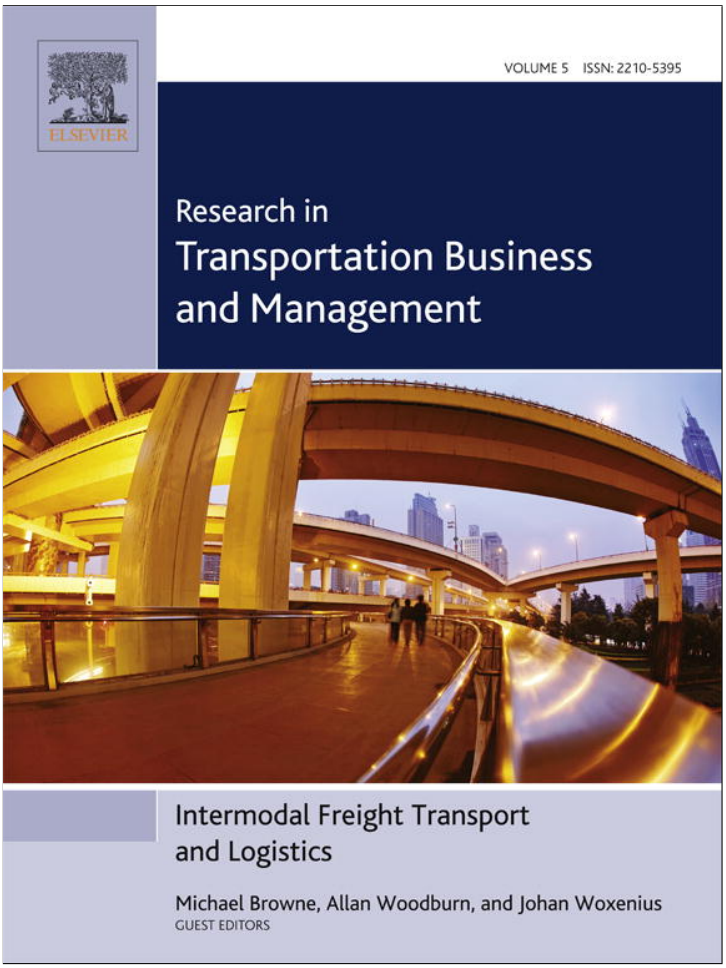

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Green port dues — The case of hinterland transport

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ABSTRACT

As the economy becomes increasingly specialised and globalised, the importance of logistics also increases. For global transportation systems, seaports play a key role as transhipment hubs. As seaports incorporate and coordinate hinterland logistic activities within the activities of the port, the strategies they employ influence the decisions made by both local and global logistic service providers. From an environmental and social perspective, seaports are thus key actors in transportation systems, and many ports have also developed corporate social responsibility (CSR) strategies. This paper examines one such strategy – green port dues – and shows how the integration of hinterland logistics and ports opens the possibility for differentiated port dues to be used as a tool to internalise external cost in the transportation systems and ensure the effectiveness of hinterland transport.

1. Introduction

The importance of logistics increases as the economy becomes ever more specialised and globalised. Changes in business environments such as globalisation, production patterns, urbanisation, and environmental awareness further support this trend. Since production and logistics arrive at a consensus where every individual product or module is produced in regions where the comparative advantage is the greatest, there is an increased focus on global supply chain, where seaports play a key role as transhipment hubs. Ports have become more important in the sense of global logistic actors (Suykens & Van de Voorde, 1998). Their influence stretches far, as their strategies and services have great impact on the decision making of both global and local logistic service providers. The role of hinterland logistics and transportation is increasing, and ports strategies and management progressively focus on incorporating/coordinating hinterland logistic activities with the activities of the seaport (cf. Notteboom & Winkelmans, 2001; Woxenius & Bergqvist, 2011).

Ports often have long local traditions, as many principal ports have been at the centre of local and regional development and are strongly associated with the city profile and image. Ports around the world have a large public ownership due to the nature, size and long-term perspective of the investments needed, although operations are often privatised. We argue that this large public ownership is central for understanding how ports can shape the social and environmental performance of transportation systems, since it allows for the internalisation of both social and environmental externalities.

