

# ANALYSIS OF THE BENEFITS OF INTRA-PORT COMPETITION

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## **Abstract**

Intra-port competition is widely regarded as beneficial, for the competitiveness of ports, for local and national economies and for consumers and exporting industries. The aim of the paper is to analyse the benefits resulting from the presence of intra-port competition. Even though this issue has been addressed before, a thorough and complete overview of the effects of intra-port competition, enabling conditions for intra-port competition and policies in case of lacking intra-port competition are absent. The paper presents first a short overview of previous studies dealing with intra-port competition. Second, it discusses the two main arguments underlying the benefits of intra-port competition. In this context, attention is given to the relation between intra-port and inter-port competition. Third, the paper examines the conditions under which these arguments are valid and intra-port competition can be introduced. Possible policy responses to limited or absent intra-port competition are discussed in this section as well. Fourth, the need to introduce effects of intra-port competition in port modelling is briefly. Finally, the paper presents empirical evidence of the effects of intra-port competition.

Keywords: ports, intra-port competition, regulation, port policies

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## 1. INTRODUCTION

Intra-port competition is widely regarded as beneficial, for the competitiveness of ports, for local and national economies and for consumers and exporting industries. These effects of intra-port competition guide EU policy initiatives to liberalise and re-regulate the market of port services (CEU 2004).<sup>1</sup> However, in most market segments in most ports, the market concentration is remarkably high and rising, partly because of the emergence of *global players*. This situation justifies attention for questions regarding the contestability of the market and conditions that enable intra-port competition.

The aim of the paper is to analyse the benefits resulting from the presence of intra-port competition. Even though this issue has been addressed before from different perspectives (cf. Goss 1999; Defilippi 2004; but also Chlomoudis and Pallis 1998; De Langen 2002; Notteboom 2002), a thorough and complete overview of the effects of intra-port competition, the enabling conditions for intra-port competition, and policy responses to a lack of intra-port competition, is lacking.

This paper provides such an overview, and discusses the following issues:

- The relation between intra-port and inter-port competition;

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<sup>1</sup> According to the European Commission this is one of two main issues that the EU policy framework) has to address: “On intra-port competition (competition between providers of a same port service within a port), the efficient provision of services in this market sector is consequently essential for the functioning of the EU’s ports” (CEU 2004, p. 3). For a thorough review of the EU Port Policy: Chlomoudis & Pallis (2002).

- Dynamic benefits of intra-port competition, with reference to theories such as ‘worlds of production’, ‘cognitive division of labour’ and ‘vibrant environments’.
- The concept of a ‘minimum efficient size’ for terminal operations, constraining the viability of intra-port competition;
- The possibilities and constraints of concessions/tender procedures to introduce intra-port competition.

First a short overview of previous studies dealing with intra-port competition is given. Second, the two main arguments underlying the benefits of intra-port competition are discussed. In this context, attention is given to the relation between intra-port and inter-port competition. Third, the paper analyses the conditions under which these arguments are valid and intra-port competition can be introduced. Possible policy responses to limited or absent intra-port competition are discussed in this section as well. Fourth, the need to introduce effects of intra-port competition in port modelling is briefly discussed. Fifth, the paper discusses the empirical evidence of the effects of intra-port competition. A concluding section finalises this paper.

## 2. STUDIES DEALING WITH INTRA-PORT COMPETITION

The issue of port competition is discussed previously in academic literature. Sargent (1938) and Morgan (1951) analyse port hinterlands and relate the structure of these hinterlands to the competitive position of a port. However, they do not discuss the effects of intra-port competition on a port’s competitive position. Verhoeff (1981) is perhaps the first scholar who discussed seaport competition in a comprehensive manner; he claims there is ‘hardly any literature on the subject’ (Verhoeff 1981, p. 49). He provides some relevant insights on port competition; his most applicable observation for this paper is that the market structure for port services is frequently monopolistic. Even though intra-port competition is an effective mechanism to prevent market power, Verhoeff (1981) does not deal with intra-port competition. In most of the later contributions to the literature, *inter-port* competition rather than intra-port competition is center stage (cf. Slack 1985; Fleming and Baird 1999; Notteboom 2002).

