. Thus, it is estimated what part of the total cost of capacity should be paid by port users each year, so that port tariffs do not vary much, and at the end of the period the users have financed the asset.

As an example of a possible formula to use, consider the case of a seaport in need of an investment of amount I that is completely financed by a loan with an annual interest rate equal to i. Then, it is possible to calculate a constant annual payment $r\,I$ such that at the end of the period of n years estimated for the asset life, the loan and its associated interest payments would be completely repaid. The unit repayment cost r would be given by the expression:

$$r = \frac{(1+i)^n \, i}{(1+i)^n - 1} \qquad [A.2]$$

Once that the part of total capacity cost for each year t is computed, the marginal cost of capacity can be approximated dividing it by the increase in the level of port activity (Q) for each period:

$$MCC_t = \frac{r \, I}{Q_t - Q_{t-1}} \qquad [A.3]$$

In the case of a port's enlargement that involves several projects to build infrastructure and superstructure elements, which can be entering into service at different dates, the definition above can be modified by taking averages to avoid jumps in the port tariffs during the construction period. A more detailed description can be seen in Nombela, Trujillo and Matas (1998).

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