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A Critical Review of Port Pricing Literature : What Role for Academic Research?

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Contents

Abstract

Few topics in the area of port economics have attracted so much attention from the side of the academic community as port pricing. The impact of such literature has been quite tangible in terms of policy development and the adoption of cost-based charging practices by many ports. Nonetheless as the port sector changes, new areas of research emerge and the academic community needs to look beyond the traditional theories to provide research that matters.

This manuscript provides a review of the existing literature on port pricing with a specific focus on the literature of the last decade. In the paper the author carried out a systematic analysis of the main maritime and port economics journals and highlighted the current literature gaps and the areas that can benefit from academic attentions. Among the most interesting ones there are charging practices aiming at reducing externalities, the development of all inclusive port charges and the application of revenue management for port infrastructure utilization.

Key Words : Port Pricing, Literature Review, Marginal Cost Pricing, Strategic Pricing, Congestion Pricing, Port Dues, Wharfage

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I. Introduction

Port pricing is one of the research topics that has attracted conspicuous attention in the maritime economics literature. Such interest is justified by the impact of some of the seminal contributions that shaped the academic discipline as we know it, by the advances made in general in the area of pricing in the broader transport economic literature, and the eagerness of the academic community to apply the concepts and methods developed elsewhere to the port sector, and by the impact that port pricing literature had on policy and practical industry action.

The academic relevance of the port pricing literature is well documented. Heaver, in his review of port economics,[1] highlights how port pricing has been an important topic since the beginning of port economics. Already in the book of Jansson and Shneerson[2] of 1982, the authors dedicate an entire section to port pricing (three chapters), highlighting the confusion and complexity that characterized pricing practices at the time. Some of the issues discussed in the book will have an impact on maritime economics for the following decades. And references to the relation between port charges and port costs are already present in the seminal work of Thomas Thorburn in 1960.[3]

In the above-mentioned manuscript,[4] Heaver identifies port costs and pricing as one of the major issues in port economics, and highlights how some of the main issues discussed in the literature remain but are affected by the changes in the organization and governance structures of ports, most notably commercialization and privatization. He notes that notwithstanding such changes, most literature tends to address charging issues at a port level instead of focusing on more specific functions, such as navigation aid, dredging or infrastructure cost recovery.

In the most comprehensive review of port economics literature to date, Pallis *et al.*[5] analyze 395 papers published between 1997 and 2008. Among those within the area of port policy and regulation port pricing appears to be one of the most prolific research areas. The authors animadvert upon such strong focus indicating that the debate has been "*inconclusive*". They highlight

1) Heaver(2006), p. 11.
2) Jansson and Schneerson(1982).
3) Thorburn(1960).
4) Heaver(2006), p. 11.
5) Pallis e.a.(2011), p. 445.

how contributions in the area of policy and regulation have remained rather fragmented as attested by the few influential articles in terms of citations.

The authors also observe how the interest in port pricing has stemmed in part as a reaction to the EU policy developments of the late 90s, that culminated with the publication of the Green Paper on Sea Ports and Maritime Infrastructure[6] and resulted in multiple academic research contributions. They reiterate the importance of ensuring that port research is not too far removed from the interest of port managers, policy makers and operators.

A more critical position is taken by Moreby,[7] who in an editorial to *Maritime Policy and Management* argues that maritime and port economics have been growing away from practice, and as the maritime world has become more turbulent, researchers have focused on safer topics, among which he lists port pricing. Such topics, that generally can be treated analytically or through the use of secondary data sources, would be today so extensively researched that they "*are now as dry as dust*".

The position of Moreby is a warning against over theorization in an applied discipline, such as port economics, that can only have its *raison d'être* in analyzing problems that matter to the industry or society by and large. Such consideration is also the main objective of this review that provides the analysis of some of the most relevant contributions in the port pricing literature with the implicit objective of stimulating a debate on the relevance of such contributions for the port industry.

The review summarizes how research in port pricing has evolved over the last decades, commenting on the concepts that have become well established in the discipline and that had major policy impacts. It also collects the recommendations for further research advanced in the past contributions and discuss whether such research areas have been followed through. New promising research areas are also identified.

