An Economic and Institutional Analysis of Multi-Port Gateway Regions in the Black Sea Basin

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Abstract

The concept of 'multi-port gateway region' has been introduced by Notteboom (2010) and has been applied to important seaport markets such as Europe and Asia. However, the dynamics and port development patterns in secondary multi-port gateway regions, such as the Black Sea region, have received far less attention in academic literature. An empirical application of established spatial and functional development models to such secondary port regions might substantiate the external validity of these models as these ports operate in a different spatial, economic and institutional environment.

The aim of the paper is to characterize the spatial dynamics of container ports of the Black Sea multi-port gateway regions by testing the validity of established spatial models on port system development. Furthermore, the expected future evolution path for port hierarchy in the Black Sea basin is discussed. By doing so, the paper assesses to what extent the Black Sea port region is following an 'expected' development path as portrayed in a number of port system development models, or alternatively, can be characterized as an atypical port system following its own development logic.

Key Words : Black Sea, Containers, Gateway, Hinterland, Port system development, Terminal.

JEL classification : R40 & R49

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1. Introduction

The Black Sea region accounts for only 2.5% of global seaborne trade, while the share of the North Sea region accounts for about 17%. However, the Black Sea is an important area of development due to its geographical size and resource base. The Black Sea container port system is among the world's fastest growing markets with a cargo growth rate in 2012 of 9% p.a., and the CAGR (2000-2011) of 20%. In the same period, the CAGR of the world amounted to 9%, South Asia 11%, Africa 11% and Western Europe 5%. The Black Sea container port system consists of 11 ports, i.e. Varna, Burgas (Bulgaria); Constantza (Romania); Odessa, Illichivsk, Yuzhnyi, Illichivsk fishery port, Mariupol (Ukraine); Novorossiysk (Russia); Poti and Batumi (Georgia). The main characteristics of these container ports are summarized in Table 1, while their respective locations are depicted in Figure 1.

Table 1.
Characteristics of the Black Sea container ports

Country	Port	Terminal operator	Year	Capacity (TEU)	Length (m)	Depth (m)	Area (m2)	Development plans	Utilization rate (2012)
Ukraine	Odessa	Hamburg Port Consulting	2001	600,000	650	15,0	145,000	0,75 mln TEU on Quarantine Mole	33%
		Brooklyn Kiev Port (together with CMA-CGM)	2008	140,000	232; 480	13,5	42,875	+1 mln TEU	
	Illichivsk sea fishing port	Ilychevsk sea fishing port	2010	200,000	1 200	11,0	400,000	14,5 depth increase	
	Illichivsk	Ilyichevsk Container Terminal (NCC)	2005	850,000	306; 656	13,5	283,085	+2,5 mln TEU by 2019	
	Yuzhnyi	Trans Invest Service (TIS)	2011	400,000	470	16,0		+0,75 mln TEU by 2018	
	Mariupol	Mariupol Ssea Port	2007	50,000	200	8,0	20,000		

Country	Port	Terminal operator	Year	Capacity (TEU)	Length (m)	Depth (m)	Area (m2)	Development plans	Utilization rate (2012)
Romania	Constantza	Socep	1991	300,000	467	13,5	150,000	extend berth till 540 m	43%
		APM Terminals	n.a.	50,000	238	10,6	40,000	n.a.	
		DPW	2004	1,170,000	381; 636	15,7; 14,5	420,000	n.a.	
Bulgaria	Burgas	Navibulgar	2013	n.a.	540; 280	11,0; 8	60,000	n.a.	
	Varna	Port of Varna	n.a.	n.a.	338; 200	7,4; 8,7	167,000	by 2020 +0,12 mln TEU	
Georgia	Poti	APM Terminals	2010	350 000	211	9,5	16,248		55%
	Batumi	Batumi Int. Container Terminal LLC (ICTSI)	2007	300 000	284; 180	11,0; 8,0	136,000	n.a.	
Russia	Novorossiysk	JSC NCSP Terminal	n.a.	170 000	165; 240; 260; 200	8,25; 11,5; 11,5; 11,5	n.a.	by 2018 +0,53 mln TEU	64%
		Novoroslesexport (NLE)	n.a.	350 000	566; 856	8,25-13, 9; 7,5-8,85	140,000	by 2014 +0,50 mln TEU	
		JSC Nutep (NCC)	2002	450 000	280; 210; 87	11,5; 10,3; 10,6	270,000	by 2015 +0,6 mln TEU	
	Taman (project)	To be determined	n.a.	0	2 000	16,0	n.a.	by 2025+ 3 mln TEU	

Black Sea ports experienced tremendous economic and institutional changes in the last 20 years. Moreover, globalization processes, structural changes in logistics and distribution networks, as well as fierce competition among ports in the Black Sea basin affected their development path. Almost all the countries within the region have major expansion plans for their respective container ports or even plan the creation of new ones (e.g. port Taman in Russia) over the next 15 years. The sizable growth potential and future changes in the region could lead to new concentration patterns, multi-port gateway regional development and other port system dynamics.

Despite the significant growth in the Black Sea region, competitive dynamics in the respective regions are not well researched (Notteboom, 2010). The aim of the paper is to characterize the spatial dynamics of container ports of the Black Sea multi-port gateway regions by testing the validity of established spatial models on port system development (Notteboom, 1997 and Notteboom, 2010). Furthermore, the expected future development path for port hierarchy in the Black Sea basin is discussed, taking into account expected or desired institutional changes, the strategies and objectives of market players and public stakeholders and the impact of port and terminal development plans on port competition and the demand/supply balance. By doing so, the paper assesses the following research question. To what extent is the Black Sea port region following an 'expected' development path as portrayed in a number of port system development models, or alternatively, can be characterized as an atypical port system following its own development logic? Moreover, we provide insight on which of the container ports demonstrate the most potential to lead in terms of competition and cargo concentration.

Source: own elaboration based on map from Daniel Dalet/d-maps.com

Figure 1.
Ports of the Black Sea container port system.

The structure of the paper is as follows. The second section describes the existing theoretical models of port system development. Next, the multi-port gateway regions in the Black Sea are presented. In the fourth section we provide an extensive port throughput and concentration analysis to shed light on the changing hierarchy in the Black Sea container port system. The fifth part provides an application of a multi-layer approach to port dynamics in the Black Sea region. The final part depicts the conclusions and future expected developments in the Black Sea region.

2. Theoretical Models of Port System Development and Port-hinterland Dynamics

The spatial analysis of ports and port systems has been extensively addressed in the scientific literature. There are two main development courses in port system development: concentration and deconcentration dynamics. For a more comprehensive overview of these papers we refer to Pallis et al. (2011) and Ducruet et al. (2009). All these empirical studies stress that ports are developing in different directions and do not follow the common evolution stages as stated by the classic study of Taaffe et al. (1963). More importantly, the numerous investigations were applied to large port systems of global importance (South East Asia, European port system, etc.). There are hardly any studies on secondary "multi-port gateway regions", a term introduced by Notteboom (2010), that have a regional implication and do not play a vital role in the global port network. The few exceptions include the study of Feng and Notteboom (2013) on the multi-port gateway regions in the Bohai Bay region in Northeast China and the research on the Southern African container port system presented in Notteboom (2010b) and Fraser and Notteboom (2012). It might very well be that these secondary multi-port gateway regions develop in a particular way having other dynamics and patterns than principal gateway port systems.

We want to look at the port system evolution in the Black Sea through the prism of port-hinterland relationships. Hinterland connections are of vital importance while analysing port performance (Notteboom and Winkelmans 2001; Robinson 2002). Van Cleef (1941) was one of the first to address the hinterland issue. Until the late 1980s, researchers agreed only upon the meaning of hinterland as an area where a port draws its majority of business. Later, that determination of the hinterland proved not to be valid anymore because of two main reasons: (i) the hinterland had a static definition without incorporating the dynamic aspects of maritime shipping (especially container shipping); (ii) logistics market developments and the discontinuous character of complex logistics networks were not

allowing the appearance of discontinuous and clustered hinterlands (Notteboom and Rodrigue, 2007). An updated concept of hinterlands, which consists of three groups of factors, will be applied to the research case. More precisely these elements are macroeconomic, physical and logistical hinterlands (figure 2).

