

# COMPETITION, EXCESS CAPACITY, AND THE PRICING OF PORT INFRASTRUCTURE

H.E. Haralambides  
Erasmus University Rotterdam  
Haralambides@ese.eur.nl

## *Abstract*

Intensified inter-port competition, combined with automated labour-saving cargo handling systems, reduces the local economic impacts of port investments, as well as the value-added of port activities. In such a situation, the beneficial impacts of low port prices are not localized, but are instead dissipated from the country in question to the foreign consignee. This issue causes considerable concern to governments contemplating the continuation of their public investment programmes, as it deprives them of the basic *rationale* of doing so, namely, that the port provides a public service to the benefit of the whole nation. Such concerns have become noticeably “vociferous” nowadays when governments have to reduce in size, cut down on spending and taxes, and allow for more private sector participation in some ‘strategic’ sectors that, until recently, were jealously guarded as government prerogatives.

However, the pricing strategy of a port depends on the way the port is financed and, ultimately, on the ownership status of the port: should, thus, a publicly owned and financed port be allowed to compete on price, for the same custom, with a privately owned port that has to charge higher prices in an effort to recover its investments? What if these ports are in the same, economically interdependent, geographic area? What if the effects of strategic pricing of different ports are, at the end of the day, felt by the same consumers or taxpayers? Should ports primarily engaged in commercial operations, such as container terminals, be publicly financed or should the port user pay in full for the port services he enjoys? Do ports need to recover infrastructure costs through pricing? And what happens if some do and others don’t while all have to compete for the same hinterland? Is there such a thing as ‘efficient port pricing’ and is there scope for policy intervention to ensure a level playing field? Should ports, regions and countries compete or cooperate when it comes to infrastructure? In principle, cooperation among producers (ports) is not to the benefit of the consumer but, on the other hand, does the latter benefit when he pays taxes to develop ‘competing’ infrastructure while knowing that he is due for reprisals in a never-ending vicious circle of public spending? Shouldn’t such public spending be also liable to the same international anti-dumping laws as other goods and services? In terms of trade policy, is there a difference between a subsidised shipyard and a subsidised port? If not, why do we shout about the former but turn a blind eye to the latter?

The European Union continues to remain neutral on the public or private ownership status of a port and it does not dispute in any way the fact that public investments are the prerogative of Member States. It nevertheless attempts to have a saying on whether a certain investment, that *in theory* is open to all, but in practice is meant for a few, could, in the spirit of its Treaties, be considered as ‘public investment’. For example, a road that connects a container terminal to the national motorway system is in principle open to all citizens and as such the road is a public good. In practice, however, the road is only used by the operator who exploits the terminal. The access channel to a port is dredged down to 15 metres. In principle, every floating craft can go through the channel but, surely, the channel wasn’t dredged to that depth

with the fisherman in mind. Should such investments be public or private? And should their costs be paid for by the taxpayer or those who directly benefit from them? These are some of the pertinent questions in port pricing that this paper aims to address with special emphasis on container ports.

The paper shows how Marginal Cost Pricing of port infrastructure can be a powerful ‘pricing discipline’ towards achieving cost recovery and fair competition among ports. To succeed in this, the paper advocates for stronger policy intervention in order to ensure greater transparency of port accounting systems, better and more harmonised port statistics, a meaningful set of state aid guidelines, and stricter application of Competition Law in port infrastructure investments.

### **Acknowledgements**

Many of the ideas developed in this paper have benefitted from numerous discussions with staff of the European Commission over the period of my involvement in the preparation of its *Green Paper on Ports and Maritime Infrastructure*. I am particularly indebted to Rodolphos Papaioannou, Fernando Aragon, Maj Theander, Lenita Lindström, Lia Athanasiou, Anne Bergenfelt and of course to Neil Kinnock himself for his remarkable insights. The usual disclaimer applies. The paper first appeared in 2002, and it should be referenced as: Haralambides, H.E. (2002) ‘Competition, Excess Capacity and the Pricing of Port Infrastructure’. *International Journal of Maritime Economics*, 4: 323-347. The present version is substantially rewritten, in view of developments since then, as well as my four years’ experiences as president of the Italian port of Brindisi. Readers are advised not to bypass, as is usually the case, the many footnotes that follow.

## INTRODUCTION

In ports, as in many other industries, prices -port dues and cargo-handling charges as they are often called- can 'make' or 'break' a port. The right prices can lead a port to prosperity and growth; the wrong ones can guide it to extinction or to the proliferation of subsidies and inefficiency. High prices would normally deprive a port of part of its patronage (vessels and cargo owners) and thus reduce demand for port services. Since, once a port is built, it has few alternative uses if any, i.e. its investments are largely sunk<sup>1</sup>, excess capacity will ensue as a result, and resources and infrastructure will become underutilised. Even when ports have some degree of monopoly power over their customers, and thus demand for port services is not reduced much, high port prices would still hurt the very trade the port is supposed to serve.

Low port prices, on the other hand, may bring clientele to the port but congestion could ensue, investment costs may not be recovered in the long-run, and the port's competitors may grudge about unfair competition, particularly when low prices are the result of subsidies.

In competitive industries, a producer has no influence on the price he sells his product or service; he either adjusts his costs to the externally determined prices or he vanishes. A port, however, operates in a market of imperfect competition<sup>2</sup> where pricing often becomes 'strategic pricing', i.e. the ability of the producer to influence, or set, prices in order to achieve certain objectives. Such objectives, many of which simultaneously pursued albeit often in conflict, include profit maximization through price discrimination; throughput maximization; generation of employment and economic activity; regional development; minimisation of ship times in port; and, last but not least, the promotion of trade.

However, the pricing strategy of a port depends on the way the port is financed and, ultimately, on the ownership status of the port: should, thus, a publicly owned and financed port be allowed to compete on price, for the same custom, with a privately owned port that has to charge higher prices in an effort to recover its investments? What if these ports are in the same, economically interdependent<sup>3</sup>, geographic area? What if the effects of strategic pricing of different ports are, at the end of the day, felt by the same consumers or taxpayers? Should ports primarily engaged in commercial operations, such as container terminals, be publicly financed or should the port user pay in full for the port services he enjoys? Do ports need to recover infrastructure costs through pricing? And what happens if some do and others

---

<sup>1</sup> Often there is some confusion between the concepts of 'sunk' and 'fixed' costs. The former are costs that cannot be recovered once the firm decides to leave the market; a breakwater could be a good point in case here. Fixed costs, naturally, are those that do not vary with output. A sunk cost could thus well be variable, e.g. marketing and advertising expenses, while a fixed cost, such as that of a gantry crane, does not necessarily have to be sunk, as the asset could be sold to another port.

<sup>2</sup> Despite the degree of competition, a port will always have a *captive* market, at least on cargoes in its immediate hinterland. This fact alone suffices to describe ports as an imperfectly competitive market where the producer, i.e. the port, may have considerable power over its prices. (Chamberlin, 1933; Robinson, 1969).

<sup>3</sup> The concept of an economically interdependent geographic area or region, as I use it here, has both a spatial and an economic dimension. It refers to a spatially delineated geographic area in which 'binding' arrangements (laws) of direct economic impact -such as for instance competition, labor and fiscal laws- are 'jointly and institutionally' put in place with the aim of maximizing collective welfare. Apart from an individual country (with its regions, provinces, etc.) that would obviously qualify under such a definition, a good example of such an area is the European Union, as well as other regional blocs, depending on the strength of their institutional ties over and above trade policy.

don't while all have to compete for the same hinterland? Is there such a thing as 'efficient port pricing' and is there scope for policy intervention to ensure a level playing field? These are some of the pertinent questions in port pricing that this paper aims to address with special emphasis on container ports<sup>4</sup>.

## THE PRODUCTION OF THE PORT SERVICE

There is no such thing that could be adequately described by the mere word 'port' and no two ports are alike. A port could be anything from a small sheltered patch of sea that protects fishermen from the roughness of the sea, allowing them to moor their boats and trade their wares in safety somewhere in the south pacific, to the huge industrial complex of the city-port of Rotterdam, embracing in its expanse hundreds of companies, roads, railway lines, distribution centres, refineries and other industrial and manufacturing activity.

Regardless of how a port is developed and organised, however, its main function is to enable, hopefully in a safe and cost effective manner, the transfer of goods from sea to shore and *vice versa*. As such, a port is an interface between sea and land; a node in a transport chain; a point where goods change mode of transport. Cargo-handling is thus a port's core business. In order to do this, a port has to organise a large array of other services, all equally important in the facilitation of cargo transfers: it has to provide (dredge) sea channels and turning basins of adequate depth (draft) to enable the approach and manoeuvres of vessels; navigational aids, breakwaters, pilots, tugs and linesmen to allow vessels to moor and unload safely; equipment to handle goods in port and move them around; warehouses to store them until they are picked up by their owners; electricity; water; security; customs; administrative offices and much more.

The paramount good a port has to provide however, in order to facilitate all this, is *land*. A port is a land-intensive industry. Here is the first issue where *port pricing* encounters its major stumbling block: what is the value of land? What is its opportunity cost? Under what terms should port land be made available to private port operators, stevedoring companies and others?

