Retraction Notice

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Competitiveness Evaluation of West Africa Coastal Countries Ports: Structure Conduct Performance Approch

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Abstract

The purpose of this article is to evaluate the competitiveness of West Africa coastal countries (WACC) Ports using market structure-conduct-performance (SCP) framework drawn from the Industrial Organization (IO) concept. Market structure is evaluated through an analysis of market concentration using four different techniques namely the K-firm concentration ratio (K-CR), the Hirshman-Herfindahl Index (HHI), the Gini Coefficient (GC) and the Shannon Entropy Index (EI). Then market conduct is assessed by adopting Shift-Share Analysis. The results reveal that the WACC's ports market exhibits a tendency toward deconcentration over the study period (2005-2014). This can clearly be noticed from the analysis of the K-CR and HHI. The K-CR analysis indicates that the market shares of the top four ports in the defined market have reduced over the study period. In the same way, the HHI value also reduced in the same period. Regarding the inequality assessment, the decrease in the value of Gini coefficients as well as the increase in Entropy indices for the WACC port market suggests a deconcentration trend within the period considered in this study. Regarding market conduct analysis, the shift-share analysis applied to the defined market over the period of study, demonstrates that the level of port concentration in the WACC port market decreased within the period of study.

Keywords

Port Competitiveness, West Africa Coastal Countries, Structure Conduct Performance, Industrial Organization, K-Firm Concentration Ratio, Hirshman-Herfindahl Index, Gini Coefficient, Shannon Entropy Index, Shift-Share Analysis

1. Introduction

Competitiveness can be defined as the ability to a firm to satisfy the wants and needs of customers in comparison to its competitors that produce the same goods or offer the same service [1]. In port sector, competitiveness can be related to the ability of one port to perform effectively and efficiently its activities in relation with those of their competitors. In other terms, a particular port is regarded as competitive when it is able to attract more cargo traffic and compete in international market than its competitors.

Several past studies conducted on port competitiveness identified, key factors explaining why one port is preferred from another one. To compete Hence, the ability of a port depends on factors such as efficiency, productivity location, cost, infrastructures, accessibility, service quality and others [2] [3]. In order to be attractive, ports need to develop and maintain a reputation for efficiency and reliability that allows the maintenance of competitive low prices that can result not only to retain their existing customers but also attract new business. As such, the main issue is to examine how port can enhance its competitiveness by improving its reputation for efficiency.

A literature review on inter-port competition conducted by Chang [4] revealed that studies on port competitiveness have varied significantly across countries and over time. Moreover the review reported that past studies on port competitiveness have been conducted from different perspectives and yield diverging results due to the sampled used, time and context. It means that each port may have its own experience, own success story due to competitive advantage related to the internal and/or external environment. Hence, exploring on port competitiveness in WACC market by applying the structure conduct performance (SCP) framework has not been found in the literature. Accordingly, this employed the SCP approach to investigate the competitiveness level of 12 ports located in that region between 2005 and 2014.

WACC region coastline totals just over 11,983 Km from Mauritania to Angola as seen in **Figure 1** below. Most ports in that region are medium-sized and smaller ports with regard to global standard. However, in order to illustrate the dynamic of port markets, this research focuses on the major ports in terms of cargo throughput handled namely Dakar (Senegal); Conakry (Guinea); Abidjan (Cote d'Ivoire); Tema (Ghana); Lome (Togo); Cotonou (Benin); Lagos (Nigeria); Douala (Cameroon); Libreville-Owendo (Gabon); Pointe-Noire (Congo); Matadi (Republic Democratic of Congo) and Luanda (Angola) between 2005 and 2014.

2. Industrial Organization and Structure-Conduct-Performance Concept

Industrial organization or industrial economics is a field of economics that study the organization of markets and firms and their strategy, especially the ways firms compete against each other. Its concerned with the issue related to imperfect competition through industrial concentration [5]. The structure-conduct-

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Figure 1. West africa costal countries. Source: *Port management association of west & central Africa* (*PMA WCA*).

performance (SCP) paradigm has long been central to the study of industrial organization. It has been applied to provide the theoretical justification for competition policy [6]. Two schools of thought form the theoretical foundations that support the SCP concept in industrial organization. The first development from the Harvard School of thought of SCP paradigm, describes the relationship between market structure, the behavior of firms and their performances. This school of thought defined market structure by the characteristics of market organization, which influenced market conduct. The conduct of the market, is related to the behavior or strategies (competition, formation of prices) applied by the organization to adjust to the market. Finally, the followers of this school assumed that organization's performance is determined by the conduct of the market. The empirical work tried to explain that market structure defined the behavior or the strategies of firms which in turn influenced their associated performances in the market. Consequently, different structures in industries can lead organizations to adopt various types of behaviors or strategies which result in different types of economic performance.