The macroeconomic hinterland includes the drivers that determine the transport demand (regional and global). The physical hinterland encompasses the character and the spread of the transport supply (incl. modal and intermodal). The logistical hinterland consists of the organisation of the flows that coordinate the transport supply and demand. The dynamics in Global Commodity Chains (GCC) are key to the configuration of the hinterland. Moreover, the modifications in the current port-hinterland relations are influenced by multiple decisions of the stakeholders involved. Governments usually are pursuing macroeconomic objectives of the region and are providing infrastructure as a major planning tool. Port authorities represent a prominent example of this stakeholder's objectives (i.e. develop infrastructure to respond to and even anticipate the strategies and needs of port users). Logistics providers are considering infrastructure to be invariable in the short term, on account of their objectives that are located in a more operational area (i.e. managing the freight flows). Because of the multiple and different stakeholders involved in shaping the port hinterland, there is some pressure between the different types of hinterland mentioned above.

Source: adapted from Notteboom (2000) and Notteboom and Rodrigue (2007)

Figure 2.
Types of hinterland and multi-layer approach to port dynamics.

The development of the Black Sea container port system will be analysed based on these hinterland types in section five. It is crucial to distinguish the differences in the

macroeconomic, physical and logistical hinterlands of all the multi-port gateway regions of the Black Sea in order to understand which factors and at which level influence portsystem development. Before moving to that multi-layer reasoning the multi-port gateway regions of the Black Sea will be presented (section three) followed by an analysis of the container throughput dynamics in the Black Sea (section four).
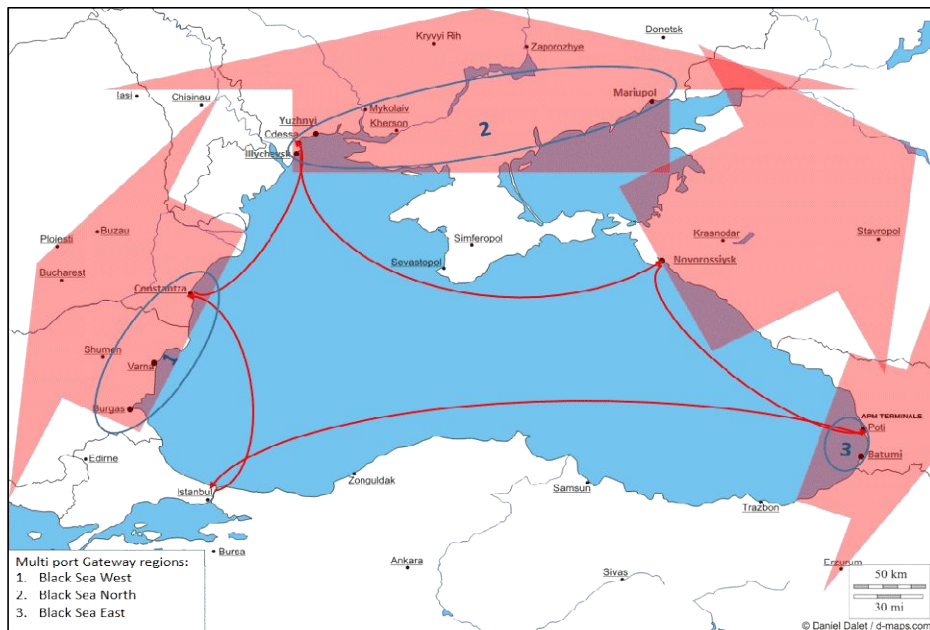
3. Multi-port Gateway Regions in the Black Sea

There is hardly any academic literature on Black Sea ports issued in international scientific journals. The existing academic papers on Black Sea ports can be found in each state of the Black Sea basin (usually in local languages). Most of these studies are pure descriptive involving no substantial academic methodology.

In this study, we group the seaports within the same gateway region together to form multi-port gateway regions. The criteria that determine the ports grouping into multi-port gateway regions are as follows (see also Notteboom, 2009). The first criterion is the communality of the hinterland that is being served by these ports. The second criterion relates to the calling patterns of the liner services of shipping lines and the related complementarity and competitive relationships among the ports concerned and the hinterland connections between the ports in the same multi-port gateway region

Figure 3 presents the main multi-port gateway regions of the Black Sea as well as the stand-alone gateway, based on the hinterlands served and the calling patterns of shipping lines. The only stand-alone gateway in the Black Sea is the seaport of Novorossiysk. Stand-alone gateways are quite isolated in the broader port system as they have weak functional interactions with adjacent ports. The neighbouring container ports of Ukraine (to the West) and Georgia (to the Southeast) serve considerably different hinterlands than Novorossiysk. The Ukrainian container ports mainly serve the local market, and only an insignificant amount of containers (5% of total port traffic in 2011) is dedicated for destinations abroad (Russia, Moldova and Belarus). As it stands for Georgian container ports (Poti, Batumi) they are serving the local market and the neighbouring states of Armenia, Azerbaijan and to a lesser extent Kazakhstan. About 70% of Georgian container port throughput is transit traffic. Moreover, there was a war between Georgia and Russia in 2004 followed by a trade embargo from Russia towards Georgia. The antagonistic relations started to get warmer since 2012 with the termination of the Russian economic sanctions. The ports of Romania and Bulgaria are considered as belonging to the same multi-port gateway region, as they serve the same market, and have a strong complementarity in liner

service networks (Notteboom, 2010). From the liner service network perspective, routing is typically organized on the basis of calling one (seldom two) ports from each multi-port region of the Black Sea as indicated in figure 3.

Source: own elaboration based on base map from Daniel Dalet/d-maps.com

Figure 3.
Ports of the Black Sea container port system and their hinterland orientation.

We conclude that the Black Sea basin can be divided into three main multi-port gateway regions, i.e. Black Sea West (Burgas, Varna, Constantza), Black Sea North (Odessa, Illichivsk, Yuzhnyi, Illichivsk fishery port, Mariupol) and Black Sea East (Poti and Batumi), and one stand-alone gateway (Novorossiysk).

4. Container Throughput Dynamics in the Black Sea

4.1. General Overview

The container traffic in the Black Sea ports is characterised by significant volume growth since 2000. The maximum container volumes handled reached almost 3.5 mln TEU

in 2008. There is some recovery of the Black Sea container volumes after the crisis, but volumes stayed below the 2008 figure.
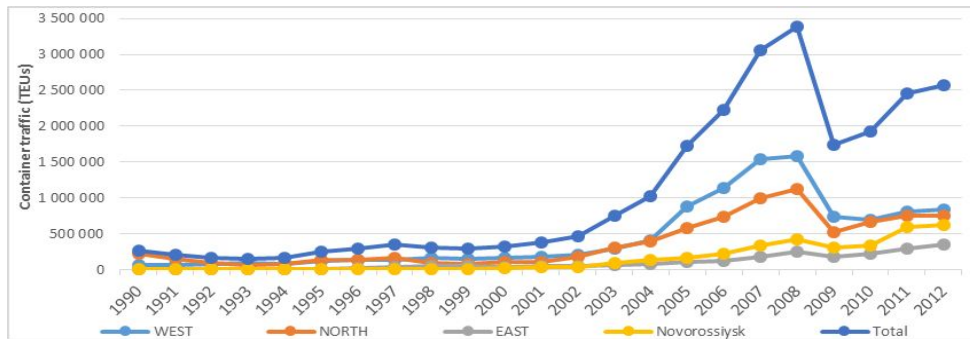

Figure 4.
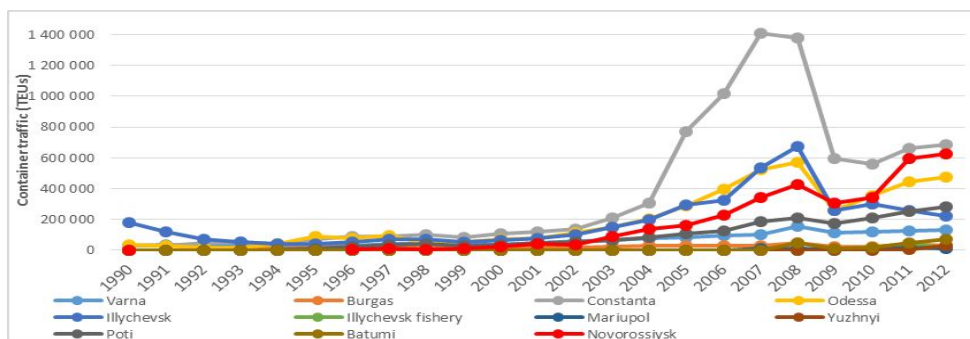Container traffic for Black Sea container port systems, 1990-2012 (TEU).

