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The EU-27 Logistics Industry: Structure and Trends of Major Subsectors and National Markets

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ABSTRACT

Europe's transport and logistics systems need to be optimized, improved and leveraged through cutting-edge logistics solutions. In other words, there is a recognized growing need for a holistic European approach to transport and logistics questions, focusing on integration and coordination between the different dimensions of transport policy.

This paper is willing to investigate the nature and the structure of the EU logistics industry. The study has been carried out analysing the last available confirmed data extracted from a wide selection of statistical sources.

Starting from the relevance of the EU logistics industry within the non-financial business economy, our main objective is to evaluate the structure and the trends characterising the major subsectors across various nations. Variables such as turnover, value added and employment will be discussed and compared following a cross-country approach.

The originality of the manuscript is to provide a comprehensive view of the industry, also facing methodological difficulties in managing data lacks and non-homogeneous statistical classifications.

Major outcomes reveal the market fragmentation within some subsectors, the progressive shifting towards East of the transport and logistics industry, as well as the vertical integration and internationalization strategies performed by some leading players.

Key words: EU logistics, transport sectors, vertical integration, market liberalization

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1. Background: the logistics industry in Europe

Logistics, as widely recognized, is not only one of the main drivers and key pillars of European competitiveness, paving the way for added industrial value, the movement of goods and cooperation among companies, but also a prime contributor to the Lisbon agenda on growth and jobs (EC, 2007). Its relevance for European Economy is primarily related to the share of the logistics industry in the European economy (estimated at close to 14% of GDP), and its growth rates have been above average of the overall economy over the recent years.

The current interest for logistics also derives from other factors. First, researchers, policy makers and the private sector agreed that production and distribution networks depend on efficient logistics chains to ensure the transport of raw materials and finished goods across the EU and beyond. In this context, transportation and logistics activities become strategic business functions, not only because related costs account for a wide share of the costs of goods sold[1], but also because logistics and transportation performance can strongly effect customer service levels (Gurav, 2004). Therefore, external logistics, including the organization and management of goods handling, warehousing and transport activities, becomes the backbone of companies' capability to compete on the final markets.

Secondly, transport and logistics services, using public resources such as environment goods, may deeply effect on environmental and territorial systems (Boscacci and Pesaro, 2002). They not only play a key role in ensuring sustainable mobility, but also "contributes to meeting other objective, like a cleaner environment, security of energy supply, etc.", as pointed out by the Commission of the European Communities (see EU COM no 336/2006)). So, with the progressive EU enlargement, freight transportation has become a hot political issue in Europe: in fact the growth of flows transported has caused congestion, pollution, noise and other environmental problem[2].

Finally, the ongoing enlargement of the EU has determined a more than proportional growth of bi-directional flows within and across the EU region, presenting the European Logistics Industry with relevant business opportunities and challenges. In particular, the outsourcing and relocation of business operations to relatively lower cost markets, the growth in trade with the countries of Central and Eastern Europe and the increase of freight traffic and congestion, stimulate logistics services providers operations

1 According to EC estimates, on average logistics costs, comprising transportation and warehousing, account for 10-15% of the final cost of the finished product.

2 In particular, as highlighted by the European Commission and many authors, the transport sector imposes costs on society. *"Road congestion alone is estimated to cost around 1.1% of GDP per year. Greenhouse gas emissions from transport increased by 28% over the period 1990-2006. Moreover, many Europeans are exposed to transport noise levels that affect their health and quality of life. Finally safety also constitutes an important concern since mobility primarily depends on people's trust in the safety of transport systems."* (Spachmueller and Tiede, 2010).

provoking an high rise in the demand of specialized and integrated logistics services which require the creation of European intermodal transport systems.

According to previous consideration, Europe's transport and logistics systems need to be optimized, improved and leveraged through cutting-edge logistics solutions. In other words, there is a recognized growing need for a holistic European approach to transport and logistics questions, focusing on integration and coordination between the different dimensions of transport policy. This approach underlines the logistics' role in ensuring the efficiency of individual modes of transport and their combination (inter-modality, co-modality, multi-modality, etc.). (COM(2006) 336). From this point of view, this paper is willing to introduce a "logistics perspective into transport policy"(EU COM no 336/2006).

As largely recognized, the European Union has been operating in a changing competitive mode for several years. In fact, progressively, "the efficiencies promised by the creation of the Single Market in 1993 are synchronizing the economies of the member nations and allowing true pan-European distribution to develop along the U.S. model" (Foster, 1999). However, even if the vexing border controls are gone, substantial differences remains among the various European countries in terms of market structure, competitive approaches and cultural identities, making the EU sector, a really complicated market to operate in.

Various authors (Christopher, 1998; Skjoett-Larsen, 2000; Zografos and Regan, 2004; Rodrigue and Notteboom, 2010) recognized the need of an integrated approach to logistics. Nevertheless, at the EU-level, a lack of an empirical and homogeneous analysis on the overall logistics market is still perceived by academics (McKinnon, 1998; Hesse and Rodrigue, 2004) and practitioners (European Logistics Consultants, 1996).

This paper, presenting the last available confirmed data from a wide selection of statistical sources, gives a general picture of the structure, development and characteristics of the European transport and logistics services business, trying to identify main trends and internal dynamics. Therefore, the main objective of this document is to value the status and importance of transport and logistics industry in Europe, considering:

- the relative importance of transport and logistics industry in comparison with other industries (in terms of number of enterprises, turnover, value added, employment, etc.);
- the structure, position and characteristics of various activities and markets which compose transport and logistics industry;
- the structural profile of the logistics sector in some major EU Member States.

The manuscript is structured as follows. Section 2 describes the major data sources and brings some methodological notes regarding statistical classification. Section 3 discusses the relevance of the logistics industry within the non-financial business economy, also splitting the logistics industry into "transport & storage" (i) and "post & courier activities"

(ii) aggregates. Section 4 and 5 analyse the "transport & storage" and "post & courier activities" aggregates in terms of turnover, value added, number of enterprises and number of persons employed. Finally, some conclusions with implication for Asia logistics market are addressed in Section 6.

2. Methodological notes: Data sources, NACE classification and selection criteria

Data and information in this paper predominantly come from Eurostat, the Statistical Office of the European Community. In particular, our major sources are: Structural Business Statistics (SBS), annual structural business statistics where all data are split by activity, according to NACE Classification; STS (Short-Term Statistics), including short-term indicators, useful for evaluating the recent economic developments; Eurostat publications (Eurostat, 2009a, 2009b, 2009c), consisting of several collections such as "News releases", "Statistical book", Pocketbooks", "Statistics in focus", "Data in focus" and "Methodologies and working papers".

The statistical methodology used by Eurostat known as NACE[3] is the "statistical classification of economic activities in the European Community". It is subjected to European legislation, which imposes the use of the classification uniformly within all the Member States, and provides a unique framework for gathering collection and presenting statistical data in various economic domains.

Following the methodology largely applied by various Eurostat sources, the non-financial business economy (NACE, Rev. 1.1 Sections C to I and K) can be split as follows: industry (NACE Sections Rev. 1.1 C to E); construction (NACE Rev. 1.1 Section F), and non-financial services (NACE Rev. 1.1 Sections G to I and K)[4] . With specific regard to the Logistics Industry, it is difficult to have a reliable picture of Europe's market, because relevant statistical information is currently not sufficient and sometime misleading.

3 NACE classification is characterized by a hierarchical structure, characterized by fourth descending levels: sections (identified by an alphabetical code); divisions (two–digit numerical code); groups (three–digit numerical code) and finally classes (four–digit numerical code). NACE classification has been progressively reviewed since its original version. In 2002, NACE Rev. 1.1, an update of previous NACE Rev. 1, was established; it introduced a few additional items and changes to some titles. In 2008 NACE Rev. 1.1 was updated by NACE Rev.2, which, according to article 8 of the NACE Regulation, is to be used, for statistics referring to economic activities performed from January 2008 onwards.

4 Note that "Agriculture, hunting and forestry" (NACE Section A) and "Fishing" (NACE Section B) are not included in the non-financial business economy. Moreover, financial services (NACE Rev. 1.1 Section J) are also kept separate because of their specific nature and the limited availability of most standard business statistics in this area.

In fact, according to NACE Rev. 1.1, Transport and Logistics activities are gathered together with communication activities in section I "Transport, storage and communication" (see Table 1). Therefore, some limitations emerge in this approach, as it includes telecommunications activities within the overall logistics industry. In order to overcome such problem, the new NACE Classification (Rev. 2, since 2008; see Annex I) has modified the composition of this aggregate, including within the overall structure the "Transportation and storage" Section (i.e. H), composed as follows: land transport, transport via pipelines, water transport, air transport, warehousing and support activities for transport, postal and courier activities.