II. Literature Review Methodology

The literature review has been performed using literature search engines and pertinent keywords such as port pricing, port tariff, marginal cost pricing, etc.

6) European Commission(1997).
7) Moreby(2004), p. 89.

Each resulting articles has been looked at to check if relevant to the search. This processes resulted in the selection of the following journals, that have then been individually searched for relevant further literature :

- Applied Economics
- Energy, Transport and the Environment
- European Journal of Transport and Infrastructure Research
- European Transport
- International Journal of Transport Economics
- Journal of Transport Economics and Policy
- Journal of Urban Economics
- Maritime Economics and Logistics
  (formerly International Journal of Maritime Economics)
- Maritime Policy and Management
- Research in Transportation Economics
- Review of Network Economics
- The Asian Journal of Shipping and Logistics
- The Journal of Shipping and Transport Logistics
- Transport Policy
- Transport Reviews
- Transportation
- Transportation Policy
- Transportation Research
- Transportation Research Part B: Methodological
- Transportation Research Part E: Logistics and Transportation Review

The total number of articles reviewed is 57 and spans from 1975 to 2013. While the review is quite comprehensive as far as the academic journal publications are concerned, less effort has been made to collect and analyze non peer-reviewed sources. Conference publications and industry reports have been excluded from the review, as it is felt that relevant contributions would have found their way in the academic journals.[8] Only two book chapters were included as they were addressing specifically port pricing. Three port economics books[9] have also been included as they dealt in one or more of their chapters directly with port pricing.

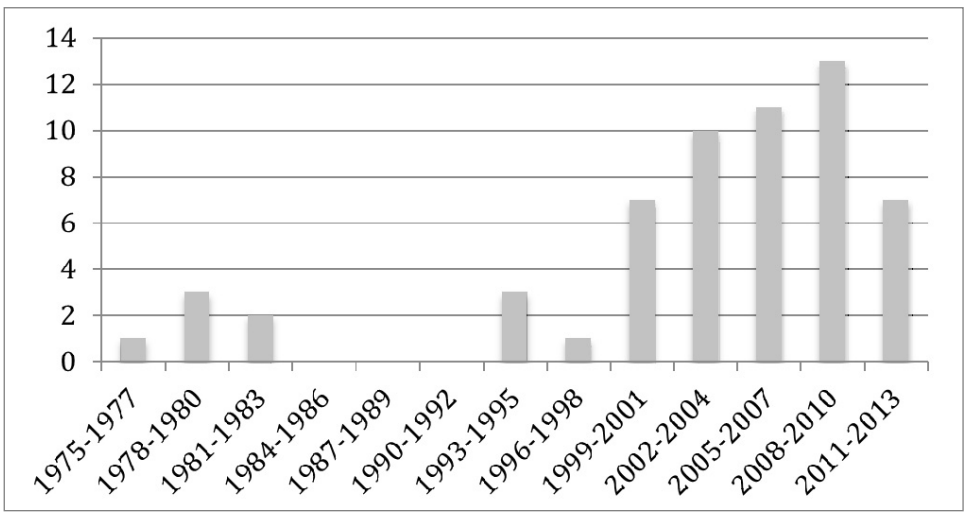
8) see Ashar(2001).
9) Bennathan and Walters(1979) ; Jansson and Schneerson(1982) ; Talley(2009).

<Table 1> Number of journal articles included in the review

Journal	No
Applied Economics	2
European Journal of Transport and Infrastructure Research	1
European Transport	1
International Journal of Transport Economics	3
Journal of Transport Economics and Policy	3
Journal of Urban Economics	1
Maritime Economics and Logistics (formerly International Journal of Maritime Economics)	15
Maritime Policy and Management	8
Research in Transportation Business and Management	1
Research in Transportation Economics	3
Review of Network Economics	1
The Asian Journal of Shipping and Logistics	2
The Journal of Shipping and Transport Logistics	2
Transport Policy	1
Transport Reviews	3
Transportation	1
Transportation Journal	2
Transportation Research	1
Transportation Research Part B: Methodological	1
Transportation Research Part E: Logistics and Transportation Review	3
Books	5
Total	**60**

