

## **ANALYSIS OF THE EAST-WEST TRADE ROUTE CONTAINER MARKET DYNAMICS**

*M. Elabbasy, M. Elsayehands & Abdelkader*

*Arab Academy for Science, Technology and Maritime Transport (AASTMT), Alexandria, Egypt*

### **ABSTRACT**

*The globalisation of international trade has significantly changed the world economy and increased mobility, thus considerably affecting maritime transport and liner shipping in particular. This paper assesses and analyses the level of the container ports in the East-West trade route for the period between 2001 and 2016. In doing so, Concentration Ratio analysis, Hirschman-Herfindahl index technique, and Shift Share analysis were used. The analysis of the market reveals a tendency towards deconcentration and increased competition among ports in the market in the period of study. Accordingly, the market can be segmented into two main categories, the present hub ports, and the potential hubs. The ports of the first category have a competitive advantage in their strategic location, while those of the second category are trying to utilize their resources more effectively in order to enhance their competitive position and increase their market share.*

**KEYWORDS:** *Maritime Transport, East-West Trade Route, Concentration Ratio, Hirschman-Herfindahl Index, Shift-Share Analysis*

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### **INTRODUCTION**

The containerization process expanded rapidly due to the adoption of standard container sizes and the awareness of industry players of the advantages and cost savings containerization brought (Notteboom and Rodrigue, 2008). Furthermore, growth in international trade, the liberalization of transport markets and concentration in the shipping industry have led shipping lines, terminal operators and logistics service providers to go through an exceptional trend towards consolidations and increased port competition worldwide (Dyck and Ismael, 2015). In recent years, ships have increased their size, becoming more efficient, and increasing the competition between ports in relation to the hinterland and in major trade routes of transport. In consequence, the shipping companies gained more bargaining power demanding higher terminal performance, better quality service, and lower prices, becoming more disloyal (Wang and Cullinane, 2006).

In 2015, the global container trade was increased by 2.2% and reached 175 million TEUs, whereas in 2017 an increase of 1.7% was achieved with total volume reaching 686.8 million TEUs(UNCDAT, 2017).In 2018, it is provisionally projected to rise by 4.6% (Clarkson Research, 2017). Expansion of traffic has to be covered either by increasing the number of strings operated, or by vessel upsizing, or both. As such, increased cargo availability has

triggered changes in vessel size, liner service schedules and in the structure of container shipping routes (Notteboom, 2006).

Container shipping routes can be divided into three main groups: (1) East-West trades (2) North-South trades and (3) intraregional trades. The East-West trade routes, (namely: Transpacific, Europe Asia and Transatlantic) circle the globe in the Northern Hemisphere linking the major industrial centers of North America, Western Europe, and Asia. UNCTAD (2016) highlighted the share percentage of the world trade which indicated that the East-West trade route accounted for 42% of global containerized volume, followed by Intraregional trades and North-South trades, which accounted for 40% and 18%, respectively. Accordingly, for much of the containerization era, the East-West trade route became the main market in the global transportation system and has experienced major development and restructuring. The East -West trade route container market has been characterized by strong long-term growth rates. Hence, the present East-West trade route container ports look completely different when compared to the structure in the 1990s.

The remainder of the paper is structured as follows. Section 2 reviews and analyses the literature focusing on the various types of studies on market assessment, Section 3 illustrates the methodology and techniques used, Section 4 discusses the East-West trade route market analysis, and Section 5 concludes the paper and suggests recommendations to parties involved in this industry and for future work.

## LITERATURE REVIEW

According to Song and Yeo (2004), port competition refers to the development and application of differentiated strategic alternatives so as to attract more customers. A port can be said to be in a competitive position when port users are presented with a competitive offering relative to other connected ports (Chang and Lee 2007). In this context, container ports should be operated with this strategic point in mind.

Cullinane, et al. (2005) analyzed the relative competitiveness of Shanghai and Ningbo in China, to develop a view of the likely future outcome of the competition between them. By using data envelopment analysis and stochastic frontier analysis, the two ports were evaluated on the basis of price and quality of service. High levels of technical efficiency were associated with scale, greater private sector participation, and with transshipment as opposed to gateway ports.

Notteboom(2010) analyzed the European container port system traffic for the period 1985- 2008. The analysis used Hirschman-Herfindahl index, Annual Net Shifts, and Market Shares. The study indicated that in the European port system, the container handling market remains far more concentrated than other cargo handling segments and a certain level of traffic concentration in a seaport system is required in order to allow a virtuous cycle of modal shifts from road haulage to high-volume transport modes such as rail, barge, and shortsea shipping.

Li and Lee (2010) investigated the competence between Shanghai Port and Ningbo Port by Using the HHI index model and shift-share method to qualitatively and quantitatively analyze the data of container throughputs of 8 main ports in the Shanghai International Shipping Center. The researchers found that the ports cluster of the Shanghai International Shipping Center is highly centralized, and undergoes a process of the first centralization then decentralization since the mid-90s, last century.

Varan and Cudem (2014) used Hirschman-Herfindahl index (HHI), Shift Share Analysis (SSA), and concentration ratio (K-CR) to analyze the industry concentration and competition of container ports in turkey to measure the outcome of Turkey's recent privatization process. They argued that the recent port privatizations have been successful

in stimulating private investments and competition. Moreover, the benefit of the attraction of new customers (shipping lines) and the future advantage of having to compete globally are possible with the improvement in the port policies and regulations that build the competitive advantage.