In many parts of the world, land, particularly land close to the sea, is a scarce good with high opportunity cost and many potential claimants. Cities can use it for residential and office space<sup>5</sup>; offshore industries have to be located in its proximity; tourism and recreation industries would naturally consider it as prime location; fishermen would also value it highly,

---

<sup>4</sup> I vividly recall a rather heated discussion on such issues, over lunch, among the members of Kinnock's 'wise men' group. In the middle of the discussion and quite unexpectedly, Kinnock walked in and, before greeting us, he said: "...so you decided to spend your time on port pricing; I can promise you one thing: you will retire discussing the same subject...".

<sup>5</sup> Sometime in the 90s, I was involved in a World Bank project on the modernization of the Indian port sector. It was the time when the WB was building, in Mumbai, one of the most modern ports in the region, the new port of Nhava Sheva (or the Jawaharlal Nehru Port). At a high level meeting, I recall myself saying, in the form of a witticism, that "...now, with a new modern seaport, JNP, Mumbai should totally scrap the old city port and develop that area into residential and office space, given the scarcity of the latter and the incredibly high real estate prices of the city...". Difficult for one to imagine how *cold* the meeting room became immediately, in spite of us being in the middle of the monsoon period... I often make the same joke to my Antwerp friends. "...I cannot understand", I keep telling them, "why Antwerp – a river port with locks and dredging requirements- is necessary, when just around the corner there is Rotterdam...".

while nature lovers would tend to preserve it, and its ecosystem, at all costs. This is why port management, and the supervision of port activities, is often entrusted to municipal authorities and other port stakeholders, who strive to steer a balanced course and reconcile the various interests at stake.

More important than the land itself, however, is how, and by whom, land is developed to become ready to provide the port service. Often, land has to be reclaimed from the sea; it has to be paved; reinforced; roads and rail trucks have to be constructed on it; while to extend a port, even by just a few hundred metres of quayside, would require massive investments. The way these investments are financed, i.e. publicly or privately, bears the most upon the way port services are priced. Simply, a publicly funded container terminal may not have to recover –through prices- investment costs and thus its prices (cargo-handling tariffs or concession fees) could be set quite low, *vis à vis* a privately developed and financed terminal, which must recover investment costs and, other things being equal, would thus be at a competitive disadvantage.

## PORT COMPETITION

In the past, particularly after WWII, the development and provision of infrastructure was largely in the hands of the State. Often, infrastructure was considered as a public good, serving the collective interest of the nation by increasing social cohesion, as well as by expanding markets for inputs and output, i.e. bringing people to work, raw materials to industry, and goods to consumers. Infrastructure and mobility allows for large-scale production of goods, consequently low unit costs, and thus international competitiveness<sup>6</sup>.

With the exception of some developing countries, infrastructure was thus invariably developed ahead of existing demand -on the part of industry, agriculture and commerce- in the hope that the latter activities would expand in the wake of the former (infrastructure) (Rosenstein-Rodan, 1943). A notable example of this was the case of the North American railways, particularly those of Canada. Furthermore, large capital indivisibilities in infrastructure development, coupled with substantial financial requirements and long gestation periods until demand picked up, had made infrastructure development the prerogative of the public sector.

With regard to ports in particular, in the past, general cargo traffic was less containerisable, regional port competition was less of an issue, and ports comprised a lot of labour intensive activities, generating considerable value-added and a multitude of direct and indirect impacts on the national economy, including of course the facilitation of international trade. They were thus seen by governments as *growth-poles* of regional and national development and, as a matter of fact, they were often used as instruments of regional planning. Around the world, countries have done so by steering public investment, through regional policies, towards ports, in order to encourage national development. Thus, investment costs did not have to be recovered, being financed by the taxpayer through the general government budget or similar regional or municipal sources.

---

<sup>6</sup> After the canals of the Great Lakes were constructed, an Ohio farmer would receive 10 times the price for his corn, which could now be sold at a much higher price in New York rather than in Cleveland.

Ports, in addition, were fairly insulated from competitive forces, each serving its own, more or less captive, hinterland. This was due to trade barriers, national borders and inadequate land transport infrastructure. No matter how inefficient the port, the ship would still have to go there. Most ports were badly run, disorganised, bureaucratic, inefficient and expensive; a shipowner's nightmare and worst enemy!

Nowadays, however, the picture is considerably different. Trade liberalisation, helped by the remarkable developments in transport, logistics and communication technologies, has drastically weakened the link between manufacturing and the location of factors of production and has stimulated a most noticeable shift in manufacturing activities towards countries with a comparative advantage.

Developments in international transport have been instrumental in shaping these processes. Containerisation and multimodal integrated transport have revolutionised trading arrangements of value-added goods and have given traders and global managers more control and choice over their 'production-transport-distribution' chain. Furthermore, transport efficiency is necessitated by the very same nature of value-added goods whose increasing sophistication requires fast transit times from origin to destination, in order to increase traders' turnover and minimise high inventory costs. Today, these costs have been brought down significantly through the use of logistical concepts and methods, and also by the increased reliability and accuracy of international transport that allow manufacturing industries to adopt flexible *Just-in-Time* and *Make-to-Order* production technologies. *Inter alia*, such technologies enable companies to cope with the vagaries and unpredictability of the seasonal, business and trade cycles and plan business development in a more cost effective way.

Trade liberalisation, land infrastructure development, and new logistical concepts in the organisation of international transport of containers have had an equally profound effect on the port industry. Port hinterlands have ceased to be captive and have extended beyond national boundaries<sup>7</sup>. Governments are increasingly realising that, from mere interface points between land and sea, ports have become the most dynamic link in international transport networks and, as a result, inefficient ports can easily wither gains from trade liberalisation and export performance. Convinced about this, governments have often taken drastic steps to improve the performance of their ports: new capacity and labour-saving cargo-handling equipment have replaced outdated facilities; port worker training has intensified; customs procedures simplified; information technology widely adopted; and management structures commercialised.

Moreover, the port industry has moved noticeably from one in which predominantly public funds were used to provide common user facilities, to one where capital -public and private- is being used to provide terminals which are designed to serve the logistical requirements of a more narrowly defined group of users. Indeed, they may be designed to serve the needs of a few or even one firm (Dedicated Container Terminals).

At the same time, economies of scale in liner shipping and the sophistication and capital-intensity of modern containerships have limited the number of ports of call to only a selected few transshipment hubs or load centres. These very important ports (such as Rotterdam, Hong Kong and Singapore) have become the *foci* of international trade, and goods are moved by land (road and rail) and water (barge) from inland centres and feeder ports to these global hubs. The hub-

---

<sup>7</sup> Often, I ask my students to tell me which is Germany's largest port, but rarely I get the correct answer; i.e. that this is the port of Rotterdam!

and-spoke system that has ensued in this way has made transshipment traffic a lucrative business to be had at all costs.

The ‘mobility’ and ‘footloose’ character of the transshipment container, however, together with intertwined land transport networks and extended hinterlands, have intensified competition among container ports immensely. Today, it makes little difference if a Hong Kong container destined for Paris will pass through the port of Rotterdam, Antwerp or Hamburg. This container has little ‘loyalty’ to any given port and it switches between ports with relative ease. The price elasticity of demand for container handling services has thus become quite high<sup>8</sup> (Table 1). Transshipment may thus be profitable for some ports (with considerable domestic cargo, such as Rotterdam) but it could also be quite risky for others (pure transshipment), even if they are as strategically positioned as the port of Singapore.

**Table 1:** Price elasticities in selected north European container ports

Port	Elasticity
Hamburg	3.1
Bremen Ports	4.4
Rotterdam	1.5
Antwerp	4.1
Le Havre	1.1

Source: *ATENCO*

In this way, each port’s development, financing and pricing decisions can have marked effects on its neighbours, nationally and -most importantly- internationally. Often, this raises strong voices for ‘market driven’ investments; a more harmonised approach in the financing of port infrastructure; as well as pricing policies that will have to allow for full cost recovery.

These are most complex and often political issues that, as a result, have not allowed much progress to be made in terms of port policy formulation in economically interdependent areas. In all my discussions with port managers over the years, no one would ever question the importance of ‘market driven’ investments and pricing for cost recovery. However, in all such discussions, there has always been an implicit ‘from now on’ assumption and no port would seriously consider that pricing for cost recovery should reflect the costs of past (public) investments.

However, in the past, investments were not always market driven. Massive amounts of public monies have in the past been funnelled into port development, enabling many ports to consolidate such a strong market position that makes it rather easy for them, now, to advocate for the need for market driven investments. This should be kept in mind and the market-driven investments argument should not become a ‘limit pricing’ strategy of large and powerful ports, deterring market entry of smaller and peripheral ports who also aspire to develop and serve *themselves* their rapidly growing regions.

---

<sup>8</sup> Whether the absolute level of the elasticities in Table 1 is correct is a much less important issue than the observation of a very substantial divergence of elasticities among the various ports. Hence, variation in prices, as a result of the adoption of alternative pricing systems, would, at least in the case of containers, lead to fundamentally different impacts on individual ports, even when engaging in similar price increases.