Most of the papers are of a conceptual nature and have been published in the last 15 years, with a steep increase in articles from 1999. As far as the journals are concerned, most of the papers that have a connection to port pricing or that discuss implications to port pricing practices are published in *Maritime Economics and Logistics (formerly the International Journal of Maritime Economics)* and *Maritime Policy and Management*, that together published almost half of the surveyed contributions. From a methodological point of view, there are very few empirical studies, generally of a descriptive nature or carried out by means of case studies. Most papers that deal with port pricing as a core issue make use of conceptual economic models and game theory.

<Figure 1> Port pricing publications



III. Port Pricing

1. Overview of the Main Themes

Before proceeding to the discussion of the main concept presented in the port pricing literature it is expedient to clarify the meaning of *port pricing*. As explained by Meersman *et al.*,[10] ports are multi-output enterprises where a chain of interlinked services defines the main activity of commercial ports. These services in practice are often charged individually and by different parties. The specific organization that has been adopted by the majority of ports around the world implies that multiple port activities are operated by means of a concession by specialized firms, e.g. terminal operators, thus multiplying the number of market transactions that take place in the port.[11]

The most common type of charges discussed in the literature are port dues (also known as harbor dues or tonnage dues), i.e. charges levied on the vessel for the use of the port; berthing charges (berth dues or quay dues), i.e. charges levied for using a berth; wharfage, i.e. charges levied on cargo; terminal handling charges, i.e. charges levied by operators for loading and unloading operations. This list is not exhaustive,[12] as there might be further charges levied for pilotage, mooring, towage, police, vessel reporting, waste disposal,

10) Meersman e.a.(2010), p. 87.
11) Ashar(2001), p. 52.
12) see for example table 1 in Meersman e.a.(2010), p. 87.

security, passenger, etc., but limited attention has been given in the literature for these ancillary charges.[13)]

Furthermore, the different physical characteristics of vessels imply that demand reacts differently to charges levied on different types of vessels. A similar argument can also be made for cargo, where different handling requirements as well as time sensitivity, and in general supply chain considerations allowed for high variance among port charges in the same port and among neighboring ports.

An important issue in such a discussion is the degree of market power that the port is able to exercise on its customers. While geographical monopolies were the dominant market structure in the port sector until not so long ago, and remain so in many developing economies, waves of deregulation and improvement of port accessibility and logistics infrastructure have eroded the geographical advantage of many ports. Most international ports in Europe, Asia and the North America have at least a direct competitor, and as long as hinterland transport costs remain low, the port captive hinterland shrivels as logistics efficiency increases.

Competition among ports and terminals has triggered great efficiency gains and lowered port costs substantially, favoring the blooming of the globalized world economy that we have witnessed in the last half-century. In a more competitive environment, pricing decision need to take into account the strategies of rival ports. Oligopoly models allow the representation of strategic interactions among ports, emphasizing the role that market power plays on port prices.

Inextricably linked to any discussion on port charges is whether charges should be designed to allow infrastructure cost recovery and, if this is the case, how to design such charges accordingly. This approach to port pricing has been rather popular in the academic literature and postulates port charges to be somehow linked to the (short-run or long-run) marginal costs of port infrastructure. The argument in favor of marginal cost pricing is based on the principle that port users should be made accountable for the additional costs they impose on the port. Implicitly such charging practice would also discourage unnecessary or politically-driven port investments and would, under certain conditions, ensure optimal resource allocations.

A further elaboration of optimal port pricing extends to include also external

13) there are a few exceptions, see for example Pinto e.a.(2010), p. 430.

costs. While from a conceptual point of view such theory extension does not appear particularly complex, the actual implementation of charges that account for full social opportunity costs is difficult. Alternatives have been proposed in the literature in particular in order to account for congestion costs that have a direct bearing on optimal infrastructure charges. Given the increasing relevance of environmental and social aspects in port management, it is felt that further research on how to operationalize social opportunity cost pricing in the port sector would be beneficial for the industry.