Elsayeh(2015) analyzed the impact of ports' technical efficiency on the improvement of Mediterranean container ports' competitiveness, by using K-CR, HHI, and Shift-Share analysis. The main results show that the increase in the number of players in the market led to the recent trend of Mediterranean container ports de-concentration, which, in turn, reshaped the market structure, changing container ports hierarchy and intensifying competition between ports.

Elbayoumi and Dawood (2016) used the Herfindahl-Hirschman index technique to analyze the market behavior and the movement of the market towards monopoly or pure and perfect competition for 24 container terminals from 12 countries in the Middle East region, for the period between 2009-2014, by analyzing the defined market data; it was found to be a promising market which tends to competition, with only 5 terminals (Dubai including Jebel Ali, Suez Canal Container Terminal, Ambarli, Salalah and Jeddah) growing constantly; the rest of the terminals are inefficient.

Hanafy, et al. (2017) analyzed the annual containers throughput data during the period from 1995 to 2014 to measure the Eastern Mediterranean market behavior concentration by using the Concentration Ratio CR3, CR5, HHI, and the Shift-Share analysis. They found that the container ports/terminals in this region were going to be concentrated in 2014 along with the continued growth rate and the market share of the port of Piraeus and Ambarli, that is the market was tending to monopoly.

The review demonstrates that research on market analysis has focused on specific markets such as the Far East, the Mediterranean, as well as the European markets. On the other hand, it reveals that there is a lack of research thrust concerning the East-West trade route, although trades along this route are mainly containerized cargoes transported by mega ships. Accordingly, market analysis related to the latter route will be the main focus of the present effort.

## **Research Methodology**

To assess the East -West trade route market dynamics, a methodology based on quantitative analysis of available data for a period of 15 years, between 2001 and 2016, which are related to the port location, throughput (productivity) as well as the market share of the 57 selected container ports is followed. Due to the unavailability and unreliability of direct data for the sample ports, the data used in this research were mainly taken from relevant national and international publications on container liner shipping market and related aspects. In addition, data collected through the use of various issues of the Containerization International yearbooks, Container Intelligence and Clarkson's Researches for the study period were also used.

For this purpose, Concentration Ratio (K-CR) analysis, Hirschman-Herfindahl index (HHI) technique, and Shift Share analysis (SSA) was used to measure market concentration for the last 15 years in order to examine the market behavior and the movement of the market towards monopoly or to pure and perfect competition.

## **East West Trade Route Container Ports Concentration**

### **Concentration Ratio (K-CR) Analysis**

One of the most well-known concentration ratios is the four -firm (CR4) and ten firms (CR10) concentration ratios. This ratio measures the percentage of market share of the top four (or ten) largest firms in the market and is

commonly used to indicate the degree to which the market control is held by the four (or ten) largest firms in the industry. The larger the ratio, the less competition there is in the market; the smaller the ratio, the more competitive the market is. More specifically, a ratio of less than 40% is considered competitive; a ratio of more than 40% is considered an oligopoly (Ibrahim, 2015). If the concentration ratio of one company is equal to 100%, this indicates that the industry is a monopoly (Chen and Liao, 2011). Moreover, this index indicates the share of any selected variable, accounted for by the  $k$  largest firms in the industry.

The concentration ratio is calculated as the sum of the market share percentage held by the largest specified number of firms in an industry, and can be expressed as:

$$.CR_K = \sum_{i=1}^k S_i \quad (1)$$

Where  $S_i$  is the share of the  $i^{\text{th}}$  port throughput and  $k$  represents the number of ports over which the index will be calculated (Ibrahim, 2015). The main advantages of the concentration ratio lie in its simplicity and the data required can usually be found in published sources.

Table (1) shows the degree of the East-West trade route container port market concentration between 2001 and 2016, using the K-Firm concentration ratio (K-CR). The market share of the top four ports is seen to have experienced significant shifts in the ranking within the period of study; the market share decreased from 31.81% in 2001 to 31.62% in 2006, to 29.13% in 2011 and to 26.39% in 2016. The market share of the top ten ports shifted from 51.40% in 2001 to 52.01% in 2006 and decreased to 51.49% in 2011 and to 50.73% in 2016, which reveals a tendency towards deconcentration and increased competition among ports in the market.

