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Port Competition Regulation: A Tool for Monitoring for Anti-Competitive Behaviour

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Experience and research strongly suggest that privatisation has been effective for enhancing efficiencies and lowering costs, provided there is a competitive environment. While governments for the most part have avoided transfers of public sector monopolies to private ones, the result in the port sector has still tended towards highly concentrated markets, as determined by any one of a number of market tests. Fierce competition may exist in such markets, but ports in these circumstances may also be more susceptible to anticompetitive behaviour. Regulators today rely on concentration ratios to measure the extent of firm dominance. These ratios, however, only focus on market structure, and are not indicative of market performance (eg the extent to which conditions may exist for anticompetitive behaviour). This article first reviews the typical 'tests' used by countries to determine the extent of market concentration and then presents a model for monitoring the conditions in which anticompetitive behaviour is likely to occur. A test application of the model is demonstrated that can facilitate the regulator's need to monitor for anticompetitive behaviour.

Keywords: Port competition; antitrust regulation; port privatisation; anti-competitive behaviour; monolopy regulation; tariff regulation; concentration ratios; market dominance.

I. INTRODUCTION

The port privatisation wave has generally avoided monopolistic settings and also has benefited both consumers and port users in terms of improved efficiencies and lower costs. Colombia, Argentina, and the United Kingdom, arguably three of the most highly lauded cases of port privatisation, are good examples of government efforts to avoid the creation of private sector monopolies. However, even in these instances, as this article will show, evidence suggests that governments should still be concerned with the potential for anticompetitive behaviour.

Antitrust policy development over the years has evolved from a number of theories related to perfect competition. In the early 1980s, one of these was referred to as the theory of contestable markets. The term 'contestability' is derived from the work of economist William J Baumol and his theory of contestable markets.[1] The theory considers the number of potential as well as actual competitors in a market and emphasises freedom of entry (and exit) as the key indicators of a market's 'contestability'.

One critical component of a contestable market is that entry and exit must entail no sunk costs. Sunk costs are those that cannot be recovered once a decision has been made to exit the market. Because of the ease of entry and exit (the latter resulting from no sunk costs), firms can be vulnerable to competitive attacks by outsiders. For example, if an existing firm in a contestable market sets a price above costs, a new firm can enter the market and, before rivals respond by lowering their prices, enjoy significant gains. If rivals do respond, the attacking rival can leave the market without cost (eg no sunk costs). In short, contestability theory suggests there is no clear relationship between the number of competitors in a market and the extent to which prices are similar to those that would emerge from perfect competition.

In spite of the various theories that abound, modern day antitrust frameworks generally find their roots in a preoccupation with market structure, the theoretical basis of which came at about the same time as the contestable market theory in the 1980s. The market structure orientation has relied on the use of a number of measures to define market structure. Theoretically, if a firm (or port) breaches a threshold that defines a dominant firm, then this raises a red flag to the regulator, as the firm has the potential to behave monopolistically. This implied relationship between market structure and firm behaviour is often referred to as the *structure-conduct-performance paradigm*. The paradigm suggests that there is a causal link between the elements of market structure (eg number of firms, the nature of their products, entry conditions, and extent of government regulation) and firm behaviour (eg pricing of services, investment, and marketing decisions) and market performance (eg allocative efficiency and profitability).[2]

Attempts to measure structure focus on the use of concentration tests. As suggested by its name, the test is an attempt to combine information about the number of firms and their size, or their 'concentration'. By extension, the greater the concentration, the greater the degree of firm dominance. The greater the degree of dominance, the more likely the firm(s) will engage in antitrust behaviour, in which case close monitoring may be warranted, or the more likely a proposed merger or acquisition would be opposed if it would result in a higher market concentration.

The most common concentration measure used today is the concentration ratio. The concentration ratio measures the percentage of total sales in an industry made by a prescribed number of the largest firms. In port parlance, it could mean, for example, the percentage of containers handled by the largest terminal operator (in terms of containers handled) or the largest group of operators. For example, an *n*-terminal operator concentration ratio (CR_n) measures the percentage of the total containers in the port industry handled by the *n* largest terminal operators in that industry. Of course, the measure of the concentration would be applied to terminal operators competing in the same market. For ports, this market could be the hinterland that the ports serve.

Alternatively, countries may use something called the Herfindahl-Hirschman Index

(HHI).[3] Like the CR test, the HHI attempts to measure market concentration, but it weighs the market shares of each market member so that a more accurate picture of the competitive dynamics of the market can be drawn. A market with a CR_4 of 80% is likely to perform one way if each of the top four members had 20% of the market, and in a completely different way if one member has 50% and each of the other three has only 10%. The HHI is determined by adding the squares of the market shares. The HHI attempts to more accurately reflect the competitive dynamics of a particular market.

Different countries use different thresholds in applying the CR test to determine if a market is highly concentrated. The United States uses the HHI where a 'score' exceeding 1800 suggests highly concentrated markets. In the initial screening process in Germany, there is a presumption of market dominance when a firm's share is at least one-third.[4] The United Kingdom assumes a company holds a monopoly or dominant position if it controls at least 25% of the market.[5] In Australia, the antitrust authority would investigate a proposed merger/acquisition if the CR_4 would supply 75% or more of the market (with the merged firm having at least 15% of the market), or the merged firm having a market share of 40% or more.

Applying these concentration tests underscores why countries, though perhaps avoiding monopolies, should still be concerned with the post-privatisation competitive environment, to the extent that monitoring may be warranted. Let us apply these standards to perhaps the four most highly lauded port privatisation cases in the last two decades: Colombia, Argentina, Malaysia, and the United Kingdom. The threshold standards for various countries are applied here to each terminal or port in these cases. As Table 1 shows, the results clearly indicate that the markets for each country case presented are characterised as having a dominant firm, or are moderately to highly concentrated if the United States' HHI test is used.

In Malaysia, for example, the terminal operator Klang Container Terminal BhD is considered, at least initially, dominant under the standards of Germany and the United Kingdom, while all of the operators together would breach the Australian standard. In Argentina, the operators of Terminals 1&2 and South Dock exceed the thresholds set by Australia, Germany, and the United Kingdom as well. Similar results are shown for Colombia in the case of the Cartagena Society terminal (applying the German and United Kingdom thresholds), and for the Atlantic coast ports in Colombia when applying the Australian standards. The United Kingdom tests breach all of the country market share thresholds as well. While not all operators in each country are considered dominant, the fact that all countries have at least one dominant operator means that the market itself may be susceptible to anticompetitive behaviour on the part of the dominant operator.

The results are only slightly dissimilar when considering the US approach using the HHI. The Malaysian and Colombian markets would all be considered highly concentrated because there are terminal operators whose HHI is greater than 1,800, while Buenos Aires and the United Kingdom would be considered moderately concentrated. In short, every test case exhibits moderate to high market concentrations regardless of the country standards used.