Empirical work would be beneficial to this stream of research which in general has been characterized by rigorous theoretical approaches, with limited practical application. One of the most relevant empirical efforts in this direction, the ATENCO study, was carried out in conjunction with the European Commission's attempt to develop a coherent policy text for the port sector, that is generally referred to as *Port Package*. The Port Package was archived in 2006 following staunch political opposition although it has been brought back on the table in a new form following recent Commission declaration.[14)]

Following this brief outlook the rest of the review is structured around five main themes :

- Strategic pricing
- Pricing and market conditions
- Pricing and infrastructure cost recovery
- Pricing and external costs
- Empirical studies

2. Strategic Pricing

It emerged quite early in the literature that prices for port services are linked to the strategic operating objectives of the port. If ports aim at promoting economic development, their charges do not need necessarily to reflect port costs. They could for example favor exports over imports. It is also well documented how ports have been able to differentiate their charges on the basis of the value of the cargo, i.e. charging what the traffic can bear.[15)] The explanation under such charging model is based on the observation that the

14) Kallas(2012).
15) Talley(2009).

cargo elasticity to different prices should be different. When the port is able to segment its demand between high-value and low-value cargo, this form of price discrimination is known as *value-of-service pricing.*[16)]

Even in the case of containers, arguably the most standardized type of cargo handled in the port, container ships differ in configuration and infrastructure requirements. Consider, for example, the ultra large container carriers (ULCC), such as the McKinney Moller just launched in June and the logistics burden that those ships will impose on port operations.

Price discrimination might not necessarily be the result of product differentiation. Different cargo owners can be charged different prices on the basis of their strategic significance to the port.[17)]

Very little attention has been dedicated to the study of revenue management and alternative pricing strategies for ports. While charging practices, such as customer discounts, differentiated cargo charges and value of service pricing, are acknowledged in the literature, they are typically discussed in order to highlight their consequences in terms of ship operation efficiency, or economic welfare.[18)] Efficient infrastructure use and development is not ensured by such charging practices. It would be valuable though to investigate why do ports then engage in such practices and what might be the consequences of inefficient charging practices in the long term. A reasonable result of inefficient infrastructure charging would be overcapacity or congestion.

3. Port Pricing and Infrastructure Cost Recovery

A large portion of port pricing literature has aimed at suggesting alternative ways to price port infrastructure with the objective of improving the efficiency of infrastructure utilization and provision.[19)] Compared to other forms of pricing, prices based on marginal cost provide better signals on port capacity. As highlighted by Haralambides,[20)] if capacity costs are not accounted for, i.e. infrastructure is provided *à fonds perdu*, there would be an incentive for port authorities to develop excess capacity as a strategic device. In absence of infrastructure cost recovery, competition among ports would be affected and

16) ibid.

17) Ashar(2001), p. 52.

18) Pettersen Strandenes(2004), p. 135.

19) e.g. Goss and Stevens(2001), p. 128. ; Haralambides(2002), p. 323. ; Haralambides and Veenstra(2003), p. 782. ; Meersman, Van de Voorde and Vanelslander(2003), p. 371.

20) Haralambides(2002), p. 323.

public resource squandering would ensue.[21)]

There is an open debate on whether long-run or short-run marginal costs should be adopted as a base for charging. While some[22)] highlight the benefits of long-run marginal costs in terms of price acceptability and cost recovery, others[23)] observe how short-run marginal cost pricing provides a better signal on whether to accept or refuse an additional user.[24)] Pettersen Strandenes[25)] adds that even if marginal cost pricing can allow better capacity planning, it does not induce optimal vessel scheduling. In other words, vessels are all treated as equal and willingness to pay for a port slot is not accounted for.