**Table 1: Measurement of East -West Trade Route Container Port Market Structure Using Concentration Ratio (K-CR)**

No.	Port	2001		Port	2006		Port	2011		Port	2016	
		Throughput (TEU)	Market Share %									
1	Hong Kong	17,800,000	11.56	Singapore	24,800,000	8.89	Shanghai	31,500,000	8.47	Shanghai	37,130,000	8.62
2	Singapore	15,570,000	10.11	Hong Kong	23,234,000	8.33	Singapore	29,937,700	8.05	Singapore	30,903,700	7.17
3	Busan	8,072,013	5.24	Shanghai	21,710,000	7.78	Hong Kong	24,384,000	6.55	Shenzhen	24,110,000	5.60
4	Kaohsiung	7,540,524	4.90	Shenzhen	18,470,000	6.62	Shenzhen	22,569,800	6.07	Ningbo	21,570,000	5.01
	<b>CR 4</b>		<b>31.81</b>			<b>31.62</b>			<b>29.13</b>			<b>26.39</b>
5	Shanghai	6,334,000	4.11	Busan	12,030,000	4.31	Busan	16,184,706	4.35	Hong Kong	19,580,000	4.54
6	Rotterdam	6,095,502	3.96	Kaohsiung	9,770,000	3.50	Ningbo	14,686,200	3.95	Busan	19,455,038	4.52
7	Shenzhen	5,076,435	3.30	Rotterdam	9,654,000	3.46	Guangzhou	14,400,000	3.87	Guangzhou	18,580,000	4.31
8	Hamburg	4,688,669	3.04	Jebel Ali	8,923,465	3.20	Qingdao	13,020,000	3.50	Qingdao	18,010,000	4.18
9	Antwerp	4,218,176	2.74	Hamburg	8,900,000	3.19	Jebel Ali	13,000,000	3.49	Jebel Ali	14,772,000	3.43
10	Port Klang	3,759,512	2.44	Qingdao	7,620,820	2.73	Rotterdam	11,876,921	3.19	Tianjin	14,500,000	3.37
	<b>CR 10</b>		<b>51.40</b>			<b>52.01</b>			<b>51.49</b>			<b>50.73</b>
11	Jebel Ali	3,501,820	2.27	Ningbo	7,089,430	2.54	Tianjin	11,500,000	3.09	Port Klang	13,169,577	3.06
12	New York	3,316,275	2.15	Antwerp	7,013,029	2.51	Kaohsiung	9,636,288	2.59	Rotterdam	12,385,168	2.87
13	Bremerhaven	2,915,169	1.89	Guangzhou	6,660,000	2.39	Port Klang	9,603,926	2.58	Kaohsiung	10,464,860	2.43
14	Felixstowe	2,800,000	1.82	Port Klang	6,326,295	2.27	Hamburg	9,014,165	2.42	Antwerp	10,037,341	2.33
15	Manila	2,796,000	1.82	Tianjin	5,951,690	2.13	Antwerp	8,664,243	2.33	Xiamen	9,600,000	2.23
16	Tokyo	2,770,000	1.80	New York	5,128,430	1.84	Tanjung Pelepas	7,520,000	2.02	Dalian	9,590,000	2.23
17	Qingdao	2,640,000	1.71	Tanjung Pelepas	4,770,000	1.71	Xiamen	6,460,700	1.74	Hamburg	8,910,000	2.07
18	Gioia Tauro	2,488,332	1.62	Bremerhaven	4,473,574	1.60	Dalian	6,400,000	1.72	Tanjung Pelepas	8,281,000	1.92
19	Laem Chebang	2,336,653	1.52	Laem Chebang	4,123,124	1.48	Bremerhaven	5,915,487	1.59	Laem Chebang	7,227,431	1.68
20	Yokohama	2,303,780	1.50	Xiamen	3,977,360	1.43	Laem Chebang	5,731,063	1.54	New York	6,251,953	1.45
21	Tanjung Priok	2,222,496	1.44	Tokyo	3,970,000	1.42	Tanjung Priok	5,617,562	1.51	Saigon	5,987,000	1.39
22	Algeciras	2,151,770	1.40	Tanjung Priok	3,346,000	1.20	New York	5,503,700	1.48	Colombo	5,734,923	1.33
23	Kobe	2,150,000	1.40	Algeciras	3,244,640	1.16	Saigon	4,674,000	1.26	Bremerhaven	5,535,000	1.28
24	San Juan	2,057,733	1.34	Dalian	3,212,000	1.15	Tokyo	4,554,000	1.22	Tanjung Priok	5,514,694	1.28
25	Tanjung Pelepas	2,050,000	1.33	Yokohama	3,200,000	1.15	Valencia	4,327,371	1.16	Algeciras	4,761,428	1.11
26	Tianjin	2,010,000	1.31	Colombo	3,079,132	1.10	Port Said	4,272,060	1.15	Valencia	4,722,273	1.10
27	Nagoya	1,890,000	1.23	Felixstowe	3,000,000	1.08	Colombo	4,262,887	1.15	Tokyo	4,700,000	1.09
28	Colombo	1,726,605	1.12	Jeddah	2,964,000	1.06	Jeddah	4,010,448	1.08	Manila	4,523,339	1.05
29	Guangzhou	1,630,000	1.06	Gioia Tauro	2,938,176	1.05	Algeciras	3,600,000	0.97	Khor Fakkan	4,330,200	1.00
30	Charleston	1,528,034	0.99	Manila	2,722,168	0.98	Felixstowe	3,519,000	0.95	Haiphong	4,100,000	0.95
31	Genoa	1,526,526	0.99	Nagoya	2,700,000	0.97	Manila	3,250,000	0.87	Felixstowe	4,100,000	0.95
32	Le Haver	1,525,000	0.99	Salalah	2,620,000	0.94	Khor Fakkan	3,229,929	0.87	Jeddah	3,956,856	0.92