Table 1. Detailed structure of Section I – Transport, Storage and Communication (NACE Rev. 1.1)

Division	Group	Section I - TRANSPORT, STORAGE AND COMMUNICATION
60		Land transport; transport via pipelines
	60.1	Transport via railways
	60.2	Other land transport
	60.3	Transport via pipelines
61		Water transport
	61.1	Sea and coastal water transport
	61.2	Inland water transport
62		Air transport
	62.1	Scheduled air transport
	62.2	Non-scheduled air transport
	62.3	Space transport
63		Supporting and auxiliary transport activities; activities of travel agencies
	63.1	Cargo handling and storage
	63.2	Other supporting transport activities
	63.3	Activities of travel agencies and tour operators; tourist assistance activities n.e.c.
	63.4	Activities of other transport agencies
64		Post and telecommunications
	64.1	Post and courier activities
	64.2	Telecommunications

Following the above considerations, in order to appreciate the real importance and composition of the logistics industry as a whole, in this study we performed a simplified re-classification of the logistics sector. Therefore, Table 2 shows the specific segments composing the entire logistics sector for the purposes of this paper. The "Logistics industry" (as labelled in this study) has been classified into two categories: "Transport and storage" and "Post and courier activities". The importance of such methodological choice is related

to the necessity of including in our sample, leading logistics players such as Deutsche Post, TNT and other parcel express and postal operators. The exclusion of "Post and courier activities", in fact, would have clearly poor statistical relevance of our survey.

Table 2. The "Logistics industry" as defined in this work after the re-classification

LOGISTICS INDUSTRY	Nace Rev. 1.1 Classification
Transport and storage	**I**
Transport via railways	I.60.1
Road Transport	I.60.2
Transport via pipelines	I.60.3
Water transport	I.61
Air transport	I.62
Warehousing and transport support activities	I.63.1
	I.63.2
	I.63.4
Activities of travel agenzie	I.63.3
Post and courier activities	**I.64.1**

3. The relevance of the EU Logistics Industry in the non-financial business economy

Transport and logistics covers various industries which includes a wide range of service providers, covering all modes of transport, as well as related services, such as warehousing, handling, stevedoring, and value added services (packaging, labelling, assembling, etc.). Besides, it comprises a huge kind of planning, organisational and management services.

Over the past years, a trend of consolidation in European Logistics industry is observed, resulting in larger, integrated firms` groups operating in the sector[5]; nevertheless, historically, this industry has always been significantly fragmented and competition has been truly intensive, as is evident in the low concentration rate of third-party logistics in Europe[6]. The increased outsourcing demand has been progressively determining a process

5 Many companies and operators, in fact, are trying to manage logistics "on a Pan-European or regional basis, rather than country by country" (Gooley, 1999). The aim is to achieve significant cost savings in "transportation, inventory, real estate, taxes, personnel, capital equipment, and more".

6 In fact, according to Ojala *et al*. (2008), the top 20 companies of third-party logistics in Europe only have a market share of 33%.

of supply concentration: few larger logistics operators are trying to achieve scale and scope economies, following qualitative and quantitative patterns of growth. They often decide to externalize the simple physical execution of some non-strategic activities to other small firms, focusing on strategic functions.

Nevertheless, in the EU, there were over 1.2 million firms (2007) operating in the Logistics industry, representing almost 5.8% of the non-financial business economy (see Table 3).

Table 3. Number of enterprises in the "Logistics industry", percentage of total EU Logistics enterprises and share of the "Logistics industry" on the non-financial business economy– EU-27, period 2004-2007.

	2004			2005			2006			2007		
	Number	%	Share	Number	%	Share	Number	%	Share	Number	%	Share
EU-27	**1,170,805**	**100.00%**	**6.20%**	**1,144,283**	**100.00%**	**5.80%**	**1,174,353**	**100.00%**	**5.80%**	**1,213,453**	**100.00%**	**5.80%**
Italy	155,453	13.28%	4.20%	156,144	13.65%	4.10%	153,182	13.04%	4.00%	149,830	12.35%	3.80%
France	96,602	8.25%	4.30%	95,496	8.35%	4.20%	94,509	8.05%	4.10%	97,738	8.05%	3.80%
Germany	90,532	7.73%	5.30%	91,783	8.02%	5.50%	93,961	8.00%	5.30%	96,588	7.96%	5.40%
UK	74,686	6.38%	4.90%	76,835	6.71%	4.80%	76,920	6.55%	4.70%	77,265	6.37%	4.60%
Spain	224,543	19.18%	9.10%	229,384	20.05%	9.00%	228,274	19.44%	8.70%	233,455	19.24%	8.60%
Top 5	641,816	54.82%	-	649,642	56.77%	-	646,846	55.08%	-	654,876	53.97%	-

Spain clearly demonstrates to be the country with the highest number of firms operating in this sector, showing a high degree of regional specialisation. Spanish enterprises operating in the Logistics business represent over 8.0% of the firms acting in the non-financial business economy. This is also ascribable to the relevant EU firms incentives received by Spain in recent years. Italy ranks second with around 150,000 enterprises, but they represent only 3.8% of the total. Thus, the Italian market appears significantly fragmented and characterized by a high number of small enterprises. France, Germany and UK show a much lower number of enterprises, holding a share on the non-financial business economy generally lower than EU average. Particularly in France the share of Logistics firms on the total is fairly low (3.8%).

Looking at turnover, in 2007 the Logistics Industry has generated over EUR 1,400 billion of revenue (6.1% of non-financial business total revenue). These figures show the relevance of this sector within the EU economy but they do not take into account all the in-house logistics performed by companies (i.e. without the establishment of an ad-hoc legal entity), as these activities escape the current EU data collection systems. In fact, although some enterprises that formerly maintained their own in-house shipping and receiving operation are farming out these tasks to third-party specialists, many others continue to not outsource such activities.

In all the sampled countries the share of the logistics industry ranges from 5.50% to 6.50% (see Table 4), in close correlation with the EU-27 average (6.00%).

Table 4. Turnover generated by "Logistics industry" (EUR million), percentage of total EU Logistics turnover and share of the "Logistics industry" on the non-financial business economy – EU-27, period 2004-2007.

	2004			2005			2006			2007		
	EUR million	%	Share	EUR million	%	Share	EUR million	%	Share	EUR million	%	Share
EU-27	**1,150,379**	**100.00%**	**6.10%**	**1,218,414**	**100.00%**	**5.90%**	**1,300,528**	**100.00%**	**5.80%**	**1,429,577**	**100.00%**	**6.00%**
Italy	130,090	11.31%	5.40%	137,790	11.31%	5.40%	147,432	11.34%	5.30%	155,367	10.87%	5.40%
France	164,114	14.27%	5.70%	173,062	14.20%	5.70%	179,883	13.83%	5.60%	186,860	13.07%	5.50%
Germany	189,902	16.51%	5.00%	205,577	16.87%	5.20%	222,502	17.11%	5.10%	241,980	16.93%	5.50%
UK	214,784	18.67%	6.80%	225,169	18.48%	6.70%	234,436	18.03%	6.60%	245,378	17.16%	6.50%
Spain	93,274	8.11%	5.40%	101,833	8.36%	5.40%	112,902	8.68%	5.50%	121,506	8.50%	5.60%
Top 5	792,164	68.86%	-	843,431	69.22%	-	897,155	68.98%	-	951,091	66.53%	-

In the same year (2007), the five leading countries as a whole have generated about 66% of the European Logistics Industry. This represents a really high share, but significantly lower than previous years (Table 4). Empirical evidence show how the EU enlargement towards East produced positive effects for all the major European countries, which in 2004 and 2005 experienced a growth above the EU average. Afterwards the leading countries showed differentiated dynamics of growth. In particular, UK and Germany are at the top of the ranking in the EU, generating a turnover of over EUR 240 billion. These countries are followed by France, Italy and Spain showing much lower figures. The UK leadership is challenged by Germany which, over the last 4 years, showed the best growth rates within the advanced economies (turnover yearly growth above 8%; see Annex II).

In 2007, the Logistics Industry has generated over EUR 490 billion of value added, equivalent to 8.3% of total value added generated in the non-financial business economy (see Table 5). Such figures clearly reveal the relevance of transport and logistics industry in generating wealth and richness across EU. The five leading countries produce about three quarters of total value added. UK and Germany appear as dominant countries in this field, with a value added at factor cost close to EUR 90 billion (2007). As for turnover figures, France (74 billion) ranks third, followed by Italy (54) and Spain (44). The weight of the Logistics industry on the non-financial business economy (see Table 5) ranges from 7.6% (Germany) to 8.8% (France), value not far from the EU-27 average (8.3%).

Table 5. Value added at factor cost (EUR million) generated by the "Logistics industry", percentage of total EU Logistics and share of the "Logistics industry" on the non-financial business economy – EU-27, period 2004-2007.