## Cost recovery and limit pricing

In industrial economics, *limit pricing* refers to a strategic behaviour whereby incumbent firms raise competitors' costs, through a multitude of ways, to a level that makes new entry unprofitable (Martin, 1993). The above strategy can be explained the simplified example of Figure 1. Port A (incumbent) of country X has a dominant market position. This has been established over many years of public expenditure both in the port itself and its related infrastructure (roads, maritime access, etc.). As such, the port is able to meet a substantial part of the trade of country Y through transshipment. Port A is a strong proponent of cost recovery policies in port development in general but, at the same time, it is allowed to consider 'bygones as bygones' and thus its prices, current and future, do not have to include the recovery of its past investments. The demand for its services is given by  $DD'$ .

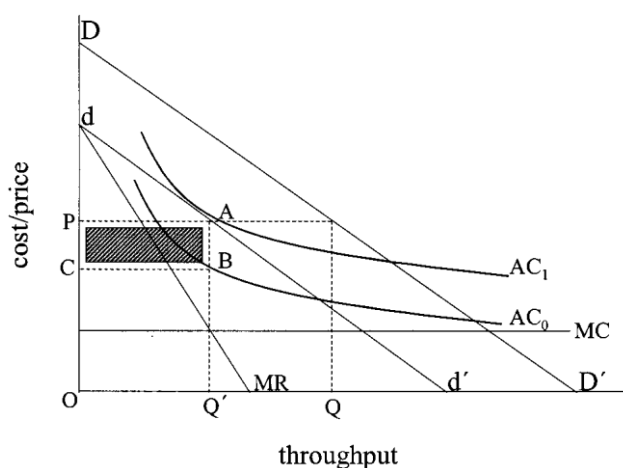


Figure 1: Cost recovery and limit pricing

Port B (entrant) in country Y is much smaller. Although in a favourable geographic position, the port has never developed its own container facilities, as a result of both lack of funds *and* because it was adequately served (feedered) by port A. The trade of country Y, however, is rapidly increasing and port B feels that it is now time to develop its own facilities and 'claim back' its traffic –and all that comes with it- from port A. The government of Y sees the importance of such an action and is prepared to fund the required investments.

Once developed, the demand for port B services is expected to be  $dd'$ ;  $dMR$  gives its marginal revenue line. Its average cost (without recovery of infrastructure costs) and marginal cost curves are given by  $AC_0$  and  $MC$ , respectively. The port maximises economic surplus (ABCP) by serving  $OQ'$  level of throughput at a price of  $OP$ . Only  $Q'Q$  of total traffic is now left to port A.

Naturally, port A is rather unhappy with these plans. Its port policy department mounts a very strong campaign, together with other ports in the same predicament, lobbying regulatory authorities on unfair competition from a to-be-subsidised port that, if it materialises, it would deprive port A of much of its traffic. Port A claims that, by not charging for infrastructure costs, port B will be producing at prices below costs and thus antidumping and competition laws should be applicable.

Were port A to succeed in demanding full cost recovery pricing, port B's average cost curve would shift upwards to a new position  $AC_1$  or even further. At this level, there is no single price that would enable port B to break-even, let alone realise a positive surplus. In such a



situation, port B wouldn't even consider expanding, leaving the whole market to port A. By insisting on, and achieving a policy of full cost recovery, port A has been successful in maintaining its dominant market position.

## THE PRICING OF PORT INFRASTRUCTURE

As it was mentioned above, strategic pricing can pursue a multitude of objectives and it can take various forms such as marginal cost pricing (MCP), average cost pricing (ACP), Ramsey Pricing (Ramsey, 1927) and two-way tariffs. Whatever the pricing method, or combination thereof, it is becoming more and more obvious among competing ports, and those who fund them, that prices should be cost-related and, in the long-run, they should allow for cost recovery, including infrastructure development costs.

There are cases however of ports that face, or pose, little competition. These serve local industries and communities and may be important centres of territorial development. Often, the port is the only major economic activity and employer in the territory. Such peripheral ports could still be considered as 'public goods', without a need to recover the costs of infrastructure development. In this case, the government should assess, through *economic impact analysis* and *social cost-benefit analysis*, the relative merits from regional development impacts *vis à vis* the (opportunity) costs of the public resources required to develop and maintain the port. If the former exceed the latter, prices could be set below costs in order to promote regional development. Ensuing deficits could then be seen as the 'social cost of regional development'.

In all other cases, particularly in the case of container ports amidst intense regional competition, the setting of prices below costs, in order to attract traffic from competitors, is not an acceptable strategy.

First, this would lead to a misallocation of resources (and taxpayer money). Intensified inter-port competition, combined with automated labour-saving cargo handling systems, reduces the *local* economic impacts of port investments and the value-added of port activities. In such a situation, the beneficial impacts of low port prices are not localized, but are instead dissipated from the country in question to the foreign consignor/consignee. This issue causes considerable concern to governments contemplating the continuation of their public investment programmes, as it deprives them of the basic *rationale* of doing so, namely, that the port provides a public service to the benefit of the whole nation<sup>9</sup>. Such concerns have become noticeably "vociferous" nowadays when governments have to reduce in size, cut down on spending and taxes, and allow for more private sector participation in some 'strategic' sectors that, until recently, were jealously guarded as *government prerogatives*.

Second, in economically interdependent regions, such as for instance the EU, below-cost pricing would lead to complaints for unfair competition and competition law would in principle be applicable, particularly as deficits would have to be covered from public funds, often seen as *state aid* rather than public investment.

However, cost-relatedness of prices and full cost recovery are things easier said than done. A port is a multi-product firm and prices for many of its services, e.g. those described as

---

<sup>9</sup> This was in broad terms the position of various Dutch governments on the issue of the new Maasvlakte II terminals in Rotterdam.

*services of general economic interest*, are often bundled in port dues. Cross-subsidisation is also common. For instance, in order to attract transshipment cargo, a port may cross-subsidize feeder operations, or penalize, through higher prices, domestic cargo which is fairly captive. The *joint cost allocation* problem in economics is therefore present here too, together with the difficulty, if not impossibility, to allocate such costs to different port services.

The difficulty of this problem is often exacerbated by our inability to accurately measure port costs, especially marginal costs. Reliable and comparable port statistics do not exist; port accounting systems diverge; and, finally, the financial flows between the port and its institutional ‘owner’ (municipality, region, State) are not always known or transparent.

Many of the above difficulties, however, are often exaggerated. What follows is an attempt to demonstrate how the consistent application of *marginal cost pricing* (MCP) in ports could eventually eliminate deficits and the need for public funding, lead to an efficient allocation of scarce resources, and achieve a level playing field among competing ports.

### **The issue of excess capacity**

As a result of inherent excess capacity, container ports are declining cost industries or, in economic terms, industries of *increasing returns to scale*<sup>10</sup>. In such industries, short-run marginal cost pricing (SRMC) results in deficits, for marginal costs –the level at which prices are set under competition- are always below average total costs.

Excess capacity in competing container ports has a number of causes. As a matter of fact it could be shown (Haralambides *et al*, 2002<sup>a</sup>) that the higher the competition among ports, the higher the need for excess capacity.

First, as already mentioned above, ports are often seen as pivots of regional development and, thus, infrastructure is built far ahead of demand in order to promote economic development. Second, managerial ‘ego-boosting’ is often not innocent of its responsibilities for the creation of excess capacity. However, the real economic culprits of excess capacity ought to be found in capital indivisibilities (lumpiness of investments), economies of scale in port construction, and over-optimistic demand forecasts.

In competing container terminals, furthermore, excess capacity is also an ‘operational necessity’, being the only way to provide quick turnaround times to ships and thus maintain or increase patronage. It can be easily shown through a simple single-channel-multiserver queuing model (Haralambides *et al*, 2002<sup>a</sup>) that once a port reaches 75% capacity utilization, congestion sets in; and waiting is unacceptable in today’s liner shipping industry. With this in mind, ‘operational’ excess capacity ought to be seen as another unavoidable cost, rather than an indication of inefficiency and wastage of resources. However, in their appeals to public funding agencies, port managers have not been very convincing in bringing this point across and, as a result, governments have been reluctant to see excess capacity in this light.

The problem of ‘operational’ excess capacity is exacerbated with the increasing deployment of ever larger containerships. As has been shown earlier (Cariou and Haralambides, 1999; Cariou, 2000<sup>a</sup>), in general, the cost per TEU of ship-time in port is an increasing function of ship size (Figure 2). In other words, one TEU, arriving on a larger ship, costs more to handle and store. This has to do mainly with the limited availability of cargo-handling equipment (cranes) that

---

<sup>10</sup> Liner shipping is another good example of such an industry, familiar to the student of maritime economics.

can be put to work on a ship, and the problem of course intensifies at higher levels of terminal capacity utilisation. Still, four and sometimes five crane operations are standard today in many major ports for post-Panamax ships. One cannot envision however eight or ten cranes working concurrently in sustained operations on a 10,000 TEU vessel in Hong Kong, Singapore, Rotterdam or Los Angeles any time in the near future. (Haralambides *et al*, 2002<sup>b</sup>).