This is not to suggest that tariff or rate-of-return regulation is justified based on the application of these tests. In spite of their widespread use, there is a tendency to assume that firms in highly concentrated markets are not competitive. Yet we know from port

Table 1: Sample application of market concentration tests

Port/Operator	TEUs	Market Concentration		Considered Dominant/Concentrated in**			
		Market Share	*HHI**	*Germany*	*United Kingdom*	*Australia*	*United States*
Malaysia – Port Klang						yes	
Klang Container Terminal BhD	946,788	68.2%	4,649	yes	yes		
Klang Port Management Sdn BhD	422,698	30.4%	927		yes		
Klang Multi Terminal Sdn Bhd (Westport)	19,150	1.4%	2				
Total HHI			5,577				yes
Argentina – Buenos Aires						yes	
Terminales Río de la Plata (Terminals 1&2)	320,492	38.0%	1,448	yes	yes		
Buenos Aires Container Terminal Services (Terminal 5)	175,830	20.9%	436				
Exolgan (South Dock)	346,031	41.1%	1,687	yes	yes		
Total HHI			3,571				yes
Colombia – Atlantic Coast						yes	
Barranquilla Society	45,235	15.2%	231				
Santa Marta Society	42,705	14.4%	206				
Cartegena Society	152,272	51.2%	2,620	yes	yes		
CONTECAR	25,028	8.4%	71				
El Bosque	32,240	10.8%	117				
Total HHI			3,175				yes
United Kingdom						yes	
Associate British Ports	1,709,107	33.6%	1,127	yes	yes		
Felixstowe (Hutchinson Whampoa)	2,042,423	40.1%	1,610	yes	yes		
Tilbury	394,772	7.8%	60				
Thamesport	350,000	6.9%	47				
Teesport	280,209	5.5%	30				
Rest of UK	313,737	6.2%	38				
Total HHI			2,845				yes

Source: For Colombian statistics, Office of the Port Superintendent – 1997 statistics; for the other ports, *Containerization International Yearbook*, 1998, statistics for 1996.

*Note: The HHI is computed from the sum of the squares of the market shares. For ease of calculation, in the UK case, the HHIs for the top four ports only are calculated. This practice reflects the norm for calculating industry HHIs, as for many industries it is not possible to determine market shares for small competitors. Regulators rationalise this by the fact that the HHIs for smaller competitors have an insignificant impact on the total HHI.

**Germany assumes market dominance exists when a single firm's share exceeds 33%. For the United Kingdom, the single firm threshold is 25%. Australia applies a CR4 (eg the top four firms) test that has 75% or more of the market. The United States uses the HHI, which is based on the market share for each industry.

industry experience that this may not be the case, as demonstrated by the fierce competition between Tacoma and Seattle, and Rotterdam and Antwerp. Moreover, the economics literature is replete with critical assessments of these tests (including the Cournot and Bertrand-based approaches).[6] Their general conclusion is that the research that is out there provides no reliable basis for setting specific standards (or thresholds) that define concentration. The studies as a whole do not show a consistent concentration/competition relationship in all of the studies, nor across industries.[7] And though one model shows a relationship between the HHI and monopolistic pricing, it does not indicate the existence of any critical threshold.[8] In other words, who is to say that 1800 or any other number is the critical concentration level.

The variations in concentration threshold policies that exist from country to country exist for the most part because of economic and legal arguments presented in antitrust cases as well as 'gut' instincts on the part of regulators. The empirical evidence is thus too imprecise to allow regulators to firmly establish the market-share levels that would trigger enforcement concerns. As a result, they should not be used by themselves to decide if markets raise anticompetitive behaviour concerns. Instead, they could be used as a preliminary indicator, or a red flag, for markets that may deserve further scrutiny. Indeed, this point was echoed in a 1990 US circuit court decision (*US vs Baker Hughes*[9]) by now US Supreme Court Justices Clarence Thomas and Ruth Ginsberg: '*Evidence of market concentration simply provides a convenient starting point for a broader inquiry into future competitiveness*.'[10]

Because these tests focus on market structure, and not market performance, they do not determine the extent to which consumers (or shippers and carriers) have viable alternatives. Consumer choice (or shippers' options) are in fact the most critical factor in determining if there are antitrust concerns, while other factors, such as rates of return or profitability, are less important, although economic regulators tend to focus on these in utility regulation today (presumably because the consumer has no choice or extremely limited ones). When the regulator eventually pursues a case, the investigation ultimately focuses on this critical issue.

It should be emphasised that consumer choice does not refer to the simple availability of more than one port facility. Carrier service frequency, connectivity, and total transport cost are the main factors affecting consumer choice in the port industry. As will be shown, these factors are considered below.

II. CONCEPTUAL FRAMEWORK FOR MONITORING FOR ANTICOMPETITIVE BEHAVIOUR

The challenge is to create a system for monitoring port competitive behaviour that addresses market performance. Countries do not have the resources to investigate every economic sector and subsector to determine the degree of competitiveness. This is why regulatory bodies will rely on complaints from an aggrieved party or internal research via monitoring trade journals, newspaper articles, and perhaps annual reports filed by certain size companies. Obviously, the internal research effort of the regulator itself can be inundated with volumes of materials, the review of which cannot possibly be

covered by the typical antitrust staff consisting of just a few market analysts, lawyers, and economists, who are charged with covering a range of industrial sectors. What is needed, then, is a system that goes beyond issues of market structure and focuses on port sector competitiveness, or the extent of options available to shippers. At the same time, such a system should reflect the noble objectives of modernised regulatory frameworks:

1. avoid imposing regulation on those companies that operate competitively (that is, in our case, a system should narrow the field to isolate those ports or terminal operators that may be tempted to engage in anticompetitive behaviour); and
2. present a balance between the need to ensure that terminal operators are not engaging in anticompetitive behaviour while simultaneously relieving ports of the constraining nature of regulation.

Figure 1 presents a conceptual framework for the Port Antitrust Practices Monitoring Model. The model incorporates a 'test' for the most important aspect of competition (transport options) as well as three other tests that are symptomatic of the existing competitive environment, including tests for operational performance, tariff levels, and financial performance. This series of tests in and of itself, and in combination, sets the approach apart from that used by the vast majority of regulatory agencies in terms of how a competitive environment is monitored and measured. As described below, these tests are also structured in a way that yields a 'final score' of the competitiveness of a

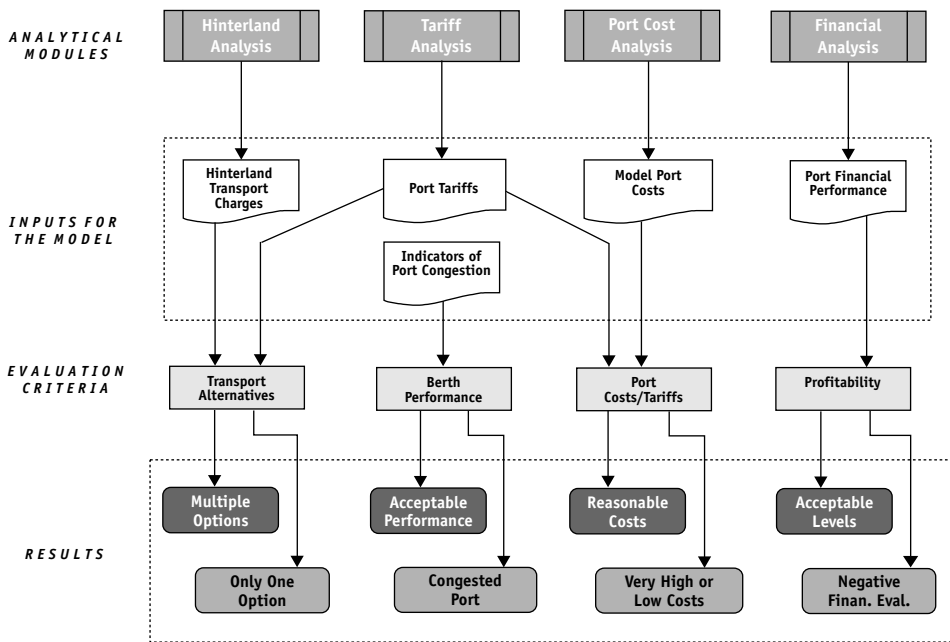

Figure 1: Conceptual framework for Port Antitrust Practices Monitoring Model

particular trade flow involving a specific port. The model is flexible in that the scoring assumptions made can be easily adjusted to reflect the changing policy emphasis in a specific country.