Designing a Port Reform Toolkit, the World Bank (2000) put forward the case for *within port* competition as a distinctive type of port competition. The World Bank taxonomy went further to suggest that within a port complex one might define two types of competition (World Bank 2000, Module 6, p. 5-6):

‘*Intra-port* competition refers to a situation where two or more different terminal operators within the same port are vying for the same market. In this case, the terminal operator has jurisdiction over an entirely terminal area, for berth to gate and competes with other terminal operators’

‘*Intra-terminal* competition refers to companies competing to provide the same services within the same terminal’.

These two types of competition are parts of an inclusive intra-port competition definition as the competition between similar and/or complementary production units, which provide port services in the context of the same port complex (Chlomoudis and Pallis 1998).

Richard Goss' article 'On the Distribution of Economic Rent in Seaports' (Goss 1999) deals with the benefits of intra-port competition. Goss (1999) provides the first and most widely acknowledged argument for intra-port competition: it prevents (monopolistic) rent seeking of port service providers. This concept has triggered, either explicitly or implicitly, a debate regarding the level and conditions of intra-port competition (cf. Notteboom 2002; Defillipi 2004).

A second argument for the benefits of intra-port competition derives from regional economics (e.g. Hotelling 1929; Porter 1990) and related theories on competition as engine of innovation and specialization, such as the concept of 'meta-fordist' production and distribution processes (e.g. Amin, 1994). This argument deals not with the prevention of rent seeking, but with intra-port competition, as a mean to achieve 'economies of scope' and flexible multi-service organisation structures (Chlomoudis and Pallis 1998; De Langen 1999; Notteboom and Wilkemens 2001a). This argument has received limited attention in discussions of the effects of intra-port competition (De Langen 2002). The following section discusses these two theoretical strands for the positive effect of intra-port competition on port competitiveness.

Possible negative effects of internal competition are not discussed in depth. A first potential negative effect could be the duplication of facilities. This would be a wasteful allocation of resources. However, assuming governments (including public port authorities) do create a level playing field and do not grossly subsidise port investments, it is hard to see how such a wasteful allocation could persist in the long run, while it also is by no means obvious it would be more likely to arise in conditions enabling intra-port competition. A second potential negative effect, that intra-port competition would generate relatively much negative externalities (for instance pollution, congestion) may hold in specific cases, but is not explored in this paper.

### **3. THE EFFECTS OF INTRA-PORT COMPETITION: EXPLORING TWO ARGUMENTS**

#### **3.1 Intra-port competition prevents market power of port service providers**

The first argument in favour of intra-port competition is widely accepted: intra-port competition prevents monopoly pricing. Goss (1999) argues that economic rents exist in seaports. These rents consist of 'the savings on generalised transport cost (...) that the use of that port offers over the next best available routing' (Goss 1999, p. 3). When a port faces limited interport competition this economic rent is substantial.

These 'economic rents' may accrue to a variety of actors (Goss 1999): the owner of the port, the port service providers, the port employees, governments (local or national) or the consumers of (trans)port services<sup>2</sup>. Monopolistic power enables ports to discriminate according to the elasticity of demand (Goss and Stevens 2001), so that port users experience 'abnormal' pricing and rigid operational conditions.

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<sup>2</sup> This fifth possibility only arises when: (a) Intra-port competition exists for all port services; (b) all relevant hinterland transport markets are also competitive; and (c) all public port charges are based on cost recovery and provided in an efficient manner.

The experience from terminal operation transfers to private operators suggests that due to the lack of intra-port competition, port users face high tariffs, and request regulatory institutions to limit the monopolistic position of terminal operators (Truhillo and Nimbila 1998). Such regulation (whether created and monitored by a government agency or a port authority) incurs costs, such as monitoring costs, including productivity and tariff controls (Juhel 2001). Furthermore, due to an ‘informational asymmetry’ between regulator and the port industry, regulation is unlikely to be ‘perfect’ in the sense of preventing all efforts to extract monopoly rents (Defillipi 2004).<sup>3</sup>

The ‘monopoly argument’ -intra-port competition prevents monopolistic rent seeking of port service providers- is only relevant when ‘inter-port competition’ is imperfect (Goss 1999). The level of economic rents is related to the price difference of a port compared to a second-best port. In port ranges with fierce inter-port competition, economic rents may not exist at all:

‘Increased competition in the European container system can prevent intra-port monopolists from acquiring supra-normal profits even if high barriers to entry to the monopolist’s port exist (Notteboom 2002, p.269).