As the environmental impact of logistics and transportation has gained recognition, ports have started to develop environmental strategies and corporate social responsibility (CSR) strategies. An essential tool for executing these strategies is the differentiation of port dues related to environmental impact. Most "green" port dues relate to vessels, e.g. the Environmental Ship Index (ESI). This paper argues that the growing attention to both hinterland logistics and CSR has made it possible to successfully extend the green port dues' toolbox to include hinterland activities.

Firstly, the segment of hinterland transportation is described in order to identify and illustrate its characteristics. Secondly, CSR is introduced, and a theory concerning which stakeholders are likely to influence companies is presented. Thirdly, a theoretical framework for green port dues for hinterland transport is presented. Finally, the impact of the normative framework is discussed from the perspective of the affected actors, i.e. the society, the port, the transport service providers, and the shippers.

2. Hinterland transport

Load units arriving at seaports are composed of load units transhipped from other seaports and units from inland destinations, i.e. the hinterland. The hinterland transportation system enables load units to be transhipped between seaports and inland destinations. The term "hinterland" is often referred to as the effective market or the geo-economic space in which the seaport sells its services (cf. Slack, 1993). A similar definition is presented by van Klink and van den Berg (1998), who define hinterland as the interior region served by the port.

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Ports and global trade are facing challenges related to capacity expansion, environmental considerations, and community restrictions. Being able to effectively and efficiently distribute load units to and from the hinterland is crucial for overall efficiency at the ports and, ultimately, for the whole supply chain (Cullinane & Khanna, 2000). As the focus of logistic service providers extends to global supply chains from, port-to-port activities, so does the importance of hinterland logistics. The logistics related to the hinterland involve many actors and activities, and require intense collaboration and coordination to work effectively and efficiently.

The available hinterland services depend on the situation of the seaport, its location, and its overall infrastructure. Some enjoy possibilities for inland waterways, while others are limited to land-based modes of transport. Containerization, in combination with intermodal transport possibilities, has enabled the seaports' hinterland to expand (Song, 2003). The increased hinterland of many ports has also led to an intensified inter-port competition (cf. Bergqvist, Falkemark, & Woxenius, 2010; Cullinane & Wilmsmeier, 2011; Notteboom & Winkelmans, 2001). This intensified competition, in combination with the complexity of hinterland transport and the associated infrastructure and strategic transhipment nodes, has made hinterland connectivity an essential part of a port's distinct value proposition (Bergqvist, 2012).

The use of high capacity transport modes, such as trains and barges, increases the capacity of hinterland transport (cf. Bergqvist, 2012). Both rail and inland waterway travel present some advantages in terms of decreased environmental impact, economies of scale, faster throughput in ports, and less delay related to road congestion. Maximising hinterland effectiveness and efficiency in terms of cost, quality, and environmental impact is a matter of finding the optimal mix of transport modes and setups, rather than identifying a single service or solution.

Increased environmental awareness and regulations emphasise the importance of identifying and implementing more sustainable transport systems. The transport sector is one of the largest polluters, and stakeholders, especially policy-makers, aim to construct regulatory frameworks that facilitate the growth of sustainable transport solutions. Fig. 1 illustrates the development of shares of CO_2 emissions among different sectors within the EU.

The development illustrated in Fig. 1 highlights the urgency with which direct (e.g. technology improvement) and indirect (e.g. system changes) measures must be identified to decrease the emissions from the transport sector. The regulatory framework related to transportation continuously changes, often with the aim to improve the competitiveness of sustainable modes of transport. The demand for more sustainable transport solutions has greatly impacted the design of hinterland transportation systems, both in terms of the technology used and the modes of transport applied. Inland waterways and rail based transport have inherited economies of scale and usually perform better over longer distances, in terms of environmental impact, than the road based transport system, given vessel technologies and fuels.