It should be emphasised that the model is intended to reflect the competitive conditions that exist. It does not indicate that a port company is engaged in anticompetitive behaviour. The fact that conditions exist where such behaviour may occur should trigger a process within the regulatory agency that would result in a more detailed investigation. This facilitates the monitoring functions envisioned for the government after privatisation takes place. The model could also be applied in those instances that are triggered by a complaint from a competitor or shipper. The model's logic, structure, and scoring system are described below. The model is then used for a variety of trade flows in a real case to demonstrate its application.

III. MODEL'S OBJECTIVE AND APPLICATION

The purpose of the Monitoring Model is to assess the level of competitiveness of the market for port services provided by a country's ports. More specifically, the Model generates a 'score' that measures the level of competition among the ports regarding a specific cargo flow.[11] The Model's score provides the basis for a determination of whether a port or terminal operator is potentially engaged in an antitrust practice that unduly affects its present or potential customers. A low score indicates that a certain setting is non-competitive and there is a reasonable basis for intervention by the regulatory agency.

The Model relates to a country's port and inland transport system that encompasses the activities that international cargo undertakes between the sea buoy at the entrance to a port and the inland point of generation/termination of the cargo. It covers activities performed by the ports themselves, stevedoring companies that use the port facilities, and private operators outside the jurisdiction of the terminal operator (eg truck lines, tug operators). The Model relates to both the charges and performance level of these activities.

IV. MODEL DATA SOURCES

The Model is essentially a diagnostic tool, which can be applied either on a periodic basis (eg annual), or in response to a change in the port and transport system (eg tariff increase, congestion, construction of a new terminal, closure of a terminal). The application of the Model is relatively simple and requires modification of input data. The calculations of indicators, criteria scores, and the overall score are done automatically by the program that drives the Model, which is Excel-based.

Most of the Model's input is derived from operational and financial data that a regulatory agency could readily collect from the terminal operators on a periodic basis. The rest of the input is collected from various sources outside the control of typical port companies (eg land transport costs, shipping schedules, etc.).

The Model as provided here includes many assumptions that are representative of industry standards, as confirmed via interviews with terminal operators. Obviously, such standards may vary from country to country. As a result, the Model's design is such that the assumptions could be easily changed without breaching the Model's integrity. It should be mentioned that in the model's description below, a number of Figures are presented that consist of the Model's actual screens. These screens depict a real life application for a particular country. Due to concerns about revealing proprietary data, the country and its ports are anonymous in the model's description and the test applications presented at the end of this article.

V. THE MODEL'S CRITERIA AND INDICATORS

The Model includes four *evaluation criteria*, each of which assesses a different aspect of the competitive setting of a country's port and transportation system. The criteria include:

Transportation Options - assessing the competitiveness of the country's entire port inland transport system in terms of total system costs of available options;
Operational Performance - assessing the competitiveness of each port in terms of availability and level of cargo handling services;
Tariff Comparison - assessing the competitiveness of each port in terms of its level of charges (costs); and
Financial Performance - assessing the competitiveness of each port, in terms of its overall profitability.

It should be noted that the first criterion relates to the entire system of port and inland transport of cargo. The other three criteria relate to *specific* ports under examination. Hence, applying the Model for a cargo flow that has the same inland point will yield the same score for all ports in the first criterion, but different scores for each port in the other criteria.

Total competitiveness score

The result of a Model run is a total competitiveness score, which is the sum of the scores for the four evaluation criteria. The score is normalised, with the highest possible score programmed to be 100 and the lowest as 0. Total scores ranging from 0-40 are considered to indicate a non-competitive setting, and 41-100 are considered to be a competitive setting, although these ranges can be easily changed in accord with a particular country's competition policy. For example, the scores can be divided into four regions (A, B, C and D), each expressing a different degree of competitiveness.

Criterion and indicator weights

Each criterion is assigned a weight, which expresses its importance relative to the other criteria. For example, in containerised cargo, the Tariff Comparison criterion is considered twice as important as the Operational Performance criterion in terms of

providing a basis for judgement of a particular port's competitiveness. Accordingly, the weight suggested for the Tariff Comparison is 20% (out of a total of 100%), while the Operational Performance criterion's weight is 10%.

Each criterion is composed of two or three *indicators*. Indicators are usually derived from a set of related data and are calculated according to certain algebraic formulas. Each indicator within a criterion is assigned a weight, reflecting this indicator's importance relative to the other indicators that compose the criterion. For example, for the Tariff Comparison criterion, the first two indicators are assigned a weight of 8% and the third one 4% (eg 8 + 8 + 4 = 20), suggesting that the first two are considered twice as important as the third. Figure 2 presents the Model criteria and indicators; the Figure actually depicts the Summary Screen for the Model, which presents the result of the Model's application.

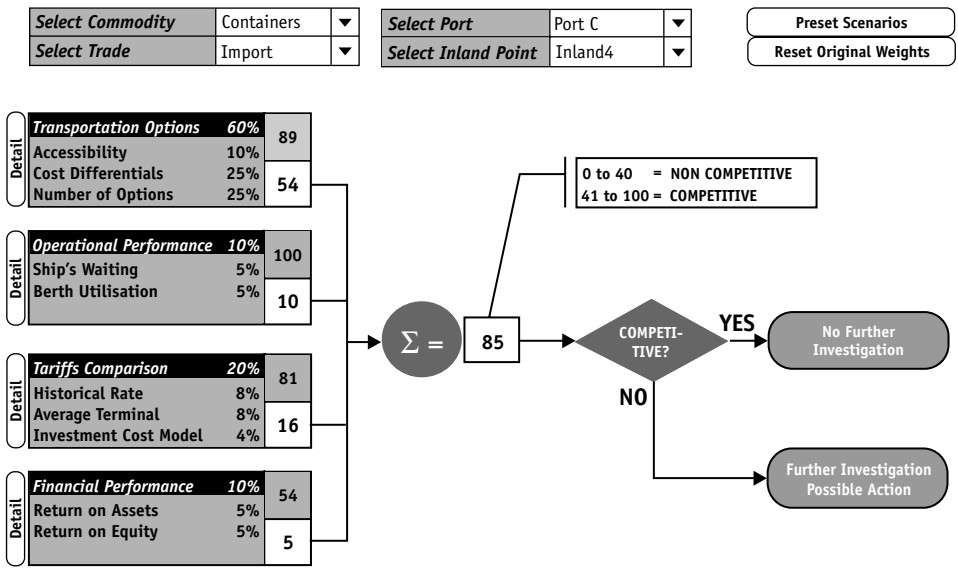

Figure 2: Model criteria and indicators

Raw, critical and normalised values

The first stage of indicator calculation, which involves manipulation of actual data, results in a raw value. The raw value is expressed either in physical or financial units, or as a percentage (fraction). For example, ship's waiting time is measured in hours/vessel-call, while berth utilisation is measured in percentage. For each indicator, the range of possible raw values is bounded by two critical values; one is defined as most competitive and the other as least competitive. That portion of the range between the two critical values is defined as the relevant range.