	2004			2005			2006			2007		
	EUR million	%	Share	EUR million	%	Share	EUR million	%	Share	EUR million	%	Share
EU-27	**421,553**	**100.00%**	**8.30%**	**440,717**	**100.00%**	**8.50%**	**462,852**	**100.00%**	**8.10%**	**490,330**	**100.00%**	**8.30%**
Italy	48,275	11.45%	8.50%	48,582	11.02%	8.20%	52,962	11.44%	8.40%	54,538	11.12%	8.10%
France	66,755	15.84%	9.30%	69,253	15.71%	9.10%	71,555	15.46%	9.00%	74,246	15.14%	8.80%
Germany	79,608	18.88%	7.50%	79,640	18.07%	7.40%	82,717	17.87%	7.20%	88,891	18.13%	7.60%
UK	76,149	18.06%	7.90%	80,336	18.23%	7.90%	85,179	18.40%	7.90%	89,943	18.34%	7.80%
Spain	35,802	8.49%	7.80%	37,031	8.40%	7.50%	40,877	8.83%	7.60%	44,066	8.99%	7.70%
Top 5	306,589	72.73%	-	314,842	71.44%	-	333,290	72.01%	-	351,684	71.72%	-

Finally, by analyzing the number of persons employed in the EU, the Logistics industry generates almost 11 million job places (see Table 6), approximately equivalent to 8.2% of persons employed in the non-financial business economy. Germany is the leading country (1.8 million), followed by France (1.5), UK, Italy and Spain. These figures, correlated with those related to the number of enterprises, confirms the fragmentation of the economic background in Italy and Spain, with many small and medium firms operating in this sector. The relevance of the Logistics industry on the non-financial business economy is generally higher than that recorded for the previous variables. Particularly, in France the Logistics industry generated almost 10% of the overall job places (see Table 6).

Table 6. Persons employed in the "Logistics industry", percentage of total EU Logistics persons employed and share of the "Logistics industry" on the non-financial business – EU-27, period 2004-2007.

	2004			2005			2006			2007		
	Units	%	Share	Units	%	Share	Units	%	Share	Units	%	Share
EU-27	**10,541,800**	**100.00%**	**8.50%**	**10,607,300**	**100.00%**	**8.40%**	**10,668,200**	**100.00%**	**8.20%**	**10,960,300**	**100.00%**	**8.20%**
Italy	1,098,266	10.42%	7.50%	1,117,561	10.54%	7.50%	1,132,752	10.62%	7.50%	1,150,077	10.49%	7.40%
France	1,413,258	13.41%	9.90%	1,398,988	13.19%	9.70%	1,404,722	13.17%	9.60%	1,489,228	13.59%	9.90%
Germany	1,638,935	15.55%	7.90%	1,688,746	15.92%	8.20%	1,762,526	16.52%	8.20%	1,817,991	16.59%	8.20%
UK	1,392,491	13.21%	7.70%	1,409,476	13.29%	7.80%	1,357,550	12.73%	7.70%	1,383,313	12.62%	7.60%
Spain	924,911	8.77%	7.20%	965,254	9.10%	7.20%	992,046	9.30%	7.10%	1,035,511	9.45%	7.30%
Top 5	6,467,861	61.35%	-	6,580,025	62.03%	-	6,649,596	62.33%	-	6,876,120	62.74%	-

By analysing the aggregate "Logistics industry" we have to go into more details in relation to the components "Transport and storage" and "Post and courier activities". Basically, the "Transport and storage" aggregate is much wider than the "Post and courier activity" one. In fact, it is composed by many items such as: "Land transport" (i.e. transport

via railways, road transport, transport via pipelines, etc.), "Water transport", "Air transport" and "Supporting and auxiliary activities". The above gap already emerges looking at the number of enterprises. Over 1.1 million of firms operate in the "Transport and storage" sector, while "only" 40,000 are those working in the other aggregate (see Table 7).

Table 7. Logistics Industry's key figures: Transport and Storage and Post and courier activities

	Number of enterprises				Turnover (EUR million)				N. of persons employed (thousands)			
	2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007
Logistics I.	**1,170,805**	**1,144,283**	**1,174,353**	**1,213,453**	**1,150,379**	**1,218,414**	**1,300,528**	**1,429,577**	**10,541**	**10,607**	**10,668**	**10,960**
Transp. & stor.	1,130,805	1,104,283	1,134,353	1,169,053	1,052,254	1,117,436	1,199,200	1,325,654	8,670	8,725	8,726	9,193
P&C	40,000	40,000	40,000	44,400	98,125	100,978	101,328	103,923	1,871	1,882	1,942	1,767
	%				%				%			
Logistics I.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Transp. & stor.	96.58%	96.50%	96.59%	96.34%	91.47%	91.71%	92.21%	92.73%	82.25%	82.26%	81.80%	83.88%
P&C	3.42%	3.50%	3.41%	3.66%	8.53%	8.29%	7.79%	7.27%	17.75%	17.74%	18.20%	16.12%

Similar differences emerge analyzing the turnover figures. "Transport and storage" produces a turnover of over EUR 1,300 billion while "Post and courier activities" of only EUR 103 billion.

Finally, looking at the number of persons employed, the "Post and courier activity" group shows to be more labour-intensive than some of the Divisions/Groups composing the "Transport and storage" aggregate. In fact, in 2006, it generates almost 2 million work places, which are much higher figures than those reported (in 2007) by "Transport via railways", "Water transport" and "Air transport" (see Table 7).

The following sections focus on the analysis of "Transport and storage" (Section 4) and "Post and courier activities" (Section 5) aggregates.

4. Transport and storage: competition and integration across various subsectors

The Transport and storage aggregate is a relevant industry in the EU-27, making a vital contribution to the functioning of the European (non-financial) economy as a whole. In 2007, there were quite 1.17 million enterprises in this sector, which employed around 9.2 million people. This represents almost 7% of those working in the non-financial business economy. In the same year this industry generated EUR 433.38 billion of value added at factor cost, with a EUR 1,304.36 billion turnover. The main structural characteristics of this aggregate are shown in Table 8.

Table 8. Transport and storage (NACE Divisions 60, 61, 62 and 63) - Structural Profile, EU-27, 2007

	Enterprises		Turnover		Value Added		Persons Employed	
	(thousand)	% of total	(EUR million)	% of total	(EUR million)	% of total	(thousand)	% of total
Transport and storage	**1,169.53**	**100.0%**	**1,304,362**	**100.0%**	**433,379**	**100.0%**	**9,193.4**	**100.0%**
Transport via railways	0.89	0.1%	73,692	5.6%	33,572	7.7%	806.1	8.8%
Road and other land transport	945.23	80.8%	399,754	30.6%	161,851	37.3%	4,944.4	53.8%
Transport via pipelines	0.16	0.0%	12,310	0.9%	6,001	1.4%	21.9	0.2%
Water Transport	20.00	1.7%	111,429	8.5%	26,332	6.1%	226.4	2.5%
Air Transport	3.77	0.3%	128,469	9.8%	31,263	7.2%	408.4	4.4%
Warehousing & transp. support activ.	112.08	9.6%	418,708	32.1%	152,360	35.2%	2,286.2	24.9%
Activities of travel agency	87.39	7.5%	160,000	12.3%	22,000	5.1%	500.0	5.4%

Source: our elaborations from SBS Eurostat database

In respect to 2006, the number of enterprises in the industry as a whole had a 2.88% growth, the turnover increased 7.84%, value added 8.27% and persons employed 3.91%.

By far the largest subsector in terms of "number of enterprises" was road and other land transport which contributed 80.8% of transport services enterprises in 2007. The two next largest subsectors were warehousing and transport support activities with more than 112,000 enterprises and activities of travel agency with quite 88,000 enterprises. The number of firms operating in water transport business reached 20,000 units, while the other three activities (transport via railways, transport via pipelines and air transport) represent only 2% of the whole industry. For transport via railways and air transport it is possible to observe that they represent truly concentrated sector, characterized by a few number of large enterprises.

In 2007, warehousing and transport support activities generated around 418 EUR billion of turnover (about one third of the whole industry turnover) obtaining the first positions, and around 152 EUR billion of value added (35.2% of the total). Road and other land transport represents the leading subsector in terms of value added (around 162 EUR billion) and the second referring to turnover (around 400 EUR billion).

In employment terms the dominance of road and other land transport subsector was noticeable. This subsector, indeed, occupied more than one half of the EU-27's transport services workforce. Road and other land transport, transport via railways and activities of travel agencies were the only subsectors whose contribution to transport services was greater in employment than in value added terms. Warehousing and transport support activities occupied more than 2.2 million of persons (about 25% of the total).

Transport via railways subsector, although characterized by a low number of enterprises (0.1% of the total), generated 5.6% of the turnover and 7.7% of the value added. It's also interesting to observe that this subsector, which in 2007 employed around 800,000

persons (8.8% of the EU-27's transport services workforce) experimented in that year a strong reduction in the number of employees (an almost 10% decrease respect to 2006).

The development of the EU-27 transport performance, in the last years, followed economic trends, as a consequence of the more relevant influences on transport and services market. In fact, as known, business cycles determine short-term cycles in trade, and regional development determines mid and long-term trends in trade; at the same time, trade influences the demand for transport and storage services. Between 1995 and 2006, goods transport performance, measured in tonne-kilometres, grew at 2.8% per annum, with an average yearly rate higher than the gross domestic product (GDP, measured at constant 1995 prices). Changes in the structure and location of manufacturing industries in production methods and distribution channels, determined by the demand for Just-In-Time (JIT) shipments, are all factors that have contributed to the overall development in goods transport performance.