On the other hand, the higher economic rents, the higher the benefits of intra-port competition. In the extreme case of a large island with only one port service provider (for instance towage or terminal handling) the economic rent is very high and all opportunities to introduce intra-port competition should be explored. The level of economic rents thus depends on the competitive advantage of a port for serving a particular hinterland. A distinction can be made between *captive* and *contestable* hinterlands<sup>4</sup>. Captive hinterlands are all those regions where a port has such a competitive advantage, because of lower generalized transport costs to those regions, that it handles the vast majority of all cargoes. Haralambides (2002) observes that for most ports, such captive hinterlands have diminished. Contestable hinterlands consist of all those regions where there is no single port with a clear cost advantage over competing ports. If the vast majority of cargo is originating from or destined to a contestable hinterland, economic rents are small or non-existent.

Notteboom (2002) introduces insights from contestability theory to the discussion of the effects of intra-port competition. Contestability theory argues that firms do not have market power on markets where they are the only provider of services if entry and exit to these markets would be costless. In such a case, the threat of potential entrants, that will enter the market as soon as profit opportunities arise, prevents a ‘monopolist’ from raising prices. Thus, actual competition is not required, as long as entry and exit is costless. Such markets are termed contestable markets.

This general theory can be applied to ports: when port service providers are constantly under threat from potential entrants, they do not have market power. Entry and exit barriers can be legal/institutional (no permit is given to start a new firm) space related

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<sup>3</sup> As Defillipi (2004) notes, the extract of monopolistic rents due to the presence of this information asymmetry is a phenomenon that has been observed in other network industries like electricity (Guasch and Spiller 1998) and telecommunications (Laffont and Tirole 2000)

<sup>4</sup> This distinction is very similar to the distinction made by Morgan (1951) between primary hinterlands, the area where the port is well established and secondary hinterlands, with rivalry among ports.

(there is no attractive site in the port for offering new services) or economic (entry is not attractive). The most important economic entry barrier is the need to make long-term non-moveable investments. Such assets cannot be sold and make (premature) exit costly. Thus, the need for such investments provides an entry barrier and reduces the contestability of the market.

If captive hinterlands are substantial and markets are not contestable, opportunities for rent extraction of the port service provider depend on the *bargaining power* of port service providers vis-à-vis the three main port users: shippers, forwarders and shipping lines. This bargaining power depends the level of economic rents itself (the larger the price difference in generalized port with a second-best port, larger the economic rent in seaports and consequently the stronger the bargaining position of port service providers) and apart from that, on two factors:

- The share of the port services in total port costs;
- Opportunities to differentiate prices to different port users;

The overall port product consists of a variety of services, such as terminal handling, towage, pilotage and ship chandling. Providers of port services that are of relatively minor importance for the overall port costs will hardly lose business when they raise prices, because port users are sensitive to total port costs, not to each individual component of these overall port costs. Thus, these service providers have a strong bargaining position vis-à-vis port users.

Second, the opportunities to differentiate prices to different port users are relevant. Three different port users can purchase port services: shippers (cargo owners), shipping lines and forwarders (or other transport intermediaries). Generally speaking, shippers have the *worst* bargaining position, because port service providers can differentiate prices between port users in the captive and contestable hinterland. Unless shippers are located in a perfectly contestable hinterland, switching to a second best port does lead to higher transport costs (see: Bichou and Gray 2004). Therefore, port service providers have bargaining power versus shippers located in the ‘captive hinterland’. They can charge high prices for ‘captive shippers’ and lower prices for ‘contestable shippers’.

However, most shippers do not have direct contracts with port service providers. Instead, they have contracts with either shipping lines or forwarders. The bargaining position of port service providers vis-à-vis these firms is substantially weaker, because forwarders and shipping lines *consolidate* cargo with different origins/destinations. Consolidation, along with the development of transshipment hubs and the increasing efficiency of inland transport, limits geographical powers (Heaver 1995) and increases the cross-elasticity of demand for ports (Goss and Stevens 2001). Thus, price differentiation related to the origin/destination of cargo is not viable when shipping lines or forwarders purchase port services. A general tariff increase leads to a substantial reduction of throughput volume when the contestable hinterland is substantial, because the port will lose this cargo. For this reason, port service providers do not have market power vis-à-vis shipping lines and forwarders in ports where the contestable hinterland is substantial<sup>5</sup> and the port service is important component of total port costs.