The determination of critical values is based on a combination of industry standards, statistical analysis of historical performance, theoretical models, and expert judgement. For example, in the case of berth utilisation for containers, the most competitive value was considered 40% and the least one 80%. That is, it was estimated that at a utilisation rate of 40% or below, there would be no ship's queue at the port, so that ships would be able to berth immediately upon arrival. Presumably, at this level of utilisation the port could be considered very competitive. In contrast, a utilisation rate of 80% and above was considered to indicate severe congestion which, in turn, would result in an unacceptable waiting time for ships rendering the port very uncompetitive. The most competitive value, 40%, is assigned the maximum score in this indicator, 5%; the least competitive value, 80%, is assigned the minimum score (0%). The relevant range of indicator values between 40% and 80% are assigned scores in direct proportion to their difference from the critical values. Indicator values above the most competitive or below the least competitive are assigned the scores of the most/least competitive values, respectively.

As indicated above, the weight assigned to each indicator reflects its relative importance within its criterion. The determination of weights is judgmental. To facilitate this determination, the Model has a built-in normalisation mechanism, allowing the user to assign weights assuming the total weight is 100%. For example, if the Port Performance, and Berth Utilisation/Ship Waiting indicators are considered to be of equal importance the Model user should assign each of them a relative weight of 50%. The adjustment to the actual scores, 5% for each, is performed automatically by the model.

Running scenarios

A Model scenario is defined here as a set of data inputs that relate to a certain combination of cargo (commodity) type, trade, specific port (or terminal), and inland point. The Model can be applied to any scenario whether it is related to an actual or hypothetical situation. The creation of scenarios can be facilitated by using the Scenario section and the database that is linked to it. Currently, the Model's database can include eight commodities, seven ports, and 20 inland points. Again, these can be easily modified to reflect a particular country's policies or unique circumstances.

The Model has a built-in set of critical values for indicators, relative weights of indicators, and of criteria. The values and weights currently loaded into the Model reflect some discretionary judgement, but can be modified to reflect either changes in the system or the judgement of the regulator. The following sections present a review and discussion of each of the evaluation criteria and their indicators.

Transportation options criterion

This criterion measures the competitiveness of a country's system of inland transport and ports in terms of choices or options available for a shipper or consignee who face a decision on cargo routing. The criterion and related indicators are applied to a specific cargo flow as defined by cargo type, inland point, and direction (import or export). The criterion measures the amount of 'market power' or control that a port and its related inland transportation have over a specific cargo flow. As already indicated above, this

criterion encompasses all ports of a system and not a specific one since it measures the competitiveness of the system as a whole.

As earlier mentioned, the only indicator that remotely measures competitiveness is based on market concentration. Neither the Herfindahl-Hirschman Index nor the concentration ratios relate to the availability of optional or potential substitutes. That is, the index excludes products that may be used if the price of the product currently in use rises beyond a certain level. For example, there may be situations whereby one port has already captured a large share of the cargo market and, therefore, according to the market concentration index, the situation would be labeled non-competitive. However, the market power of this port (or its capability to increase the price) would be limited if other ports, even if (and perhaps because) they had not captured the particular cargo flow, would provide an attractive alternative and therefore keep a competitive pressure on this port's prices. To capture the impact of the competitive pressure by potential ports and transport routes routing through them, and hence overcome the shortcoming of prevailing competitive measures, the criterion is a novel approach in that it relates market competitiveness to market contestability.

The indicator that reflects market contestability is based on a combination of the number of transport options as determined by the cost differentials among them. A higher score in this indicator, which means a more competitive setting, implies a larger number of options and/or smaller cost differences among them. The cost differentials relate to the summation of the inland cost of transport and the shipper's portion of the port cost. Figure 3 presents the spreadsheet for calculating this criterion.

Definition of transport options

The number of options is defined according to the technical capabilities of the ports and their available inland connections. For example, in the country application here, there are seven terminals handling containers, three of which are located at one site. Accordingly, the decision on the routing of any cargo flow of containers in this country involves seven options, each consisting of two cost components: inland transport and a port. This number will remain constant until another terminal is constructed on a site not in proximity to an existing port, or in proximity to an existing port or terminal.

Cost proximity indicator

The first step in assessing the competitiveness of the port and transport system is to identify the lowest cost option. Then, the competitiveness of each option is determined by its cost difference to the lowest cost option, defined here as *cost proximity*. A cargo flow that moves through a system with many options, all of which are in close proximity (small cost differentials), faces a highly competitive market setting. Conversely, if there are few options and the cost differentials among the options are large, the market setting is non-competitive.

The indicator that was devised to reflect the competitiveness of a set of options, each with its cost, is determined as follows:

> Indicator of Cost Proximity = Sum of the inverse of cost differentials for all relevant Transport Options

Selected Commodity	**Containers**
Selected Port	**Port C**
Select Inland Point	**Inland4**
Select Trade	**Import**

Inputs to Transportation Options Comparison		
Containers	*Optimal Weekly Sailing*	7
	"Penalisation" for Low Accessibility ($/day)	25

Cargo Moved Through >>>	Port A	Port B	Port C	Port D	Port F	Port G
Accessibility						
Sailings per Week	12	7	5	8	4	2
Transport Cost						
Land Transport	$1,133.33	$1,088.89	$1,066.67	$1,222.22	$1,133.33	$1,133.33
Port Costs	$110.00	$115.00	$104.00	$107.00	$105.00	$106.00
Total Land + Port Cost	$1,243.33	$1,203.89	$1,170.67	$1,329.22	$1,238.33	$1,239.33
Cost Adjustment & Differentials						
Penalisation for Low Accessibility	$14.58	$25.00	$35.00	$21.88	$43.75	$87.50
Adjusted Cost	$1,257.92	$1,228.89	$1,205.67	$1,351.10	$1,282.08	$1,326.83
Difference with Least Cost (LC)	$52.25	$23.22	$0.00	$145.43	$76.42	$121.17
Indicator of Proximity with LC	0.019139	0.043062	LC	0.006876	0.013086	0.008253

Cost Proximity Indicator	**0.090416**
Normalised Score	**89.4**

Figure 3: Transportation Options score calculation

The indicator's value in this formula is in direct relation to the number of options, but in inverse relation to the cost differentials. For example, assume a situation of two options where the cost differential between them is $10. For the purpose of calculating the indicator, the situation is defined as having one option (to the lowest cost one) with a $10 differential. The score, according to the above formula is 1/10. If an additional (second) option is available, also with a $10 differential, the score is now 2/10, or twice the score of the first situation, indicating that the competitiveness of the second situation is twice that of the first one. If in the first situation of one option the cost differential is doubled to $20 (by 100%), the competitiveness score decreases to 1/20 (by 50%).[12]

It should be noted that the indicator uses the *absolute* and not the relative (%) value of the cost differentials. The absolute value better reflects the decision making process of shippers, in which they compare the cost differentials between options with the cost of *switching* between them.

Connectivity

The cost differentials included in the indicator formula relate to the actual charges that a shipper may be billed while using a transport option. However, the selection of a transportation option is only partially based on these cost differentials. Shippers, especially in the liner trade, prefer to use ports where more services are available, or ports that offer higher connectivity. Higher connectivity ports have the benefit of

offering more direct services to/from more points worldwide which, in turn, results in higher frequency and shorter dwell times. Put differently, a shipper will not consider a port competitive for a certain cargo flow if the service offered to a desired destination offshore is infrequent and involves long transit times.