Various transport modes were able to catch the evolving market opportunities in a very different way. As such, within the EU transport and logistics industry, a profound modal unbalance in favour of road emerged. Since 1990s, European policy makers have tried to settle the question and reach a modal shift, by the means of extensive subsidy and supporting programs. Nevertheless, until 2006, "the modal split trends remained almost unchanged" (Notteboom, 2008), and only in the last years, a clear interest in intermodal initiatives and modal shift came out directly from the market side.

4.1 Transport via railways: market liberalization and emerging opportunities

In order to understand the actual structural profile of the rail transport sector we have to keep in mind the considerable legislative efforts to open up and revitalize this market. The EU liberalization process started in 1991 and over the last twenty years radically changed the overall picture. Since the beginning of 2007 both national and international rail freight networks had been opened, and from January 2010 also international passenger transport has been opened to competition.

Major aims of such legislative intervention were to improve the competitiveness of rail in respect to road transport, through the increase of the commercial speed and a higher service reliability, and to encourage competition for the market. Such a process was in practice a compulsory choice, considering the long-run decline of rail transport in EU's transport system (Oxford Analytica, 2010). In fact, as pointed out by the European Commission, rail freight transport has suffered "from a lack of reliability and efficiency, caused, inter alia, by insufficient technical and administrative interoperability, and by the priority given to passenger trains on lines with mixed traffic" (COM(2006) 336).

As a result, in 2007 there were 890 rail enterprises in EU. Unsurprisingly Germany hosts almost 33% of the railway undertakings (290 enterprises), followed by Poland (104),

UK (100), Romania (88) and Italy (36). This is clearly the results of the liberalization process across the EU. About 70% of the railways operator is concentrated in the top five Member States.

Historically, the European market appears strongly fragmented, due to the presence of entry barriers related to interoperability problems (rail span, railway signaling, electrification system, etc.), sunk costs, monopolistic rentals, etc. Nevertheless, with specific regards to freight sector, new rules for liberalization, harmonization, standardization and utilization of infrastructure intensified the trend towards the development of a pan European rail services on a one-stop shop basis (Notteboom, 2008) and the internationalization of rail enterprises (Spachmueller and Tiede, 2010). In fact, an interesting number of rail operators are now venturing into other countries' rail markets, aiming to exploit and leverage their own national competitive advantages (e.g. Veolia, Trenitalia, etc.).

The new generation of rail operators, acting in a more commercial way, had permitted the railway sector to reach a higher competitiveness in respect to other transport modes and a more satisfactory profitability. Even if some national rail operators continue to face profitability issues, value added in the EU-27's rail transport sector reached EUR 33.6 billion in 2007, equivalent to 7.7% of the total transport services (NACE Divisions 60 to 63). It is worth mentioning how the rail's value added share slightly declined in respect to 2005 (8.4%). As shown in Table 9, the generated value added is fairly concentrated in a handful of countries. In fact, in 2007, the top five Member States (Germany, The United Kingdom, Italy, Poland and Spain), represented almost 50% of the total. In particular, Germany holds a 17% share. The United Kingdom and Italy represent almost 10% each. Full and complete data analysis on all European countries had permitted to observe that some transition countries such as Czech Republic, Hungary and Poland have strong rail networks, which shall favor the development of multi-modal transport infrastructure in Western Europe, as these nations are located along the major corridors within the European market (Bialas-Motyl, 2010).

Table 9. Transport via railways: Ranking of Top five Member States, 2007

Ranking	Largest number of Enterprises			Highest Turnover			Highest value added			Largest number of employed		
	Country	Units	% of EU-27	Country	(EUR Million)	% of EU-27	Country	(EUR Million)	% of EU-27	Country	Units	% of EU-27
1	Germany	290	32.7%	Germany	16,474	22.4%	Germany	5,666	16.9%	Poland	120,382	14.9%
2	Poland	104	11.7%	UK	10,237	13.9%	UK	3,868	11.5%	Germany	79,358	9.8%
3	UK	100	11.3%	Italy	6,323	8.6%	Italy	3,241	9.7%	Italy	64,115	8.0%
4	Romania	88	9.9%	Poland	4,041	5.5%	Poland	1,968	5.9%	UK	55,746	6.9%
5	Italy	36	4.1%	Austria	2,533	3.4%	Spain	1,420	4.2%	Hungary	43,073	5.3%
	Top Five	618	69.7%	Top Five	39,608	53.7%	Top Five	16,163	48.1%	Top Five	362,674	45.0%

Source: our elaborations from SBS Eurostat
Note: data on the French rail industry are not available

The total EU-27's rail transport turnover amounted to EUR 73.7 billion (2007), with an almost 10% increase in respect to 2006. Germany is again the leading country, accounting for EUR 16.5 billion (22.4% of the total), followed by UK (13.9%), Italy (8.6%), Poland (5.5%) and Austria (3.4%). As such, the five leading nations generated over 53% of the European rail transport's turnover.

Finally, looking at the persons employed in the railways sector, it is possible to observe the leadership of Poland, with almost 120,500 employees, which represent roughly 15% of the total. Germany, Italy and UK reported significantly lower figures in 2007, due to the recent progressive downsizing process of former monopolistic operators.

4.2 Road and other land transport: managing market fragmentation and achieving economies of scale

The aggregate "Road and other land transport" covers road freight transport, urban and suburban passenger transport by bus, coach, tram, trolleybus, underground or elevated railway, inter-city land passenger transport (other than railways), as well as taxi operations and charters. Road transport has been one of the main areas of growth in the transport services sector as it benefited from increased demand for mobility and flexibility from private individuals and enterprises alike.

The road transport market structure is deeply affected by the political and environmental changes (i.e. the legislative framework) and the competitive relationships within the sector.

From a regulation viewpoint this sector was quite active at the EU level over the last few years (Lehmkuhl, 2002). In particular, in May 2007 the European Commission adopted three proposals (COM(2007) 263 to 265) aiming at modernising the rules governing road transport operators and the access to the road transport market. The proposals aim to reduce distortions of competition and improve transport operators' compliance with the provisions of social legislation and road safety rules. Moreover, in July 2008, the European Commission adopted a proposal (COM(2008) 436) to reform the legislation on road charges for heavy goods vehicles. The proposal is intended to enable Member States to reduce environmental damage and congestion through more efficient and environmentally-targeted road tolls for lorries. A Regulation of the European Parliament and of the Council (EC, No 1370/2007) on public passenger transport services by rail and by road was adopted in October 2007. Finally, in September 2007 the European Commission published a Green paper on urban transport (COM(2007) 551), to look, among others, at the questions of congestion and pollution linked to urban transport.

With regards to the second factor (i.e. the competitive relations), the main driving force re-defining the structure of the haulage industry and its competitive dynamics, is

the increased cost pressure (Mason *et al*., 2007). This is not only coming from customers, but also derives from the sector's liberalization, i.e. the new European legislation (EU Working Time Directive for Mobile Workers, WEE directive, congestion charges and safety compliance), and from some exogenous factors such as fuel price growth, increasing insurance premium and road congestion[7].

In this competitive context, thus, it became strategic for enterprises to improve and leverage cost reduction capabilities, throughout qualitative and quantitative growth patterns. The pursuit of economies of scale through an endogenous growth does not represent anymore the only way for achieving a cost savings. In fact, the capability of developing organisational innovations and effective partnerships with players involved in the supply chain (Hamel, 1991; Koka and Prescott, 2008; Hoetker and Mellewigt, 2009), are increasingly important for ensuring a higher process efficiency.

Looking to the main structural and economic variables of the sector, an estimated 945.2 thousand enterprises were registered in the EU-27's road and other land transport (NACE Group 60.2) sector which employed about 4.9 million persons in 2007. As such, the road and other land transport sector supplied just over half of the workforce in transport services (NACE Divisions 60 to 63).

The EU-27's road and other land transport sector generated value added of EUR 161 billion in 2007 from turnover valued at EUR 400 billion. As a result, road and other land transport accounted for around two fifths of all value added generated by transport services in 2007.

Within road and other land transport services the largest activity was the road freight transport (NACE Class 60.24) subsector. This subsector accounted for around two thirds of the value added created by the EU-27's road and other land transport sector in 2007 and occupied around three fifths of the workforce.

In terms of number of enterprises, Spain shows the highest number of firms in this sector (over 200 thousand), followed by Poland and Italy.