Figure 5.
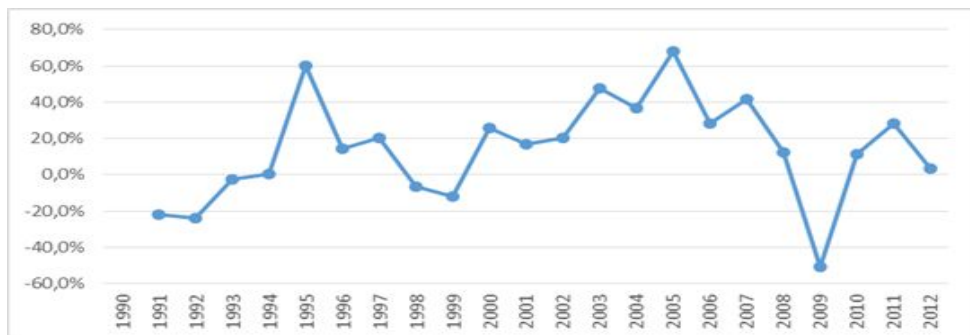Container traffic for Black Sea container ports, 1990-2012 (TEU).

Figure 6.
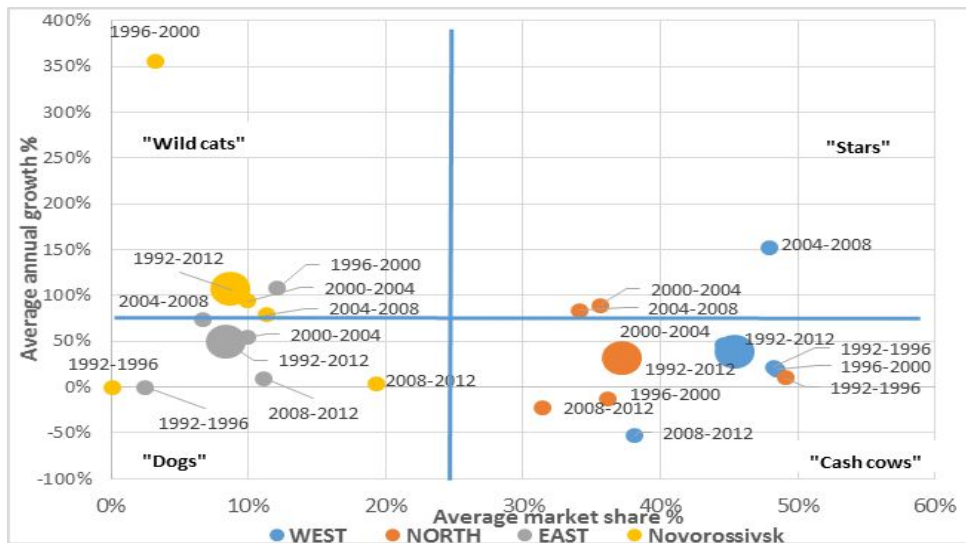Year-on-year container traffic growth rates for Black Sea container ports (%).

Figure 7.
Positioning of the three multi-port gateway regions and the stand-alone port in the Black Sea for given periods (basis=TEU).

More details on the container traffic evolution of the Black Sea ports is presented using the Boston Consulting (BCG) matrix (see also Notteboom, 1997 for methodology). In figure 7 the Black Sea port sub-systems are presented for a 20-year period (1992-2012) according to their average market shares (on the horizontal axis) and the average growth rates (on the vertical axis).

There are clearly multi-port gateway regions that perform better than others such as West Black Sea and North Black Sea (located in the quadrant of "cash cows" with a moderate growth rates and significant market shares). The active growth of the North Black Sea (in 2000-2004) was driven by the additional container terminal handling facilities (HPC) put into operation in 2001 in the port of Odessa. The major driver for the second "star" position of North Black Sea ports (in 2004-2008) was the commissioning of a new container terminal (NCC) in Illichivsk port in 2005. The world economic crisis moved the port region back to its initial position of "cash cow" (i.e. 2008-2012). The West Black Sea port system followed the same logic of evolution, with the difference that it maintained the status of "stars" only for a short period (i.e. 2004-2008). That evidence is due to the fact that ports had a shortage of container facilities which was eliminated only in 2004 by starting the operations on the DPW container terminal in Constantza port. The Black Sea East port region is underperforming in terms of growth rate and market share, which resulted in its allocation to the "dogs" quadrant for the overall period (1992-2012). The

period of 2008-2012 brought the East Black Sea system back in the "dogs" quadrant lowering from the "wild cat" quadrant (2004-2008). While there were two new container terminals commissioned in 2007 and 2010 (in the port of Poti and in Batumi respectively), the region did not realize a high growth rate. The stand-alone gateway of Novorossiysk shows significant growth but its market share remains low, which contributed to its allocation to the "wild cats" quadrant of the BC matrix (i.e. 1992-2012).

The BC matrix applied to individual ports (figure 8) confirms the above-mentioned evolution (figure 7). There are two definite "stars" ports: Odessa and Constantza. There are two ports located in the "cash cows" quadrant: Varna and Illichivsk. The main reason of Varna's underperformance is the tight rivalry with its neighbour from Romania – Constantza. The underperformance of Illichivsk can be explained by the legal tensions between the terminal operator and the port authority that led to the suspension of the operator from handling activities between June 2009 and February 2012. There are three "wild cats" ports with a significant growth potential but a market share below average: Novorossiysk, Poti and Yuzhnyi. The remaining ports are located in the "dogs" quadrant. These ports only got involved in container operations recently, and have a more local trade function.
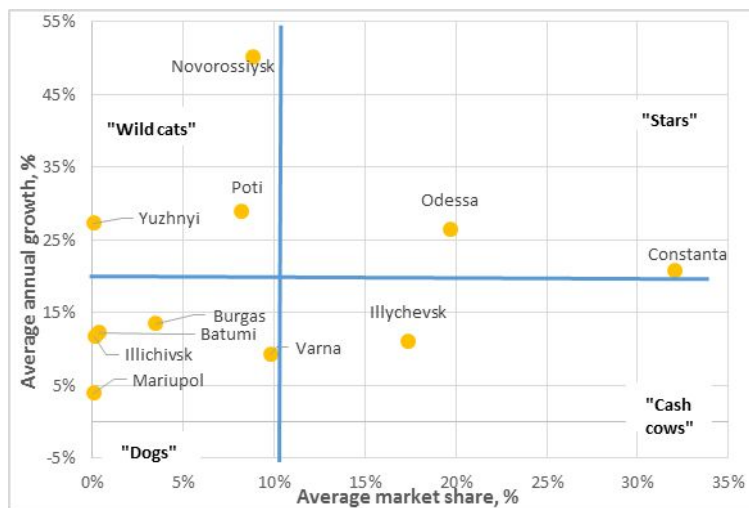

Figure 8.
Positioning of 11 container ports for the period 1992-2012 (TEU basis).

4.2. Cargo Concentration Pattern

In order to analyse cargo concentrations patterns in the Black Sea port system, we deploy the methodology developed by Notteboom (1997, 2010) mainly revolving around the application of concentration indices (Gini coefficient, Lorenz curves and Hirschman-Herfindahl index) and the so-called net shift analysis. The result of these earlier port studies revealed that the European port system is becoming more deconcentrated. However, the container handling market in the European port system remains far more concentrated in comparison with other cargo handling markets such as dry bulk or liquid bulk cargoes. Looking at the market shares of the 11 ports in the Black Sea region, we notice that there are some clear concentration and deconcentration processes in certain ports and port systems (figures 9 and 10).
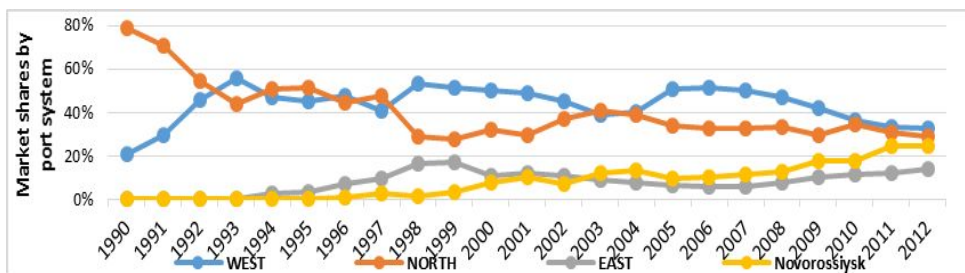

Figure 9.
Market share evolution by multi-port gateway region (TEU basis).