The level of connectivity of a transport option, an important factor in the decision making process of shippers, is captured here through an 'opportunity' cost. The term opportunity denotes that the cost is not actual and does not usually involve a charge on behalf of the port or the line. Estimating this cost is based on comparing theoretical values of *inventory costs*, mainly interest on the value of the cargo, for the time the cargo stays at the port. For simplicity, the time in the inventory cost calculation is assumed to be the *inter-arrival* time between sailings. For example, if the time-value of a container is estimated at \$25 per day[13] and a port has two weekly services, it is assumed that there is an added cost of holding the container for 3.5 days (7:2), which is equivalent to a cost of \$87.

Adjusted cost

The cost differentials to be used in calculating the Indicator of Cost Proximity include both the actual and estimated costs. This combined cost, defined here as *adjusted cost*, is therefore a combination of two costs:

1. the 'cash' cost (charges) for land transport and port handling (shipper's portion); and
2. the 'opportunity' cost (estimated inventory cost), based on frequency of services available at the port.

It should be noted that for cargo flows originating/terminating far away from the port, where the land transport cost is relatively high, the impact of the inventory cost component is relatively small.

Transportation options score

It was earlier noted that the Model consists of a set of diagnostic tests and a related database of critical values and weights that require periodic calibration. The process of calibration of the Transportation Option criterion should be conducted through interviews with shippers and forwarders, presenting them with comparative situations and asking them to assess their competitiveness. For present purposes, 0.1 is assumed to be the most competitive and 0.01 as the least competitive score for containers. For uniformity of scoring, non-containerised cargo will have the same scoring system, except that cost will be calculated on a per truck basis carrying a load of 30 tons. Hence, the critical values of non-containerised and containerised cargo will be the same. The weight assigned to this criterion is 60%, which is by far larger than all other weights. This reflects the importance of availability of choice as the most effective way of assuring competitiveness.

The assignment of a weight of 60% is also aimed at assuring that there should be at least two relevant transportation options for any setting to be defined as competitive. For example, hypothetically a cargo flow has only one transportation option and

therefore its score for the transport option criterion is zero. In this instance, even if the cargo flow earns a score for the port-specific criteria of 40% (the maximum possible), the setting is still defined as uncompetitive because the competitive range here is defined as 41% or higher.

Operational performance criterion

This criterion uses operational performance indicators to assess the relationship between supply and demand for port services in a particular country. Presumably, shortage in supply indicates a possible tendency towards monopolistic practices by a port or terminal operator. Using the supply/demand relationship itself as an indicator may be inadequate because of difficulties in direct estimation of demand and supply.

Estimating the demand for port services is, in general, difficult because the demand for a port is derived from the demand for transportation which, in turn, is derived from the demand for the delivered product. Estimating demand for a specific port is even more difficult because of the substitution possibilities by other ports.

Estimating the supply or capacity of existing terminals can be conducted by applying theoretical formulas. However, this process requires many assumptions on operational practices and actual usage of facilities that, in turn, make this estimate too general. Altogether, the previous analysis of capacity/throughput may provide a general indication to the overall port situation in a country, but it cannot be used as a reliable criterion to measure the competitiveness of a single port (or terminal).

Instead of the throughput/capacity (supply/demand) ratio, two indicators that relate directly to a potential shortage in supply of port services were used: berth utilisation and ship waiting for berth. Both indicators are, in fact, two different aspects of one phenomenon, port congestion. Berth utilisation has a direct relationship to capacity utilisation in ports where the berthage is the limiting factor of terminal capacity. This, however, is usually not the case in container terminals, where the limiting factor is the yard. Nevertheless, even in container terminals, berth utilisation provides a good indicator for capacity utilisation.

Ship waiting has distinctive relationships with berth utilisation. When utilisation is low, there is usually no (or minimal) ship waiting. However, at a certain utilisation level, waiting begins to increase very rapidly. Thereafter, a small increase in the level of berth utilisation results in congestion and long waiting times for ships. Although these two indicators are closely related, both are included in this criterion in order to obtain a more comprehensive assessment of port congestion. Figure 4 presents the spreadsheet for calculating this criterion.

Berth utilisation

The input data for this indicator are typically readily available from operational reports generated by the ports or terminal operators. The utilisation indicator is calculated separately for container, general cargo, and bulk ships.[14] The most competitive values are assumed to be 40% for containers and 20% for non-containers; the least competitive is 80% for containers and 90% for non-containers.

Selected Commodity	Containers
Selected Port	Port C
Select Inland Point	Inland4
Select Trade	Import

Multicriteria and Normalised Scoring			Worst	Best
Performance Indicator	Importance	Cargo Type	0 points	100 points
Berth Utilisation	50%	Container	80%	40%
		General Cargo	90%	20%
		Bulk	90%	20%
Ship Waiting	50%	Container Ship (hrs)	4	0
		General Cargo Ship (hrs)	6	0
		Bulk Ship (hrs)	6	0

Calculation of Port Performance Combined Score				
Performance Indicator	Value	Relevant to Cargo/Port	Normalised Score	Weighted Score
Berth Utilisation				
Container Ships Berths	***40%***	YES	100	50
General Cargo Ships Berths	***40%***			
Bulk Ships Berths	***40%***			
Ship's Waiting (hrs)				
Containers	-	YES	100	50
General Cargo	-			
Bulk	-			
			Combined Score >>>	100

Figure 4: Operational Performance score calculation

Ship's waiting

The input data for this indicator are also typically available from port or terminal operator operational reports. The ship-waiting indicator is calculated as the average waiting hours per ship, by type of commodity. The waiting should only include cases whereby it was the result of unavailability of port facilities or equipment. The most competitive value for all types of cargo is assumed to be 0 hours; the least competitive value for containers would be 4.0 hours and for non-containers 6.0 hours.

Operational performance score

The two indicators that comprise this criterion are judged to have the same importance. The weight assigned to the entire criterion is 10%, which is relatively small. It reflects the view that utilisation and waiting time indicators do not always reflect shortage of capacity that, in turn, affects the competitiveness of a port. Congestion (high utilisation) may well be the result of other factors (eg the time a vessel has to wait for the cargo, type and seasonality of cargo, etc.).

Operational performance and transport options

It should be noted that the Operational Performance criterion is closely related to the Transportation Options one. A transportation option that involves a congested port is

presumably not a competitive option. In theory, the cost of congestion, which is mainly the value of the ship's time that is lost from waiting, could be added as another 'opportunity' component of port cost. However, estimating ships' cost, especially the marginal cost that is often the relevant portion, varies according to each line's fleet composition and service rotation. Consequently, it was decided not to attempt to estimate the opportunity cost of ship waiting, and to keep the two criteria separated.

Tariff comparison criterion

The objective of this criterion is to determine if the tariff level of a port is within a reasonable range. Presumably, an abnormally high tariff level of a port indicates a trend to exert market power and employ unfair trade practices. The criterion relates to the port cost, which includes charges to shipping lines and cargo, but does not include 'opportunity' costs. The calculation of the port cost is based on a representative basket of 'basic services' and their respective charges.

The judgement whether a tariff level is within a reasonable range is made based on three indicators. The current rates of the port under consideration are compared with: (a) historical rates of the same port; (b) rates at other ports in the same country; and (c) theoretical rates based on a 'port cost' model.