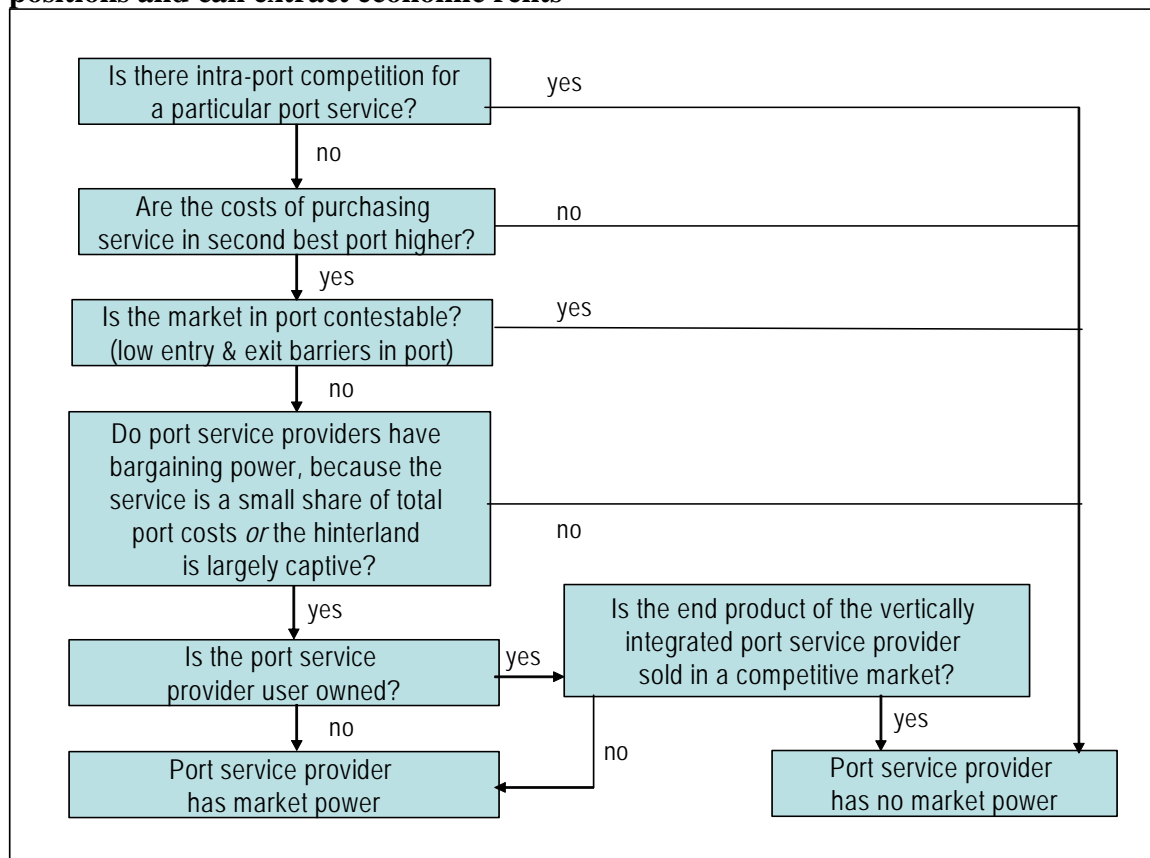
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<sup>5</sup> ‘Substantial’ can be defined further as ‘so large that the loss of volume (volume effect) offsets the additional revenues from the price increase’.

The threat of rent seeking of port service providers may lead to *vertical integration* (Williamson, 1985). By providing port services ‘in-house’ port users prevent abuse of market power. Two kinds of port users, the shippers and the shipping lines frequently own and operate dedicated facilities. Especially the involvement of large shippers in port services is mainly aimed at preventing being exposed to market power. This explains why many shippers in liquid and dry bulk (such as Shell, Esso, BP, Corus Steel, and CVRD – Brazil) own terminal facilities. Shipping lines also own terminals<sup>6</sup>, and these investments may be partially explained by the above considerations, but also stem from a strategy to offer a ‘door-to-door’ transport product.