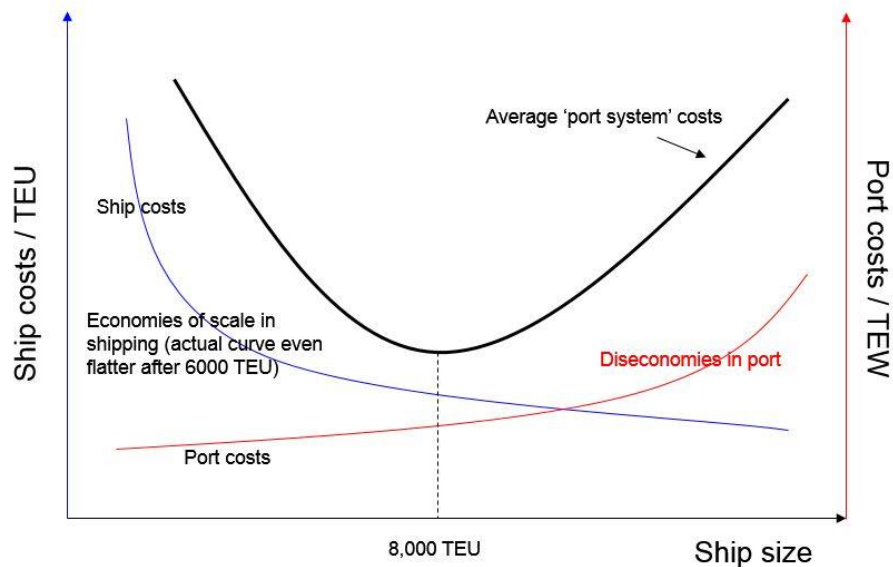


Figure 2: The need for joint optimization: Economies of scale in shipping, diseconomies in ports

Figure 2 deserves some further discussion. If you ask a carrier how large a port should be, the answer you will invariably get is ‘as large as possible’. The carrier’s objective is to have ample port capacity, if and when he calls, so as to minimize his turnaround time. To the same question, a port manager will answer ‘as small as possible, even if carriers would have to queue for a berth’. Here, the port’s objective is obviously the maximization of the utilization of its infrastructure. A middle road, a compromise in other words, needs to be taken and this is what Figure 2 shows.

Figure 2 two presents the declining average costs of shipping (economies of scale), and the increasing average port costs (diseconomies of scale), as functions of ship size. The ‘compromise’ consists in the minimization of *average ‘port system’ costs* (u-shaped line), derived by adding up the two average cost lines. In doing so, the optimum ship size is also derived at the lowest point of that line. Ships larger than this increase port costs, while those smaller increase shipping costs by not enjoying economies of scale.

Thus, other things being equal, the handling of larger vessels requires more excess capacity in ports. There is one more reason for this. A daily demand of 15,000 TEU, at a certain 900-meters quay-wall container terminal, could be served either by 3 panamaxes (280 meters length) or 2 post-panamaxes (350 meters length). In the latter case, the berth is underutilized by 33%.

Figure 3 tells the same story for a 600m quay terminal, serving an annual demand of 720,000 TEU<sup>11</sup>. The example presents four scenarios in which the above annual traffic is served by ships

<sup>11</sup> The example of Figure 3 was prepared by my good friend and colleague Yvo Saanen of TBA whom I thank for allowing me to reproduce it here.

of different sizes, ranging from panamax (4000 TEU) to the 18,000 TEU Malacca-max. In the latter case, and assuming constant berth service time, berth productivity needs to quintuple, while berth utilization is cut to a third.

VESSEL INCREASE AT EQUAL VOLUMES				
Parameter	Set-up 1	Set-up 2	Set-up 3	Set-up 4
Volume (TEU) per m quay length	1,200	1,200	1,200	1,200
Berth length (m)	600m	600m	600m	600m
Yearly berth volume (TEU)	720,000 TEU	720,000 TEU	720,000 TEU	720,000 TEU
Average vessel length (TEU)	4,000 TEU	9,000 TEU	12,500 TEU	18,000 TEU
Average vessel length (m)	270m	350m	400m	400m
Average call size (containers)	1,000	2,250	3,125	4,500

ASSUMED AND REQUIRED PRODUCTIVITY LEVELS AND CRANE DENSITY				
Parameter	Set-up 1	Set-up 2	Set-up 3	Set-up 4
Gross berth time (=net + 2 hrs.)	24	24	24	24
Resulting vessel service time	22	22	22	22
Required berth productivity (moves per hour)	45	102	142	205
Operational quay crane productivity (moves per hour)	28	30	32	30
Resulting crane density	1.6	3.4	4.4	6.8
Required number of quay cranes per ship	2.0	4.0	5.0	7.0

NUMBER OF CALLS AND NUMBER OF CRANES				
Parameter	Set-up 1	Set-up 2	Set-up 3	Set-up 4
Yearly number of calls in order to handle yearly volume	450	200	144	100
Realised berth utilisation with yearly volume (C)	55%	32%	26%	18%
Crane hours per year to handle yearly volume (C)	16,071	15,000	14,063	15,000
Required number of quay cranes	4	4	5	7
Crane utilisation (100% = 8760 hrs/y)	46%	43%	32%	24%

Figure 3: Impact of large ships on berth utilization (*source: TBA*).

Finally, the creation of excess capacity can also be seen as a form of *limit pricing* (see above) and this often explains the reluctance of both governments and regulatory authorities (e.g. the European Commission) to sanction and finance ambitious port development plans that go beyond what would normally be regarded as ‘realistic’ demand forecasts. Here, hub-port strategies and port investments that encourage the construction of larger and larger container ships<sup>12</sup> increase the sunk costs of new entrants, thus consolidating the incumbent ports’ market power on the one hand, and making new entry unprofitable on the other.

Competition and excess capacity mix an ‘explosive cocktail’. Competition pushes prices down to marginal costs, not allowing full cost recovery (and, often, survival). In liner shipping, an industry with similar structure to that of ports, this problem has been solved -at least so far- through self-regulation and the organisation of carriers in conferences and global shipping alliances. The objective of the former (conferences) is to cover long run average costs through price-fixing, while the objective of the latter (alliances) is to achieve the same

<sup>12</sup> e.g. by dredging approach channels; turning basins; and quay walls at unreasonable drafts.

result albeit by better capacity utilization, through mutual slot charters; vessel swaps; and, in general, joint planning and scheduling.

### Short- and Long-run Marginal Costs

Let us try to see the above context through the use of a simple graph (Figure 4) that will also be our vehicle for showing how *long-run marginal cost pricing* (LRMCP) can have the positive effects mentioned above. In order to do this, a brief elaboration on the concepts of short- and long-run marginal costs is necessary; particularly of the latter which is a most crucial, albeit misunderstood, concept in maritime economics.

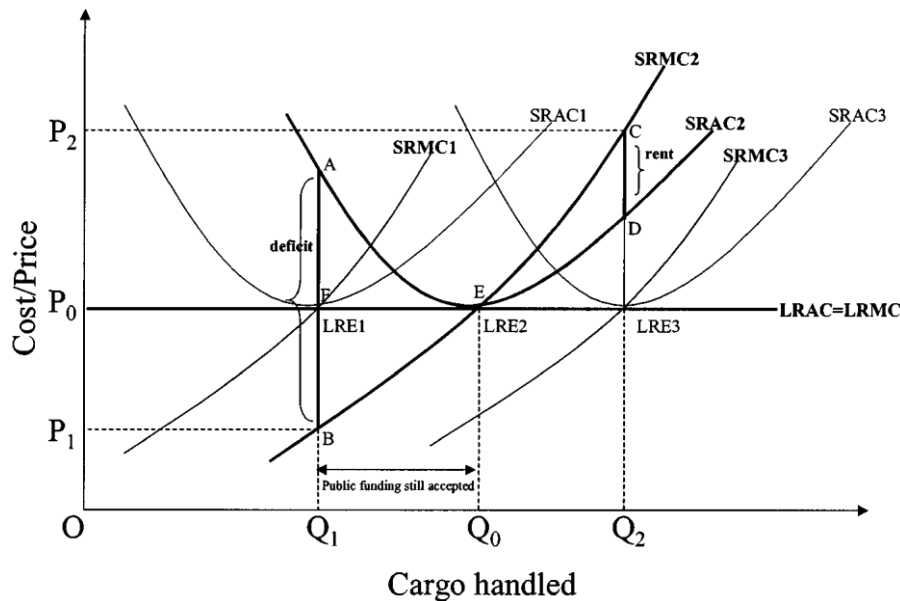


Figure 4: Marginal cost pricing in ports

In the short-run, the size of a port must be considered as fixed. The costs of fixed capital assets, such as quays, yards and rest of infrastructure, are invariant to output, and variable costs mainly relate to those of cargo-handling and nautical services (e.g. pilotage). In the short-run, marginal costs (SRMC) consist of the increment in variable costs required to produce and extra unit of port service, e.g. the handling of an extra container, when all other costs are kept constant.