Comparison to historical rate[15]

This indicator measures the difference in port costs between the time of analysis and past time, either in the previous year or before the recent rate increase. The difference in rates is expressed as a percentage. The most competitive value of this indicator is assumed to be 0% (no increase) and the least competitive is 10%. A reduction in port cost will result in negative values, which will be considered as most competitive (same as 0%).

Comparison to country's average

This indicator measures the difference in port cost between a specific port and the average of the country's ports that handle the same cargo (including the port under consideration). As in the previous indicator, the difference is expressed as a percentage. Here, it is assumed that the most competitive value in this indicator is 0% and the least competitive is 30%. In case the cost of the analysed port is below average and the indicator yields a negative difference, it will be considered as 0%.

Comparison to model port costs

This indicator measures the difference between the actual and theoretical costs of a specific port based on a Port Cost Model that generates the 'model' costs for a country's ports in general. The cost model only relates to facility (installation) charges, but does not directly relate to operating and administrative costs. The aim of the model is to calculate the cost equivalent of the dockage and wharfage, the primary tariff items of any port. The model is based on four groups of assumptions:

Terminal Operations and Capacity, the definition of the required terminal facilities including berthage, yard and storage shed;

Terminal Facility Costs, the cost of construction of the above facilities (excluding land);

Financial/Cost Coefficient, the cost of capital (required rate of return), maintenance and amortisation coefficients; and

Cost Allocation, the division of facility costs between cargo and vessel related charges (dockage and wharfage).

The model relates to three types of cargoes and their respective terminals: containerised, general, and bulk cargoes. For each cargo, the model defines a dedicated terminal with a single berth, yard and shed (for general cargo). Terminal capacity is calculated for the typical ship and its typical amount of cargo assumed to be handled at each terminal. It is assumed that cost recovery for the investments can be expected to be reached at 60% capacity. The rate of return for the investment, including allowance for overhead, is assumed to be 15%. Economic life of facilities is assumed to be 20 years. Cost of land is excluded, but an equivalent cost of land leasing is assumed at the rate of $0.91/ton.

Cost allocation between dockage and wharfage is 10% for dockage and 90% for wharfage. Dockage includes all charges against the vessel based on its length and time at berth. Wharfage includes all charges against cargo based on cargo volume (per move, TEU or ton). Wharfage includes cargo-related charges paid by lines, consignees and operators. Figure 5 presents the cost model calculations for the three cargo types.

Total model port cost

The cost model calculates only facility charges. To complement these charges and calculate the entire port cost, operating costs are added based on actual costs at the port under consideration.

As in the previous indicator, the difference between the Model and Actual cost is expressed as a percentage. The most competitive value of this indicator is assumed to be 0% and the least competitive 50%. The wider range applied for this indicator than in the previous ones is intended to reflect the differences in costs among ports due to differences in the cost of land, availability of building materials, etc.

Tariff comparison score

The weights assigned to the three indicators, Historical Rate, Country Average, and Model Cost, are 40%, 40%, and 20% respectively. The cost model indicator is assigned a lower weight because of its general results; that is, the results are general estimates in nature, and do not necessarily apply to a specific port. The entire criterion is assigned a weight of 20%, or twice that of the previous criterion of Port Performance, suggesting it is a more important one as an indicator. Figure 6 presents the spreadsheet for calculating this criterion.

Financial performance criterion

The objective of this criterion is to determine if a port has been earning abnormal profits. The assumption here is that abnormal profits may indicate an uncompetitive market setting and a possible tendency for ports to be engaged in unfair trade practices, taking advantage of their monopolistic market power.

	Container Vessels		General Cargo Vessels		Bulk Vessels	
	Unit	Specialised	Unit	General	Unit	Small
Ship Assumptions						
Ship's Capacity	TEUs	1,500	DWT	30,000	DWT	30,000
Ship's Length	meters	220	Meters	150	Meters	180
Cargo per Ship	moves	300	Tons	5,000	Tons	20,000
Throughput Assumptions						
Gross Gang Productivity	Moves/Hr	18	Tons/Hr	60	Tons/Hr	60
Gangs per Ship		1.5		2.0		3.0
Vessel Cycle and Yearly Equivalent						
Berth Hours per Ship	Hrs	12	Hrs	42	Hrs	112
Inter-Ship Time	Hrs	6	Hrs	8	Hrs	24
Vessel Cycle	Hrs	18	Hrs	50	Hrs	136
Berth Capacity and Throughput						
Available Berth Days	Days	330	Days	330	Days	330
Throughput -- Vessels	Vessels/Year	440	Vessels/Year	159	Vessels/Year	59
Throughput -- Cargo	Moves/Year	132,000	Tons/Year	795,000	Tons/Year	1,180,000
Throughput -- Cargo	TEUs/Move	1.4				
Berth Capacity	TEUs/Year	184,800	Tons/Year	795,000	Tons/Year	1,180,000
Expected Average Usage		60%		60%		60%
Expected Throughput	TEUs/Year	110,880	Tons/Year	477,000	Tons/Year	708,000
Yard Requirements per Berth						
Dwell Time	Days	5		5		
Peak factor		1.3		1.5		
Slot Requirements	TEUs	3,291	Tons	16,336	Tons	
Storage Density	TEUs/Acre	300		150		
Area Requirement	Acres	11	Sq m	10,890	Sq m	
Gate, Apron, and Circulation	Percent	20%		40%		
Yard Area	Acres	13.2	Sq m	15,247	Sq m	
Cost Indicators						
Cost/Berth		8,000,000	Cost/Berth	6,000,000		4,000,000
Cost/Acre		1,500,000	Cost/Sq m	500		
Cost/Yard		19,745,753		7,623,288		
Required Rate of Return		15%		15%		15%
Ammortisation Years		20		20		20
Annualised Cost of Berth		1,278,092		958,569		639,046
Berth Maintenance		2%		2%		2%
Maintenance Cost		160,000		120,000		80,000
Total Annual Cost of Berth		1,438,092		1,078,569		719,046
Annualised Cost of Yard		3,154,611		1,217,908		--
Berth Maintenance		5%		5%		5%
Maintenance Cost		987,288		381,164		--
Total Annual Cost of Yard		4,141,898		1,599,072		--
Total Annual Cost of Berth and Yard		5,579,990		2,677,641		719,046
Concession Fee Costs						
Unit Cost	$/TEU	6.89	$/ton	0.91	$/ton	0.91
Total Annual Concession Fee		763,819		434,070		644,280
Total Annual Cost		6,343,809		3,111,711		1,363,326
Tariff Equivalent						
Dockage Percentage		10%		10%		10%
Wharfage Percentage		90%		90%		90%
Dockage	$/meter-hour	0.55	$/meter-hour	0.31	$/meter-hour	0.11
Wharfage	$/TEU	51.49	$/ton	5.87	$/ton	1.73
Total Costs						
Dockage	$	1,442	$	1,957	$	2,311
Wharfage	$	21,627	$	29,356	$	34,661
Total Cost per Ship	$	23,068	$	31,313	$	36,972
Total Cost per Unit	$/container	76.89	$/ton	6.26	$/ton	1.85

Figure 5: Port Cost Model and its calculation by cargo types

Selected Commodity	Containers
Selected Port	Port C
Select Inland Point	Inland4
Select Trade	Import

Multicriteria and Normalised Scoring		Worst	Best
Comparison with	Importance	0 points	100 points
Previous Own Tariff	40%	10%	0%
National Average	40%	30%	0%
Cost Model	20%	50%	0%