In any case, such user owned port facilities prevent rent extraction *if the end products of these vertically integrated firms are sold in a competitive market*. This is the case for most user owned oil, iron ore and steel terminals as well as most user owned container terminals. However, only very large port users have the scale to develop dedicated terminals. In other cases, terminals are owned by a joint venture of a limited number of port users. However, for port users with only a small volume of cargo, the strategy of vertical integration to prevent rent extraction is not viable. Thus, the ‘invisible hand’ does not prevent market power through vertical integration in all markets<sup>7</sup>. Figure 1 summarises the conditions under which port service providers have dominant market positions and can extract economic rents.

**Figure1: Conditions under which port service providers have dominant market positions and can extract economic rents**



<sup>6</sup> In 1991, the shipping lines controlled 11% of world container port handling, and by 2001, their share had risen to 19% (Slack and Fremont 2005)

<sup>7</sup> In such cases, essential facility regulation may be a means to secure access to port facilities or services.

### 3.2 Intra-port competition leads to specialisation, flexible adaptation and innovation

The second argument in favour of intra-port competition derives from the fact that such competition fosters specialisation (Baptista 2000), innovation and diversity. Intra-port competition is competition on a perfect level playing field (or to put it differently: cost curves are similar). Competitors face the same regulation. They have the same labour market conditions, the same trade costs, and the same supplier base. In such a competitive environment specialisation of products and services is more likely than when competitors operate in a different environment. This argument can be related to the work of Hotelling (1929) who argues that competition between services provided at different locations is by nature 'oligopolistic' because of the importance of transport costs. The location itself is a 'source' of specialisation. Porter (1990) argues that internal competition leads to dynamism in the cluster:

“Differentiation and specialization enhance the performance of the cluster as a whole because in a cluster with internal competition customers can purchase products and services that match their specific demand (...). Pride drives managers and workers to be highly sensitive to other companies (...). Domestic rivals fight not only for market share but for people, technical breakthroughs and, more generally, ‘bragging rights’” (Porter, 1990, p. 119).

This argument is especially relevant in seaports since the contemporary port product is a chain of (specialised) interlinking functions (Suykens and Van de Voorde 1998). In most cases, this port product is not offered by one singly corporate hierarchy, but by a network of firms. These networks consist of different firms, operating in different 'worlds of production'.

Chlomoudis *et al* (2003) suggest that ports need to provide both *generic* services with a *standardised process* defined in advance and *dedicated* services responding to individual demand, based on the mobilisation of specialised resources. Some actors in the port network will (have to) focus on standardised services, strong price competition and *increased volumes of services*, while others focus on *increased range of services*, concentrate on economics of variety and competition based on superior quality of products and services.

Port services can be provided in three 'worlds of production': (a) the traditional industrial world, (b) an *interpersonal world*, based on dedicated specialised services, economies of variety, competition centred on quality, skilled labour, and uncertainty; and (c) the *market world*, based on dedicated but standardised services, economies of scale and differentiation, competition centred on price flexibility, semi-skilled labour, and conditions of uncertainty. The provision of *variety* of these services improves the competitiveness of the port as a whole.

Such variety cannot be provided by one large comprehensive port organisation, because one large organisation cannot operate in three different 'worlds of production' simultaneously and instead will be based on large standardised processes, aiming to decrease average cost and to achieve large-scale operations that satisfy the demand for massive quantities of generic (i.e. pre-defined by the producer) port services. This lack of variety is especially relevant given the transition of ports, as well as of the whole

maritime sector (Selkou and Roe 2004), to post-fordist models (Chlomoudis and Pallis 1998; Van Klink and De Langen 1998; De Langen 1999, 2004a; Bonasich 2003). The argument that one comprehensive organisation limits customer choice is relevant irrespective of the ownership status of such an organisation.

Intra-port competition creates conditions for the design of organisational structures based on both economies of scale and economies of variety. The competition and/or interaction between several providers of port products/services/facilities promotes the prospect of autonomy, entrepreneurship, creativity, and decentralised management. This variety ensures innovations are introduced (and copied) and competing firms constantly aim to improve services to their customers. This dynamic process keeps ports competitive.