In the long-run, all costs are considered variable. The concept of long-run marginal cost (LRMC) is similar to before with the difference that, now, LRMC is the increment in *total* costs required to produce an extra unit of port service. By considering total costs, i.e. by including infrastructure costs as variable ones, LRMC becomes a *planning* concept. In other words, it gives us the *long-run equilibrium* (LRE) port size, able to satisfy a given level of demand at minimum average total cost, without incurring deficits or realising *economic rent* (i.e. supernormal or monopoly profit). In the absence of rapid technological change, we often assume that  $LRMC=LRAC=Constant$  (Figure 4).

### Increasing returns to scale

The above could be better grasped by looking at Figure 4. Assume that the size, organisational structure and 'operational' excess capacity of our port can be adequately described by its short-run average total cost curve SRAC2. The port faces intense regional competition from

neighbouring ports, its investments are publicly funded and, at present, the level of demand it has to satisfy is  $Q_1$ . Increasing returns to scale are thus present.

As a result of competition and the lack of a need to recover (publicly funded) infrastructure development costs, our port will be tempted -if not forced- to set prices equal to marginal costs, i.e.  $P_1$ . (SRMC2 is our port's short-run marginal cost curve). Such costs regard technical-nautical services; regular maintenance; security; and other services of general economic interest. A deficit of the order of AB is thus created and MCP does not allow the port to recover its infrastructure costs. Apparently, our port is too large for that level of throughput ( $Q_1$ ).

Unless demand picks up considerably far beyond  $Q_1$ , such a situation is not sustainable in the long-run without continuing public support. Taxpayers, however, will become increasingly sceptical and competitors abundantly vociferous, in whichever way they can, on unfair competition. In long-run equilibrium (LRE), that level of throughput ( $Q_1$ ) ought really to be produced by a much smaller port (LRE1 / SRAC1) whereby SRMC pricing would allow the recovery of full costs. At that size, the port would exhibit *constant returns to scale* and it would be able to produce its services at minimum average cost.

### **Diminishing returns to scale**

Let us now see what would happen if our port was faced with a situation where demand for its services was substantially higher, say  $Q_2$ . Here, the port exhibits *diminishing returns to scale* (diseconomies of scale) and although State coffers cannot complain in terms of revenues, congestion is a chronic problem and ship waiting times unacceptably long. Port capacity is over-utilised, accidents in cargo-handling very likely, and carriers impose surcharges on shippers. Demurrages are claimed. Such a situation, common in many ports during the pre-containerisation era, can still be found in many general cargo ports around the world.

Here, MCP is not only appropriate but strongly recommended as a pricing strategy that rationalises demand and allocates scarce port capacity according to carriers' and shippers' willingness to pay. Apparently, *balking* (carriers refusing to call at the port) and *reneging* (existing carriers leaving the port) are at this point the least of our port's concerns.

Setting price equal to marginal cost in this case means that our port charges a price of  $P_2$  for the last ton of cargo it handles and this price is over and above (line CD) what on average it costs the port to handle a ton of cargo when the total amount of cargo handled in a certain period of time is  $Q_2$  tons. Now, the port realises *economic rent*, or supernormal profit, i.e. an economic surplus after all factors of production have been paid for, including entrepreneurship, as well as a normal return on capital. Total economic rent accrued to the port beyond the minimum cost production level  $Q_0$  is thus equal to the area ECD.

Here too, the situation is not sustainable in the long-run. Clearly, the port is too small for that level of throughput. Eventually it will have to expand to its long-run equilibrium position LRE3 / SRAC3 where it will only earn normal profit, producing and charging at minimum average cost. The port will be helped in this by its competitors who will also invest and expand in an effort to capture part of its economic rent.

### **Constant returns to scale**

However, port development and contraction are dynamic processes and rarely, or by accident, would a port be found on its LRE position. As said earlier, lumpiness of investments, economies of scale in port construction and wrong demand forecasts would see to it. This is why we stressed above that LRMC is a planning, i.e. normative, concept; a snapshot of a dynamic process. At any point in time, a port could diverge markedly from the idealised situation of LRE.

Having said that, however, if all competing ports within a certain economically interdependent geographical region were to be taken together, it would be reasonable to assume that the industry as a whole demonstrates constant returns to scale and, therefore, LRMC pricing, if ever achievable, would lead to efficient resource allocation, maximisation of social welfare and a level playing field among competing ports. This was the spirit and philosophy of the European Commission's White Paper on *fair payment for infrastructure use* which ascertained that '*...the entire infrastructure complex of the EU as a whole may not exhibit economies of scale...*'. This means that, at least at an aggregate level, it should be possible to recover total costs.

### **Cost recovery through MCP**

But let us, for the time being, return to our example of Figure 4 and the case where our port faces the limited demand of  $Q_1$ . The port management remains optimistic that their plans and forecasts will eventually materialise and demand will pick up to the level of  $Q_0$ , if not further. However, costs have now to be recovered through port charges. If at the level of  $Q_1$  the port charges a price of  $P_1$ , equal to its long-run average and marginal cost, there would still be a deficit but now reduced from AB to AF.

In so doing, i.e. by consistently charging at  $LRMC=LRAC$ , and as demand picks up, the port will eventually reach its LRE level of throughput where costs will be fully recovered. In the range of output  $Q_1$  to  $Q_0$ , public funds are gradually and increasingly recovered until the deficit is phased out completely at point E.

Such public funding is and should be allowed given its digressiveness (temporary and declining) and the private sector's frequent reluctance to finance chunky investments of long gestation periods. The understanding now however is that these funds will have to be eventually recovered, irrespective of whether they are ploughed back to the public sector or used for further development by the port itself. In an era of reduced public spending, such an understanding may also help in enticing private funds to the port sector, as well as in giving an answer to the important question as to whether the pricing of port expansions should also reflect the cost of past (public) investments.

Despite the elegance and desirability of MCP, a lot of questions still remain open. Could this be done in practice? Could a port voluntarily and single-handedly charge prices higher than its competitors? Is there scope for policy intervention in pricing matters? Can we measure LRMC? Is MCP economically efficient when applied by some ports only, while the rest of the infrastructure connected to these ports (e.g. roads and railways) does not follow suit? Let us take these questions in turn.

### **Measuring marginal costs**

With a given level of technology and organisation -fairly standard aspects in modern ports today-, the measurement of long-run average or marginal costs simply boils down to forecasting future demand for port services (Figure 4). Once this is established, the LRE size of the port can be established too and the only cost element required for the measurement of LRMC is the construction cost of an additional metre of quayside and all that comes with it (aprons, yards and possibly organisational costs as a result of bigger size). Port engineers have fairly accurate data on these.

### **Forecasting port throughput**

But can demand for port services be forecasted with any degree of confidence? This is one of the trickiest and most complex questions in maritime economics and one that can only be treated rudimentarily in a paper such as this.

In a closed economy, forecasting port demand is straightforward: observe population, agglomeration, consumption, personal incomes, and consequent international trade volumes and translate them -mostly through regression analysis- into required port capacity; a popular exercise for students of maritime economics.

In an open and economically interdependent economy, however, things are different. As a result of intertwined and extended (common) hinterlands; abundant land infrastructure; short-sea feedering networks; continuously evolving liner shipping networks; and the infamous 'mobility' of a 'footloose' container, port demand is very volatile and unpredictable today: from deterministic in the past, port demand has now become stochastic. Port market shares are thus unstable, and investments in one region or country have an impact on another. For example, a dedicated railroad line connecting Rotterdam with the Ruhr area in Germany will impact north sea German ports; new container capacity in Antwerp will take away traffic from Rotterdam; the port of Tanjung Pelepas in Malaysia has stolen Maersk from Singapore; and Korea invests tremendously in order to compete, as a hub, with both Japan and China.

In such a 'fluid' environment, how could one forecast port demand with any degree of credibility? Should ports, regions and countries compete or cooperate when it comes to infrastructure? In principle, cooperation among producers is not to the benefit of the consumer but, on the other hand, does the latter benefit when he pays taxes to develop 'competing' infrastructure while knowing that he is due for reprisals in a never-ending vicious circle of public spending? Shouldn't such public spending be also liable to the same international anti-dumping laws as other goods and services? In terms of trade policy, is there a difference between a subsidised shipyard and a subsidised port? If not, why do we shout about the former but turn a blind eye to the latter?

Answers to such questions belong to the realm of public- rather than maritime economics. One could however start fathoming the answers by looking at the role of *public investment*; a concept that, surely, globalization, and regulatory authorities, will redefine before too long. Here are two examples of such *public investment*. A road that connects a container terminal to the national motorway system is in principle open to all citizens and as such the road is a public good. In practice, however, the road is only used by the operator who exploits the terminal. The access channel to a port is dredged down to 15 metres. In principle, every floating craft can go through the channel but, surely, the channel wasn't dredged to that depth with the fisherman in mind. Should such investments be public or private? And should their



costs be paid for by the taxpayer or those who directly benefit from them? I firmly believe it should be the latter.

### The kinked demand for port services

Another question we posed above was whether a port would, voluntarily and single-handedly, charge a price higher than that of its competitors. The answer here is ‘no, unless it has to’, i.e. unless it has to recover costs. As we mentioned above, ports operate in an oligopolistic market and individual upward price moves tend not to be matched by competitors who will most likely maintain their own prices low in an effort to benefit by capturing a larger market share. A port’s demand curve is thus a *kinked* demand curve such as  $dD'$ , depicted in Figure 5.