The Second development derived from the Chicago school of thought. The Chicago school emphasized a positive correlation between the structures of the markets and the behavior of firms with the structure of a market determined by the strategies of firms [7]. The school of Chicago sustained that a positive correlation between the concentration of firms and profitability reveals a difference in efficiency between competitive firms with an increase in the market shares of the most efficient firms at the cost of less efficient ones, thus market share is not a

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cause of efficiency but its consequence [8] tested the traditional structure conduct-performance model and the efficiency structure hypothesis to investigate the relationship among market structure and performance in property-liability insurers. The efficiency terms in this analysis were evaluated using a stochastic frontier analysis. The results illustrated that efficient firms had lower prices than competitors which enable them to capture larger market shares, leading to increased concentration.

The SCP approach developed by [9] from the Harvard school is applied in industrial organizations in competition analysis. The SCP framework is applied as an analytical tool to examine the relationship between market structures, conduct and market performance. IO economists suggest an effective structure conduct and performance [10]. Market structure is defined in traditional industrial economics as the number of competing firms and their market share [11]. Market structure is concerned with a spectrum of economic organizations that range from pure competition at one extreme to pure monopoly at the other. In between are oligopolies with few firms and monopolistically competitive firms. It is an essential determinant of market conduct, magnitude of price and non-price competition. Consequently, the behavior of firms in the market that is market conduct determined economic performance, principally if the profits of firms increased through the practice of monopoly power or oligopolistic collusion. However, the economists in industrial economics have made no clear emphasis regarding the causal relationship between concentration and competition [12].

3. Methodology

3.1. Ports Market Structure Evaluation

Four concentration measures are applied to test WACC port market structure over the period of study. These measures are the K-firm concentration ratio (K-CR), the Hirshman-Herfindahl Index (HHI), the Gini Coefficient (GC) and the Shannon Entropy Index (EI). The results obtained from these concentration measures assist in assessing the competitive or monopolistic environment in the market.

3.1.1. The K-Firm Concentration Ratio (K-CR)

A concentration ratio is the ratio of the combined market shares of a given number of firms to the whole market size. The concentration ratio is the measure of the percentage market share in an industry held by the largest firms within that industry. A high concentration ratio shows a great degree of market concentration with market close to an oligopolistic or monopolistic type of market structure and high market power. On the other hand, low concentration ratio specifies that firms have limited market power. In general, the decreasing trend of concentration ratio in the market illustrates the evidence of growing competitiveness in the market and vice versa.

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In this research, the k-firm concentration ratio (*CR*) measures the share of throughput S_i accounted for by the k largest ports in the WACC market, and can be expressed as follows:

$$CR_k = \sum_{i=1}^{k} S_i \tag{1}$$

The k-firm concentration ratio reflects only the k largest ports in the defined market and that the role played by the small ports in that market is neglected. The index also emphases only on the inequality between the leading ports and the others outside that group and, as a result, omit the relative size differences within the leading group [13].

In order to circumvent the above stated drawbacks of the k-firm concentration ratio and to provide a comprehensive investigation for port market structure, Hirschman-Herfindahl index (HHI) is used to determine how competitive the WACC ports market are.

3.1.2. Hirschman-Herfindahl Index (HHI)

Hirschman-Herfindahl Index (HHI) is applied to estimate the degree of concentration in an industry and also describes the degree of competition among competitive firms. In port literature, it is computed as the sum of the squares of the market shares of each port in a defined market [14]. It can take be expressed as follows:

$$\mathrm{HHI} = \sum_{i=1}^{k} S_i^2 \frac{10000}{n} \le \mathrm{HHI} \le 10000 \tag{2}$$

where S_i is the market share (throughput of port *i* divided by the total throughput of the WACC port market) and n is the total number of the defined ports in the market. The highest value of the HHI is 10,000 where there is a perfect monopoly with a single port having 100 per cent of the market.

HHI formulated above takes its minimum for $S_i = 1/n$, and its maximum for $S_i = 1$. The values computed with this formula cannot be compared due to the fact that the lower limit of HHI differs with the number of ports n. Hence, normalization is needed to obtain an index within the range [0, 1] irrespective of the number of ports n. accordingly the normalized HHI is formulated as follows:

$$\mathrm{HHI}_{norm} = \frac{\mathrm{HHI} - 1/n}{1 - 1/n} \tag{3}$$

HHI fails to capture the distribution of the firms output. In order to circumvent this constraint Gini coefficient is applied to illustrate the degree of equality of the ports output that is the throughput.