The North Black Sea ports started as undoubted leaders of the market. After a period of nearly the same market shares as West Black Sea ports (1993-1997), the leader's status was gained and maintained by the latter (1998-2012). When analysing the East Black Sea port system and its neighbour Novorossiysk, we observe the same sequence of developments, namely the East Black Sea ports acted as market leader, but have been bypassed by Novorossiysk port in 2003, which preserved the predominant share over East Black Sea ports until 2012.
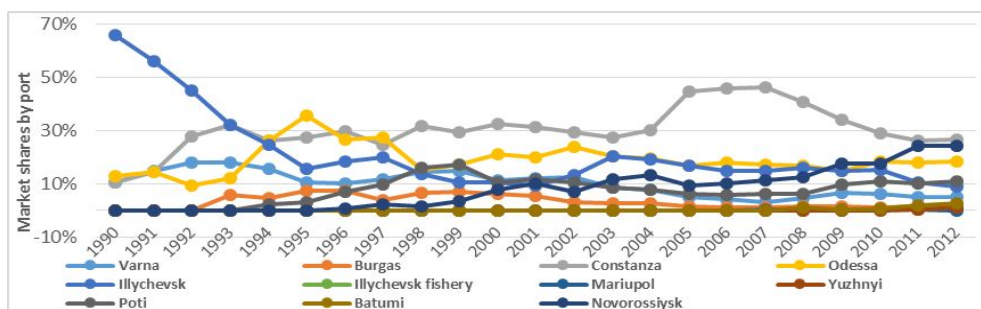
Figure 10.
Market share evolution by port (TEU basis).

Analysing the evolution per port (figure 10), until 1994 there was only a port that was leading in terms of market shares − Illichivsk. Lately Odessa and Constantza started to gain market shares and overtook the original leader. In 1998, Constantza gained a dominant market share in the Black Sea basin and managed to maintain its position even during the economic crisis and further. Odessa and Illichivsk were ranked second and third after Constantza's overtake. In 2009 Novorossiysk started to increase container volumes and even tried to challenge the market shares of Constantza (2011-2012). Varna port started from the same position as Odessa and Constantza, but during the past 20 years it slowly lost market share. The Georgian port Poti proved to be a promising entrant in 1994, that started to increase its market share and managed to become the fourth biggest container port in the Black Sea (2012).

In order to approach more in detail the concentration patterns in the analysed basin we used the Lorenz curve, Hirschman-Herfindahl index and Gini coefficient (figures 11-13). The market concentration between 1992 and 1995 was quite high while the port system started to deconcentrate until 2004. The second wave of market concentration was observed between 2004 and 2008, which was followed by a deconcentration process (2008-2012).
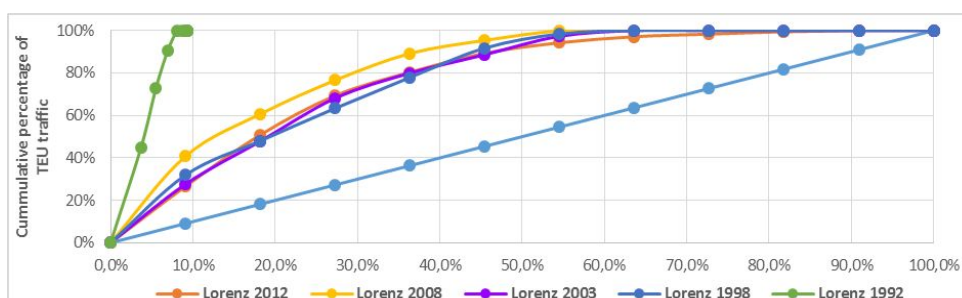

Figure 11.
Lorenz concentration curves for the Black Sea container port system (11 ports).
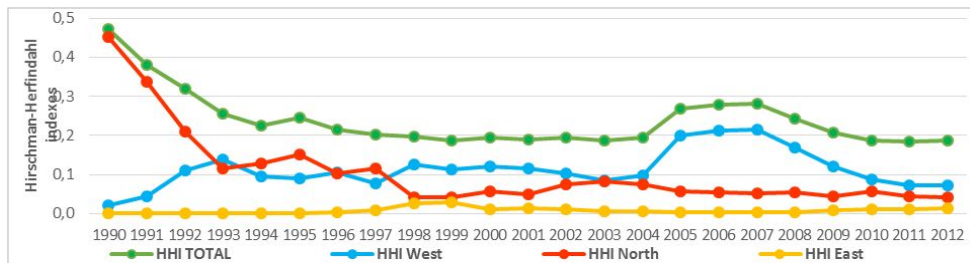
Figure 12.

Hirschman-Herfindahl indexes for multi-port gateway regions in the Black Sea.

Figure 13.

Evolution of the Gini coefficients for the Black Sea container system (11 ports).

The "net shift" analysis results in figure 14 provide more insight on the throughput dynamics in the port system. Some multi-port gateway regions were missing the potential growth to ports situated in other regions. Ports of the West and North Black Sea lost growth potential (during 14 years) in favour of East Black Sea port system and the Novorossiysk gateway (which lost potential growth only during 10 and 9 years respectively). For the methodological means used, see Appendix A.

Figure 14.

Shift analysis for the Black Sea port system.

Figure 15.
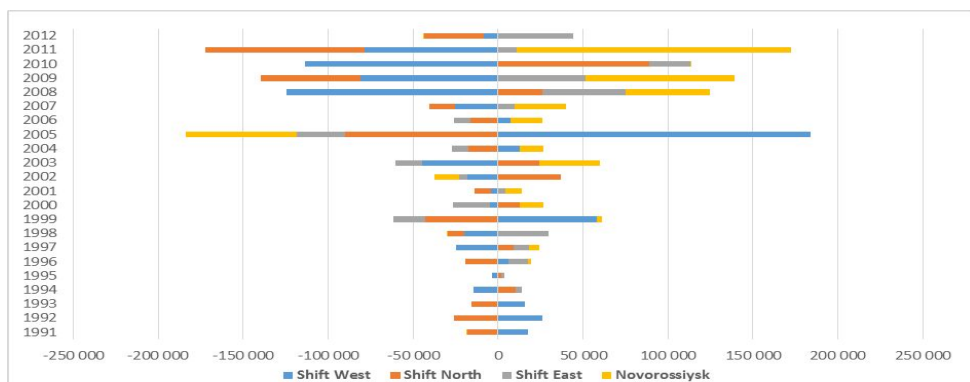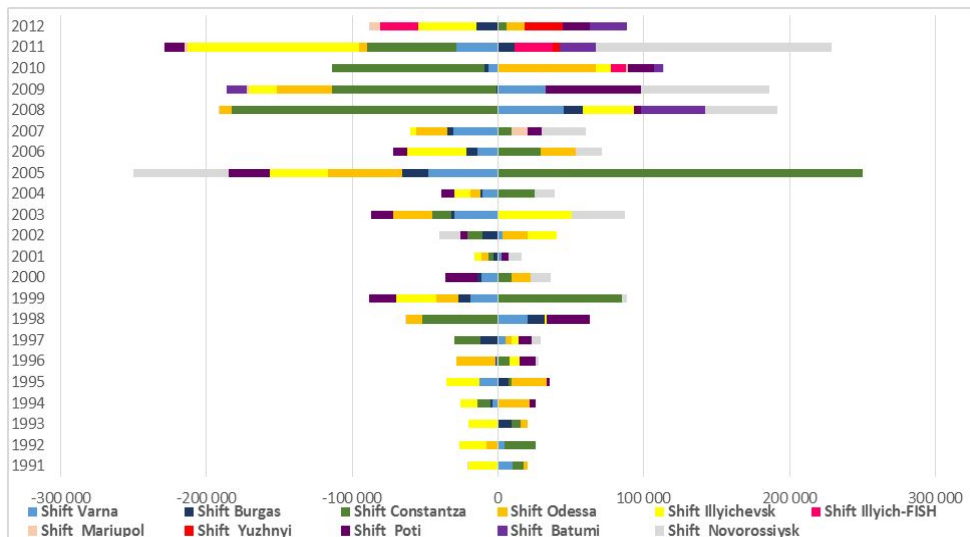Inter-port shift analysis in the Black Sea.