Unsurprisingly, the larger Member States contributed the greatest shares of EU-27 value added in this sector (see Table 10). The United Kingdom and France each accounted for around 15% of EU-27 value added in 2007. These countries are followed by Germany (13.4%), Spain (13.1%) and Italy (11.0%). However, an analysis based on relative specialisation highlights the importance of the road and other land transport sector in several other Member States. For example, this activity contributed around 6% of non-financial business economy value added in Lithuania, and over 3.5 % in Latvia, Finland, Luxembourg,

7 The effects of road congestion on logistics enterprises' cost structures have been clearly pointed out by Foster (1999). In fact, according to the author "[r]oad congestion is being exacerbated daily by growing intra-European trade, centralized manufacturing, time-definite delivery requirements, and the move toward placing smaller orders". Moreover, "[n]ot only does this congestion cause delays and add extra costs, but it also has evoked a political reaction from an environmentally conscious public, which has called for restrictions on truck movements and higher road fees and taxes".

Spain, Slovenia and Greece. Looking at the turnover, the same top 5 countries, namely UK, Italy, France, Germany and Spain, accounted for almost 65% of the EU-27 total figure.

Finally, in terms of persons employed, France ranks first, occupying over 13% of the EU-27 workforce in this field. This country is followed by Germany, Spain, United Kingdom and Italy.

Table 10. Road and Other land transport: Ranking of Top five Member States, 2007

Ranking	Largest number of Enterprises			Highest Turnover			Highest value added			Largest number of employed		
	Country	Units	% of EU-27	Country	(EUR Million)	% of EU-27	Country	(EUR Million)	% of EU-27	Country	Units	% of EU-27
1	Spain	204,432	21.6%	UK	56,918	14.2%	UK	25,503	15.8%	France	659,123	13.3%
2	Poland	132,521	14.0%	Italy	55,097	13.8%	France	23,306	14.4%	Germany	620,856	12.6%
3	Italy	116,806	12.4%	France	54,871	13.7%	Germany	21,745	13.4%	Spain	594,923	12.0%
4	France	80,188	8.5%	Germany	44,455	11.1%	Spain	21,212	13.1%	UK	520,959	10.5%
5	Germany	59,374	6.3%	Spain	47,544	11.9%	Italy	17,811	11.0%	Italy	497,260	10.1%
	Top Five	593,321	62.8%	Top Five	258,885	64.8%	Top Five	109,577	67.7%	Top Five	2,893,121	58.5%

Source: Our elaborations from SBS Eurostat

4.3 Water Transport: firms' internationalization and vertical integration

Water transport activities include, both sea and coastal transport (NACE Group 61.1) and inland water transport (NACE Group 61.2). Sea and coastal transport is made up of transport of passenger and freight over water (whether scheduled or not), operation of excursion, cruise or sightseeing boats, operation of ferries, transport by towing or pushing of barges. This class also includes renting of ships and boats with crew. Inland water transport comprehends transport of passenger or freight via rivers, canals, lakes and other inland waterways, including inside harbors and docks.

As shown in Table 11 sea and coastal transport dominated the water transport sector, with EUR 111.5 billion of turnover in 2007 (equivalent to 94.5% of the whole water transport sector's turnover), about EUR 24.03 billion of value added (91.2%) and almost 1.83 million of persons employed (80.7%). The remainder accounted for by inland water transport.

It is worth observing the relative importance of inland water transport in terms of number of enterprises; in fact, in this subsector there are 9,324 enterprises (2007), equivalent to 45.9% of the total. Such equal distribution is also due to the relevant concentration process which has characterized shipping line subsector in recent years. As widely recognized, the numerous takeovers and mergers which took place in the competitive arena, have created a handful of big companies with a high market share, thus reducing

the whole number of enterprises operating in the subsector (Stopford, 2009). The water transport sector has been historically characterized by a clear-cut separation of roles among the firms operating in the two subsectors. In the past, in fact, inland water transport services, in particular barge services, were offered by independent barge operators (Charlier and Ridolfi, 1994). Nevertheless in recent years some deep-sea carrier "got directly involved in inland navigation" (Notteboom, 2008). This choice was triggered by the will of exploiting the market opportunities coming from a quite profitable business and it was also driven by the need of integrating their core activities for providing a higher quality and capillarity of services.

The EU heavily relies on maritime transport for its external trade, as a consequence of the relative importance of water transport, which depends on geographical and historical factors. In 2007, in the European water transport subsector there were about 20,000 enterprises, with a good increase in respect to 2006 (18,000 units). They represent only 1.7% of the transport services enterprises in 2007. As revealed in Table 11, the top five Member States host 68.5% of the total. Surprisingly Netherlands and Greece together represent about 37% of the whole subsector; they are followed by Germany (14.4%), France (9.7%) and Italy (7.6%).

Table 11. Water transport: Ranking of Top five Member state, EU-27, 2007

Ranking	Largest number of Enterprises			Highest Turnover			Highest value added			Largest number of employed		
	Country	Units	% of EU-27	Country	(EUR million)	% of EU-27	Country	(EUR Million)	% of EU-27	Country	Units	% of EU-27
1	Netherlands	4,330	21.7%	Germany	29,154	26.2%	Germany	7,380	28.0%	Germany	40,082	17.7%
2	Greece	3,031	15.2%	Denmark	22,983	20.6%	Uk	3,154	12.0%	Italy	28,724	12.7%
3	Germany	2,873	14.4%	Italy	11,102	10.0%	Denmark	3,118	11.8%	Greece	18,488	8.2%
4	France	1,948	9.7%	France	11,097	10.0%	Italy	3,021	11.5%	France	17,991	7.9%
5	Italy	1,513	7.6%	UK	10,043	9.0%	Netherlands	2,768	10.5%	Sweden	17,158	7.6%
	Top Five	13,695	68.5%	Top Five	84,379	75.7%	Top Five	19,441	73.8%	Top Five	122,443	54.1%

In terms of number of persons employed, Germany ranked the first position with more than 40,000 units (17.7%), followed by Italy (28,724 persons employed; 12.7%), Greece (18,488 employees), France and Sweden (both more than 17,000 units). This data also explain how different countries are characterized by various enterprises' average size class.

Value added in water transport subsector reached about EUR 26.5 billion in 2007, equivalent to 6.1% of the "transport and storage" industry, with a significant increase in respect to the previous years (EUR 22.0 billion in 2006), as a consequence of the goods trends in seaborne transport of goods until 2007. It is also possible to observe that value added generated in the EU-27 water transport subsector is fairly concentrated in a handful

of countries; in fact, the top five States reached about EUR 19.5 billion, equivalent to 73.8% of the whole value added. In particular, Germany obtained the first position, generating 28% of the total valued added, followed by UK (12%), in spite of the low number of enterprises and persons employed, Denmark (11.8%), Italy (11.5%), and Netherlands (10.5%).

In 2007 the total turnover reached EUR 111.43 billion in 2007. In terms of turnover the five leading countries reached in 2007 about EUR 84.38 billion, equivalent to 75.7% of the total. Unsurprisingly Germany represent the first market, with almost EUR 30 billion (26.2% of the total), followed by Denmark (20.6%), which also represents a really dynamic and relevant market, Italy (10%), France (10%) and UK (9%).

In conclusion, this in-depth analysis of the available data allowed to observe some relevant trends affecting the sector. First, the process of concentration characterising the sector over the last few years recently stopped. Second, some shipping companies undertook a process of vertical integration in warehousing and transport supports activities, not only for achieving economies of scale and scope, but also for better controlling the entire supply chain (Levy, 1985; Stukey and White, 1993). For instance some shipping lines are diversifying their core activities, also providing rail services. Third, a high level of specialization in the water transport sector in some of the smaller and medium-sized Member States (Enache, 2009), in particular, Baltic Sea country. This process has also been supported by the presence, in this regions of ports which are equipped to handle virtually any combination of intermodal transport.

4.4 Air Transport: market liberalisation, low-cost carrier's growth and UK hegemony

Basically, the aggregate of "Air transport" concerns enterprises engaged in the transport of passengers and freight by air on scheduled (NACE Group 62.1) as well as unscheduled services (NACE Group 62.2). The expansion of air traffic has faced criticism, notably because of the growing levels of emissions and noise from this means of transport, although emissions have grown more slowly than air traffic volumes due to technological improvements. In November 2008, a Directive was adopted (EC, No 101/2008) to include aviation in the existing emissions trading scheme for carbon dioxide, starting from 2012. Growth in EU air traffic has occurred during a period of market liberalisation and structural change, with an increased number of operators, particularly low-cost carriers.

The development of low-cost carriers (LCCs) has expanded the market for air travel, by offering the possibility of relatively cheap flights for the leisure market. The three largest low-cost carriers in Europe in 2008 in terms of revenue passenger-kilometres were Ryanair, EasyJet and Air-Berlin. Actually, the growth of LCCs is focused on the Western European Market (Dobruszkes, 2006).

Increased competition, allied with greater costs (notably for fuel), and the rapidly worsening economic climate, have led to a number of airlines struggling to continue operations, with Alitalia, for example, entering administration in 2008, before emerging in a restructured form in 2009. In September 2008, a Regulation (EC, No 1008/2008) for air services was adopted, updating legislation from 1992. With the aims of ensuring more competition, and improving quality, it covers a wide range of issues, such as price transparency, oversight of operating licences, market access, aircraft registration, and public service obligations.