3.1.3. The Gini Coefficient (GC)

The Gini coefficient is generally employed to measure income distribution and can be derived from the Lorenz curve. The Gini coefficient and Lorenz curves are applied to assess industry concentration [15]. For the purpose of our study, the Lorenz curve illustrates the variation in the cumulative throughput of all

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ports while the Gini coefficient computed as the ratio of the area between the Lorenz curve and a diagonal line of equal distribution. The Gini coefficient is computed with the following formula:

$$GC = \left| 1 - \sum_{i=1}^{n} \left(x_i - x_{i-1} \right) \left(y_i + y_{i-1} \right) \right| \quad (4)$$

where x_i is the cumulative percentage of the population of ports of the WACC market and y_i represents the cumulative percentage of all ports market share above i.

An integrated method for Gini coefficient is the entropy index.

3.1.4. The Entropy Index (EI)

Entropy index is a useful tool employed to identify difference in distributions at particular moments in time and examines change over time. The entropy index calculates the data that is specified in the form of a frequency, distribution or probability. This research applied the entropy index developed by [16]. It takes the following form:

$$\mathrm{EI} = -\sum_{i=1}^{n} S_i \ln S_i \quad 0 \le \mathrm{EI} \le \ln n \quad (5)$$

where S_i is the throughput of port i and n is the total number of ports in the West and Central Africa market. The entropy index computed varies between 0, when the market is concentrated into a single port and ln (n), when cargo traffic is distributed equally among all ports [17].

Accordingly, the results generated from this formula are not comparable since the upper limit of the entropy index differs with the number of ports n. Hence, the entropy Index must be normalized. The normalized entropy index is given as follows:

$$\mathrm{EI}_n = 1 - \frac{\mathrm{EI}}{\ln(n)} \quad (6)$$

Furthermore, the entropy index obtained is estimated as the opposite of the degree of concentration [17]. In other words, the greater the estimated level of entropy index, the lower the level of market concentration.

3.2. Ports Market Conduct Evaluation

Market conduct is defined as the behaviors that firms follow in adopting or adjusting to the market in which they operate to attain the precise goal and conduct involves firms' strategies to compete with each other such pricing, advertising, research and development, merger and acquisition [18]. The behavior of firms in the market is influenced by market structure since the strategies of firm differ with competition. Conversely, conduct can influence market structure since firms can make entry cost endogenous by choosing various levels of quality, advertising, and so forth, hence affect the potential number of competitors [13]. Shift-share analysis is a powerful tool to evaluate market conduct and to

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explain the competitiveness of industries in a given region or to examine the region's economic growth pattern [19].

Shift-Share Analysis

The shift-share analysis initially constructed in the context of regional economics has been used in maritime literature to describe the dynamic of port traffic [14] [15]. The shift-share analysis decomposes the variation in ports' throughput into two components namely shift effect and share effect. The total shift indicates the total cargo traffic a port has actually lost to or won from competing ports in the same market, with the estimated cargo traffic that is share effect as a reference. A net positive shift suggests enhancements in competitiveness regarding the ports as a whole and a negative value indicates decline in competitiveness [13]. The total sum of the shift-effects of all ports under studied equals zero.

Accordingly, the shift-share model can be written as follows:

$$\text{ABSGR}_i = \text{Throughput}_{it_1} - \text{Throughput}_{it_0} = \text{SHARE}_i = \text{SHIFT}_i \tag{7}$$

$$\text{SHARE}_i = \left\{ \frac{\sum_{i=1}^{n} \text{Throughput}_{it_1}}{\sum_{i=1}^{n} \text{Throughput}_{it_0}} - 1 \right\} \cdot \text{Throughput}_{it_0} \tag{8}$$

$$\text{SHIFT}_i = \text{Throughput}_{it_1} - \frac{\sum_{i=1}^{n} \text{Throughput}_{it_1}}{\sum_{i=1}^{n} \text{Throughput}_{it_0}} \cdot \text{Throughput}_{it_0} \tag{9}$$

where ABSGR, is the absolute growth of throughput in port i over the period (t_0, t_1). SHARE represents the share-effect of port i over the period (t_N, t_1). Throughput is the traffic of port i expressed in tons, and n is the number of port in the defined market.

4. Empirical Results and Explanation

4.1. Port Market Structure

4.1.1. K-Firm Concentration

Applying the K-Firm concentration ratio (K-CR), **Table 1** illustrates the degree of concentration in the WACC port market between 2005 and 2014. The measures of concentration were equal to 57.92% in 2005 to 55.14% in 2009, 53.38% in 2011 and 51.15% in 2014, suggesting a moderately concentrated market. These values reflect that the defined market was concentrated in the four biggest ports in terms of cargo throughput. Furthermore, the market share of the top four ports has declined from 57.92% in 2005 to 51.15% in 2014 which reveals a tendency towards deconcentration in the market. On the other hand, it can be noted that there have been shifts in the ranking of ports over the study period. Abidjan, Lagos, Dakar and Tema were ranked as the top four ports in 2005 respectively. In 2009, Abidjan, Lagos and Dakar have secured their competitive

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Table 1. Measurement of west africa coastal countries port market structure using k-firm concentration ratio (CR4).