In order to go more into details of the shifts within the port systems we present below the results of the net shift analysis applied to the whole Black Sea port system (figure 15).

The overall (1991-2012) leaders and followers by the net volume shifts are as follows:
• Novorossyisk acted 13 times as leader, especially its active growth started in 2006 and slowed down in 2012.
• Constantza acted 12 times as leader, with a strong growth potential use in period between 2004 and 2007. That tremendous growth was mainly thanks to the transshipment volumes induced by the shipping lines. After that, the port was underperforming for 4 years in a row, which was caused mainly by the withdrawal of transshipment volumes from Constantza and their relocation to the ports outside of the Black Sea, mainly to the Mediterranean ports.
• Poti was benefiting from the growth potential for 11 years. The period 2007-2012 was the most stable and fertile in terms of volume shifts (except 2011).
• Odessa acted 10 times as a leader of shifted volumes. The main reason the consequent change from a leader to a follower position lays in the bureaucratic institutional environment and complicated customs procedures in Ukraine.
• Varna managed to act 9 times as a leader in the shift analysis. The tight competition with Constantza affects significantly the traffic volumes in Bulgarian ports.
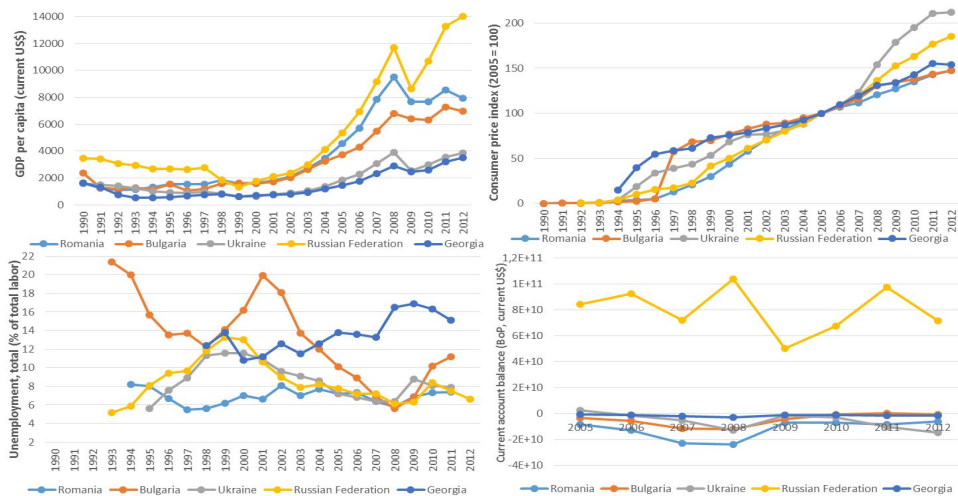
- Burgas suffered most from the tight competition in the East Black Sea port system. It managed only for 4 times to be in a leader position.
- Since 1996 Illyichevsk managed to act six as a leader. The significant attracted volumes were in 2003 and 2008 (last year before the terminal operator suspension).
- Batumi port is an entrant as from 2008, but operated quite confidently performing only once as follower (in 2009). In 2012 the port attracted a growth volume of 25,600 TEU.
- Mariupol, Illichivsk fishery port and Yuzhnyi are the newest entrants, so it is hard to draw firm conclusions. Mariupol was losing growth potential during five years in a row after one year from the start of operations. In 2012 Illyichevsk fishery port lost a potential growth of about 26,200 TEU mainly because carrier ZIM Line that used to call at this port in the two previous years moved its business to Odessa and Illyichevsk.

5. Structural Changes in the Environment of Black Sea Ports

The structural changes in the environment of Black Sea ports cover the multi-layer approach to port dynamics and the three types of port hinterlands introduced in section two of the paper, namely: macro-economic hinterland (discussed in section 5.1 and 5.4), physical hinterland (section 5.3) and logistical hinterland (section 5.2). Applying this methodology we provide evidence on the reasons behind the observed throughput dynamics in the Black Sea container port system presented in sections three and four of the paper. The main drivers for the structural changes that have taken place are: (i) economic changes at the state level; (ii) changes in container liner shipping; (iii) hinterland connections; (iv) institutional changes.

5.1. Economic Changes at State Level

The macro-economic hinterland as defined in the multi-layer approach to port dynamics (figure 2) serves as a basis for the physical and logistical hinterlands, which will be discussed in the following sections. In this section the macro-economic hinterland will be discussed from the perspective of the economic changes at the state level. Section 5.4 will address again the macro-economic hinterland but from the port institutional and governance side.

Source: own compilation based on World Bank data

Figure 16.
Macro-economic parameters of the Black Sea States.

The evolution and transformation paths of the Black Sea states, in which the ports developed, could be divided into two groups. One group of countries (i.e. Ukraine, Russia and Georgia) followed a path of tremendous economic and institutional changes in the past 20 years, from being Soviet centralized ports benefiting from public shelter policies to ports belonging to different autonomous countries and facing a new market economic reality based on efficiency and the demand/supply balance. All of the states experienced tremendous decline in their economy since the dissolution of the USSR (1991) with a peak collapse between the years 1995 and 1998 (i.e. a GDP decline of up to 50% compared to the late 1980s). The second group of states (Romania and Bulgaria) was exposed to the termination of the Soviet influence in the early 1990s and a stepwise transformation from Socialist states to full EU Member States. Romania and Bulgaria also suffered form an economic downturn with a significant GDP decline (e.g. Romania's GDP in 1993 and Bulgaria's GDP in 1997 both declined by 40% in comparison with 1990), see also figure 16.

5.2. Changes in Container Liner Shipping

This section discusses the logistical hinterland (container flows) of Black Sea ports from the container liner shipping perspective.

5.2.1. The Deployment of Post-panamax Container Vessels

There are five Black Sea ports called directly by shipping lines: Constantza (Romania), Odessa and Illyichevsk (Ukraine), and since 2011 also Yuzhnyi (Ukraine) and Nororossyisk (Russia). As from 2003, the size of the container vessels entering the Black Sea grew from 2500 TEU up to 8000 TEU. A significant restriction on vessel size in the Black Sea is the Bosporus Strait with its physical characteristics. Because of its nautical profile (length of the strait of 31 km and minimal width of 704 m), towage and pilotage services are obligatory for vessels passing through the strait and vessel traffic is allowed only during day light. Moreover, only one-way traffic is allowed and the vessel's length is limited to 300 m. Due to all these shipping restrictions, container shipping lines can deploy vessels of up to 10,000 TEU for the Black Sea, while vessels of up to 18,000 TEU are already calling at ports in the Mediterranean. Furthermore, shipping economics would not allow for much bigger ship sizes because of the current market demand.

5.2.2. Liner Service Networks and the Container Terminal Operating Business

The Black Sea ports as well as ports in other regions of the world have experienced pressure from consolidations of the major market players such as shipping lines, terminal operators (TO) and logistic service providers (LSP). All these market players played a significant role in shaping the physical and logistical hinterland of Black Sea ports and their contribution is further portrayed. Shipping lines mainly call Black Sea basin in a shared calling pattern (table 2).

There are only four direct services between the ports of the Black Sea and the Far East. The largest container vessels in this area are deployed on two joint services: the Black Sea service AE-3 of Maersk Line and CMA CGM with the annual operating capacity of 338,832 TEU and the Asia-Med Loop 5 of the future P3 network - Maersk/MSC/CMA CGM - with annual capacity about 442,000 TEU. Other large direct services to the Black Sea include joint services of CSCL / K Line / Yang Ming / PIL / Wan Hai (average annual capacity of 286,000 TEU) and the Asia-East Med Express service of Zim/OOCL (annual capacity of 221,468 TEU). Two other weekly services of Maersk Line are connecting other regions of the world to the Black Sea ports: Ecumed service (annual capacity of 150,000 TEU) operating to/from Central America and the ME-3/Prime 3 service (annual capacity of 230,000 TEU) serving the Middle East and India.