Another issue, which has been presented in the literature, is that marginal cost pricing does not ensure financial viability of the infrastructure when port operations are characterized by economies of scale.[26)] While there is evidence of economies of scale for port operations,[27)] their existence cannot be taken for granted for all ports. This issue is further complicated by the difficulty in accurately estimating marginal costs. In addition, market dynamics will also have an impact on the applicability and the appropriateness of marginal cost pricing, as explained by Bennathan and Walters.[28)]

4. Port Pricing and Market Conditions

The academic interest in port pricing is related to the role that ports play as trade facilitators and in global supply chains. High port prices would reduce the benefits obtainable from the port and potentially damage trade.[29)] Such argument is built on the hypothesis that the port exploits some form of geographical monopoly power and as such regulation needs to ensure that prices are set efficiently. Furthermore, as privatization increases in the port sector, abuse of market position may arise.[30)] This might occur more often in developing countries with limited or no competition among ports, than in those areas of the world where the geographical monopoly position of a port has somewhat been eroded.

21) Gardner, Marlow and Pettit(2006), p. 2. ; Haralambides(2001), p. 368. ; ibid.
22) Button(1979), p. 6. ; Haralambides(2002), p. 323. ; Pettersen Strandenes and Marlow(2000), p. 315.
23) Meersman, Van de Voorde and Vanelslander(2003), p. 371. ; Meersman e.a.(2010), p. 87.
24) see for a detailed explanation Meersman, Van de Voorde and Vanelslander(2003), p. 371.
25) Pettersen Strandenes(2004), p. 135.
26) ibid. ; see also Devanney III and Tan(1975), p. 329. ; Talley(1994), p. 15.
27) Jara-Diaz, Tovar de la Fe and Trujillo(2005), p. 275. ; Jara-Diaz e.a.(2006), p. 67. ; Tovar and Wall(2012), p. 23.
28) Bennathan and A. A. Walters(1979).
29) Van Niekerk(2005), p. 141.
30) Flor and Defilippi(2003), p. 116.

While a certain degree of monopoly power is a common (implicit) assumption in part of the early literature on port pricing,[31] this is far from reality in most ports, where various degrees of market power can be observed among ports and within ports. Market power typically reflects on prices and it would be expected that, as deregulation increases, governments need to monitor carefully for market distortions.

Several contributions[32] have focused on competition among ports, making use of stylized game theory models. These models often deal also with port pricing, albeit not as the primary focus of their analysis. Seo and Ha[33] show how the competitive position of a port can be enhanced by adequate incentives to compensate for differences in the size of the port (incumbent advantage). De Borger *et al.*[34] study how congestion arises in duopoly as a result of strategic price responses to capacity investments. In another contribution[35] they highlight how these results extend to the hinterland and how port capacity investment may result in higher hinterland congestion.

5. Pricing and External Costs

Congestion is one of the main issues that have been addressed in the port pricing literature. Inefficient pricing strategies in fact may result in congestion that may have larger repercussions on port demand than high charges. Congestion arises as port users interfere with each other, either as a result of specific policies adopted by the port authority, e.g. to favor certain users against others, or as a result of inefficiency in port operations or scarce port capacity. The relevance of congestion for port operations is evident already from the work of Jansson and Schneerson,[36] who dedicate several chapters of their book to how congestion arises though a queuing model and how it affects port costs. An earlier analysis of congestion is presented in Vanags,[37] who discusses the role of shipping conferences and shows how a congestion charge in this case would result in underutilization of the port. More recent contributions[38] encompass queuing methods in the definition of optimal

31) Bennathan and A. A. Walters(1979), ; Heggie(1974), p. 3. ; Jansson and Dan Schneerson(1982), ; Walters(1975), p. 299.

32) e.g. De Borger, Proost and Van Dender(2008), p. 527. ; De Borger and Van Dender(2006), p. 264. ; Ishii e.a.(2013), p. 92. ; Saeed and Larsen(2010), p. 237. ; Seo and Ha(2010), p. 49.

33) Seo & Yeong-sok Ha(2010), p. 49.

34) De Borger and Kurt Van Dender(2006), p. 264.

35) De Borger, S. Proost and K. Van Dender(2008), p. 527.

36) Jansson and Dan Schneerson(1982).

37) Vanags(1977), pp. 192-212.

38) Laih, Lin and Chen(2007), p. 1855. ; Laih and Chen(2008), p. 209.

pricing policies to improve berth arrival patterns.