In 2007, there were almost 3.8 thousand enterprises in the air transport sector in the EU-27. In the same year, the estimated 408.4 thousand persons employed in this sector generated EUR 31.3 billion of value added, and as such the air transport sector's contribution to the transport & storage total was over 4% for employment and around 7% for value added. Three tenths of the EU-27's value added in air transport was generated in the United Kingdom alone, while France's contribution was one fifth. For the fourth consecutive year Germany recorded a negative value added for air transport in 2007, and this Member State's relative size can be better expressed by its 14.0 % share of the EU-27 workforce.

By analysing the top 5 Member States (see Table 12), the United Kingdom shows the highest figures for all the selected variables. In relation to the number of enterprises, UK is followed by France (555,000) and Germany (425,000). The top 5 countries host 65% of EU-27 firms operating in this sector. In terms of turnover, the ranking is similar to the previous one, with the entry of Spain in the 5th place.

By analysing the figures related to the value added, after UK and France, the Netherlands emerges as third leading country. Indeed, in 2007, the value added was highly concentrated in the top 5 countries; the leading nations generated almost 77% of the EU-27 value added. Finally, in employment terms, UK (22.9%), France (17.9%) and Germany (14.0%) confirm to be the major leading forces in this field, occupying a great portion of the overall EU-27 workforce.

Table 12. Air transport: Ranking of Top five Member State, 2007

Ranking	Largest number of Enterprises			Highest Turnover			Highest value added			Largest number of employed		
	Country	Units	% of EU-27	Country	(EUR million)	% of EU-27	Country	(EUR Million)	% of EU-27	Country	Units	% of EU-27
1	UK	1,014	26.9%	UK	29,737	23.1%	UK	8,667	27.7%	UK	93,431	22.9%
2	France	555	14.7%	France	19,673	15.3%	France	6,590	21.1%	France	73,229	17.9%
3	Germany	425	11.3%	Germany	14,959	11.6%	Netherlands	3,221	10.3%	Germany	57,335	14.0%
4	Italy	243	6.4%	Italy	11,081	8.6%	Spain	2,831	9.1%	Spain	38,840	9.5%
5	Netherlands	235	6.2%	Spain	10,538	8.2%	Italy	2,699	8.6%	Italy	22,531	5.5%
	Top Five	2,472	65.5%	Top Five	85,988	66.9%	Top Five	24,008	76.8%	Top Five	285,366	69.9%

Source: Our elaboration from SBS Eurostat

4.5 Warehousing and transport support activities: the emergence of new logistics players

This Section gathers information on auxiliary and supporting transport activities as covered by NACE Groups 63.1 (Cargo handling and storage), 63.2 (Other supporting transport activities) and 63.4 (Activities of other transport agencies), not considering travel agencies (NACE Group 63.3).

Thus, "warehousing and transport support activities". includes various activities such as support services for all modes of transport (baggage & cargo handling, storage & warehousing, freight forwarding & brokerage) and the operations of terminals and infrastructure as well as navigational services (notably for air and water transport), towing, berthing and parking services[8].

Cited services are often provided by a variety of trade specialists who can offer various functions to facilitate the movement of cross-border shipments. The efficiency of transport and logistics facilities becomes crucial not only for logistics performance (attracting intermodal operators), but also for local industries' competitiveness (ensuring lower transport and logistics costs). Although companies opt today for lean production lines and just-in-time delivery, warehouses still play an important role in the logistics activities, being strategic hubs in the flow of goods within a logistics system. In the recent years, the centralization of distribution chain, the increase in effective outsourcing and the request for wider logistics infrastructures have urged to create new modern warehouse infrastructures. In such an environment, there has been a remarkable increase in the development of large-scale logistics facilities across Europe (Blaskoza, 2008). Moreover the requirement of a higher integration of terminal operations in the supply chain management (Lambert *et al*., 1998; Marlow and Paixao, 2003; Carbone e De Martino 2003; Panayides and Song, 2009), has forced leading terminal operators and warehousing companies to develop diversification strategies, aiming

8 In particular "cargo handling and storage" includes, within the other, operations of loading and unloading of goods or passengers' luggage irrespective of the mode of transport used for transportation, stevedoring, operations of storage and warehouse facilities for all kind of goods (notably operations of grain silos, general merchandise warehouse, refrigerated warehouse, storage tanks, etc.), but excludes operations of terminal facilities (included in NACE Group 63.2). The class "Other supporting transport activities" includes a wide number of activities related to land transport, water transport and air transport; within the other, the following are worthy of note: operation of terminal facilities such as railway stations, bus stations, stations for the handling of goods, harbors and piers, airway terminals; operation of railroad infrastructure; maintenance and minor repair of rolling stock; winter storage of caravan; operation of waterway locks; navigation, pilotage and berthing activities; lighterage, salvage activities; lighthouse activities; airport and air-traffic-control activities; ground services activities on airfields. Finally, the class "Activities of other transport agencies" includes several services like forwarding of freight, arranging or carrying-out of transport operations by road, sea or air, receipt of group and individual consignment (including pick-up of goods and grouping of consignments), issue and procurement of transport documents and way-bills, organization of group consignment by road, rail, air or sea, activities of customs agents, activities of sea-freight forwarders and air-cargo agents, good-handling operations (e.g. temporary crating for the sole purpose of protecting the goods during transit, uncrating, sampling, weighing of goods).

to control larger parts of the supply chain. As a result, pursuing a door-to-door approach, some operators have transformed into logistics organizations, often asset-based. Similar strategies have been performed by LTL (Less Than a Load) operators, which are progressively expanding into warehouse activities.

When logistics facilities or/and intermodal operators lack, the intermediaries, such as forwarders, could have a role in ensuring transport integration. With specific regard to European Ports, some contributions (Ducruet and Lee, 2007; Ducruet and Van Der Horst, 2009) highlighted that they permit to obtain a higher efficiency in transport chain when intermodal operators' absence (or weak presence), determines infrastructures' low performances.

In 2007, there were more than 112,000 enterprises operating in warehousing and transport support activities, in the EU-27. As shown in Table 13 the leading country is Italy, which hosts 17,642 enterprises, equivalent to 15.7% of the total, followed by Germany (13.2%) and Spain (12.0%), UK (9%) and finally Greece (7%). The Spanish third position and Greek fifth position are worthy of note. According to previous figures a wide number enterprises operating in warehousing and transport supports activities are located in Southern European Country.

Table 13. Warehousing and transport support activities: Ranking of Top five Member States, 2007

Ranking	Largest number of Enterprises			Highest Turnover			Highest value added			Largest number of employed		
	Country	Units	% of EU-27	Country	(EUR million)	% of EU-27	Country	(EUR Million)	% of EU-27	Country	Units	% of EU-27
1	Italy	17,642	15.7%	Germany	91,004	21.7%	Germany	37,694	24.7%	Germany	508,133	22.2%
2	Germany	14,772	13.2%	UK	63,199	15.1%	UK	29,828	19.6%	Italy	321,884	14.1%
3	Spain	13,469	12.0%	France	54,577	13.0%	France	18,427	12.1%	UK	306,955	13.4%
4	Uk	10,081	9.0%	Italy	43,319	10.3%	Italy	16,161	10.6%	France	254,175	11.1%
5	Greece	7,808	7.0%	Spain	35,541	8.5%	Spain	13,379	8.8%	Spain	208,714	9.1%
	Top Five	63,772	56.9%	Top Five	287,640	68.7%	Top Five	115,489	75.8%	Top Five	1,599,861	70.0%

Source: Our elaborations from SBS Eurostat

The total EU-27 warehousing and transport support activities' turnover, in 2007, amounted to EUR 418,708 million. This information fairly help to understand the relevance of this subsector in respect to the transport services sector and generally the whole logistics industry. The top five Member States in terms of turnover, generated altogether almost 69% of the European total turnover. In particular Germany obtained the first position, reaching more than EUR 91 billion of turnover (21.7% of the total), followed by UK (15.1%), France (13%), Italy (10.3%) and Spain (8.5%) respectively.

In terms of value added generate, unsurprisingly Germany is the first Member State, again, with a result of more than EUR 37.6 billion of value added, equivalent to

24.7% of the European total. Other dynamic and profitable markets are UK, which generate almost EUR 30 billion (19,6%), France (12.1%), Italy (10.6%) and finally Spain (8.8%). As a result in the five leading Member State is concentrated more than 75% of the total value added generated in the EU-27.

Warehouse and transport support activities largely contributed to the EU-27 employment, occupying in 2007 almost 2.3 million of persons. On this point of view the leading countries are Germany[9], where persons occupied in this sub-sector were more than 0.5 million, and Italy, with more than 0.32 million of employees.