Table 2.

Direct calls to Black Sea ports

Shipping Company	Liner Services	Vessel size (TEU)	Rotation
Caribbean			
Maersk Line	Med-Caribbean-Panama service - String of Ecumed	2800-3200	Algeciras, Marsaxlokk, Izmit Korfezi, Istanbul-Ambarli, Yuzhny, Novorossisk(NCSP), Istanbul-Ambarli, IzmitKorfezi, Izmir, Marsaxlokk, Algeciras, Caucedo, Manzanillo(Pan)... (WCSA)... Manzanillo(Pan), Algeciras
Middle East-India			
Maersk Line	Black Sea-East Med-Middle East-India service (ME-3 / Prime 3)	4200-5000	Port Said (SCCT), Mersin, Istanbul-Ambarli, Izmit Korfezi, Novorossisk(Nutep), IzmitKorfezi, Istanbul-Ambarli, Izmir, Mersin, Jeddah, JebelAli, Pipavav, Hazira, Mumbai-NhavaSheva, JebelAli, Salalah, PortSaid(SCCT)
East Asia			
CSCL / K Line / Yang Ming / PIL / Wan Hai	Asia-Black Sea service (ABX / CBX / SB 1 / SBS) (Zim : ABS)	5500	Piraeus, Istanbul-Ambarli, Ilichevsk, Constantza, PortKelang, Shanghai, Ningbo, Shekou, Singapore, PortKelang, Piraeus
P3 network (Maersk / MSC / CMA CGM)	Asia-Med Loop 5 (AE-3 / Black Sea / BEX)	8500	Istanbul-Evyap (Izmit), Istanbul-Ambarli, Constantza, Odessa. Ilichevsk, Istanbul, Piraeus, Port Said (SCCT), Singapore, Xiamen, Busan, Qingdao, Shanghai, Ningbo, Yantian, Chiwan, Singapore, Port Kelang, Istanbul-Evyap
Maersk Line / CMA CGM -	Asia-Black Sea service (AE-3 / BEX) (Bosphorus Express)	6500-8000	Istanbul-Evyap (Izmit), Istanbul-Ambarli (Avcilar), Constantza, Odessa, Ilichevsk, Istanbul-Ambarli(Avcilar), PortSaid, PortKelang, Singapore, Dalian, Xingang, Kwangyang, Busan, Shanghai, Ningbo, Chiwan, Yantian, TanjungPelepas, Istanbul-Evyap
Zim / OOCL	Asia-East Med Express service (EMX) (CSCL : AMX 2)	4250	Haifa, Istanbul-Ambarll, Odessa, Novorossisk, Istanbul-Ambarli, Haifa, Mumbai-NhavaSheva, Colombo, PortKelang, DachanBay, Busan, Ningbo, Shanghai, DachanBay, PortKelang, Haifa

Source: own compilation based on data Alphaliner

The other ports in the Black Sea are called by feeder services from Mediterranean ports and Northwest European ports with an annual capacity of 1.7 mln TEU. The ports used for transhipment are: Istanbul , East Mediterranean ports (Mersin, Damietta, Port Said, Ashdod, Haifa), West and Central Mediterranean ports (Marsaxlokk, Setubal, Castellon, Gioia Tauro), Antwerp or other Northwest European ports.

The Mediterranean ports play an increasing role in the Far East-Black Sea trade. As from mid 1990s, the Mediterranean has witnessed an active development of hub-feeder container systems as well as short sea shipping networks driven by the growth of the container volumes dedicated to the southern part of Europe. The transhipment hubs in the Mediterranean have increased their market share in European container port throughput grew from 4.9% from 1993 up to 14.3% in 2004. Later the Mediterranean transhipment hubs market share started to decline (up till 12.2%) because of the volume growth in the mainland ports of the Mediterranean (e.g. Valencia, Barcelona, Genoa, etc.) that motivated shipping lines to shift to more direct calls (Notteboom, 2010). Therefore, the intensification of the Med container traffic, as well as the rehabilitation of the economies in the Black Sea states, have spurred the influx of containers into the Black Sea. The Black Sea container market witnessed substantial and stable growth as from 2000 (13% - 60% p.a.). This implied ports to find new ways and means to develop the container terminal capacities of ports (e.g. in 1993 Odessa port started to create new forms of enterprises involving the private sector to provide handling services (companies of joint activity)).

Global terminal operators as from 2001 have started to enter the Black Sea market. The first entrants were HHLA in Odessa port (2001) and NCC in Novorossiysk port (2002). A second wave of new entrants included DPW in Constantza (2004) and NCC in Illichivsk (2005). The last big inflow of global terminal operators included APMT in Poti (2011) and a joint involvement of CMA-CGM in Odessa, together with a local terminal operator (2008).

Despite a growing involvement of global terminal operators in the Black Sea region, Constantza's container throughput fell sharply from 1.38 million TEU in 2008 to 0.59 mln TEU in 2009. In the following years the port could only present a modest growth to reach 0.68 mln TEU in 2012. Early on in its development, Constanta was very much seen as the transshipment gateway for the Black Sea and reached a transshipment incidence of some 75% in 2008. However, the crisis hit many container lines changed their liner services in search of cost-efficient logistic solutions. A number of direct services from the Far East into the Black Sea region were cancelled, negatively affecting transshipment volumes. As a result, in 2012 almost three-quarters of the volumes handled at the port consisted of local import and export containers, with the remaining quarter being transshipment. Still, Constantza handles the largest vessels operated in the Black Sea (some 8,000 TEU).

Terminal productivity plays an important role in the future development of container terminals in the Black Sea region, where operators in both Ukraine and Russia such as Odessa and Novorossiysk are trying to attract both transshipment and import/export business. The Bulgarian ports of Varna and Burgas remain small players in the container market. The traffic decline in Black Sea ports is in sharp contrast to strong growth witnessed by Piraeus and Turkish deepsea ports near the Sea of Marmara. This development demonstrates shipping lines for the time being prefer a hub-feeder model in the Med to service the Black Sea area instead of direct deepsea calls in the Black Sea.

All these new dynamics shaped the competition in the region and, as a result, Black Sea ports/terminal operators have to deal with large market players that influence considerably their activity.

5.3. Hinterland Connections

Hinterland connections of ports are of vital importance for their development, especially for gateway ports which have to serve efficiently the adjacent hinterland (Notteboom and Rodrigue, 2007). This section provides an analysis of the Black Sea container ports' hinterland connections. By doing so we apply the multi-layer approach to port dynamics and elaborate on the physical level of the ports' hinterlands.

5.3.1. Railways

There are two gauge size systems in the Black Sea states: Russian gauge (1,520 mm) in Ukraine, Russia and Georgia; and Standard gauge (1,435 mm) in Bulgaria and Romania. Until 1992 railway transport was very consolidated: the majority of Black Sea states (Ukraine, Russia and Georgia) were managed by a monopolistic state owned railway operator. Since 1992, all the newly formed states started to have their own state run railway companies. Moreover, private market players entered the railway market and industry became more deconsolidated. Notwithstanding this fact, the railway transport is still very concentrated.

Romania. The network was previously monopolized by Căile Ferate Române (CFR), the state railway company, CFR's rail freight division became CFR Marfă. Since 1998, a number of private companies began operations, both in passenger and/or freight transport.

Ukraine. Ukrzaliznytsia (Ukrainian Railways) is the State Administration of Railroad Transportation in Ukraine, a monopoly that controls the vast majority of railroad transportation in the country. Ukraine, however, does have prospective container transit

projects. The "Viking" and "Zubr" schemas in particular deserve attention. Both of the schemas connect the Black Sea and Baltic Sea regions. For the moment, the containers transported by the "Viking" train are insignificant. The main disadvantage of this train is the lack of a fixed schedule and the registration procedure of containers at the loading points or ports that can easily take more than one day.

Russia. The Russian railway system has many market players involved but still most power is in the hands of Russian railway Company RZD. There are several major market players: rolling stock owners, operators of railways, 3PLs and state owned railway company RZD. RZD, via its subsidiaries (First Cargo Company and others), still largely dominates the freight market. Several private operators are functioning in particular niches (owing 36.4 % of the total Russian rolling stock in 2007). Moreover, in the segment of highly profitable goods, such as oil, fertilisers and ore, private companies now dominate the market. RZD exerts a strong pressure on the local market level and more importantly on the interstate level, by means of discriminative tariff policy on cargo handled in non-domestic ports. This protectionist behaviour of RZD makes other ports in the Black Sea less competitive in comparison with Russian ones.