The complexity of hinterland logistics, in combination with the quest for sustainable and cost-efficient services, highlights the importance for developing hinterland strategies that maximise the combined output in terms of environmental performance, cost-efficiency, and logistics quality. In this aspect, the collection of green port dues related to hinterland transportation is an important tool for the focal port. In this situation, goods are allocated towards an "optimised" hinterland transport system and modal distribution, given the specific condition of the focal port. A seaport is heavily dependent on the efficiency of its hinterland infrastructure, and as a consequence, infrastructure development and collaboration with responsible infrastructure organisations is of strategic importance. Here, a differentiated port dues system can not only promote modal shift by means of infrastructure development but also by means of market price influences and inter-mode competition. A differentiated port dues system would thus enable better opportunities for traffic allocation of different modes of transport related to the focal port and its related hinterland transport system. The overall effect would be a more efficient hinterland transport system and global transport chains, beneficial to all transport system stakeholders.

The overall impact on total costs would also be limited. Given that the average cost for importing a 20 foot container is about 1600 USD (including costs for documents, administrative fees for customs clearance and technical control, customs broker fees, terminal handling charges, and inland transport) for the period 2007–2011 (The World Bank, 2012), the impact on overall costs will be marginal. A green port due of 2–5% of total cost is likely to have a significant impact on modal choice decisions; at the same time, the overall cost would be limited.

3. CSR and stakeholder theory

A corporate social responsibility (CSR) movement has exploded over the last two decades, with the aim of expanding corporations' responsibility for their actions (e.g., Hoffman, 1999; McWilliams & Siegel, 2001; Waddock, Bodwell, & Graves, 2002). Logistic service providers have been quick to adopt the CSR rhetoric, and numerous large logistic service providers have adopted CSR and sustainability policies and research, introducing concepts such as LSR (logistics social responsibility) (e.g., Carter & Jennings, 2002). At the core of the CSR movement is the idea that companies voluntarily engage in activities beyond what is required by law to further environmental and

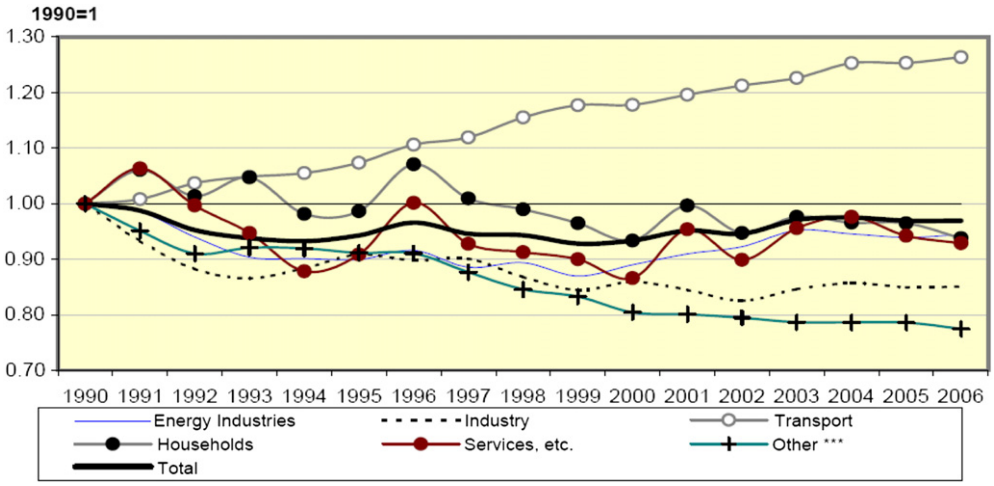

Fig. 1. Emissions of CO_2 by sector.
Source: European Commission, 2010.

social ends, for reasons of legitimacy, competitiveness, or ethics (e.g., Bansal & Roth, 2000; McWilliams & Siegel, 2001).

While a plethora of concepts attempt to capture the expanded role of firms in society such as LSR, CSR, corporate citizenship, business ethics, and sustainable development (e.g., Schwartz & Carroll, 2008), we will focus here on one of the most central of these concepts: stakeholder theory. Stakeholder theory analyses the interaction between firms and their stakeholders (e.g., Egels-Zandén & Sandberg, 2010; Heugen & van Oosterhout, 2002; Orts & Strudler, 2002), and since the publication of Freeman's (1984) landmark book, *Strategic Management: A Stakeholder Approach*, hundreds of articles have been written about stakeholder theory (Buchholz & Rosenthal, 2005; Donaldson & Preston, 1995; Jones & Wicks, 1999). Research has, for example, analysed how firms should interact with stakeholders to improve shareholder value (e.g., Berman, Wicks, Kotha, & Jones, 1999), how stakeholders influence strategies (e.g., Frooman, 1999), and how networks of stakeholders influence companies (e.g., Rowley, 1997).