#### **4. Conditions for introducing intra-port competition**

Intra-port competition may be desirable to prevent market power and secure introduction of new methods of port services production, but can be impossible to introduce. An important condition for the viability of intra-competition is that *the market should be at least twice as large as the Minimum Efficient Scale (MES) for providing a port service*. A small market size relative to the minimal efficient scale prevents intra-port competition. In such a market scale economies are only fully realised with *one* supplier of port services. A second, smaller competitor has a 'structural' cost disadvantage that prevents profit-making. Thus, such a competitor will exit the market and leave the market to one operator with sufficient scale. The MES of port services depends on cost curves: the MES is reached when marginal and average costs no longer decrease when capacity is expanded. For port services such a container terminal, or an iron ore terminal, this MES is clearly quite large, and intra-port competition may be feasible in large volume ports but unfeasible in ports handling small volumes. The large MES explains the relatively high concentration for most port services.

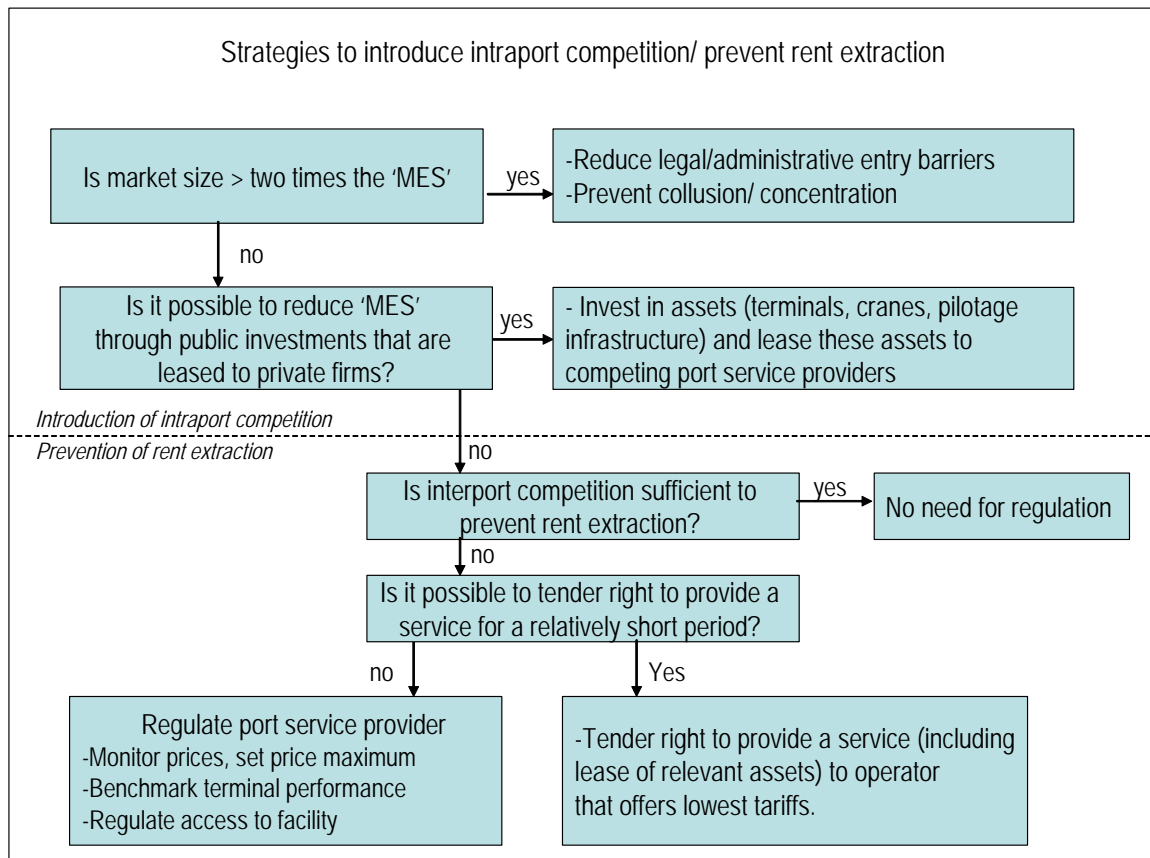
The MES can be reduced through a public authority (in most ports the port authority would be the appropriate organization) that owns assets and leases those assets to private firms. In such an arrangement, this public authority can secure scale economies, for instance in equipment purchasing, maintenance, port planning and terminal lay-out, and let relatively small firms provide port services. Such an arrangement may for instance be viable in pilotage, where groups of pilots can use various assets for providing pilotage services.