Table 1: Contd.,

33	Valencia	1,506,805	0.98	Valencia	2,609,600	0.94	Salalah	3,120,000	0.84	Piraeus	3,737,000	0.87
34	Osaka	1,502,989	0.98	Saigon	2,532,000	0.91	Yokohama	3,083,432	0.83	Savannah	3,644,527	0.85
35	Barcelona	1,400,000	0.91	Kobe	2,400,000	0.86	Savannah	2,944,681	0.79	Ambarli	3,221,000	0.75
36	Salalah	1,322,000	0.86	Barcelona	2,300,000	0.82	Ambarli	2,686,000	0.72	Marsaxlokk	3,084,000	0.72
37	Hampton Poads	1,303,797	0.85	Savannah	2,160,000	0.77	Nagoya	2,623,138	0.71	Port Said	3,035,900	0.70
38	Xiamen	1,290,000	0.84	Le Haver	2,130,000	0.76	Kobe	2,470,000	0.66	Kobe	2,801,160	0.65
39	Ningbo	1,210,000	0.79	Port Said	2,127,243	0.76	St Petersburg	2,365,174	0.64	Gioia Tauro	2,797,000	0.65
40	Dalian	1,210,000	0.79	Hampton Poads	2,046,285	0.73	Marsaxlokk	2,360,489	0.63	Yokohama	2,780,328	0.65
41	Jeddah	1,180,427	0.77	Charleston	1,968,474	0.71	Gioia Tauro	2,304,982	0.62	Nagoya	2,657,112	0.62
42	Piraeus	1,165,797	0.76	Osaka	1,906,121	0.68	Le Haver	2,215,262	0.60	Hampton Poads	2,655,704	0.62
43	Marsaxlokk	1,165,070	0.76	Khor Fakkan	1,731,000	0.62	Osaka	2,170,000	0.58	Salalah	2,569,000	0.60
44	Southampton	1,163,722	0.76	San Juan	1,729,000	0.62	Barcelona	2,034,119	0.55	Le Haver	2,519,000	0.58
45	Khor Fakkan	1,089,866	0.71	Houston	1,606,360	0.58	Hampton Poads	1,918,029	0.52	Genoa	2,352,511	0.55
46	Savannah	1,077,478	0.70	Southampton	1,500,306	0.54	Houston	1,866,450	0.50	Barcelona	2,236,960	0.52
47	Houston	1,071,601	0.70	Marsaxlokk	1,485,000	0.53	Genoa	1,847,102	0.50	Osaka	2,200,000	0.51
48	La Spezia	974,646	0.63	St Petersburg	1,449,958	0.52	Piraeus	1,680,133	0.45	Houston	2,182,894	0.51
49	Saigon	900,000	0.58	Ambarli	1,446,267	0.52	Southampton	1,563,040	0.42	Charleston	1,996,276	0.46
50	Marseilles	742,020	0.48	Genoa	1,419,335	0.51	Alexandria	1,490,000	0.40	Southampton	1,957,000	0.45
51	St Petersburg	580,639	0.38	Piraeus	1,403,408	0.50	San Juan	1,484,595	0.40	St Petersburg	1,746,012	0.41
52	Haifa	571,645	0.37	Alexandria	1,175,175	0.42	Charleston	1,381,349	0.37	Alexandria	1,634,000	0.38
53	Port Said	544,094	0.35	La Spezia	1,137,000	0.41	La Spezia	1,307,274	0.35	Mersin	1,453,000	0.34
54	Ambarli	503,739	0.33	Haifa	1,053,098	0.38	Haifa	1,235,000	0.33	Haifa	1,443,000	0.33
55	Alexandria	500,299	0.32	Marseilles	941,000	0.34	Mersin	1,126,588	0.30	La Spezia	1,272,425	0.30
56	Haiphong	331,000	0.21	Mersin	643,749	0.23	Haiphong	1,018,794	0.27	Marseilles	1,251,744	0.29
57	Mersin	189,076	0.12	Haiphong	463,899	0.17	Marseilles	944,047	0.25	San Juan	1,176,000	0.27
	<b>Total</b>	<b>153,987,734</b>	<b>100</b>		<b>278,985,611</b>	<b>100</b>		<b>372,065,834</b>	<b>100</b>		<b>430,897,333</b>	<b>100</b>

However, there have been significant shifts in the ranking of the selected ports within the period of study. In 2001, ports of Singapore, Shanghai, and Hamburg have secured their competitive positions in the second, fifth and eighth places in the market, respectively, while Jebel Ali has succeeded to enhance its competitive position from the eleventh place in 2001 to the eighth place in 2006. Port of Antwerp lost its competitive position from the ninth place in 2001 to the twelfth place in 2006 followed by the ports of New York, Algeciras and Port Said that took the ranks sixteenth, twenty-second, and fifty-third, respectively. Shanghai has taken the lead and enhanced its competitive position from the third place in 2006 to the first place in 2011 followed by Singapore which retreat the second place, while Jebel Ali succeeded to secure the ninth place in the study ports hierarchy. Port Said has significantly enhanced its competitive position moving from the fifty-third place in 2001 and the thirty-ninth place in 2006 and to the twenty-sixth place, followed by Algeciras in the thirty-ninth place, in 2011. The situation has not significantly changed in 2016; while Shanghai, Singapore, and Jebel Ali continued their success to occupy the first, second and ninth places, respectively, Port Said retreated to the thirty-seventh place and Algeciras proceeded to the twenty-fifth place.

The above analysis reveals the intense competition among the study ports in the East-West trade route container market. In the next section, the Hirshman-Herfindahl Index (HHI) is used to provide further elaboration of the changes in the market share in relation to the total market throughput.

### **Hirschman-Herfindahl Index (HHI) Analysis**

Similar to the concentration ratio, the Hirshman-Herfindahl Index (HHI) is a measure of the size of firms in relation to the industry as a whole. It is also an indicator of the degree of competition between firms in the market. The HHI is used to provide further elaboration of the changes in the market share in relation to the total market throughput. A low HHI value indicates a high level of competition and vice versa.