Port C Charges Based on Basket of Tariffs Defined For Each Cargo Type					
Cargo Type	Unit	Previous Rate	Current Rate	Country Average	Cost Model
Containerised	Container	$104	$109	$109	$119
General Cargo	ton	$19	$19	$19	$19
Bulk	ton	$8	$8	$7	$4
Charges for selected commodity type >>>		$104	$109	$109	$119

Current Rate Difference With	Previous		Country Average	Cost Model
	4.8%		0.2%	-8.4%
Normalised Scores	52		99	100
Weighted Scores	21		40	20

Combined Score	81

Figure 6: Tariff Comparison score calculation

Economic theory maintains that suppliers possessing monopoly power tend to charge prices that exceed marginal and average costs.[16] Ideally, a criterion to assess competitiveness should be based on the comparison of price and marginal cost. In this case, a large difference between price and marginal cost is indicative of a non-competitive market setting and unfair trade practices.[17] Unfortunately, there is no practical way of conducting such comparisons. First, there are many problems in defining marginal cost in capital intensive industries such as the port industry. Second, there are many joint costs in the port system. Even if an economic definition of marginal cost can be developed, there will still be many problems of data compilation, since the accounting systems of ports are not organised to provide such data. Altogether, direct measurement of the difference between price and marginal cost is impractical. Instead, indirect measurement is used by calculating indicators for returns on investment.

Return on investment

The financial profit (net income and earnings) of a port is used as a proxy for the difference between market price and marginal cost. Presumably, abnormally high profits indicate a non-competitive setting that, in turn, suggests a possible indication of anticompetitive behaviour. To assess the level of profit, it is usually compared to the

investment. There are two common indicators that relate profit to investment: return on equity and return on assets. The calculation of the two is through a simple division of two values typically available in port financial statements:

Return on Equity (ROE) = Net Income/Shareholders Equity
Return on Assets (ROA) = Net Income/Total Assets

The least competitive value of the ROE is assumed to be 30% and the most competitive is 10%; for the ROA they are 20% and 5%, respectively. Figure 7 shows the spreadsheet for calculating this criterion.

Selected Commodity	**Containers**
Selected Port	**Port C**
Select Inland Point	**Inland4**
Select Trade	**Import**

Multicriteria and Normalised Scoring		**Worst**	**Best**
Indicator	**Importance**	**0 points**	**100 points**
Return on Assets	50%	20%	5%
Return on Equity	50%	30%	10%

Port C **Financial Data (*000 US $)**	**Year** **1996**
Net Profit	$2,126,485
Total Assets*	$14,918,897
Net Worth (Total Equity)	$13,385,283

Financial Indicators	**Year** **1996**	**Normalised** **Score**	**Weighted** **Score**
Return on Assets	14%	38	19
Return on Equity	16%	71	35
		Combined Score >>>	**54**

Figure 7: Financial Performance score calculation

Financial performance score

The weights assigned to the two indicators are equal. The weight assigned to the Financial Performance criterion is 10%, which is relatively low. The low weight reflects the possibility that high profitability is not necessarily the result of unreasonably high prices for port services. It could well be that the profitability is affected by financial activities that have nothing to do with the cost of operations or charges collected for them. For example, decisions related to debt *vs* equity financing, purchase or lease of assets, and retaining or distributing earnings may affect both the ROE and the ROA indicators. Another problem in assessing these two indicators relates to the

determination of realistic critical values. Ports typically at the early stages following privatisation are on accelerated development schedules because of concession commitments or because the nature of the markets merits short-term investments. As a result, ports are involved in heavy investments, expecting big changes in their revenues, profits and assets, as well as in the ROE/ROA values.

VI. APPLICATION OF THE PORT ANTITRUST TRUST PRACTICES MONITORING MODEL

The model just described is used here to demonstrate its application. As earlier mentioned, the application represents a real life port system. Because of the proprietary nature of the majority of data used, the ports are treated here anonymously. Nevertheless, the Model includes data on three types of cargoes, 19 inland points, seven ports, and two directions of flows (import and export). This represents a total of 798 different cargo flows ($3 \times 19 \times 7 \times 2$) in the model, presenting a very thorough test of its application. As mentioned earlier, the number of cargo flows can be expanded even further as new ports or inland points are added to a country's port system.

Figure 8 presents a sample of one run of the Model for all inland points and the most important cargo flows for import and export containers. The main ports processing that cargo flow are included. Note that the Transport Option score is presented at the beginning of each row (second column, and following the inland point); the port specific score (representing an aggregated score of the three port specific criteria, including operational performance, tariff comparison, and financial performance) is shown below each port. Total scores for each inland point/port combination are un-shaded or shaded to show if the specific cargo flow is assessed as competitive or non-competitive (shaded means non-competitive): 0 to 40 points denote non-competitive and 41 to 100 denote competitive.

The Model run in this case would show scores for 350 cargo flows: 85 for container imports, 95 for container exports, 102 for general cargo imports, and 68 for solid bulk imports. Of this sample, 103 were assessed as competitive (29%); container exports and general cargo imports show more competitive flows (33% and 32%) than container imports (29%) and solid bulk imports (21%).

VII. CONCLUSIONS

It should be emphasised that this conceptual framework for monitoring port competitiveness is intended to reflect the competitive conditions that exist. It does not indicate that a port company is engaged in anticompetitive behaviour. The fact that conditions exist where such behaviour may occur should trigger a process within the regulatory agency that would result in a more detailed research and/or investigation. This facilitates the monitoring functions envisioned for the government after privatisation takes place. The system could also be applied in those instances triggered by a complaint from a competitor or shipper.

Inland Point	Transportation Options Score	Ports and Port Specific Scores				
		Port F	Port B	Port D	Port A	Port C
		40	26	36	28	31
Inland2	1	41	27	37	29	32
Inland3	3	43	29		31	34
Inland4	54	94	80	90	82	85
Inland5	0	40	26	36	28	31
Inland6	0	40	26	36	28	31
Inland7	34	74	60	70	62	65
Inland8	52	92	78	88	80	83
Inland9	0	40	26	36	28	31
Inland11	0	40	26	36	28	31
Inland12	13	53		49	41	44
Inland13	1	41	27	37	29	32
Inland14	0	40	26	36	28	31
Inland15	0	40	26	36	28	31
Inland16	0	40	26	36	28	31
Inland18	0	40	26	36	28	31
Inland17	5	45	31	41	33	36
Inland19	4	44	30		32	35

Inland Point	Transportation Options Score	Ports and Port Specific Scores				
		Port F	Port B	Port D	Port A	Port C
		40	26	36	28	31
Inland1	0	40	26	36	28	31
Inland2	0	40	26	36	28	31
Inland3	25	65	51	61	53	56
Inland4	40	80	66	76	68	71
Inland5	0	40	26	36	28	31
Inland6	0	40	26	36	28	31
Inland7	34	74	60	70	62	65
Inland8	44	84	70	80	72	75
Inland9	4	44	30		32	35
Inland10	0	40	26	36	28	31
Inland11	1	41	27	37	29	32
Inland12	55	95	81	91	83	86
Inland13	2	42	28	38	30	33
Inland14	0	40	26	36	28	31
Inland15	0	40	26	36	28	31
Inland16	0	40	26	36	28	31
Inland18	0	40	26	36	28	31
Inland17	6	46	32	42	34	37
Inland19	4	44	30		32	35

Note: Shaded areas indicate non-competitive flows.