Bulgaria. Since the last reforms in 2007, a new organizational structure of Bulgarian railways has been approved: BDŽ Inc. (a holding company with one shareholder, the Republic of Bulgaria).

Georgia. The government owned railway company Georgian Railway LLC is charged with both management and maintenance of the rail infrastructure, as well as all operations of passenger and freight services.

5.3.2. Inland Waterways

Inland navigation is not well developed in the Black Sea states. However, actively used rivers from this region are the Danube and Dnepr (figure 17).

Source: adapted from Via Donau and Sif-Service

Figure 17.
Significant ports on the Danube and Dnepr.

Taking into account rail and road transport tariffs (notably of Ukraine), river transport is competitive and has opportunities to take over a share of container traffic in the Black Sea region from road and rail. More effective inland waterway navigation can be used to support short-distance river-based container traffic and sea-river traffic. There are significant ports on the lower part of Danube River belonging to four states Ukraine (four ports); Moldova (one port); Romania (ten ports); Bulgaria (nine ports).

Strengths	Opportunities
- Trimodal transport hubs in mainly all ports - Both rail gauges available in ports: 1435mm (Romania, Bulgaria, Moldova) and 1520 mm (Ukraine, Moldova) - There are two entrances to Danube from Black Sea: one through canal Bystroe (5 .85 m in Ukraine) and another through Sulina Canal (7.32 m in Romania) - Handling facilities within the EU or CIS - Ports on the Danube River are in a good condition (better than the ones from Dnepr River). - Dry bulk dominates the river traffic: coal, coke, iron ore, finished and semi-finished steel products, grain, paper, scrap metal.	- Port capacities significantly higher than recent volumes - Maritime Danube 7m draught available, typically up to 12,000 dwt - Fluvial Danube direct access across Europe via the Danube, Main-Danube canal and Rhine. - Danube carried circa 45 mln.ton in 2011, approximately half of the 1987 figure and circa 10% of the existing capacity) - Total cargo traffic along Danube in 2009 counted 45.4 mln tons. Transported cargo from Black Sea to ports along the Danube counted only 5.3 mln tons. - Container terminals: designed at virtually every port; contemporary container facilities are in Galati and Giurgiulesti. Only Giurgiulesti has a scheduled liner service (from Constanta, Romania). - Ukrainian cargo owners were among largest exporters on the Danube with approximately 6.8 mln ton in 2010 - Significant foreign investment in Ro and MD for (e.g. Mittal Steel and Damen Shipyards in Galati, Danube Logistics Holding BV in Giurgiulesti)
Weaknesses	**Threats**
- Outdated and bureaucratic legal system in the Ukrainian port sector; - Until recent times Ukraine's river ports were offering handling rates according to the indications of Ministry of transport (which often were not competitive). - Bad maintained Ukrainian ports' infrastructure and handling equipment - Reni and Izmail ports are bad railway connected.	- Strategic "Danube Corridor" Ukrainian national project shelved (which included a new Odessa-Reni road, Izmail-Reni railway and other major infrastructure projects and initiatives). - Significant river fleet (about 450 propelled units and about 1500 barges) but with high average age of more than 35 years.

Figure 18.
SWOT analysis for the Lower Danube River ports.

The main ports on the Dnepr River are located on the territory of Ukraine (11 ports). Using the SWOT analysis, the ports from Danube and Dnepr Rivers are analysed from the perspective of the inland container traffic development (figures 18 and 19).

Strengths	Opportunities
- Active navigation possible on the Ukrainian part of the River from the Dnepr Delta until Kiev (with a barge Europe 2 type or a sea-river vessel). - All year -round navigation except from the period middle of December- mid February	- For the moment, it is about 6 mln ton per year transported via the river. (e.g. late 1990s volumes were about 120 mln ton/year). - No container terminals on the River (except Nikolaev port that is before the locks) - Freight rate for barging is quite competitive in comparison with the tariff for railway (calculated per ton of cargo). One of the reasons for that is the actually high railway tariffs. - Main market players on the Dnepr River: Ukrrechflot and Nibulon and other little barge owners. - It can serve as a logistics aorta for not only Ukraine but also for Russia and Kazakhstan.
Weaknesses	**Threats**
- Law on river navigat ion is not mature yet. Especially barge navigation legislation does not correspond to EU norms (i.e. according Ukrainian legislation barges are not allowed to leave the river and on the contrary barges in EU are allowed to navigate along the sea coastline at 3 and 4 beaufort) - South from lock of Novaya Kakhovka navigation by barge is not possible anymore (because of Ukrainian navigation law). - Ukrrechflot barge fleet disappeared because of the no maintenance which resulted in the present little amount of rive r barge fleet - Inland ports are in a bad technical condition	- The tolls paid at locks and bridges are still economically feasible notwithstanding the fact that tolls are not paid anymore on the West European Rivers such as Rhine, Scheldt, Seine and others.

Figure 19.
SWOT analysis for the Dnepr River ports.

Applying the multi-layer approach to the above-presented SWOT analysis of river ports, we can conclude that there are satisfactory though somewhat outdated port physical hinterlands. However, the macro-economic and logistical container river port hinterlands are nearly absent for the reasons presented in weaknesses and threats quadrants of the SWOT matrix.

5.4. Institutional Framework - Port Governance

A crucial aspect for the Black Sea ports evolution paths is their institutional evolution in the context of their macro-economic hinterland. A more autonomous management system of ports has been introduced in the last 10 years in the Black Sea ports. All of them have gone through different stages of the liberalization of their management and operational activity.

Ukraine. Until 2012, the seaports in Ukraine were directly subordinated to the Ministry of Infrastructure of Ukraine. There was a very tight relation of coordination and control of all the port operational activities between the ports and the Ministry. However,

the port institutional system is being changed to a more decentralized governmental system. The Ukrainian government has adopted a new legislation that allows privatization of seaport infrastructure and gives opportunities for new investments in Black Sea ports. Port authorities now control the navigation in the port's water area and some of the operational/stevedoring activities. The ports represent a form of public-private partnership bringing together companies of small and medium-sized business.

Russia. Adopted in November 2007, the Federal Law "On Sea Ports in the Russian Federation and Amendments to Certain Legislative Acts of the Russian Federation" has become a key element of the legal and regulatory framework of Russian ports. In the Russian Federation (RF) port authorities provide the functions of supervision, environmental control, sanitation services, as well as the safety of navigation. This governmental entity has no right to carry out business. The second state structure is RosMorPort. This is the State Property Fund that manages all the assets that are not privatized. In 2006, a centralized port stevedoring holding company was created at Novorossiysk seaport, which includes virtually all terminal operations.

Bulgaria. There are private and publically owned ports in Bulgaria. The second type of ports are usually given into concession according to the Law "On Concessions" of 2006. The Maritime Administration of Bulgaria runs the management of the state port infrastructure.

Romania. Romanian ports are publically owned. Control functions are entrusted to two bodies: the National Company "Maritime Port Administration" (NC MPA) and the "Romanian Maritime Administration", under the Ministry of Transport. The terminal handling services are provided by private stevedoring companies on the basis of concession agreements with NC MPA.

Table 3.