Of particular interest here is the stakeholder literature that discusses which stakeholders are most likely to influence companies, i.e. what stakeholders are salient, since we in this paper will argue that the ports are unlikely to introduce green port dues without being pressured by their stakeholders. Based on a synthesis of previous research, Mitchell, Agle, and Wood (1997) proposed – in their seminal contribution to stakeholder theory (Neville, Bell, & Whitwell, 2011) – that managers give priority to powerful, legitimate, and urgent stakeholders. This theory of stakeholder salience has subsequently received empirical support from other researchers (e.g., Agle, Mitchell, & Sonnenfeld, 1999; Eesley & Lenox, 2006; Knox & Gruar, 2007; Magness, 2008; Parent & Deephouse, 2007).

In addition to being empirically supported, the theory of stakeholder salience has also been further refined in several important ways. First, Driscoll and Starik (2004) added the attribute "proximity" to the framework, arguing that stakeholders geographically close to the company are likely to be more influential than geographically distant stakeholders. This is well in line with Marquis, Glynn, and Davis (2007), for example, who found that companies' CSR activities are shaped by community level influences. Second, Eesley and Lenox (2006) distinguished between the legitimacy and urgency of the claim and the stakeholder, arguing that both these aspects need to be considered to fully grasp the influence of different stakeholder groups. The authors also argue that it is the urgency of the claim (and not the stakeholder) that influences stakeholder salience. Third, Neville et al. (2011) argued that it is only the moral legitimacy that influences stakeholder salience, since the cognitive and pragmatic legitimacy are subsumed in the other attributes presented by Mitchell et al. (1997). Fourth, Neville and Menguç (2006) showed that stakeholder salience in practice is driven not only by individual firm-stakeholder relations but also by coalitions of stakeholders. This finding is in accord with stakeholder literature, arguing that stakeholders act in coalitions rather than solely as individuals (e.g., Frooman, 1999; Rowley, 1997).

Table 1 summarises the above reasoning and outlines the aspects that are likely to determine stakeholder salience. It is worth noting that it is the company management's *perception* of these attributes that is theorised as influencing stakeholder salience rather than an "objective" assessment of the attributes (Mitchell et al., 1997).

Table 1
Aspects related to stakeholder salience.

Attribute	Definition
Power	The degree to which a stakeholder can get the company to do something that the company would not have otherwise done.
Moral legitimacy – Stakeholder legitimacy – Claim legitimacy	The degree to which a stakeholder and/or claim is viewed by the management team as morally desirable or appropriate.
Claim urgency	The degree to which the claim is time sensitive (i.e. aimed at the company's current, as compared with future, activities), and the importance of the claim for the stakeholder.
Proximity	The degree to which the stakeholder is geographically close to the company's headquarters.

4. A framework for green port dues for hinterland transportation

Previous research related to port dues and charging systems have mainly been directed towards areas such as waste, oil pollution (Carpenter & MacGill, 2001), air pollution (Kågeson, 1999; Michaellowa & Krause, 2000; Swahn, 2002), port facilities, and charging structures (Bergantimo & Coppejans, 2000; Haralambides, Verbeke, & Musso, 2001; Heggie, 1974; Suykens, 1986). Research, such as Gardner, Marlow, and Pettit (2006), shows that ports are aware of the externalities, related to hinterland traffic for example, but choose not to assess it. Rather, they focus solely on complying with environmental legislations on the local, regional, and international level. Based on existing research, it is evident that little research has been directed towards charging systems of port's hinterland activities at the same time it is recognised as an important environmental factor.