Such policies to reduce the MES demand the transformation of the port authority, to a 'smart institution' (Chlomoudis and Pallis 2004). Port authorities might 'secure' the presence of multiple providers by acting as the 'brain' of the port that sets targets in co-operation with several partners (state and municipal authorities, scientific societies, voluntarily organisations, chambers, and trade unions) and re-defines accordingly the operational framework. Beyond that, such a 'smart' co-ordinator has to monitor the application of the rules of the game, preventing phenomena of competition rules breaking and/or externalities produced by individual firms.

In the case intra-port competition for a certain service is not viable, policy options include tender procedures to make sure the economic rent accrues to a public organization and tariff monitoring and benchmarking of port service providers. Furthermore, access to port

services can be regulated based with ‘essential services’ access regulation. Port services and port facilities can be termed ‘essential’ if they are necessary components of transport chains and economically viable alternatives (e.g. outside the port or in other ports) are not available. Such essential facilities include towage, pilotage, mooring, and stevedoring and shore handling (Flor and Defilippi 2003). Access regulation may for instance allow a firm to use the terminal of a terminal operating company (TOC) to handle its ships, with a reasonable charge paid to this TOC for the use of its facilities. Figure 2 shows all available policy options and shows which policies are required in different circumstances.

**Figure 2: Strategies to introduce intra-port competition and prevent rent extraction**



## 5. INCORPORATING THE EFFECTS OF INTRA-PORT COMPETITION IN PORT MODELLING

The effects of intra-port competition are directly relevant for various models on port competition and port efficiency. Most models of terminal efficiency do not incorporate dynamic effects of intra-port competition on productivity. For instance, Turner presents a model to examine ‘seaport performance, as opposed to terminal performance’ (Turner 2000 p. 284), but does not pay attention to the effects of intra-port competition on seaport performance since he assumes competition between ports provides sufficient incentives for innovation. Turner’s conclusion that ‘pooling independent carrier demand for terminal services reduces total carrier cost’ is hardly surprising, pooling can only have positive effects and it would be very surprising if coordination would not reduce handling and waiting times. However, these advantages may be more than offset by the effects pooling

(implying a reduction of intra-port competition<sup>8</sup>) on terminal productivity. Such competitive behaviour may have beneficial effects on productivity and innovation in the long run.

Haralambides *et al* (2002, p. 25) argue that, *ceteris paribus*, whenever increasing returns to scale are present, a port should normally opt for a common user arrangement in order to maximise capacity utilisation and thus minimise unit costs (see also: Haralambides, 2000). For this reason, they argue that the charges for the right to operate a dedicated terminal should include a compensation for the loss of ‘network externalities’ of the smaller carriers in the port. However, a dedicated terminal may create competition for the common user terminal, since alliance partners, feeders and shortsea vessels can be handled by the dedicated terminal. This competition may be beneficial for port users, including the small carriers, compared to a port with just one common user terminal.

In general, the vast body of models dealing with terminal efficiency contrasts with the lack of models on the effects of intra-port competition, while this effect may be important for port users and policy makers alike. This seems a relevant avenue for further research.

## 6. THE EFFECTS OF INTRA-PORT COMPETITION: EMPIRICAL EVIDENCE

Even though the theoretical arguments for the effects of intra-port competition seem compelling, and many scholars acknowledge the role of intra-port competition in preventing market power, the effects of intra-port competition have hardly been studied empirically. An exception is an analysis of the effects of intra-port competition in port towage (Atkin and Rowlinson 2000). This study reveals towage tariffs were reduced substantially. This was possible because of cost reduction, through ‘flagging out’ and hiring cheaper foreign labour.

Atkin and Rowlinson (2000) however, do not conclude internal competition has had the positive effects of ‘breaking monopolies and encouraging innovation’. Instead, they advocate, increased competition may lead to ‘a collapse in investment and a long term deterioration of quality of the European towage fleet’ (ibid, p. 271). Four years later, this scenario has not materialised. Instead, innovations have been introduced in the towage industry, such as the ‘Rotortug’, introduced in Rotterdam, by the new entrant, KOTUG. This new tug won the Seatrade awards for innovations in ship operation, London 2001. This weakens the claim of Atkin and Rowlinson (2000) that new entrants operate with inferior tugs, limiting quality of port services.