From data, emerges the relevance of Germany in the sector, ranking the first place with reference to three of the four analyzed variables. Considering that infrastructure management enterprises belong to supporting transport activities, Germany's performance in the sector seems to be influenced by the presence in the country of relevant nautical assets for the logistics industry, such as efficient ports (no fewer than 10 seaports providing unrivaled access to the shipping lanes of the North Sea and Baltic, expansive rivers (Rhine, Elbe and the Danube) and extensive coastline[10]. Moreover in this Member States, maritime terminals are connected to an extremely efficient system of rivers and canals with more than a hundred ports of their own.

5. Post and courier activities

Post and courier activities mainly concerns pick-up, transport and delivery of mail, parcels and the like: it includes both national post activities (NACE Class 64.11)[11] and other courier activities (NACE Class 64.12)[12].

According to a recent inquiry[13] on postal services promoted by the European

9 To maximize the efficiency of Germany's distribution infrastructure, government agencies have been cooperating with the logistics industry to develop so-called "freight villages". These cargo support centers (called GVZ in Germany) act as regional nodes with optimal access to long haul networks and local delivery points. They also provide essential services such as customs clearance, security and vehicle maintenance. GVZ are becoming increasingly common throughout Europe.

10 For a deep analysis of the European ports' throughput see Amerini (2010a, 2010b). These studies also contribute to show the impact of the general economic crisis on European ports' activities and the main trends in the maritime transport of goods.

11 National post activities comprises a variety of services such as pick-up transport and delivery (both domestic and international) of mail and parcels, collection of mail and parcel from public letter-boxes and post offices, distribution and delivery of mail and parcels, mailbox renting, etc..

12 Courier activities other than national post activities includes picking-up, transport and delivery of letters and mail-type parcels and packages by firms other than national post. Either only one kind of transport or more than one mode of transport may be involved and the activity may be carried out with either self-owned transport or via public transport.

13 ITA Consulting, WIK-Consult (2009), The evolution of the European Postal Market since 1997, Final Report, Study for the European Commission, DG Internal Market and Services, August 2009.

Commission (DG Internal Market and Services), the role of postal services is evolving substantially. This sort of services, in fact, today finds itself at the crossroads of three markets relevant for development: transport, communication and advertising. Indeed, the role of postal and courier services becomes more and more important in economies (as European economy) characterized by manifold in-sourcing and outsourcing activities of non-core business.

Insofar as they still exist, the former national monopolies in the field of post are today in competition with various enterprises from the private sector. In fact in a wide number of Member States, universal service providers (USPs), operators that could be no longer public organizations and that have replaced traditional postal administrations, still operate as a monopoly and have exclusive rights, balanced by the fact that they have a universal service obligation, but, at the same time, private operators' role in the express services is progressively growing, so that they dominate this market, providing letter and parcel services, specifically to the business-to-business, direct mail and business-to-private segments of the market. Such a situation is the main consequence of the gradual development toward market liberalization for post and courier services, started since the mid-1990s. As a result, today parcels and express services are markets completely open to private operators, where competition is strong enough. The recent development in Community legislation affecting the European postal sector, goes towards the whole abolishment of remaining restrictions on mail deliveries under 50 grams, which had been remained a "reserved area" for national operators" until February 2008, and opens up Europe's postal sector to full competition, with relevant consequences on the operators of the market. Finally it is possible to observe that Corporatization and privatization of former postal administrator have permitted considerable progress to the commercialization of the postal business. In order to face new entrants in the parcel and express business and, more recently in their letter post business USPs are increasingly commercially minded and customer-oriented. However, competition does not emerge smoothly, in fact, National regulatory and competition authorities have still to face with abusive behavior of universal services providers who still dominate the national letter market.

European postal and courier operators have now to cope with remarkable changes in their sector, referring to new competition rules and sophisticated customer needs. In particular, the electronic means, as substitute products have determined a decline in mail volume (postal operators' core business), urging postal incumbents to diversify their activities "by providing mail preparation, printing solution, mailroom management and electronic services" (Mollet, 2008). At the same time postal operators have identified various business opportunities aiming to increase their revenue and sustain their balance. Express, delivery financial services and logistics are the main areas considered by operators. Similar problems have been encountered by couriers.

In such an environment, some postal operators and couriers have founded really

attractive the logistic business, considering the relatedness with their traditional core activities, and have tried to enter the market, in order to obtain both economies of scale and economies of scope. In particular, economies of scope could be reached with regards to supply chain's support activities (i.e. sharing infrastructure and technology, leveraging network management skills) and to supply chain's primary activities (i.e. marketing activities and customer know-how; area coverage, etc.).

Nevertheless, as correctly pointed out by Mollet (2008), diversification in logistics activities also carries risks for postal operators and couriers, because, if they do not implement adequate strategies, they could succumb in the struggle with other operators which cover the sector. Logistic Industry, despite actual remarkable growth, remains a highly competitive business, where it appears difficult to identify profitable niches, with high margins. For such a reason some national postal operators have decided to focus themselves on traditional activities (mail), entering new geographic markets (i.e, Osterreichische Post, Austria; De Poste, Belgium; Royal Mail, UK; Post Denmark, Denmark) or have preferred to develop their business in other activities such as financial services (i.e. Poste Italiane, Italy; La Poste, France). Only few operators, such as DPWN (Germany), TNT (Netherlands) and Die Post (Switzerland) have been able to exploit and leverage their traditional competitive advantages and found remarkable synergy, entering successfully logistics markets.

As shown in Table 14, there were more than 44 thousand enterprises in the EU-27's post and courier activities sector (NACE Group 64.1) in 2007. In particular, only 1,572 enterprises (equivalent to 3.5% of the total) operated in "National post activities" subsector, while almost 43 thousand belonged to "courier activities" subsector.

Table 14. Post and courier activities (NACE Division 64.1) – Structural profile, EU-27, 2007

	Enterprises		Turnover		Value Added		Persons Employed	
	Units	% of total	(EUR million)	% of total	(EUR million)	% of total	Units	% of total
Post and courier activities	44,400	100.0%	103,923	100.0%	61,310	100.0%	1,882,300	100.0%
National post activities	1,572	3.5%	56,819	54.7%	41,271	67.3%	1,199,900	63.7%
Other courier activities	42,828	96.5%	47,104	45.3%	20,039	32.7%	682,400	36.3%

Source: our elaboration from SBS Eurostat
Note: number of persons employed, 2006

Adopting a country's perspective, it's possible to observe (see Table 15) a significant concentration of enterprises in the five leading Member States. As a whole they hosted around 31 thousand enterprises in 2007, equivalent to more than 70.4% of the total. In particular UK reached the first position with a share of 26.1%, followed by Germany (20.3%), and Spain (12.2%). Unsurprisingly Netherland obtained fourth position (6.1%), followed by Belgium (5.6%). It's worth underlying the absence of Italy among the leading countries, and, at the same time, the presence of two Member States characterized by little

geographical dimensions.

Table 15. Post and courier activities: Ranking of Top five Member State, 2007

Ranking	Largest number of Enterprises			Highest Turnover			Highest value added			Largest number of employed		
	Country	Units	% of EU-27	Country	(EUR million)	% of EU-27	Country	(EUR Million)	% of EU-27	Country	Units	% of EU-27
1	UK	11,609	26.1%	Germany	23,762	22.9%	Germany	12,275	20.0%	Germany	443,713	23.6%
2	Germany	8,995	20.3%	UK	21,259	20.5%	UK	11,378	18.6%	UK	282,410	15.0%
3	Spain	5,427	12.2%	France	14,271	13.7%	France	11,361	18.5%	France	271,229	14.4%
4	Netherlands	2,710	6.1%	Italy	12,039	11.6%	Italy	8,113	13.2%	Italy	165,245	8.8%
5	Belgium	2,499	5.6%	Spain	5,090	4.9%	Belgium	2,011	3.3%	Spain	106,331	5.6%
	Top Five	31,240	70.4%	Top Five	76,421	73.5%	Top Five	45,138	73.6%	Top Five	1,268,928	67.4%

Source: Our elaboration from SBS Eurostat

For 2007, employment data referring to this sector are not available for EU-27 as a whole, for the absence of data relative to some countries. In 2006 there were close to 1.9 million persons employed in the sector: unsurprisingly national post activities was the largest of the two subsector within post and courier activities sector in terms of employment, with almost 1.2 million persons employed (63.74%), the remainder being accounted for by courier activities (Table 14).

"Post and courier activities" fairly represents an important subsector for Germany, where in 2007 were employed more than 443 thousand persons (equivalent to 23.6% of total Post and courier activities' employment in 2006). The other four leading countries in terms of employment, in 2007 were UK (282,410 employed), France (271,229), Italy (165,245) and Spain (106,331).

The total EU-27's turnover generated by the post and courier activities reached in 2007 almost EUR 104 billion, with an increase equivalent to about 3 percentage points in respect to 2006 (EUR 100,978 billion). As shown in Table 14, even if the class "National post activities" remains the largest of the two subsectors in terms of turnover within the post and courier activities sector, accounting for 54.7% of the total, the two subsector reached closer performance in respect to previous years. This is the consequence of the extremely high performance of the "Other courier activities" class, which has grown almost 7% between 2006 and 2007, while "National post activities" has seen a slight decrease (equivalent to -0.11%) in the same year.