The fundamental idea of a port dues system related to hinterland transport is to construct a port dues scheme based on direct cost recovery (i.e. IMO, 2000, chap. 11) that has the ability to facilitate the allocation of load units. This is done according to the desired distribution between transport modes from the perspective of the port and/or a public actor such as a city, port owner, etc. The reasons for introducing such a system are mainly:

1. The region/public actor may want to distribute traffic in a different way (this solves other problems besides environmental), either with regard to time during the day, modal shift, or routing.
2. The port may want to improve efficiency by decreasing congestion at the port, queuing times, handling efficiency, etc.
3. By introducing a differentiated port dues system for hinterland transport, transport service providers will enjoy higher efficiency and better utilisation of resources as a result of a more efficient modal shift distribution for that specific port and its related hinterland.
4. Depending on what the revenues from the port dues are used for, there can be investments in infrastructure and equipment that provide a significant increase in transport operations efficiency.
5. From a social perspective, the overall utilisation of infrastructure enables more efficient use of infrastructure resources and investments. Environmental efficiency improves as the city is able to distribute traffic in a way that minimises the local environmental impact, e.g. pollution, safety, noise, vibrations, etc.

A hinterland port dues system has two central and very different categories of stakeholders involved, namely public and private actors. The public actors are mainly concerned with the total costs for society (i.e. social costs), while the private sector is more concerned with the private costs (i.e. private costs). Social cost includes the total average cost to society, calculated as: SC = BC + EC, where SC = Social Cost, BC = Business Cost, and EC = External Cost. External costs include costs such as pollution, congestion, vibration, noise, and land-use.

The overall goal of the system is to achieve the desired modal shift distribution with the lowest relative fee level. The desired modal shift is a likely combination of the fee introduced, its implication on the marginal modal shift cost per load unit in the system, and the decrease of external cost in the system. The fee might have undesired implications for the competitiveness of the industry if increasing the fee leads to less comparative decreases in marginal cost and external cost, as illustrated in Fig. 2. Corresponding to the overall goal of the port dues system, there are price differentiation possibilities, as illustrated in Fig. 2.

Although the cost-curves are quite smooth, the modal shift is less smooth, as capacity is introduced step-wise. The effect on private and social cost when first introducing port dues is probably not as direct as is illustrated in Fig. 2. This is based on the assumption that the hinterland

port dues system introduced initially will not produce direct and immediate benefit compensation for the corresponding cost increase related to the fee per load unit, since the transport system is not able to respond quickly to the changes in fee levels. The lag is usually a consequence of transaction cost and system lock-ins, such as contract periods, dedicated transport services, system designs, supplier integration, etc.

From a pricing strategy perspective, the ranges most interesting for determining a suitable fee related to modal shift costs and external costs are:

(1) Fee ≥ marginal modal shift cost (≤P1)
(2) Fee ≤ marginal modal shift cost (≥P1) and fee ≤ marginal external cost (≤P2)
(3) Fee ≤ marginal external cost (≤P3) and marginal modal shift cost ≥ marginal external cost (≥P2)
(4) Fee ≥ marginal external cost (≥P3)

The first case illustrate a condition where the induced fees are greater than the marginal cost of the modal shift, which means that the cost impact of the fee is less than the fee itself. A pricing strategy below this limit (P1) is termed *Marginal modal shift cost strategy* and relates to range (1).

The second case illustrates a situation where the fee is less than the marginal modal shift cost but also less than the marginal external cost, and the marginal modal shift cost is greater than or equal to the fee. A pricing strategy within the limits (P1-P2) is termed *Marginal external cost strategy* and relates to range (2). Keep in mind that the marginal external cost in Fig. 2 relates to the less sustainable mode of transport.

The third case illustrates a situation where the marginal modal shift cost of a load unit is equal to or greater than the marginal external cost of a load unit and where the fee is less than the marginal external cost. A pricing strategy between P2 and P3 is termed *Balanced cost strategy* and relates to range (3).

The possibility for pricing beyond the point of P3 is of course possible. A pricing strategy above P3 is termed *External cost strategy* and relates to range (4). This option might be desirable when the decision makers want to focus heavily on the external costs. Reasons for this might be the need for substantial investments cost in order to keep the current modal shift distribution or its current trends and growth. Which strategy to implement depends on the objectives and time perspective of the policymakers. From an implementation perspective, the initial strategy would be of transitional character starting at the pricing level (P1). After an evaluation period an assessment can be made on how the transport system would react to levels between P2 and P3, i.e. the system's modal shift elasticity.