2005			2009			2011			2014		
Port	Throughput	Market Share	Port	Throughput	Market Share	Port	Throughput	Market Share	Port	Throughput	Market Share
Abidjan	18,661,784	19.76	Abidjan	21,200,000	19.46	**Lagos**	23,365,000	20.06	**Lagos**	21,735,000	16.12
Lagos	16,931,000	17.93	Lagos	21,119,000	19.38	**Abidjan**	16,642,542	14.29	**Abidjan**	20,812,952	15.44
Dakar	9,850,000	10.43	Luanda	9,022,912	8.28	**Dakar**	11,408,789	9.8	**Dakar**	13,412,416	9.95
Tema	9,249,977	9.8	Dakar	8,742,971	8.02	**Tema**	10,748,943	9.23	**Luanda**	13,000,000	9.64
CR4		**57.92**	**CR4**		**55.14**	**CR4**		**53.38**	**CR4**		51.15
Douala	6,111,900	6.47	Tema	7,406,490	6.8	Luanda	9,825,670	8.44	Tema	11,126,355	8.25
Conakry	6,086,888	6.45	Lome	7,326,128	6.72	Douala	8,568,798	7.36	Douala	10,791,717	8.01
Luanda	5,100,000	5.4	Douala	7,262,725	6.67	Lome	8,248,393	7.08	Cotonou	10,547,445	7.82
Lome	5,000,000	5.29	Pointe noire	7,087,249	6.5	Conakry	6,976,441	5.99	Lome	9,280,004	6.88
Pointe noire	4,982,299	5.28	Cotonou	6,698,365	6.15	Cotonou	6,804,634	5.86	Pointe noire	7,833,050	5.81
Cotonou	4,930,086	5.22	Conakry	5,947,881	5.46	Pointe noire	6,823,801	5.84	Conakry	7,399,039	5.49
Libreville	4,719,628	5	Libreville	5,551,251	5.09	Libreville	5,272,465	4.53	Libreville	5,958,565	4.42
Matadi	2,800,000	2.97	Matadi	1,600,000	1.47	Matadi	1,780,000	1.53	Matadi	2,911,079	2.16
Total	94,423,562	100	Total	108,964,972	100	Total	116,465,476	100	Total	134,807,622	100

position in the first, second and fourth position in the market while Luanda has considerably improved its competitive position from being in the seventh position in 2005 to be in the third position in 2009. Tema lost its competitive position from being in the third position in 2005 to be in the fifth position in 2009. In 2011, with the political turmoil in Cote d'Ivoire, Abidjan lost one rank in the hierarchy to be in the second place while Lagos has taken the lead and improved its competitive position from the second place in 2009 to the first place in 2011. Moreover, Tema has also enhanced its competitive position from being in the fifth place in 2009 to the fourth place in 2011 while Luanda lost its competition position and was ranked fifth in the same year. Dakar enhanced its competition position and moved to the third place. In the last year of observation, Lagos, Abidjan and Dakar had the first, second and third place respectively while Tema lost its competitive position from being fourth in 2011 to fifth in 2014. The port of Luanda has achieved a growth and enhanced its competitive position to be the fourth in 2014.

The above analysis indicates the intense competition among the ports analyzed in the West Africa coastal countries region.

4.1.2. Hirshman-Herfindahl Index (HHI)

Hirshman-Herfindahl Index (HHI) is applied to provide additional explanation of the dynamic in ports' market shares regarding the total market throughput.

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The assumption underlying the Hirshman-Herfindahl Index is that a low level of concentration is assumed to reflect a high level of competition and vice versa. A market with a HHI value of 1800 or higher is highly concentrated; a market with HHI value less than 1000 is regarded as un-concentrated whereas a value between 1000 and 1800 shows a moderately concentrate market [20].

Figure 2 and Table 2 below indicate that in 2005 and 2014, HHI was about 1146.323 and 1018.988 respectively, indicating in both years a moderately concentrate market. However, considering the overall level of concentration in the port market analyzed, the HHI has declined from 1146.323 in 2005 to 1018.988 in 2014, demonstrating a decreasing trend of the level of concentration in the market. In others time, the decreasing value of the HHI over time reveals a trend towards de-concentration and that the competition between the players in the market is intensifying.