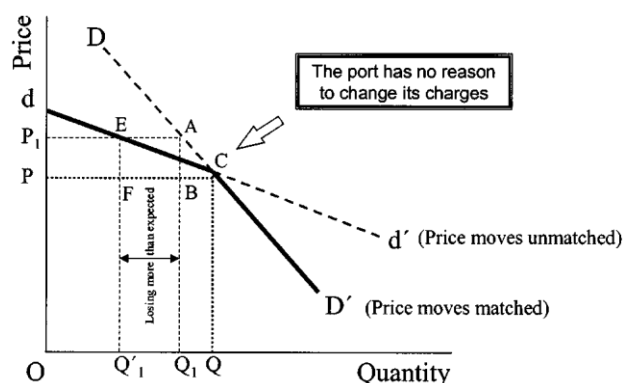


Figure 5: The kinked demand for port services

Assume that, originally, the demand for the services of our port is given by  $DD'$ . The port is at equilibrium, charging a price of  $P$  per ton of cargo for a total throughput of  $Q$ . The port, believing that its competitors will follow suit, plans to raise prices to  $P_1$ . Knowing its price elasticity of demand, the port calculates that the increase in revenue as a result of higher prices ( $ABPP_1$ ) will more than compensate the loss in revenue due to lower ( $Q_1$ ) throughput ( $BCQQ_1$ ); that is  $ABPP_1 - BCQQ_1 > 0$ .

To its bad luck, however, the competitors of our port maintain prices at the same level hoping to capture a greater market share. This does of course happen and our port’s demand curve flattens to  $dd'$ . At the higher price of  $P_1$ , our port is only able to serve a  $Q'_1$  level of throughput. It loses revenue much more than what it was expecting ( $FBQ_1Q'_1$  more), while its extra revenue due to the price increase is only  $EFPP_1$ , less by  $ABFE$  from what the port was originally anticipating. Had our port known, as it should, that its competitors would not follow suit in raising their prices, it would have no good reason to raise its own price single-handedly, as this would make it worse-off in the end. This is the more so when ports and governments are aware that LRMC pricing can lead to allocative efficiency only as long as other markets are also efficient (Pareto optimality). If the latter condition is not satisfied because of institutional restrictions, then, according to the *Theory of Second Best* (Lipsey and Lancaster, 1956) ‘...it is in general neither necessary nor sufficient to satisfy the remaining conditions...’; i.e. to endorse MCP in ports when roads, railways and the rest of the infrastructure do not do the same.

In the context of the European Union, a voice is often loudly raised, by both the Commission and the port industry, arguing that MCP in ports will only make port services ‘unilaterally’ more expensive thus penalising the Union’s efforts to check road traffic and promote short sea shipping; a most valid argument indeed. In this light, efficient port pricing cannot be seen in

isolation but only through a general equilibrium approach where the rest of the port related infrastructure and its pricing are also being considered simultaneously.

## POLICY INTERVENTION

If ports are not, naturally, individually prepared to disadvantage themselves by charging higher prices, in order to recover costs, is there scope for *policy intervention*? Could a ‘pricing discipline’ be imposed on competing ports in economically interdependent regions that could alleviate their own misgivings about unfair competition?

In the European Union, this was the objective of the Commission’s *Green paper on ports and maritime infrastructure*<sup>13</sup>. The Paper set out the broader context of Community port policy, with a focus on the issue of state aids and infrastructure charging. The main question was whether, and how, an efficient pricing system, leading to cost recovery, could be implemented in practice in the port sector, taking into account a variety of relevant objectives and constraints including higher market based efficiency; increased cohesion; distributive goals; the development of short sea shipping; the improvement of safety and environmental protection, etc.<sup>14</sup>

The *Green Paper* attracted growing industry attention on the desirability and scope of a more harmonised European seaport financing and pricing strategy. A large scale, pan-European research study for the European Commission (DG Transport and Energy), known under the acronym “ATENCO” (Analysis of the main Trans-European Network ports’ Cost structures), was subsequently carried out<sup>15</sup>, with the main goal to provide input for an in-depth reflection at European level on (a) the design of a strategy to achieve efficient pricing and (b) the possible impacts of a cost recovery approach on the functioning of ports.

The study came up with a number of conclusions, the most important of which were: (a) The high sensitivity of demand for port services to changes in prices (Table 1). As an example, the study calculated that if the port of Hamburg were to recover the dredging costs of river Elbe from user charges, this would add Euro10 (or roughly 5%) to its terminal handling charges per TEU. According to Table 1, such a price increase would lead to a 15.3% (roughly half a million TEU) reduction in container traffic<sup>16</sup>. (b) No policy intervention on pricing matters would ever be acceptable by the industry, who strongly felt that pricing policies are solely for the ports themselves to decide. The argument here was that even when full cost recovery is sought as an overall objective, ports apply a variety of pricing principles simultaneously in order to achieve managerial effectiveness at the micro-level. (c) However, it was unanimously agreed, by every port management team interviewed, that *cost recovery* -regardless of how

---

<sup>13</sup> The author had the privilege of being member of the then EU Transport Commissioner, Neil Kinnock’s group of experts that drafted the Paper. The Commissioner opened the first meeting of the group with a statement that took everyone aback: ‘...if countries want to spend public money to develop their ports, so be it and there is nothing we can do about it...’. A lot has changed since then though.

<sup>14</sup> Other, more recent, policy documents at European level have also addressed this issue; cf. *Final Report* by the high level group on transport infrastructure and charging, concerning options for charging users directly for transport infrastructure operating costs.

<sup>15</sup> The author was involved in this exercise as Chairman of the Academic Experts Group.

<sup>16</sup> Such estimates have to be viewed with utmost caution and full understanding of the assumptions underlying them. For instance, this impressive percentage assumes that other ports in the region would be able to absorb smoothly the extra traffic or additional costs. It is also assumed that no changes take place in the pricing of the rest of the infrastructure (roads, etc.).

this was to be achieved by each individual port- should be pursued and, for that purpose, better port statistics, accounting systems and transparency of port accounts are required<sup>17</sup>.

Following the ATENCO results, the Commission came up with what has come to be known as its 'port package' (European Commission, 2001<sup>a</sup> and 2001<sup>b</sup>). In this, the EC, convinced now about the desirability of cost recovery in ports, has taken a fresh look at two most important issues: (a) the need for greater transparency in the efficient allocation (leases/concessions) of port land to service providers on an equal opportunity basis and in a way by which leases reflect better the opportunity cost of port investments; (b) the no longer indiscriminate treatment of port infrastructure investments as 'public investment'. Particularly with regard to the latter, although the Commission continues to remain neutral on the public or private ownership status of a port, and it does not dispute in any way the fact that public investments are the prerogative of Member States, it nevertheless attempts to have a say in whether a certain investment, that in theory is open to all, but in practice is meant for the few, could, in the spirit of the Treaty, be considered as 'public investment'.

---

<sup>17</sup> Surprisingly, most port authorities expected that the adoption of full cost recovery pricing would have little impact on pricing levels. It is believed here that, although in private ports, such as those of the UK, this may well be the case, this is far from truth in all other ports and this conviction of many port managers can only be explained by their inability to grasp in full the notion and implications of long-run marginal costs.

## CONCLUSIONS

Cost recovery and the pricing of port services are complex and controversial issues, both technically and conceptually. This is so because they deal with the development and provision of infrastructure; economic development; public investment; fiscal policy and the role of the State in economic activity. Before too long, economic analysis of this type takes one into the realm of *moral philosophy*. Indeed, the type of *economics* we accept as valid reflects nothing more than our philosophical inclinations as regards the evolution of society, the desirability of equity, and the importance of production.

The issue of port pricing in maritime economics has not arisen only out of academic interest but as a response to the need felt in the port industry itself for a self-discipline mechanism that, if consistently applied, would eventually lead to the recovery of port investment costs and to future investments that are largely *demand driven*. This requirement has been the result of the recognition that, in the intensified regional port competition of today and the increasingly tightened fiscal constraints, it is no longer acceptable to indiscriminately and without a formal economic *rationale*, spend taxpayer money on port investments, often aimed at increasing market share at the expense of other ports, particularly within the same economically interdependent area.

Naturally, pricing for cost recovery looks at the ‘user’ rather than the ‘taxpayer’. This is just as well, given that ports (at least container terminals) are being transformed from public to private enterprises. The allocative and income distribution effects of such a switch in direction are obvious: investments are recovered, and port revenues generated, from the user of a (private) facility, who will have to somehow pass these costs on to the final consumer. The latter will in all likelihood have to pay higher prices for the goods he consumes but, at least in efficient markets, he is compensated by correspondingly paying less taxes (for infrastructure investments). Obviously, such issues are highly complex and have yet to be researched.

In principle, pricing for cost recovery should mean that depreciation of port infrastructure is included as a cost in the port’s pricing system. Something like this would undoubtedly raise the level of port prices, but the overall effect of this on consumer prices and traffic diversion may not be as large as some might at first sight expect. This effect depends on the percentage of port costs in final consumer prices; the import and export elasticities of traded goods; the level of competition in transport markets (especially liner shipping) as well as all other markets along the door-to-door chain (i.e. distribution, wholesaling, etc.). It could well be argued that higher port prices are not necessarily passed on to consumers but are instead absorbed by transport operators and other market intermediaries.