The cases above are based on a linear undifferentiated port fee system. A very basic and undifferentiated system has the risk for requiring a higher fee in order to reach the desired modal shift distribution. Hence, possible methods for differentiating the system are desirable. The more the system is differentiated, the more "accurate" the system becomes. The risk is of course that the system gets complicated, less transparent, and difficult to manage. However, the load unit arriving at the port has extensive information attached to it, such as transport mode, origin, destination, type of goods, etc., which creates great possibilities for a differentiated port dues system. Examples of variables available for differentiating the system are:

- Transport mode. Fundamental information providing a platform for the port dues.
- The distance to the port. A load unit originating far from the port is more likely to be able to use high-capacity means of transport as opposed to units originating close to the port.
- Technical performance. The system can be differentiated on the basis of the environmental performance of individual vehicles delivering the load units at the port, e.g. emission standards, engine standards, fuel types, etc.
- Another variable is the distance a load units needs to be transported in order to reach the nearest intermodal hinterland terminal.

The variables listed above should be viewed as a possible assortment of available variables, and any implementation decision has to balance the possible value every variable brings in terms of increased accuracy and the complexity it generates. The variables could be designed to form an index, similar to the rationale behind the Energy Efficiency Design Index (EEDI) amendment to the MARPOL Annex VI Regulations.

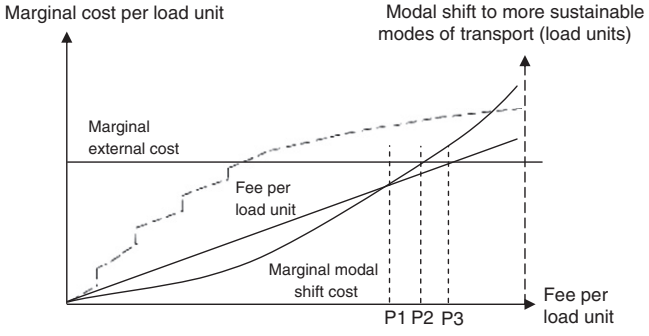

Fig. 2. The relationship between marginal external cost, marginal modal shift cost, and fee per load unit.

5. A stakeholder perspective

While a system of green port dues is a promising tool for improving the environmental and social performance of transportation systems, this is not a sufficient criterion for a solution to be successfully implemented. Equally important is how different actors perceive the tool and how it influences relations between actors in the transportation system. In this section, we start by analysing green port dues from the seaport's perspective and then shift to the perspectives of different stakeholders, using the theory of stakeholder salience previously outlined.

Starting with the seaport, it has limited incentives to introduce green port dues, since green port dues are equivalent to raising prices. While increased prices certainly are attractive to all companies, it is reasonable to assume that there are more effective ways for seaports to achieve price increases than green port dues. The risk of price increases is reduced business volume, making ports unlikely to propose green port dues. Additionally, as will be discussed below, many shippers and transportation service providers are likely opposed to green port dues, further increasing the ports' reluctance to introduce green port dues. The main benefit from the ports' perspective is the potential of improved legitimacy, thanks to green port dues signalling that the ports seriously engage in climate change mitigation (cf. Bansal & Roth, 2000), but this benefit is likely smaller than the costs and risks associated with proposing and introducing green port dues. In sum, although these dues are a promising tool – from a sustainability perspective – seaports are unlikely to voluntarily introduce it, implying that stakeholders have to pressure seaports to adopt green port dues.

It is thus imperative to answer the following: i) what is the likelihood of the seaport's stakeholders demanding that the seaport introduce green port dues; ii) if it is likely that some stakeholders will demand the introduction of green port dues, how salient are these stakeholders; and iii) if some stakeholders demand the introduction of green port dues, what coalitions of stakeholders are likely to form for and against green port dues? Table 2 lists seaports' main stakeholders and outlines their likelihood of demanding the introduction of green port dues, their salience, and the likely coalitions of stakeholders.