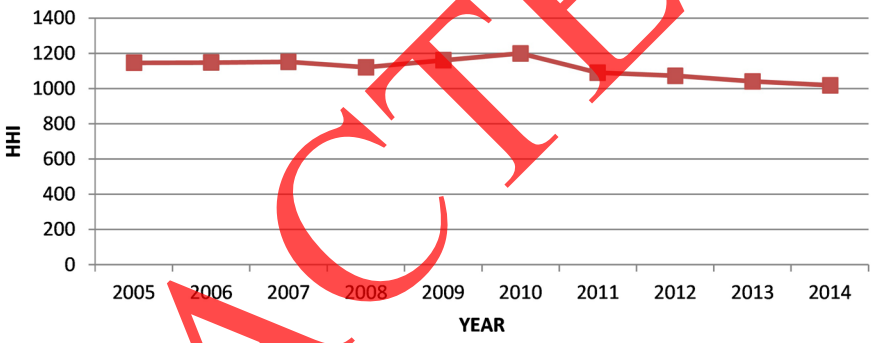

Figure 2. West Africa coastal countries Port Market Concentration (2005-2014).

Table 2. Hirshman-Herfindahl index for west africa coastal countries ports market (2005-2014).

Port	2005			2014			Average Growth Rate
	Throughput	Maret share (%)	HHI	Throughput	Market share (%)	HHI	
Abidjan	18,661,784	19.76	390.458	20,812,952	15.44	238.4	1.22
Tema	9,249,977	9.8	96.04	11,126,355	8.25	68.06	2.07
Lome	5,000,000	5.29	27.984	9,280,004	6.88	47.33	7.11
Dakar	9,850,000	10.43	108.785	13,412,416	9.95	99	3.49
Cotonou	4,930,086	5.22	27.248	10,547,445	7.82	61.15	8.82
Lagos	16,931,000	17.93	321.485	21,735,000	16.12	259.9	2.81
Douala	6,111,900	6.47	41.861	10,791,717	8.01	64.16	6.52
Matadi	2,800,000	2.97	8.821	2,911,079	2.16	4.666	0.43
Pointe noire	4,982,299	5.28	27.878	7,833,050	5.81	33.76	5.16
Libreville	4,719,628	5	25	5,958,565	4.42	19.54	2.62
Luanda	5,100,000	5.4	29.16	13,000,000	9.64	92.93	10.96
Conakry	6,086,888	6.45	41.603	7,399,039	5.49	30.14	2.19
Total	94,423,562	100	1146.323	134,807,622	100	1018.988	4.04

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4.1.3. Gini Coefficient (GC)

Gini Coefficient (GC) is a statistical method applied by a numbers of scholars to assess concentration or traffic inequality in port market [14] [15] [21]. Gini coefficient is an index used to measure concentration extent or inequality of a variable in a distribution of its elements [21]. Given the dependence of Hirschman index to port number and the restriction of Gini coefficient in producing biased results in case of analyzing industry with small firms, Fageda [22] suggested using both indexes in the analysis of port concentration. The trend over time of the Gini coefficient for the WACC port is presented in **Table 3**. The value of the index was 0.454 in 2005, revealing a concentration, followed by a period of increasing equality in 2014 as the index value decreased to 0.256. Overall over the studied period, the index demonstrated a different trend over time, from high concentration to low inequality. Furthermore, as indicated by [14], Gini coefficient can be employed with the Lorenz concentration for analyzing the degree of port concentration. The index is defined as the area ratio between Lorenz curve and diagonal line. If all ports in a port system are equals in size, the index will be 0 and Lorenz Curve will be equal to diagonal line. In case only one port accounts for total throughput, Gini Coefficient will be 1 and Lorenz Curve equal to area under diagonal line [22].

Figure 3 and **Figure 4** show the West Africa Coastal Countries ports market trend concentration as the area ratio between the curves of inequality in relation to the diagonal line which characterizes the total equality of port population distribution. The Gini coefficient represented in **Figure 3** and **Figure 4** illustrate a continued deconcentration trend between 2005 and 2014. On the other hand, the Lorenz Curve described as the cumulative proportion of output represented different proportions of the ports distribution, and hence illustrate the inequality rather than the concentration of the market shares of ports analyzed.

The Lorenz Curve exhibit in **Figure 3** explains the size inequality of the major ports in 2005, and illustrates that almost 50% of the ports account for approximately 29.16% of the total throughput. Nonetheless, in 2014, as shown in **Figure 4**, the Lorenz curve demonstrates that about 50% of the ports account for almost 32.59% of the total throughput. Inequality has slightly decreased over the studied period. These results can be related to the rise of port development in the region which flattened cargo throughput involving a tendency toward a decrease of inequality of traffic distribution. However, the port in the earlier phase of development is expected to grow and thus this growth will likely involve a shift toward concentration of throughput [23] region.

To avoid some problems related to the disadvantages of the Gini coefficient such as small sample bias, sensitivity to ordering and sensitivity to data errors [15], the Shannon entropy index (EI) is also employed.