What is particularly interesting about the contribution of De Borger *et al.* briefly discussed earlier[39] is that the authors show how investment in the port hinterland infrastructure is likely to lead to more port congestion and higher prices for the port that is carrying out the investment and less congestion and lower prices for the competing port. The interaction between completion and congestion is also discussed in the most-cited contribution of Haralambides.[40] In this paper the author argues in favor of marginal cost pricing as a solution for port congestion that would easily ensue in case of decreasing returns to scale, as well as for excess capacity that would derive in case of increasing returns to scale.

In another paper[41] Haralambides *et al.* analyze the role of excess capacity for container terminals and show how servicing larger vessels efficiently would require larger excess capacity in order to avoid congestion and larger availability of cargo-handling equipment. The development of dedicated container terminals would benefit liner-shipping operators but could have potentially negative impacts on port competition. As such the paper argues that port pricing has a role to play in ensuring that network externalities are accounted for in the pricing of the dedicated container terminal. This is the only contribution to date that addresses network externalities and their link with port pricing.

Several contributions[42] argued that port pricing ought to account for the external costs of the provision of port services. Marginal cost pricing, in fact, ceases to be optimal if external costs, such as those deriving from water and air pollution, are not accounted for.[43] Early contributions[44] already highlighted the importance of including social costs in the marginal cost computation. Abbes,[45] however, argues that, albeit beneficial, marginal social cost pricing cannot be applied in ports as a result of the difficulties inherent to the calculation of marginal social costs.

A recent paper by Bergqvist and Engels-Zandén[46] discusses the role that port dues can play in reducing the environmental impacts of ports with

39) De Borger, S. Proost and K. Van Dender(2008), p. 527. ; De Borger and Kurt Van Dender(2006), p. 264.
40) Haralambides(2002), p. 323.
41) Haralambides, Cariou and Benacchio(2002), p. 21.
42) Abbes(2007), p. 4. ; Button(1979), p. 6. ; Goss and Stevens(2001), p. 128.
43) Talley(2009).
44) Button(1979), p. 6.
45) Abbes(2007), p. 4.
46) Bergqvist and Egels-Zandén(2012), p. 85.

respect to hinterland transportation. In their paper the authors explain how the increasing integration of port and inland logistics favors the development of differentiated charges that could be used to internalize transportation external costs and reduce hinterland congestion. The paper is one of the few academic attempts to discuss green port charges, although similar mechanisms are already in place in some ports.[47] There is an increasing interest[48] in this area and a focus on pricing would offer an interesting angle in the analysis.

6. Empirical Studies

As highlighted in a recent paper[49] empirical contributions on port pricing are generally limited. Most studies make use of anecdotal evidence and only one recent study by Bandara et al.[50] presents a rigorous empirical analysis of port pricing. The authors investigate the determinants of infrastructure charges using data for 159 ports through a system of simultaneous equations. The model tested the hypothesis that channel dues and berth chargers depend on infrastructure costs among other parameters. The data seem to support the theory that at least in part port infrastructure charges are based on port costs. The study also indicates among the other important factors for the determination of port charges demand levels and the port governance structure.

Other studies[51] have discussed the efficiency of existing charging practices in specific contexts. Some authors[52] made use of a methodology based on data envelopment analysis (DEA) to assess *ex-post* the efficiency of port charges and concession fees in the Spanish and Italian contexts. The method allows for the implementation of a price-cap regulation that would improve the efficiency of charging practices on the basis of the efficiency of port and terminal operations.

The works of McIntosh and Skalberg[53] and Kumar[54] look at the Harbor Maintenance Tax and discuss how the mechanisms of a tax to maintain the depth of US port access channels is characterized by inefficiencies and inequality. The authors suggest alternative taxation schemes that would

47) See for example the US CARB program, or the Green Award incentive system.
48) Acciaro(2013) ; Denktas-Sakar and Karatas-Cetin(2012), p. 301. ; Lam and Van de Voorde(2012), ; Lun(2011), p. 559.
49) Bandara, Nguyen and Chen(2013).
50) ibid.
51) Kumar(2002), p. 149. ; McIntosh and Skalberg(2010), p. 263. ; Perez-Labajos and Esteban Garcia(2000), p. 141.
52) Ferrari and Basta(2009), p. 121. ; Perez-Labajos and Esteban Garcia(2000), p. 141.
53) McIntosh and Randall K. Skalberg(2010), p. 263.
54) Kumar(2002), p. 149.

be more efficient and would spread the burden of repaying the costs of maintenance works on a more equitable basis. The proposed alternatives[55] advocate a taxation fee based on the maximum draft of each ship using the port, the number of days that ship stays in port, and the total volume of cargo loaded or unloaded at the port.