As shown in Table 2, it is unlikely that transportation service providers and shippers will demand the introduction of green port dues, since at least in the short term it increases the cost of using ports. Furthermore, these actors can willingly choose transportation modes based on either environmental or financial criteria. The only consequence of green port

dues from their perspective is that they are forced to prioritise environmental criteria higher than they necessarily want to do. Hence, green port dues both increase costs and restrict the freedom of shippers and transportation service providers, making it unlikely that they would demand its introduction. The only potential exception to this are shippers and service providers that are leaders in sustainability that could see green port dues as a way to impose sustainability costs on less sustainable competitors, i.e. their competitive position is improved through stricter environmental regulation. However, companies are generally restrictive in lobbying for more stringent environmental demands, making this an unlikely turn of events. Labour unions are similarly unlikely to demand the introduction of green port dues, since it might negatively affect the ports' business volume and thus partly threaten their members' employment. Thus there is a potential conflict between environmental improvements and employment at the seaports, and in similar situations labour unions have tended to prioritise employment (cf. Egels-Zandén & Hyllman, 2006).

It thus seems as if those actors closely linked to the ports' business are unlikely to demand green port dues, since they potentially reduce the seaports and stakeholders' profits and consequently threaten employment. Hence, green port dues have to be demanded by stakeholders with a more holistic perspective such as public owners, local governments, non-governmental organisations, or the media. For these stakeholders, green port dues present a tool to address numerous different environmental and social challenges. Most evidently, green port dues address the climate change challenge by lowering the CO_2 emissions of transportation. In addition to this, green port dues lead to a shift to more environmentally friendly modes of transport that, in turn, reduce local pollution, noise, and vibrations, and improve traffic safety. Green port dues thus solve numerous environmental and social challenges that stakeholders such as local governments or NGOs attempt to address, regardless of seaports. For example, numerous cities around the globe have introduced congestion taxes to address these challenges. Green port dues provide a similar tool, with the advantage of not negatively influencing private persons.

The stakeholder group that is arguably most likely to demand the introduction of green port dues is environmental NGOs. However, while environmental NGOs frequently are presented as highly salient (e.g., Frooman, 1999; Hendry, 2006), they seem to have low salience in relation to green port dues. They lack the power to force ports to introduce green port dues against their will, the claim is of limited importance to the stakeholders (since there are numerous other ways of addressing these environmental challenges), and they lack geographic proximity since NGOs often operate on the national or international rather than local scene. What environmental NGOs do have is moral legitimacy, making them at best a potentially powerful ally for other more salient stakeholders.

Table 2
Stakeholder assessment.

Stakeholder	Likelihood of demanding green port dues "High/medium/low"	Stakeholder salience "High/medium/low"	Likely position if a demand of introducing green port dues is made "Positive/negative"
Owners	High (public) Low (private)	High	Positive
Local government	High	High	Positive
Transportation service providers	Low	High	Negative/neutral
Shippers	Low	High	Negative/neutral
Media	High	Medium	Positive
Labour unions	Low	Medium	Negative/neutral
NGOs	High	Low	Positive

The other stakeholder group that is likely to demand green port dues is local government — in their role as legislators and/or owners of the port. Local governments possess power, moral legitimacy, proximity, and urgency, making them a highly salient stakeholder (cf. Mitchell et al., 1997). The urgency derives from the fact that many local governments have to resolve traffic congestion in the near future, which requires extensive infrastructure investments that might be postponed if transportation is shifted from road to railway. While local governments, in the same way as labour unions, might hesitate to introduce green port dues since this could threaten employment, it is likely that the benefits in terms of traffic decongestion and improved local environmental conditions will outweigh this risk.

If local governments demand green port dues, it is likely to be supported by environmental NGOs and (local) media. It is debatable whether the media represent a stakeholder group or a spokesperson for other stakeholder groups. Regardless, the positive environmental and social effects of green port dues in the local context are likely to make media reporting positive towards green port dues. Hence, a coalition of local government, NGOs, and media is likely to put pressure on seaports to introduce green port dues. Combined, this coalition possesses all the attributes argued in stakeholder theory to lead to salience. The question is then what coalition of stakeholders will form to resist this pressure.