4.1.4. Entropy Index

The entropy index developed by Shannon (1948) is described as a negative measure of concentration, the higher its value, the lower the level of concentra-

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tion [24]. As shown in Table 3, the Entropy index was 2.323 in 2005 and slightly increased to 2.375 in 2014. Due to it dependent to the number of firms, the normalized Entropy index (EI) is also considered in the analysis. The normalized index also confirms the tendency towards deconcentration in port market as presented in Table 3.

The statistical measure applied to measure the concentration of the market and thus, the degree of inter-port competition in the defined market is summarized in Table 3. Overall, the results demonstrate that there is a tendency towards deconcentration in the West Africa coastal countries port market over the period of study, revealing the intensified competition between ports in region.

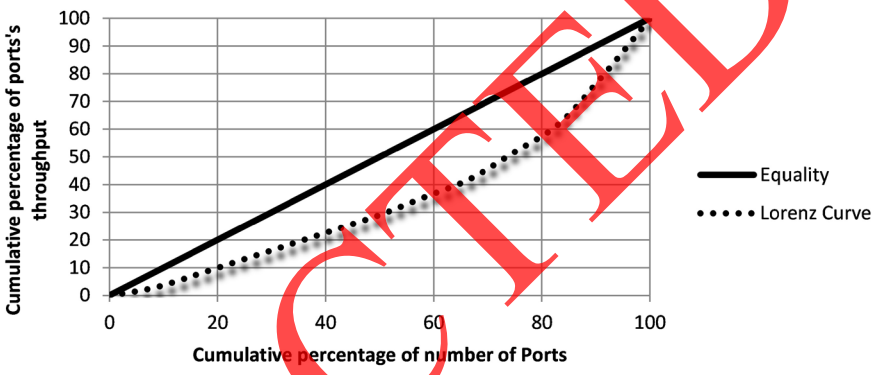

Figure 3. Lorenz Concentration curve for WACC Port Market (2005).

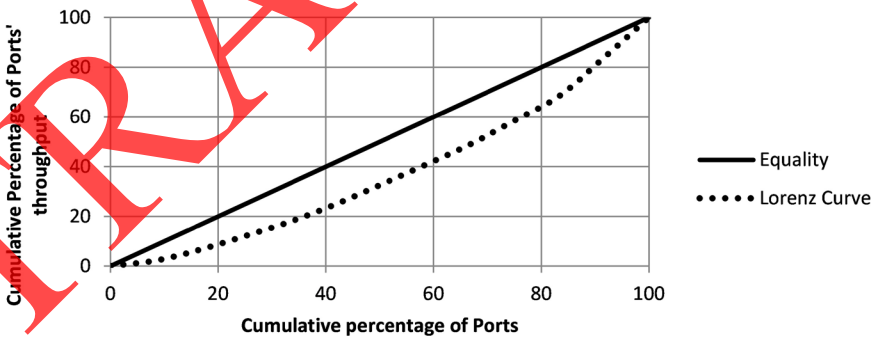

Figure 4. Lorenz Concentration curve for WACC Port Market (2014).

Table 3. Summary of WACC port market concentration indexes.

Index	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CR4 (%)	57.92	56.07	56.47	54.63	55.14	57.19	53.38	53.44	51.75	51.15
HHI	1146.3	1147.9	1151.4	1120.7	1161	1199.3	1090.6	1072.5	1040.6	1018.99
Normalized HHI	0.034	0.034	0.035	0.031	0.036	0.04	0.028	0.026	0.023	0.02
Gini coefficient	0.454	0.306	0.301	0.282	0.297	0.33	0.287	0.279	0.262	0.256
Entropy Index (EI)	2.323	2.32	2.318	2.334	2.312	2.291	2.341	2.351	2.366	2.375
Normalized EI	0.935	0.934	0.933	0.939	0.93	0.922	0.942	0.946	0.952	0.956
Number of ports	12	12	12	12	12	12	12	12	12	12

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4.2. Market Conduct

Shift-Share Analysis

Market conduct describes the way ports in WACC region respond to the conditions produced by the market structure and interact with competing ports. Constructed in regional economy context, the shift-share analysis is also applied to throughput port growth [14]. It allows a decomposition of the growth or decline of ports into the share effect and the shift effect. The share effect specifies the expected growth of cargo traffic in port as if it would maintain its market share. The shift effect indicates the cargo traffic that ports have won from or lost to rivalry ports in the same market with the share effect as a reference. Thus, the shift effect is a zero-sum game. The shift effect allows a better analysis of a competiveness of a particular port as it removes the growth of the overall port. The shift effect analysis enables a better evaluation of a port's competitiveness as it focuses on the development of each individual port in the market.