Figure 8: Competitiveness scores for import and export containers

Narrowing the field

As earlier suggested, competition regulators are generally responsible for monitoring a range of economic sectors. As a result, they are inundated with complaints and reams of materials necessary to adequately monitor for antitrust behaviour. At the same time, market share tests do not accurately reflect the competitiveness of the port sector; among other shortcomings, the tests do not address specific trade flows in which ports may potentially exercise dominance. For example, Port B may have only 10% of the container trade, but may have 100% of the containers on a particular trade flow (port + destination or origin + port). The conceptual framework presented here overcomes this shortcoming by targeting trade flows and the dominance that ports may have over specific flows. In so doing, regulators can narrow the focus of monitoring or investigation, saving time and resources, and at the same time address specific routes where anticompetitive behaviour has particularly strong potential.

Striking a balance between the need to regulate and allowing the markets to discipline port behaviour

As noted earlier, countries will typically impose tariff regulations on all ports as a means to control for monopolistic behaviour. This presupposes that such regulation is necessary because of unsubstantiated or irrational assumptions. For example, by imposing universal tariff regulation, the regulator assumes that the market is 'cargo handling'; this market definition is too broadly defined, as it may include cargo niches for which there should be no concern about antitrust behaviour. This in effect distorts the competitive dynamics in markets that need not be regulated, because it forces markets to behave against the 'natural' behaviour induced by 'perfect' or highly competitive markets. The concept also reduces regulation and the costs thereof in general. The data requirements to support the conceptual framework are typically readily available and are such that ports would normally be willing to provide them, getting around the information monopoly issue associated with pricing or rate-of-return regulation. This in turn minimises the costs to both the regulator and the regulated.

Acknowledgement

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ENDNOTES

1 See Baumol (March 1982), Baumol (1982), and Baumol (1986).

2 General criticism of this paradigm is that it has encouraged policy makers to place too much emphasis on the number and size of firms in their efforts to determine if a monopoly exists, putting off more important considerations, such as degree of potential competition or ease of entry. Even so, this is still the standard paradigm in competition regulation today. See Brozen (1982).

[3] The HHI's development is attributed to two different economists: Orris C Herfindahl, who developed it as part of his doctoral dissertation, *Concentration in the Steel Industry*, at Columbia University, New York, in 1950, and noted economist Albert O Hirschman, who used it in his research in industry concentration in 1950. There are several complex models available that are intended to reflect market behaviour (eg Cournot and Bertrand models and their derivatives), but their roots are embedded in the general concepts of market concentration and firm dominance. See Cournot (1927) and Bertrand (1883).

[4] German Act Against Restraints of Competition, Section 22(3), No. 1. This is only the first step in the evaluation process. German regulators typically then proceed to an examination of the company's financial resources. Further, in the case of proposed mergers, if a firm participating in a merger records a combined turnover of at least DM 12 billion and at least two of the participants had turnovers of at least DM 1 billion each, it is presumed that the merger will create or strengthen a dominant market position, regardless of the markets in which the companies are active.

[5] The United Kingdom's Fair Trading Act of 1973 is directed to the behaviour of monopolists, as defined by the 25% threshold test. The Competition Act of 1980 enables regulators to investigate the conduct of a single firm which meets the 25% market share test, but also has an annual turnover of a least £10 million per year.

[6] Harris (1999), 23-51.

[7] Weiss (1989), for example, attempted to determine industry-specific critical concentration levels. His results tended to contradict each other. For example, Weiss ran regressions using the HHI, a variety of other concentration measures, and alternative critical concentration ratios as explanatory variables, and came up with a variety of results, even across similar products or in different years for the same products. In the airline industry, for example, he concluded that for minimum unrestricted daytime fares, the HHI provides the best fit, but for average unrestricted daytime fares a three-firm critical concentration ratio of 93% yielded the best results. Weiss found similar contradictions in analysing empirical studies for retail gasoline, rail freight rates, banking, and even auctions.

[8] The model referred to in this case is the Cournot model. The Cournot model postulates that the price-cost margin is affected by both the HHI and market demand. The price-cost margin increases as concentration levels increase and market elasticity declines. Harris and Smith cite the following example: assume marginal cost equals 1, and market demand elasticity equals 1. With these assumptions, the Cournot model shows that if the HHI increased from 1800 to 1900, then prices would rise from 1.22 to 1.23, or about 1%. A change in the HHI from 1800 to 2500 raises prices from 1.22 to 1.33 or about 9%.

[9] In US *vs* Baker Hughes, Tamrock AG, a subsidiary of Finnish company Tampella AB, proposed the acquisition of Eimco, SA, a subsidiary of the US company Baker Hughes. Both subsidiaries were manufacturing hardrock hydraulic underground drilling rigs (HHUDRs) and, under the US pre-merger/acquisition notification guidelines, sought approval for the transaction. The US challenged the proposed acquisition on the grounds that it would substantially reduce competition in the US HHUDR market, in violation of the US Clayton Act. The government successfully sought a temporary restraining order blocking the transaction, and then requested a permanent injunction, which was rejected in district court. The government next sought an appeal, and lost.

[10] Harris (1999), p. 25. In fact, the US government's own Merger Guidelines acknowledge that '*in a variety of situations, market share and market concentration data may either understate or overstate the likely future competitive significance of a firm or firms in the market*.' See Merger Guidelines of the US Department of Justice (1984), CCH Trade Reg. Report, at 20,561.

[11] As described below, the model 'looks' at the competitiveness of specific trade flows, that is, the cargo flow between the port and a city it serves. A port operator may exhibit monopolistic behaviour on one trade flow, but may have a number of competitors serving another trade flow – hence, the focus on trade flows.

[12] The number of cost differentials in the formula is defined as the number of options minus one (the lowest-cost option). Accordingly, the highest score is equal to the number of options minus 1, or 6 in the case of containers. The formula is inapplicable if there is only one option (and the system is obviously non-competitive). A minimum of a $1 differential is assumed in situations of equal costs (to avoid dividing by zero). It can be shown, using derivatives, that the impact of an option on the score decreases by the square of the increase in cost. For example, an increase of cost differential of $1 from $10 to $11 results in a decrease in the score from 0.1 to 0.091, or roughly by 1/100. If desirable, the relative weights of the two factors that compose this indicator can be adjusted by using exponents (eg squares of differentials).

[13] This figure could of course vary with the value of the container's goods. In this instance, the $25 time value is based on 10% cost of capital and a goods value/TEU of about $100,000. This was the typical value for containerised goods in the country where this model has been applied.

[14] Only bulk cargo handled in general cargo berths is included here.

[15] For clarification, it should be noted that 'historical rate' applies only to the tariff that existed at the time the most recent tariff change was made. The interest here is to see how a port reacts to the market with a change in its tariff. A substantial tariff increase may indicate a change in the competitive environment (eg diminished competition).

[16] A monopolistic supplier will maximise its profits by producing the rate of output that equates MR (marginal revenue) with MC (marginal cost); at this rate of output, price is greater than MC. In contrast, competitive firms will continue producing until price equals MC.

[17] Dissatisfaction with the concentration ratios led some scholars to propose performance-based indicators of monopoly power. The two most common are the Lerner Index and the Bain Index, which address the extent that price exceeds marginal cost (Lerner) or the extent that a firm makes 'excessive' profits (Bain). See Lerner (1934) and Bain (1941).

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