While most large shippers and transport service providers are salient and likely negative towards green port dues, they are unlikely to resist its introduction. This paradox is due to the attempts of shippers and transport service providers during the last two decades to portray themselves as environmentally and socially responsible. Since local government, media, and NGOs are likely to make debates about green port dues public, it would damage the image of shippers and transportation service providers to publicly criticise green port dues. The costs of damaged public images are likely greater than the costs of green port dues, making shippers and transport service providers likely to accept green port dues. Furthermore, the shippers and transport service providers could use their transportation mode shift to gain legitimacy by portraying themselves as sustainable, further offsetting the cost of the green port dues (cf. Bansal & Roth, 2000). The only shippers and transport service providers that are likely to actively resist green port dues are smaller companies that have not portrayed themselves as environmentally and socially responsible. However, these smaller companies lack the power, moral legitimacy, and thus salience to influence decisions in any significant way. In sum, thanks to shippers and transport service providers' recent CSR interest, it is likely that green port dues could be successfully implemented if green port dues are demanded by local governments in their role as owners and/or legislators.

6. Implications for managerial practice

From a cost perspective, the introduction of a differentiated port fee related to hinterland transport can have a limited effect on overall costs. At the same time, the environmental impact of hinterland transport is significantly decreased if the fee levels are set at suitable levels, given the elasticity of the hinterland transport market. The main reason for this is that the shift to more environmentally friendly modes of transport often has associated economies of scale, given a less than proportional increase in transport cost as compared with the introduced charges.

Furthermore, communicating a clear strategy and the future charging structure well in advance would secure the strategic consideration of these charges by transport service providers and other stakeholders.

However, despite its merits, it is evident from a stakeholder analysis that there are small incentives to propose such a differentiated port dues system by industry actors, and it is mainly the public actors that have clear incentives for proposing such a system. On the basis of the stakeholder assessment and green port dues discussion, we formulated the following hypotheses related to the likelihood of introducing differentiated port dues related to hinterland transport:

1. Situations where the current modal shift requires substantial future infrastructure investments increase the likelihood of stakeholders demanding green port dues.
2. A situation with heavy congestion at the port and/or the city increases the likelihood of stakeholders demanding green port dues; it especially contributes to the attributes of moral legitimacy and claim urgency of the local government.
3. A public owner of the port increases the likelihood of implementation due to high stakeholder salience and the possibility of implementation due to owner's initiative and not legislation.

The local government as a public owner of the port provides the most likely platform for proposing differentiated green port dues. The local government in such a situation has many incentives to act as well as power, moral legitimacy, proximity, and potentially urgency, and other salient stakeholders are unlikely to take an active negative position against it. Which pricing strategy to implement depends on the desired modal shift, from a stakeholder's perspective. The *Marginal modal shift cost strategy* or the *Marginal external cost strategy* could be used to ensure positive changes to the overall social costs. The *Balanced cost strategy* and the *External cost strategy* puts priority in minimising external costs in spite of social cost increases.

This is a judgement that the ultimate decision maker of the port dues has to take based on the trade-off between achieved environmental benefits and increased business costs and any other related issues. This is by no means an easy assessment; however, it provides an opportunity to construct a more dynamic and local/regional tool for internalising external costs. Cases where road tolls/congestion tolls have been implemented illustrates that such assessments can be made, and that the systems are quite dynamic and can meet new and changed circumstances and conditions.

Overall, it is an attractive tool for the local government in the context of infrastructure planning, city congestion, and external costs from hinterland transport. The stakeholder analysis also recognises that it is unlikely for any stakeholder to strongly resist the introduction of a differentiated hinterland port dues system once it is initiated.

Furthermore, if carefully designed and managed, it can provide a powerful tool for port management to manage overall efficiency, especially hinterland transport efficiency and the environmental impact of hinterland transport. Overall, there is potential for more effective and efficient transport systems based on well-designed and managed differentiated port dues systems related to hinterland transport. These systems are also feasible given the recent CSR trend among shippers and transportation service providers.

To increase the feasibility of differentiated port dues, a regulatory framework of a larger area as opposed to a single port authority would minimise distortion of competition and large inter-port shift of volumes. The regulatory area could be defined either by administrative boundaries or functional considerations, such as the SOx Emission Control Area (SECA).

Based on the possible strategies developed and the stakeholder analysis, the paper has provided a framework for developing differentiated green port dues related to hinterland transport that is of value for both management practitioners and science. Further research is needed to assess the impact of the different strategies on the overall transport systems, which generates a combined need for transport modelling and ultimately case studies.

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