The average annual net shift figures for the ports analyzed indicate a gain (positive sign) or a loss (negative sign) of potential traffic. Moreover, a shift of zero indicates that the port have the same growth rate as the total port market.

Figure 5, Appendix 1 and Appendix 2 illustrate the results of the shift-share analysis applied to the WACC port market over the period 2005 and 2014. For the purpose of this research, the study period from 2005 to 2014 were employed as years of reference in the shift-share analysis. Furthermore, in order to facilitate interpretation, the shift effect results summarized in Appendix 1 and Appendix 2 are in absolute terms (one thousand tons). The results reveal major winners and losers in terms of total shifts in the defined market over the study period. In 2005, the ports of Abidjan, Douala and Libreville were the major winners in 2006 with total shift of 1030.4, 810.7, and 652 respectively. While the ports of Lagos, Lome and Dakar showed the worst performance. The port of Lagos recorded the largest negative shift of 1060.1, followed by Dakar (−856.9) and Lome (−854.3). In 2008, the port of Lome, Conakry and Luanda were the major winners with a net shit of 829.3, 670.1 and 527.1 respectively. In contrast, Abidjan, Dakar, and Libreville recorded a lost in terms of net shift of −1318, −749.4 and −570.4 respectively. With the political turmoil in Ivory Coast, Abidjan has lost market share in terms of transit traffic to neighboring ports [25].

As such, traffic was diverted to the port of Lome, which is well position in terms of distance to shippers from Burkina Faso, Mali and Niger the landlocked countries, those main port was Abidjan before 2002. In the same vein, in 2011, with the decline of political situation in Ivory Coast and the enhancement in infrastructure, the ports of Lome and Tema realized the best performance in terms of net shift followed by Pointe Noire. Ports of Lome, Tema and Pointe Noire recorded a gain of 3259.2, 1686.1 and 838.3 respectively. The remarkable gain of Pointe Noire is related to the private investment in the port that took place in that period. However, the port of Abidjan, Cotonou and Libreville were the major loser.

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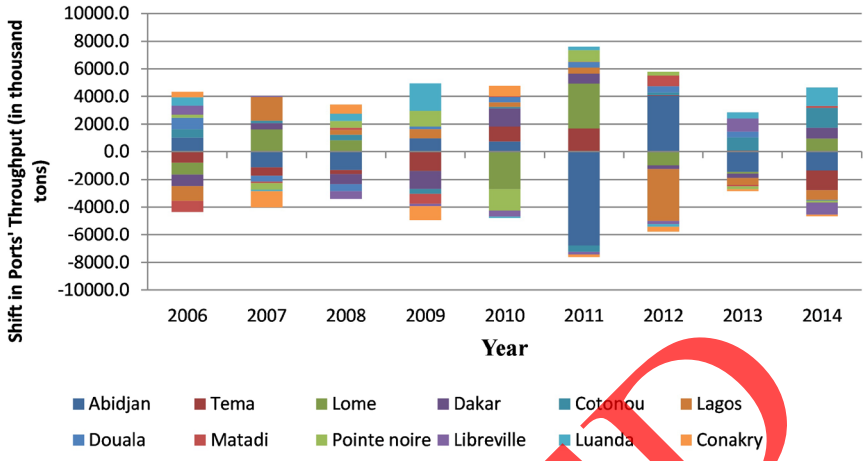

Figure 5. Shift in WACC port's throughput from 2005 to 2014.

In 2014, port of Cotonou was the major winner. The port registered a positive shift of 1425.3, followed by the ports of Luanda and Lome that respectively gained a positive shift of 1370 and 945.4. The significant positive shift recorded by the port of Cotonou is due to the recent infrastructural investment made in port which attracts more customers in the ports. Conversely, Tema, Abidjan and Libreville were the major losers during that period.

The involvement of private investment in port sector resulting in enhanced infrastructure, locational advantage and national political stability appear to be the main reason for the emergence of new ports in the defined market. The shift-share analysis demonstrates a strengthening of the position of the small sized ports, for instance Lome, at the expense of the medium ones, such as Abidjan and Lagos. Landside access will definitely prove to be indispensable to sustain a competitive edge for the ports in the sub-region.

5. Conclusions

Despite the fact that the cargo traffic registered in the West African Coastal Countries ports is still low in comparison to the global traffic, ports in the region have experienced a significant development leading to an increase of cargo throughput and a restructuration of the market. With, the development and changing status of ports in the WACC region, it is worth to analyze the dynamic in market concentration and the impact of such transformation on the competitive positioning of ports. Accordingly, the purpose of this study was to analyze the competitive level of ports WACC port market over the period of 2005 and 2014 in terms of market concentration and deconcentration tendencies and the effect of such trends on the competitiveness of the ports evaluated.