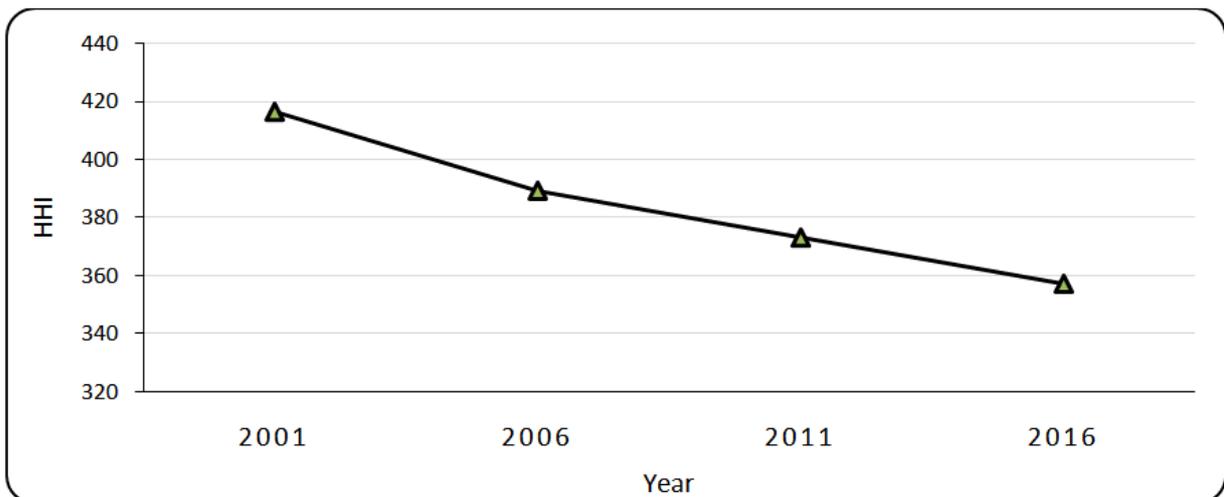
The HHI accounts for the number of firms in a market, as well as concentration, by incorporating the market share of all firms in a market. In this paper, it is defined as the sum of the squared values of each port's market share  $S_i$ , that is:

$$.HHI = \sum_{i=1}^n S_i^2, \tag{2}$$

$$.\frac{10000}{n} \leq HHI \leq 10000, \tag{3}$$

where  $S_i$  is the market shares of the  $i^{th}$  port on the East-West trade route and  $n$  is the total number of the defined ports in the market. As such, the HHI considers the entire size distribution of ports on the market by assigning a weight to both the number of ports in the market and the inequality of market shares. Note that the HHI takes into account the relative size distribution of the firms in a market, and gives extra weight to a single firm that has a particularly wide market share (Liu, et al. 2011).

Figure (1) and Table (2) show the overall level of competition in the East -West trade route container port market as measured by the HHI and reveal decreasing values of the HHI over time, which indicates that the level of competition is increasing. In 2001 the HHI was about 416.47, which indicated low market concentration. By 2016, the HHI had decreased to 357.36 reflecting intensified competition among the market players, in agreement with the results of the K-CR analysis presented earlier.



**Figure 1: East -West Trade Route Container Port Market Concentration, as Measured by HHI**

The above analysis of the market structure using the K-CR and HHI demonstrates that the recent deconcentrating tendency of the East-West trade route container port market, which can be attributed to the increased number of market players and the consequent distribution of container traffic among the ports under study. The K-CR analysis revealed that the market shares of the top four container ports in the defined market have decreased; also the market share of the top ten ports decreased within the study period. Similarly, the value of the HHI has also decreased in the same period, which indicates that the market moves towards deconcentration leading to pure and perfect competition.