Spatial development patterns in the Black Sea port system

Port region/ stand-alone region	Concentration level	Concentration factors	Deconcentration factors	Path dependency	Hinterland served
BS West region (Constantza, Varna, Burgas)	Mixed dynamics, with deconcentration away from Constantza.	Mainly caused by the influx of transshipment flows to Constantza. Commissioning of two new container terminals in Constantza (DPW, APMT)	Increased participation of Burgas port. Retreat of the transshipment flows from Constantza to ports outside Black Sea (to Med ports)	Non linear	Romania, Bulgaria, Balkans (part of)

Port region/ stand-alone region	Concentration level	Concentration factors	Deconcentration factors	Path dependency	Hinterland served
BS North (Odessa, Illyichevsk, Illyichevsk sea fishing port, Yuzhnyi, Mariupol)	Mixed dynamics, with deconcentration away from Illyichevsk.	Active port expansion in Odessa (HPC; Brooklyn Kiev) + dry port creation (Europort) in its neighborhood. Active port expansion in Illichivsk port (NCC). Suspension of NCC terminal operator from Illichivsk port (2008-2012)	New entrants: Mariupol, Illyichevsk sea fishing port, Yuzhnyi.	Non linear	Mainly Ukraine, insignificant amount for other destinations (Russia, Moldova etc.)
		Political and economic stability			
BS East (Poti, Batumi)	Deconcentration away from Poti		New entrant: Batumi	Non linear	Georgia, but mainly serving the neighboring countries (Azerbaijan, Armenia and Caspian states)
Novorossiysk	Increased concentration in Novorossiysk	Increased number of direct calls by shipping lines Expansion of container terminals	Future possible deconcentration caused by expected greenfield port Taman.	Non linear	Russia (from South of Moscow till Ural)

6. Conclusions

The Black Sea is a secondary port system, with its own specific peculiarities. First, there is the natural barrier of the Bosporus Strait which limits vessel sizes entering the Black Sea. Secondly, the three multi-port gateway regions and one stand-alone gateway serve different and specific hinterlands that have almost no overlap. These factors determine port competition, development stages and development paths.

This paper determined (1) the current and past concentration levels of container traffic in the Black Sea container port system, (2) the development stage of port development at the overall and regional level and (3) the development path of the Black Sea ports.

Applying the multi-layer approach to port dynamics, together with the port spatial development model and port traffic analysis we answered the research question presented in this paper (the main findings are summarized in table 3).

The analysis of the spatial dynamics in the multi-port gateway regions showed that container traffic had a significant stable volume growth since 2000. The market concentration before 1995 was quite high while the port system started to deconcentrate until 2004. The second wave of market concentration was observed between 2004 and 2008, which was followed by a deconcentration process. The premises for those developments were that the North Black Sea ports lost its market position in favor of the West Black Sea ports (1993-1997), the leader's status was gained and maintained by the later. The East Black Sea port system and its neighbor Novorossiysk, exhibit the same sequence of developments, namely the East Black Sea ports have been bypassed by Novorossiysk port in 2003, which preserved the predominant share over East Black Sea ports.

The port development process of the Black Sea port system cannot be clearly linked to the model developed by Taaffe et al. (1963). The Black Sea port development exhibits a particular case. The amount of ports has not decreased and the cargo did not concentrate in specific ports (as the Taaffe et al. model suggests in its final development stages). On the contrary, the number of ports increased and is expected to increase even further, while the concentration patterns fluctuate. Following the classical "Anyport model" of Bird (1980) the Black Sea ports are reaching the stage of specialization in their development. The ports have not reached the advanced stage of "port regionalization" (Notteboom and Rodrigue, 2005).

A case of an unsuccessful challenge of the periphery (Hayuth, 1981) is observed in the western part of the Black Sea: Bulgarian ports Burgas and Varna were losing shares and still face fierce competition from Constantza. Illyichevsk port is loosing growth potential to its competitors from Black Sea North Region. Novorossiysk being a stand-alone gateway, benefits from growth potential for the six years in a row (2006-2011). Growth is driven by the rise of local consumption along with container terminal facilities development, as well as an active strategy to deviate Russian cargo away from Ukrainian ports. This trend is supported by the Russian government for all types of transport modes.

The analysis of the macro-economic, physical and logistical hinterlands of the Black Sea ports was used to explain the bellow stated developments.

Firstly, the stratification of the specific macro-economic, physical and logistical hinterlands in the Black Sea ports conducted the evolution path of the ports in the region. It can be concluded that the physical hinterland (including the port capacities, railways, inland navigation) is well present. Remarkably, the logistical hinterland of the Black Sea ports is

still fairly behind in its feasible progress. That is mainly justified by the unsustainable and reversible macro-economic hinterland of the Black Sea region.

Secondly, any modal shift in the multi-port gateway regions (or stand-alone gateway) from road haulage to high volume transport modes such as rail, barge and short sea shipping, requires sufficient cargo concentration in the region. As shown in the analysis, these high volume transport modes are not yet practical for the current state of the macro-economic hinterland of the Black Sea ports. This explains why despite the availability of the infrastructural/physical hinterlands of the Black Sea ports, the logistical hinterland is relying on trucking to direct container flows from/to the ports. In the long run hinterland access will remain a critical success factor for the growth dynamics in the container ports of the Black Sea basin

Thirdly, during the period 2005-2009 an internal hub-and-spoke system was in use for serving the container market in the Black Sea: i.e. transhipment via Constantza. After the tremendous decline of container volumes in the Black Sea (50% decline in 2009 compared to 2008), the transhipment operations were no longer carried out in the Black Sea but moved to the Mediterranean ports. So far there are only five Black Sea ports being called directly by deepsea vessels: i.e. Constantza, Odessa and Illyichevsk and since 2011 also Yuzhnyi and Nororossyisk, but even for these ports a large share of the volume is feedered via ports outside the Black Sea. Black Sea ports are called by direct and feeder calls in the ratio of 49/51, which means that there is still room for demand growth in the region in order to have more direct calls to Black Sea ports.

The container market of the Black Sea port system is saturated in terms of supply which has led to underutilized handling capacities (utilization rate between 30% and 60% depending on region). In 2010, there were two new entrants in the North Black Sea region (Illichivsk fishery and Yuzhnyi in Ukraine). In the next 5-15 years more new entrants are expected, more precisely port Taman in Russia (100 km up North from Novorossiysk), a new port in Crimea (Saki Region in Ukraine) and a new port in Georgia (Anaklia - 30 km North from Poti). Port Taman together with the existing port of Novorossiysk will likely form a new multi-port gateway region in the North-East Black Sea. The new port in Crimea is not likely to influence significantly the container port systems in the Black Sea, because of the lack of a strong consumer base in the region and a lack of good hinterland connections. Moreover, seeing the recent geopolitical tangles in Crimea, this project seams even less feasible. The new port Anaklia will lead to increased competition in the East Black Sea multi-port region.

Nevertheless, the main forthcoming competition in the Black Sea region will be dictated by the major shipping lines' decisions through the upcoming P3 alliance (Maersk, CMA CGM and MSC) whose aggregated volume of the container flows represent 53 % of

the market in the Black Sea. Substantial competition is expected in the North Black Sea region between incumbent terminals in Odessa port (Brooklyn Kiev and HPC) and CTI terminal in Illyichevsk with the two new entrants (Illyichevsk sea fishery port and TIS terminal in Yuzhnyi port) for the attraction of joint P3 services. Hitherto the P3 joint services were spread over three ports: Odessa (Brooklyn Kiev and HPC), Yuzhnyi (TIS) and Illyichevsk (CTI).

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Annex 1. Net shift analysis

Mathematically the net shift analysis is a variation on the shift−share analysis presented by Notteboom (1997) The net shift analysis mirrors the entire container volumes (in TEU) that a port has actually lost or won from competing ports in the same range with the anticipated growth rate. The sum of all shift-effects equals to zero. The time intervals with considerable net volume shifts refer to a high degree of competition and dynamics within the container port system. The succeeding formulas were used to calculate the shift effects between (inter) and within (intra) the different multi-port gateway regions:

$$VOLSHFT_{total} = \frac{\Sigma_{i=1}^{n} \left| SHFT_{ij} \right|}{2} = VOLSHFT_{intra} + VOLSHFT_{inter}$$

$$VOLSHFT_{inter} = \sum_{j=1}^{m} \left(\frac{\Sigma_{i=1}^{r} SHFT_{ij}}{2} \right)$$

$$VOLSHFT_{intra} = \sum VOLSHFT_{intraj}$$

$$VOLSHFT_{intraj} = \frac{\Sigma_{i=1}^{n} |SHFT_{ij}| - \Sigma_{i=1}^{n} |SHFT_{ij}|}{2}$$

with $VOLSHFT_{intra}$ is the net volume of TEU shifted between ports of group j, $VOLSHFT_{inter}$ the net volume of TEU shifted between ports situated in different port groups, $VOLSHFT_{total}$ the total net volume of TEU shifted between container ports in the system, r is the number of ports in group j, n = number of ports in the port system, m = number of port groups (i.e. multi-port gateway regions or stand-alone gateways) in the port system.