In this sense, the Industrial economics theory and the structure-conduct-performance approach is adopted to evaluate the market structure and to measure market concentration that illustrates the dynamic of market and competitiveness of ports. In this context, this work focused on the assessment of market structure and conduct. Market structure is evaluated by adopting statistical

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measures of market concentration and inequality. Market concentration is assessed by using the K-CR and HHI. The market inequality is measured by applying the Gini coefficient and Entropy index. Market conduct is explored by using the shift-share analysis method.

The findings reveal that the deconcentration tendency observed in the defined market is due to the emergence of new ports and the distribution of cargo traffic among the ports analyzed. This can clearly be identified from the evaluation of the K-CR and HHI. The K-CR analysis showed that the market shares of the four largest ports in the defined market have decreased over the study period. In the same vein, the value of the HHI has also decreased in the same period. Accordingly, the first hypothesis assuming that the market moves toward deconcentration is supported.

The results related to the inequality analysis reveal that the decline in value of Gini coefficients and the increase in Entropy indices for the WACC port market illustrate a tendency toward deconcentration over the period of study. The rise of port development with the involvement of private investment in enhancing port operation in ports such as Lome, Cotonou, Luanda, Pointe Noire, Abidjan Tema and so on, affected the present hierarchy in the defined market with small ports in terms of cargo traffic strengthening their positions vis-a-vis larger ones. The adoption of the Gini coefficient and Entropy indices as analytical tools allows observations regarding the net contribution of the inequality among individual ports to the whole traffic concentration in the defined port market. In this sense, the study is able to obtain an overview on spatial dynamics in the WACC port market than provided only by the Gini coefficient.

On the other hand, the shift-share analysis applied to the defined market over the period of study, demonstrates a strengthening of the position of the small ports in terms of cargo traffic,

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix 1. Shift in WACC port's throughput from 2005 to 2014 (in thousand tons).

Year Port	2006	2007	2008	2009	2010	2011	2012	2013	2014
Abidjan	1030.4	−1129.7	−1318.9	969.5	739.4	−6787.2	4034	−1448.1	−1351.5
Tema	−789.1	−604	−282.1	−1377.2	1100.2	1686.1	50.1	72.1	−1444.4
Lome	−854.3	1622.1	829.3	−1.9	−2726.5	3259.2	−990.7	−129.2	945.4
Dakar	−856.9	453.2	−749.4	−1325.1	1303.8	705.3	−250.3	−313.5	803.1
Cotonou	618.1	179.4	411.0	−345.5	88.9	−447.5	210.6	984.9	1425.3
Lagos	−1060.1	1696.4	344.9	678.2	343.6	434.3	−3755.7	−509.8	−691.5
Douala	810.7	−409.6	−501.6	178.4	377.0	413.2	453.3	415.6	−49.4
Matadi	−800.3	−100.1	157.9	−714.9	58.9	8.5	762	−106.4	130.2
Pointe noire	223.1	−517.9	482	1143.4	−1525.4	838.3	284	−220.1	−147.7
Libreville	652	66.7	−570.4	−181	−438.6	−203.9	−228.6	930.7	−855.7
Luanda	597.4	−91.4	527.1	1984.2	−97.1	282.9	−193.5	453.2	1370
Conakry	428.9	−1165.0	670.1	−1008.1	775.8	−189.3	−375.1	−129.4	−133.8

Appendix 2. Shares in 1000 tons.

Year Port	2006	2007	2008	2009	2010	2011	2012	2013	2014
Abidjan	−835.4	2192.9	1498.9	130.5	544.5	945.9	1037.2	1210.9	687.9
Tema	−414.1	935.8	630.5	56.7	190.2	365.9	669.9	639.6	390.2
Lome	−223.8	456.1	451.5	47.3	188.2	201.4	514.1	433.4	258.7
Dakar	−440.9	994.6	752.5	64.9	224.6	432.1	711.1	661.9	391.4
Cotonou	−220.7	619.6	461.0	45.4	172.0	292.8	424.1	414.8	283.1
Lagos	−757.9	1757.6	1397.1	131.8	542.4	925.7	1456.2	1174.7	696.1
Douala	−273.6	773.2	527.7	45.7	186.5	329.2	534.1	532.9	336.5
Matadi	−125.3	218.0	149.9	14.9	41.1	71.5	110.9	147.9	86.3
Pointe noire	−223.0	579.4	379.5	38.3	182.0	241.6	425.3	420.1	247.7
Libreville	−211.3	600.1	438.5	37.0	142.6	221.1	328.6	299.6	211.5
Luanda	−228.3	636.0	452.5	45.4	231.8	385.2	612.4	571.3	361.0
Conakry	−272.5	726.1	436.7	44.9	152.8	289.3	434.8	392.4	233.8

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