**Table 2: Hirshman-Herfindahl Index (HHI) for East -West Trade Route Container Port Market**

No.	Port	2001			2006			2011			2016		
		Throughput (TEUs)	Market Share %	HHI	Throughput (TEUs)	Market Share %	HHI	Throughput (TEUs)	Market Share %	HHI	Throughput (TEUs)	Market Share %	HHI
1	Shanghai	6,334,000	4.11	16.92	21,710,000	7.78	60.56	31,500,000	8.47	71.68	37,130,000	8.62	74.25
2	Shenzhen	5,076,435	3.30	10.87	18,470,000	6.62	43.83	22,569,800	6.07	36.80	24,110,000	5.60	31.31
3	Ningbo	1,210,000	0.79	0.62	7,089,430	2.54	6.46	14,686,200	3.95	15.58	21,570,000	5.01	25.06
4	Busan	8,072,013	5.24	27.48	12,030,000	4.31	18.59	16,184,706	4.35	18.92	19,455,038	4.52	20.39
5	Hong Kong	17,800,000	11.56	133.62	23,234,000	8.33	69.36	24,384,000	6.55	42.95	19,580,000	4.54	20.65
6	Guangzhou	1,630,000	1.06	1.12	6,660,000	2.39	5.70	14,400,000	3.87	14.98	18,580,000	4.31	18.59
7	Qingdao	2,640,000	1.71	2.94	7,620,820	2.73	7.46	13,020,000	3.50	12.25	18,010,000	4.18	17.47
8	Tianjin	2,010,000	1.31	1.70	5,951,690	2.13	4.55	11,500,000	3.09	9.55	14,500,000	3.37	11.32
9	Xiamen	1,290,000	0.84	0.70	3,977,360	1.43	2.03	6,460,700	1.74	3.02	9,600,000	2.23	4.96
10	Kaohsiung	7,540,524	4.90	23.98	9,770,000	3.50	12.26	9,636,288	2.59	6.71	10,464,860	2.43	5.90
11	Tokyo	2,770,000	1.80	3.24	3,970,000	1.42	2.02	4,554,000	1.22	1.50	4,700,000	1.09	1.19
12	Nagoya	1,890,000	1.23	1.51	2,700,000	0.97	0.94	2,623,138	0.71	0.50	2,657,112	0.62	0.38
13	Yokohama	2,303,780	1.50	2.24	3,200,000	1.15	1.32	3,083,432	0.83	0.69	2,780,328	0.65	0.42
14	Kobe	2,150,000	1.40	1.95	2,400,000	0.86	0.74	2,470,000	0.66	0.44	2,801,160	0.65	0.42
15	Osaka	1,502,989	0.98	0.95	1,906,121	0.68	0.47	2,170,000	0.58	0.34	2,200,000	0.51	0.26
16	Dalian	1,210,000	0.79	0.62	3,212,000	1.15	1.33	6,400,000	1.72	2.96	9,590,000	2.23	4.95
17	Singapore	15,570,000	10.11	102.24	24,800,000	8.89	79.02	29,937,700	8.05	64.74	30,903,700	7.17	51.44
18	Tanjung Pelepas	2,050,000	1.33	1.77	4,770,000	1.71	2.92	7,520,000	2.02	4.09	8,281,000	1.92	3.69
19	Saigon	900,000	0.58	0.34	2,532,000	0.91	0.82	4,674,000	1.26	1.58	5,987,000	1.39	1.93
20	Tanjung Priok	2,222,496	1.44	2.08	3,346,000	1.20	1.44	5,617,562	1.51	2.28	5,514,694	1.28	1.64
21	Manila	2,796,000	1.82	3.30	2,722,168	0.98	0.95	3,250,000	0.87	0.76	4,523,339	1.05	1.10
22	Port Klang	3,759,512	2.44	5.96	6,326,295	2.27	5.14	9,603,926	2.58	6.66	13,169,577	3.06	9.34
23	Laem Chebang	2,336,653	1.52	2.30	4,123,124	1.48	2.18	5,731,063	1.54	2.37	7,227,431	1.68	2.81
24	Haiphong	331,000	0.21	0.05	463,899	0.17	0.03	1,018,794	0.27	0.07	4,100,000	0.95	0.91
25	Colombo	1,726,605	1.12	1.26	3,079,132	1.10	1.22	4,262,887	1.15	1.31	5,734,923	1.33	1.77
26	Jebel Ali	3,501,820	2.27	5.17	8,923,465	3.20	10.23	13,000,000	3.49	12.21	14,772,000	3.43	11.75
27	Jeddah	1,180,427	0.77	0.59	2,964,000	1.06	1.13	4,010,448	1.08	1.16	3,956,856	0.92	0.84
28	Khor Fakkan	1,089,866	0.71	0.50	1,731,000	0.62	0.38	3,229,929	0.87	0.75	4,330,200	1.00	1.01
29	Salalah	1,322,000	0.86	0.74	2,620,000	0.94	0.88	3,120,000	0.84	0.70	2,569,000	0.60	0.36
30	Haifa	571,645	0.37	0.14	1,053,098	0.38	0.14	1,235,000	0.33	0.11	1,443,000	0.33	0.11
31	Port Said	544,094	0.35	0.12	2,127,243	0.76	0.58	4,272,060	1.15	1.32	3,035,900	0.70	0.50
32	Alexandria	500,299	0.32	0.11	1,175,175	0.42	0.18	1,490,000	0.40	0.16	1,634,000	0.38	0.14
33	Ambarli	503,739	0.33	0.11	1,446,267	0.52	0.27	2,686,000	0.72	0.52	3,221,000	0.75	0.56
34	Marsaxlokk	1,165,070	0.76	0.57	1,485,000	0.53	0.28	2,360,489	0.63	0.40	3,084,000	0.72	0.51
35	Rotterdam	6,095,502	3.96	15.67	9,654,000	3.46	11.97	11,876,921	3.19	10.19	12,385,168	2.87	8.26
36	Antwerp	4,218,176	2.74	7.50	7,013,029	2.51	6.32	8,664,243	2.33	5.42	10,037,341	2.33	5.43
37	Hamburg	4,688,669	3.04	9.27	8,900,000	3.19	10.18	9,014,165	2.42	5.87	8,910,000	2.07	4.28
38	Bremerhaven	2,915,169	1.89	3.58	4,473,574	1.60	2.57	5,915,487	1.59	2.53	5,535,000	1.28	1.65
39	Felixstowe	2,800,000	1.82	3.31	3,000,000	1.08	1.16	3,519,000	0.95	0.89	4,100,000	0.95	0.91
40	Marseilles	742,020	0.48	0.23	941,000	0.34	0.11	944,047	0.25	0.06	1,251,744	0.29	0.08
41	Algeciras	2,151,770	1.40	1.95	3,244,640	1.16	1.35	3,600,000	0.97	0.94	4,761,428	1.11	1.22
42	Valencia	1,506,805	0.98	0.96	2,609,600	0.94	0.87	4,327,371	1.16	1.35	4,722,273	1.10	1.20
43	La Spezia	974,646	0.63	0.40	1,137,000	0.41	0.17	1,307,274	0.35	0.12	1,272,425	0.30	0.09
44	Piraeus	1,165,797	0.76	0.57	1,403,408	0.50	0.25	1,680,133	0.45	0.20	3,737,000	0.87	0.75
45	Le Haver	1,525,000	0.99	0.98	2,130,000	0.76	0.58	2,215,262	0.60	0.35	2,519,000	0.58	0.34
46	Gioia Tauro	2,488,332	1.62	2.61	2,938,176	1.05	1.11	2,304,982	0.62	0.38	2,797,000	0.65	0.42
47	Barcelona	1,400,000	0.91	0.83	2,300,000	0.82	0.68	2,034,119	0.55	0.30	2,236,960	0.52	0.27
48	Genoa	1,526,526	0.99	0.98	1,419,335	0.51	0.26	1,847,102	0.50	0.25	2,352,511	0.55	0.30
49	Mersin	189,076	0.12	0.02	643,749	0.23	0.05	1,126,588	0.30	0.09	1,453,000	0.34	0.11
50	Southampton	1,163,722	0.76	0.57	1,500,306	0.54	0.29	1,563,040	0.42	0.18	1,957,000	0.45	0.21
51	New York	3,316,275	2.15	4.64	5,128,430	1.84	3.38	5,503,700	1.48	2.19	6,251,953	1.45	2.11
52	Hampton Poads	1,303,797	0.85	0.72	2,046,285	0.73	0.54	1,918,029	0.52	0.27	2,655,704	0.62	0.38
53	Savannah	1,077,478	0.70	0.49	2,160,000	0.77	0.60	2,944,681	0.79	0.63	3,644,527	0.85	0.72
54	Charleston	1,528,034	0.99	0.98	1,968,474	0.71	0.50	1,381,349	0.37	0.14	1,996,276	0.46	0.21
55	St Petersburg	580,639	0.38	0.14	1,449,958	0.52	0.27	2,365,174	0.64	0.40	1,746,012	0.41	0.16
56	Houston	1,071,601	0.70	0.48	1,606,360	0.58	0.33	1,866,450	0.50	0.25	2,182,894	0.51	0.26
57	San Juan	2,057,733	1.34	1.79	1,729,000	0.62	0.38	1,484,595	0.40	0.16	1,176,000	0.27	0.07
	<b>Total</b>	<b>153,987,734</b>	<b>100.0</b>	<b>416.47</b>	<b>278,985,611</b>	<b>100.0</b>	<b>389.35</b>	<b>372,065,834</b>	<b>100.0</b>	<b>373.23</b>	<b>430,897,333</b>	<b>100.0</b>	<b>357.36</b>