But even if higher port prices are, to some extent, passed on to consumers, the overall effect on society could be ascertained by comparing the loss in consumer surplus, as a result of higher port prices, to the welfare gains had the public funds in question been invested in other sectors of the economy or led to lower taxes in general.

This paper has argued in favour of pricing for cost recovery among competing commercial ports and it has shown how long-run marginal cost pricing can be a powerful pricing discipline that can eliminate subsidies and establish a level playing field among ports.

However, a ‘pricing discipline’ imposed on ports through policy intervention would be unacceptable. The objectives often pursued by ports are so divergent that any uniform

approach to pricing becomes meaningless and politically unfeasible. Pricing matters on the other hand, at least in a liberal economic environment, ought to be, ideally, left to the producers (ports) themselves.

The ATENCO study has demonstrated that, however controversial the issue of port pricing itself may be, there is general consensus on the importance of cost recovery. And this was an important development and step forward. Indeed, as long as this objective is respected, the specific pricing policy of the individual port becomes of secondary importance and only in so far as crowding out effects and efficient allocation of resources are concerned.

Once cost recovery is generally accepted as a guiding principle in port investment and pricing, the way forward is much simpler. It involves the compilation of better and more harmonised statistics on port costs; adoption of standardised port accounting systems; greater transparency of port accounts and of financial flows between the port and its institutional master; and, perhaps, a common glossary of terms. Last but by no means least, the institution of an *Independent Regulatory Authority*, or in any case the existence of efficient *supervisory control*, would be a sine qua non. And these are objectives not so difficult to achieve.

In conclusion, therefore, port policy is reorienting its attention from the idea of adopting uniform cost based pricing principles, towards: (a) more indirect incentives promoting cost based thinking in ports (e.g. by defining more clearly what constitutes acceptable public support in port infrastructure); and (b) rethinking how conventional competition rules (related, *inter alia*, to market access; abuse of dominant position; collusive behaviour, etc.) should be applied to the port sector.

## REFERENCES (and recommended reading)

- Andrews, P.W.S. and Brunner, E. (1975) *Studies in pricing*. London: Macmillan.
- Andrews, P.W.S. (1949) *Manufacturing business*. London: Macmillan.
- Arnold, J.H. (1985) *Port tariffs: Current practices and trends*. Technical Paper. World Bank..
- Baumol, W.J. and Sidak, J.G. (1994) *Toward competition in local telephony*. Cambridge: MIT Press.
- Baumol, W.J. and Bradford, D.F. (1970) Optimal departure from marginal cost pricing. *American Economic Review*, **60**: 265-283.
- Bennathan, E. and Walters, A.A. (1979) *Port pricing and investment policy for developing countries*. Oxford: Oxford University Press.
- Bergantino, A.S. and Veenstra, A.W. (2002) Interconnection and cooperation: an application of network theory to liner shipping. *International Journal of Maritime Economics* (forthcoming).
- Braeutigam, R.R. (1980) An analysis of fully distributed cost pricing in regulated industries. *The Bell Journal of Economics*, **1980**: 183-196.
- Bromwich, M. (1978) Port costs -an alternative approach. *International Journal of Transport Economics*, **5**: 227-240.
- Button, K.J. (1979) The economics of port pricing. *Maritime Policy and Management*, **6**: 201-207.
- Cariou, P. (2000<sup>a</sup>) *Les alliances stratégiques dans le transport maritime de lignes régulières: efficacité ou pouvoir de marché*. Thèse de Doctorat. Université de Nantes.
- Cariou, P. (2000<sup>b</sup>) Les économies d'échelle dans le transport maritime de lignes régulières. *Cahiers Scientifiques du Transport*, **37**: 75-96.
- Cariou, P. and Haralambides, H.E. (1999) Capacity pools in the East/West trades. International Association of Maritime Economists (IAME) Conference: Liner Shipping: What's Next? Halifax, Canada, September 1999.
- Carlton, D.W. and Perloff, J.M. (1994) *Modern industrial organisation* (2<sup>nd</sup> edition). New York: Harper and Collins.
- Chamberlin, E. (1933) *The theory of monopolistic competition*. Harvard University Press, 1933.
- Coase, R.H. (1974) The lighthouse in economics. *Journal of law and economics*, **1974**: 357-376.
- Coppejans, L. and Bergantino, A. (1998) *Economic considerations with respect to port pricing*. Cardiff University Report.
- Coppejans, L. and Bergantino, A. (1998) Shipowner preferences and the allocation of port infrastructure costs. Paper presented at the 8th WCTR, 12-17 July 1997, Antwerp, Belgium.
- Coto-Millan, P., Banos-Pino, J. and Villaverde, J. (1998) Maritime (General Cargo) import and export functions in the Spanish economy. In: P. Coto-Millan (ed.) *Economic Inquiries in Maritime Transport*. European Institute of Maritime Studies.
- Dally, H.K. (1973) Containers - a note on berth throughputs and terminal handling. *National Ports Council Bulletin*, No. **4**.
- De Silva, H. (1991<sup>a</sup>) A policy analysis of Port of Melbourne's new pricing structure. Paper presented to 'New thinking on port pricing', Executive Development Programme. University of Wollongong, Centre for Transport Analysis.

- De Silva, H. (1991<sup>b</sup>) Applying cost axiomatic principles to Port of Melbourne data - an example. Paper presented to 'New thinking on port pricing', Executive Development Programme. University of Wollongong, Centre for Transport Policy Analysis.
- Dowd, T.J. and Fleming, D. (1994) Port pricing. *Maritime Policy and Management*, **21**: 29-35.
- European Commission (1992) White Paper. *Common European Transport Policy*. COM (92): 494.
- European Commission (1995) Green Paper. *Towards fair and efficient pricing in transport*. COM(95): 691.
- European Commission (1997<sup>a</sup>) *Green paper on sea ports and maritime infrastructure*. Final: 678.
- European Commission (1997<sup>b</sup>) White Paper. *Intermodality and intermodal freight transport in the European Union; A systems approach to freight transport*. COM (97): 243.
- European Commission (1998<sup>a</sup>) *Future perspectives for European sea ports*. Proceedings of the Conference on the Green Paper on Sea Ports and Maritime Infrastructure. Barcelona 7-8 May 1998.
- European Commission (1998<sup>b</sup>) White Paper. *Fair payment for infrastructure use: A phased approach to a common transport infrastructure charging framework in EU*. Com (98): 466
- European Commission (2001<sup>a</sup>) Communication from the Commission to the European Parliament and the Council: *Reinforcing quality service in sea ports: a key for European transport*. Proposal for a Directive of the European Parliament and of the Council on market access to port services. COM(2001): 35.
- European Commission (2001<sup>b</sup>) Commission Staff Working Document. *Public financing and charging practices in the Community sea port sector*. SEC (2001).
- European Parliament (1993) *European sea port policy* -Annexes to the Final Report-. Directorate General for Research.
- Fernández, J.E. and Fernandez, J.M. (1998) Privatisation of ports in developing countries. The case of container terminals. Paper presented at the 8<sup>th</sup> WCTR, 12-17 July 1998, Antwerp, Belgium.
- Frankel, E.G. (1987) *Port planning and development*. New York: John Wiley and Sons.
- Gardner, B. (1977) Port pricing - an alternative approach. In: *Transport of steel exports - an investigation into the scope for rationalisation*. **I**: Chapter 4.2. Department of Maritime studies, Transport Research Unit.
- George, K.D. and Shorey, J. (1978) *The allocation of resources: theory and policy*. London: George, Allen and Unwin.
- Gold, B. (1981) Changing perspectives on size, scale, and returns: an interpretative survey. *Journal of Economic Literature*, **XIX**: 5-33
- Goss, R.O. (1968) Towards an economic appraisal of port investments. *Studies in Maritime Economics*. Cambridge: Cambridge University Press.
- Goss, R.O. (1979) *A comparative study of seaport management and administration*. London: Govt. Economic Service.
- Goss, R.O. (1986) Seaports should not be subsidised. *Maritime Policy and Management*, **13**: 83-104.
- Grosdidier de Matons, J.C. (1986) Economic and financial appraisal of port projects at the World Bank: a review of policy and practice. *Maritime Policy and Management*, **13**: 259-275.
- Hall, R.L. and Hitch, C.J. (1939). Price policy and business behaviour. *Oxford Economic Papers*, **2**: 12-45.