More empirical evidence is presented by De Langen (De Langen 2004b). This evidence – briefly discussed here - is based on on a survey among ‘port experts’ in three ports, located in three different continents: Durban, Rotterdam and the ‘Lower Mississippi Port Complex’ (LMPC). Table 2 shows survey results with regard to propositions on the effects of internal competition.

**Table 2: Survey results on internal competition in port clusters**

| Proposition | Agree | Disagree | No opinion |
|-------------|-------|----------|------------|
|             |       |          |            |

<sup>8</sup> This reduction of competition is assumed more or less implicitly in Turner’s model, since such competition is likely to lead to deals for priority berthing or price reductions in off peak hours. Both are impossible in his model.

|  |     |    |   |
|--|-----|----|---|
| Since the competitive environment is practically the same for competitors in the same port cluster, internal competition is a stronger force inducing firms to specialise than external competition. | 82* | 17 | 2 |
| Internal competition leads to low “switching costs” for port users; switching costs are higher when port service providers only face external competition.   | 84* | 9  | 8 |
| Internal competition leads dynamism and a “vibrant competitive environment”. Such an environment is conducive for innovation.  | 91* | 9  | 2 |

\* Significant majority of experts

Expert opinions clearly confirm the validity of the arguments for the positive effects of intra-port competition on performance. However, in the three studied ports, intraport competition is limited. Pilotage is a regulated monopoly in all three ports. Especially in the LMPC, this monopoly has a clear negative effect on the performance of the cluster. Apart from pilotage, intra-port competition in the LMPC is moderate to fierce. This is mainly because the LMPC is not administered by one port authority, but by five competing port authorities. Entry is relatively easy because port authorities are eager to accommodate an entrant, even if this entrant duplicates existing port facilities. In contrast, in Rotterdam or Durban, entry is more difficult because the port authority is not necessarily interested in creating intra-port competition, especially when the minimum efficient scale is relatively large compared to the size of the market.

In Durban and Rotterdam, intra-port competition is limited in most cargo segments. Only in breakbulk is the competition moderate to fierce, in the other segments, including container handling, intra-port competition is limited or absent. In Rotterdam efforts to introduce intra-port competition in pilotage and mooring have failed to date.

The limited evidence presented above suggests that intra-port competition contributes to the performance of ports, but that, given the relative large minimum efficient scale, the number of intra-port competitors is limited. In this environment, perhaps the most sustainable model for intra-port competition is between port service providers with a distinctive specialisation that nevertheless compete.

## 7. CONCLUSIONS

In this paper, all relevant arguments and insights on the effects of intra-port competition were discussed and analysed. A distinction can be made between two different central arguments. First, and widely discussed: intra-port competition prevents rent extraction by a port service provider. This is a compelling argument for creating intra-port competition, but it is only valid when:

1. Inter-port competition is imperfect. This is the case when port users have an inelastic demand.
2. The market is not contestable.
3. Port users do not have a strong bargaining power (through consolidation)
4. The port service is not provided through a user owned subsidiary.

The second argument is that intra-port competition promotes innovation and specialisation. This is beneficial for a port since the benefits of innovation and specialization are passed on to port users. This argument is especially relevant since ports

no longer operate in one 'world of production' with a shared focus on low costs and standardization. A port with different port service providers, with different production models is superior to a port with just one port service provider. This second argument is relevant even when inter-port competition is very fierce and the other three criteria listed above do not apply. Thus, this argument for intra-port competition holds in all ports for all port services.

Ports can design policies to introduce intra-port competition. In some cases, lowering entry barriers is sufficient. In other cases, a policy of public investments in assets that are leased to competing service providers is required. In other cases, this is not a viable option either. In such cases, tendering or as a last option, regulation to prevent rent extraction are policy options.

Even though these arguments for the benefits of intra-port competition are compelling, empirical research is scarce. De Langen's (2004) study of three ports validates the arguments discussed above and also shows that intra-port competition is limited or absent for many port services. This emphasizes the need for more empirical research on this issue and the development of models/simulation to enhance the understanding of the precise effects of intra-port competition.

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