**Shift -Share Analysis (SSA)**

Market conduct is the actual behavior of ports in the defined market. It explains how the East -West trade route container ports respond to the conditions imposed by the market structure and interacts with competitors. SSA was originally established within the framework of regional economics and applied in order to analyze the behavior of ports in a defined market. It is appropriate to use it in the maritime sector to get more insight into the issue of the growth of ports throughput (Notteboom, 1997).

Although SSA cannot express changing conditions in the current competitive environment, it enables dividing the growth or decline of a variable ‘shift’ effect and ‘share’ effect. The ‘share’ effect indicates the estimated growth of container traffic in a port as if it would simply preserve its market share. The total shift reveals the total number of containers (TEUs) ports have actually won from or lost to competing ports in the same market, with the estimated container traffic (share effect) as a reference. The ‘shift’ effect enables a better evaluation of a port’s competitiveness as it eliminates the growth of the overall container sector. This means that only the net amount of TEU shifts between ports remains. The sum of the shift effects of all study ports equals zero (Notteboom, 1997).

Mathematically these constituents can be calculated as:

$$ABSGR_i = TEU_{it_1} - TEU_{it_0} = SHARE_i + SHIFT_i, \tag{4}$$

$$SHARE_i = \left( \frac{\sum_{i=1}^n TEU_{it_1}}{\sum_{i=1}^n TEU_{it_0}} - 1 \right) \cdot TEU_{it_0}, \tag{5}$$

$$SHIFT_i = TEU_{it_1} - \left( \frac{\sum_{i=1}^n TEU_{it_1}}{\sum_{i=1}^n TEU_{it_0}} \right) \cdot TEU_{it_0}, \tag{6}$$

$$VOLSHIFT_{total} = \frac{\sum_{i=1}^n |SHIFT_i| - \left| \sum_{i=1}^n SHIFT_i \right|}{2}, \tag{7}$$

where  $ABSGR_i$ ,  $SHARE_i$  and  $SHIFT_i$  are, respectively, the absolute growth, share effect and shift effect of container throughput in the  $i^{th}$  port for the period from  $t_0$  to  $t_1$  in TEUs, whereas  $VOLSHIFT_{total}$  is the total net volume of TEUs shifted between container ports and  $n$  is the number of ports in the East-West container market.

Figure (2) shows the results of a market-based total shift analysis applied to the East-West trade route container ports. For comparison, the study period, from 2001 to 2016, was used as years of reference in the analysis. It is clear that the total net volume of shift effects increased from 6.9 million TEUs in 2001 to 9.4 million TEUs in 2016 within the market under study. The percentages shift in TEUs within the defined market amounts to around 4.5% of the total throughput in 2001 and about 2.2% in 2016. The decrease in percentages might explain those dynamics, in terms of TEU, shifts. The total volume of containers shifted among the respective ports reached an exceptionally high level in the study period, peaking to 12.9 million TEUs with the percentage of TEUs shift 3.1% in 2014.