- Haralambides, H.E., Westeneng, M. and Zou, S. (1994) GATT and its effect on shipping and ports. Proceedings of the KMI/IAME Conference on International Trade Relations and World Shipping, Seoul, June 1994.
- Haralambides, H.E. (1995<sup>a</sup>) Port restructuring and labour reform: The ILO experience from Asia and the Pacific. In: W.C.H. van Zutphen (ed.): *Proceedings of the 25th International Port Training Conference on the Impact of Port Structural Adjustment Programmes on Training*. Rotterdam.
- Haralambides, H.E. (1995<sup>b</sup>) Socio-economic considerations on the issue of port privatisation. In: Moukhtar, G.E. and Bassiouny, A.H. (eds.): *The 11<sup>th</sup> Port Logistics Conference on Free Ports and Free Zones*. Alexandria, Egypt.
- Haralambides, H.E. (1998<sup>a</sup>) Future trends in international transport and their impact on the Mediterranean region. Second International Transport Conference on *Development of transport connections between Western Europe, the Mediterranean and the Black Sea*. Sochi, Russia, April 2-3, 1998. Published also in: *Shipping International Monthly Review*, **177**: 332.
- Haralambides, H.E. (1998<sup>b</sup>) Port pricing and cost recovery: a challenge for Europe. Seaport Policy in the 21<sup>st</sup> Century Conference, University of Antwerp, May 1998.
- Haralambides, H.E. (1998<sup>c</sup>) The economic and social impacts of port reform. 29<sup>th</sup> PIANC Congress, The Hague, September 1998.
- Haralambides, H.E., Verbeke, A., Musso, E. and Benacchio, M. (2001) Port financing and pricing in the European Union: theory, politics and reality. *International Journal of Maritime Economics*, **3**: 368-386.
- Haralambides, H.E., Cariou, P. and Benacchio, M. (2002<sup>a</sup>) Costs, benefits and pricing of dedicated container terminals. *International Journal of Maritime Economics*, **4**: 21-34.
- Haralambides, H.E., Craig, R., Cheung Tam He, C. and Nam, K.C. (2002<sup>b</sup>) Logistical diseconomies of scale in liner shipping: small is still beautiful. *International Journal of Maritime Economics* (forthcoming).
- Heaver, T.D. (1975) The Routing of Canadian container traffic through Vancouver and Seattle. Report. Centre for Transport Studies: University of British Columbia.
- Heaver, T.D. (1996) The implications of increased competition among ports for port policy and management. *Maritime Policy and Management*, **22**: 125-133.
- Heggie, I.G. (1974) Charging for port facilities. *Journal of Transport Economics and Policy*, **8**: 3-25.
- Hölterling, H. (1966) *Die tarife für seehafenleistungen*. Duncker & Humbolt.
- Jansson, J.O. and Shneerson, D. (1982) *Port economics*. Cambridge, MA: The MIT Press.
- Jara, S.R., Cortés, C.E., Vargas, A.D., and Martínez, E. (1997) Marginal cost and scale economies in Spanish ports: a Mullet-Product approach. Proceedings of the European Transport Forum.
- Lipsey, R.G. and Lancaster, K. (1956) The general theory of second best. *Review of Economic Studies*, **24**: 11-32.
- Martin, S. (1993) *Industrial economics: Economic analysis and public policy*. MacMillan Publishing, 1993.
- Meersman, H., van de Voorde, E. and Steenssens, C. (1997) *Container throughput, port capacity and investment*. Report. SESO, Antwerp, Belgium.
- Meyrick, S. (1991<sup>a</sup>) Clear directions for pricing services in Australian ports. Paper presented to 'New thinking on port pricing', Executive Development Programme. University of Wollongong, Centre for Transport Policy Analysis.



- Meyrick, S. (1991<sup>b</sup>) Deciding port prices - how far does Economic Theory really take us? Paper presented to 'New thinking on port pricing', Executive Development Programme. University of Wollongong, Centre for Transport Policy Analysis.
- Minasian, J.R. (1979) Indivisibility, decreasing cost, and excess capacity: the bridge. *The Journal of Law and Economics*, **1979**: 385-397.
- Moulin, H. (1995) *Cooperative microeconomics - A game theoretic introduction*. New-Jersey: Princeton University Press.
- Musso, E., Ferrari, C. and Benacchio, M. (1999) On the global optimum size of port terminals. *International Journal of Transport Economics*, **26**: 415-437.
- Van Niekerk, H.C. (1996) Efficient pricing for public ports. IAME International conference: Vancouver, Canada (1996).
- Nombela, G., Trujillo, L. and Matas, A. (1998) *The Economics aspect of charging for trans-european (TEN) seaport infrastructure in the European Union*. Report. Department of Applied Economics: University of Barcelona.
- Notteboom, T., Coeck, C. and Van den Broeck, J. (2000) Measuring and explaining the relative efficiency of container terminals by means of Bayesian stochastic frontier models. *International Journal of Maritime Economics*, **2**: 83-106.
- Peston, M.H. and Rees, R. (1971) Port costs and the demand for port facilities. National Ports Council, United Kingdom.
- Pollock, E.E. (1980) Port tariff policy in Europe - a British view. *Tijdschrift voor de vervoerswetenschap*, **1980**: 199-204.
- Ramsey, F. (1927) A Contribution to the theory of taxation. *Economic Journal*, **37**: 47-61.
- Rees, R. (1984) *Public enterprise economics* (8<sup>th</sup> ed.). London: Weidenfeld & Nicolson.
- Robinson, R. (1991) Pricing port services in Australia - the issues. Paper presented to 'New thinking on port pricing'. Executive Development Programme. University of Wollongong, Centre for Transport Policy Analysis.
- Robinson, J. (1969) *The Economics of imperfect competition* (2<sup>nd</sup> edition). London: MacMillan.
- Rosenstein-Rodan, P. (1943) Problems of industrialisation of East and South-East Europe. *Economic Journal*, **1943**: June-September.
- Samet, D. and Tauman, Y. (1982) The determination of marginal cost prices under a set of axioms. *Econometrica*, **50**: 895-909.
- Suykens, F. (1986) Ports should be efficient (even if this means that some of them are subsidized). *Maritime Policy and Management*, **13**: 105-126.
- Suykens, F. (1996) Influence of port tariffs on maritime transport. Paper presented at the VI International Congress of Maritime Traffic and Port Handling, Vigo, Spain.
- Suykens, F. and Van de Voorde, E. (1998) A quarter of a century of port management in Europe: objectives and tools. *Maritime Policy and Management*, **25**: 251-261.
- Talley, W.K. (1988) *Transport carrier costing*. New-York: Gordon and Breach.
- Talley, W.K. (1994) Port pricing: a cost axiomatic approach. *Maritime Policy and Management*, **21**: 61-76.
- Thomas, B.J. (1978) Port charging practices. *Maritime Policy and Management*, **5**: 117-132.
- Tirole, J. (1988) *The Theory of industrial organisation*. Cambridge: MIT Press.
- Train, K.E. (1991) *Optimal regulation: The economic theory of natural monopoly*. Cambridge: MIT Press, 115-145.
- UNCTAD (1969) *Development of ports*. TD/B/C.4/42/Rev.1. New York: United Nations.
- UNCTAD (1971) *Port statistics*. TD/B/C.4/79/REV.1. New York: United Nations.
- UNCTAD (1975<sup>a</sup>) Berth throughput: systematic methods for improving general cargo operations. TD/B/C.4/109. New York: United Nations, 196.

- UNCTAD (1975<sup>b</sup>) *Port pricing*. TD/B/C.4/110/Rev.1. New York: United Nations.
- UNCTAD (1976<sup>a</sup>) *Port performance indicators*. TD/B/C.4/131/Supp.1/Rev.1. New York: United Nations.
- UNCTAD (1976<sup>b</sup>) *Manual on port management - Part Four (Modern management techniques): Port Pricing*. New York: United Nations.
- UNCTAD (1978) *Port development; a handbook for planners in developing countries*. TD/B/C.4/175/Rev.1. New York: United Nations.
- UNCTAD (1985<sup>a</sup>) *Co-operation between ports*. TD/B/C.4/AC.7/4. New York: United Nations.
- UNCTAD (1985<sup>b</sup>) *Development and improvement in ports*. TD/B/C.4/291. New York: United Nations.
- UNCTAD (1992) *Port marketing and the challenges of the third generation port*. TD/B/C.4/AC.7/14. New York: United Nations.
- Varian, H. (1992) *Microeconomic analysis*. (3<sup>rd</sup> edition). New York: Norton.
- Verhoeff, J.M. (1981) Seaport competition: some fundamental and political aspects. *Maritime Policy and Management*, **8**: 49-60.
- Voorhamme, R. and Winkelmans, W. (1980) Port tariff making in 10 EEC seaports. *Tijdschrift voor de vervoerswetenschap*, **1980**: 253-272.
- Voorhamme, R. and Winkelmans, W. (1982) *The issue of cost-related port dues*. Report. University of Antwerp.
- Walters, A.A. (1975) Marginal cost pricing in ports. *The Logistics and Transportation Review*, **11**: 299-308.
- Wanhill, S.R.C. (1978) On the cost-benefit analysis of port projects. *Maritime Policy and Management*, **5**: 315-326.
- Wiling, D. (1992) Port tariff, structure and pricing. In: Stuchtey, R.W. (1991): *Port Management Vol. 3 - Port Marketing*. Institute of Shipping Economics and Logistics: Bremen, 191-212.
- Zachcial, M. and Hantau, M.U. (1998) *Relevant pricing techniques applied to port and maritime infra- and superstructure*. Report. Institute for Shipping Economics and Logistics: Bremen.