IV. Conclusions and Recommendations

This manuscript has reviewed the existing literature on port pricing with a particular focus on the academic publications of the last decade. The review includes over 60 papers and books and subdivided the research field in five main research areas :

- Strategic pricing
- Pricing and infrastructure cost recovery
- Pricing and market conditions
- Pricing and external costs
- Empirical research

While port pricing has been one of the most prolific research fields in maritime economics, also with considerable policy and industry impacts, the debate is still open on multiple issues.

As far as strategic pricing is concerned, very limited attention has been paid to the development of analytical models that can capture the saliency of the application of price discrimination in the port sector. Considering that various forms of price discrimination are in use in the port sector, it would be beneficial to have further research developed in this area. A possible area for investigation is provided by all-inclusive charging practices, e.g. a single tariff for a package of port services.

Pricing and infrastructure cost recovery is certainly one of the most researched areas within the field. Although several contributions have investigated the theoretical options available for port authorities and port managers mostly in terms of marginal cost pricing and two-part tariffs, limited attention has been dedicated to the practical applicability of such techniques.

55) Kumar(2002), p. 149. ; McIntosh and Randall K. Skalberg(2010), p. 263.

The development of sound methods for the estimation of costs, including the appropriateness of using historic or present value of assets, or the assumed value of land, have attracted little attention from the academic circles.[56] Furthermore the interaction between various types of charges within the same ports in terms of impacts for cost recovery practices has appeared only to the margin of most of the literature.

The investigation of port competition has attracted the attention of many academics mostly through the use of game theory. The pricing impact of different market structure models is often reported as one of the outputs of analytical formalizations used to describe the strategic interactions among ports. One of the main difficulties with such models is that they tend to be removed from practice, as they are highly stylized representations of reality. Major efforts should be made to ensure that this prolific area of research is supported empirically so to ensure that the hypotheses developed in the theory reflect the reality of port management and operations.

The limited amount of empirical research in the area of port pricing has been highlighted before and with the exception of a few new contributions, not much exists in the literature. The paucity of empirical studies is probably due to the difficulty in accessing reliable port data and the confidentiality that typically characterizes pricing and cost information. There are here nonetheless very valuable research opportunities that could contribute bridging the widening gap between practice and academia. It is the position taken by this paper that valuable findings in port economics can arise by studying those research areas in between theory and practice, as it has been the case for many research contributions in the past.

The field of port pricing has also expanded in an area that has increased in importance for ports in recent years, namely the role of ports in controlling the negative external impacts of port activities. There is an emerging literature on green ports and the existing theories and pricing methods can valuably contribute to the current policy debate on how ports should act to reduce the negative external impacts deriving from port activities and shipping activities within ports. Such models could also explore how could ports stimulate the adoption of green practices by port users and what form of commercial advantages could they obtain from such practices.

The last fifteen years have witnessed a substantial increase of academic

56) Heaver(2006), p. 11.

publications on port economics in general, and port pricing in particular. This research has impacted the industry with important contributions of the academia to the policy debate at a national and international level, e.g. the European Union port policy initiatives. Also at the individual port level, academics have been involved as advisors and consultants, producing high-quality research that significantly advanced the status of the discipline and appeared in prestigious academic journals. It is surely befitting the academic community that such publications increasingly feature rigorous approaches, well-grounded in the theory, which often require the use of mathematic techniques and advanced modeling. It would though be a matter of regret if the pursuit of sophistication in the methods estranged the academia from the practice. The dialogue between science and practice is in the end one of the fundamental tenets of applied research, which should endeavor to create value for society beyond individual's academic success.*

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