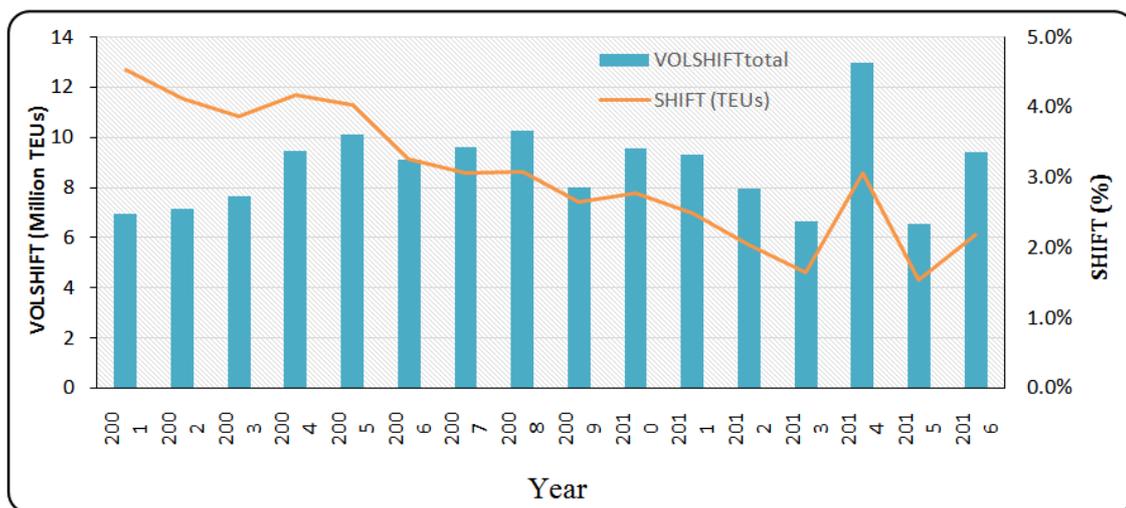
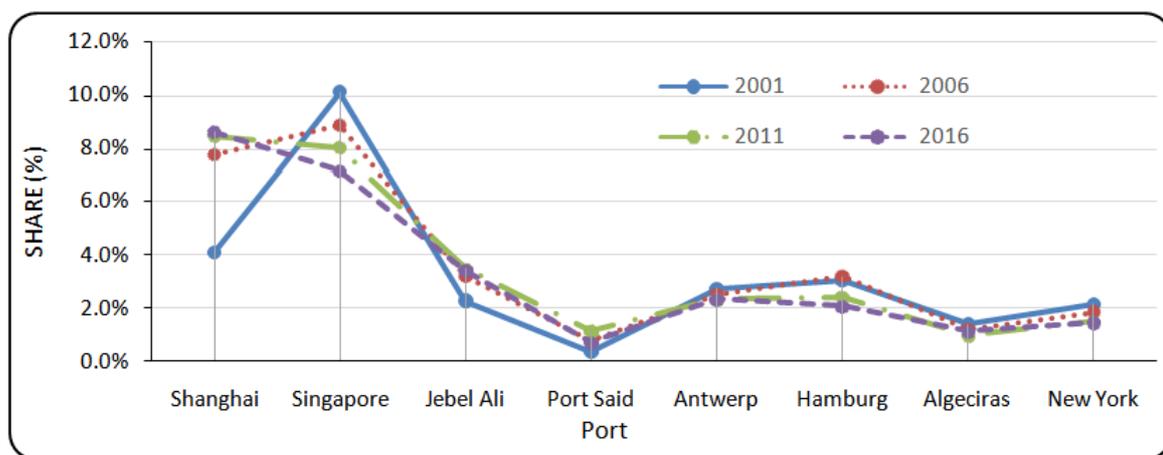


Figure 2: Shift in the East -West Container Ports Throughput

As far as the sharing analysis is concerned, the market share of each port is calculated as a percentage of the total throughput of the 57 ports selected in this study. The market share of transshipment hubs in the total East -West container ports throughput faced a noticeable decline during 2008 due to the effect of the world financial and economic crisis that took place in this period and affected the port industry worldwide. However, the market share of the total East -West container ports throughput increased since 2009; the main reason for this growth is that some shipping lines rely on the hub and spoke operation pattern in the East -West trade route.

Figure (3) illustrates that, in 2001, Singapore was the leader with a market share of 10.1%, followed by Shanghai with a market share of 4.1%. Hamburg and Antwerp had market shares of 3.0% and 2.7%, respectively. Similarly, Jebel Ali and New York had approximately equal market shares of 2.3% and 2.2% respectively, while Algeciras and Port Said had the lowest market shares of 1.4% and 0.4%, respectively.



**Figure 3: Share in the East -West Container Ports Throughput**

In 2006, the market share of Singapore dropped to 8.9% but the port succeeded to maintain its competitive position as the leader in the East -West market followed by Shanghai that achieved a market share of 7.8%. Hamburg and Jebel Ali had equal market shares of 3.2% each. In the same year, the Antwerp market share declined to 2.5%. Moreover, New York, Algeciras, and Port Said had market shares of 1.8%, 1.4% and 0.8%, respectively. In 2011 and 2016, the market share of Singapore dropped to 8.1% and 7.2%, respectively; the reduction in Singapore market share was directly related to the increase of Shanghai market share to 8.5% and 8.6%, respectively, where the latter succeeded to be the market leader in the East -West market. In 2016, Jebel Ali, Antwerp, Hamburg, New York, Algeciras, and Port Said had market shares of 3.4%, 2.3%, 2.1%, 1.5%, 1.1% and 0.7%, respectively.

## CONCLUSION AND RECOMMENDATIONS

Recent dynamics in the East-West trade route container port market was examined and analyzed for the period from 2001 to 2016 in terms of market concentration and deconcentration tendencies. A number of measurement techniques were used. Market concentration was measured and analyzed by using the K-CR and HHI, while market conduct was investigated through the use of the SSA technique. The analysis of market conduct, together with the shift -share analysis, reveals that the level of port market concentration in the East -West trade route container port market stagnated in the period of study. Accordingly, in terms of port hierarchy, the market can be segmented into two main categories, the present hub ports, and the potential hubs. The former, such as Shanghai and Singapore, have a competitive advantage in their

strategic location, while the latter, such as Algeciras and Port Said, are trying to utilize their resources in terms of terminals infra/superstructure in order to enhance their competitive position and increase their market share. This results are in agreement with those of Li and Lee (2010) and are in line with Elsayeh (2015) findings.

To further expands the scope of this endeavor, future studies could consider other geographic areas, transportation routes, types of cargo and other decision-making models.

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