Adopting a country's perspective, it is possible to observe that European post and courier turnover is fairly concentrated in a handful of countries. In fact, in 2007, the top five Member States represented 73.5% of the total. In particular Germany reached the first position, with almost EUR 24 billion of turnover (equivalent to 22.9%), followed by the United Kingdom, which obtained a performance slightly lower (EUR 21.2 billion),

equivalent to 20.5% of the total. The other three leading countries, unsurprisingly are France (EUR 14.2 billion), Italy (EUR 12.03 billion) and Spain (EUR 5.09 billion), so that we can argue that the five largest EU economies were also the five largest contributors to the post and courier activities sector in 2007, measured in turnover.

Post and courier activities generated in EU-27 (2007) a value added at factor cost of EUR 61.3 billion, with an increase of 2.2% in respect to 2006. In terms of value added the class "National post activities" remain fairly the most important of the two subsectors, probably as a consequence of the fact that in various countries they still operate as a monopoly and have exclusive rights.

In 2007 the top five Member States obtained a share equivalent to 73.6% of the whole value added generated in EU-27. In particular Germany maintained the first position with more that EUR 12.2 billion (20.0%), followed by the United Kingdom (18.6%), France (18.5%), Italy (13.2%) and, surprisingly, Belgium with more than EUR 2 billion (3.3% of the total).

6. Concluding remarks

Main general economic trends, such as the enlargement of the EU, the strong growth of periphery regions and the growing necessity for costs and environmental externalities' reduction, have deeply affected EU Transport and Logistics Industry. As results, some relevant conclusions can be finally pointed out:

i) A unitary and homogeneous EU approach to transport and logistics industry, with regards to both "modal" and "geographical" aspects, is required. From a modal point of view, transport and logistics should be analyzed and managed aiming to optimize the value of supply process as a whole and create an efficient, sustainable, integrated European transportation and logistics network. According to such an approach effective inter-modality, co-modality and multi-modality become a must, if the EU wants to efficiently manage the increasing flows of transported goods and maintain its role in the worldwide logistics market. Thus, the value of each transport node depends on its capacity to interface with and to coordinate multiple transport modes. From a "geographical" viewpoint, the EU logistics market progressively became more homogeneous. Nevertheless national distinctive features must be considered and market segmentation appears as necessary: in fact, service requirements from customers (in terms of delivery time, flexibility, packaging, reliability, etc.) "vary widely in Europe, and logistics networks should reflect this reality" (Foster, 1999).

ii) The analysis of European transport and logistics industry and markets require new tools and methodological approaches (see point i). Traditional EU statistical methods, in fact, have made available a remarkable amount of statistical information, which however, often has produced a misleading picture of EU's logistics market. With the introduction of the Rev. 2.1 classification, a relevant improvement will be soon appreciable in the forthcoming EU statistical reports.

iii) Leading European Countries remain the key logistics markets, but, with the shifting East of the geographic centre of Europe, new challenges are emerging. Although Germany, UK, Italy, France, Netherlands and Spain, actually represent the larger portion of European logistics markets, Eastern Europe is gaining in importance, both as a manufacturing location and as a consuming market. Consequently, Central European countries like Poland, the Czech Republic, and Hungary are experimenting a dynamic trend in the logistics industry and thus they hold the most potential for logistics providers (Lee *et. al.*, 2007).

iv) New big integrated operators are appearing. The trend towards outsourcing the logistics services continues, bringing new competitive rules, and stressing towards a more concentrated sectorial structure. In such an environment, main logistics operators, in particular third-party logistics, are urged to grow rapidly in firm's size and service quality. The strategies adopted by economic actors widely differ from each other. Some transport operators have preferred to enrich and enlarge their range of logistics services offered throughout vertical integration, transforming in integrated logistics operators. Finally, a few specialized logistics players have decide to undertake a growth strategy in various countries exploiting and leveraging their national competitive advantage.

As is the case with EU, the trend will appear in Asia, notably, Northeast Asia, because they will also be unified into a big economy community. Asia should recognize the trend and prepare new analytical tools and accurate statistics data to analyse its logistics industry.

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Annex I

Detail structure of Section H – Transportation and Storage (NACE Rev. 2)

Division	Group	Section H - TRANSPORT AND STORAGE
49		Land transport and transport via pipelines
	49.1	Passenger rail transport, interurban
	49.2	Freight rail transport
	49.3	Other passenger land transport
	49.4	Freight transport by road and removal services
	49.5	Transport via pipeline
50		Water Transport
	50.1	Sea and costal passenger water transport
	50.2	Sea and coastal freight water transport
	50.3	Inland passenger water trasnport
	50.4	Inland freight water transport
51		Air transport
	51.1	Passenger air transport
	51.2	Freight air transport and space transport
52		Warehousing and support activities for transportation
	52.1	Warehousing and storage
	52.2	Support activities for transportation
53		Postal and courier activities
	53.1	Postal activities under universal service obligation
	53.2	Other postal and courier activities

Annex II

Turnover growth rates

	2004-2005	2005-2006	2006-2007	Total Growth	Composite growth rate
EU-27	**5.91%**	**6.74%**	**9.92%**	**24.27%**	**7.51%**
Italy	5.92%	7.00%	5.38%	19.43%	6.10%
France	5.45%	3.94%	3.88%	13.86%	4.42%
Germany	8.25%	8.23%	8.75%	27.42%	8.41%
UK	4.84%	4.12%	4.67%	14.24%	4.54%
Spain	9.18%	10.87%	7.62%	30.27%	9.21%
Top 5	6.47%	6.37%	6.01%	20.06%	6.28%

Value added growth rates

	2004-2005	2005-2006	2006-2007	Total growth	Composite growth rate
EU-27	**4.55%**	**5.02%**	**5.94%**	**16.32%**	**5.17%**
Italy	0.64%	9.02%	2.98%	12.97%	4.15%
France	3.74%	3.32%	3.76%	11.22%	3.61%
Germany	0.04%	3.86%	7.46%	11.66%	3.74%
UK	5.50%	6.03%	5.59%	18.11%	5.71%
Spain	3.43%	10.39%	7.80%	23.08%	7.17%
Top 5	2.69%	5.86%	5.52%	14.71%	4.68%

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The Arctic Fisheries Regime and Its Implications to Korea

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ABSTRACT

In the near future, the thawing of the Arctic Ocean will influence the fisheries by creating more fishing opportunities. The Arctic Ocean coastal states and other states like China, Japan, and EU have competitively established and announced their development policies for the Arctic including those related to fisheries. And it is no doubt an opportunity for the Korean fishing industries as well as those who are seeking new fishing grounds abroad due to diminishing fishing resources and forthcoming free trade regimes such as FTA and WTO/DDA. Despite the uncertainties in developing the Arctic fisheries and the lack of scientific data or statistics, the Arctic fisheries can become the center of world fisheries in the near future. The aim of this paper is to examine the current Arctic fisheries, their regimes and its implications, and to suggest objectives for Korean policymaking on the Arctic fisheries.

Key words: Arctic Fishery, Arctic Fishery Regime, Arctic Council, RFMO, Scope of Arctic fishing grounds

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1. Introduction

In the near future, the thawing of the Arctic Ocean is anticipated to influence the fisheries by creating more fishing opportunities; it is no doubt an opportunity for the Korean fishing industries as well as those who are seeking new fishing grounds abroad due to diminishing fishing resources, forthcoming free trade regimes such as FTA and WTO/DDA, and rising fuel prices. Thus it is essential for the Korea fish industry to prepare strategies to participate in Arctic fishing. Moreover, it is crucial to have a comprehensive view of the Arctic since its activities are becoming global concerns in various fields.

The aim of this paper is to examine the current Arctic fisheries, their regimes and its implications, and to suggest objectives for Korean policymaking on the Arctic fisheries. Among numerous instruments of the Arctic fisheries, this paper focuses on the United Nations Convention on the Law of the Sea (further referred to as UNCLOS), United Nations Fish Stocks Agreement (the Agreement), and the FAO Code of Conduct for Responsible Fisheries (FAO Code). With regards to the institutions, it discusses regional fishery management organizations (RFMOs) and the Arctic Council.

2. Korea's challenges to develop the Arctic fisheries

The arctic is most directly affected by global warming than any other areas on earth. For example, its inhabitants, the circumpolar species, face extinction due to the direct influence of the disappearing ozone layer. As such, the Korean fishery industries and related policy makers should take measures to incorporate such circumstances in making decisions.

First, Korean fish industries need new fishing grounds to overcome their financial difficulties. A substantial decline in fishing productivity was caused by policy changes resulting from WTO and DDA negotiations, FTA expansion, reduction of fishery resources and high oil prices. In order to survive under these conditions, Korean fisheries must develop new fishing grounds like the Arctic Ocean.

Second, Korea needs a stable supply of cold-water fish such as Pacific Cod and Alaska Pollock, in order to meet its high consumption. The Alaska Pollock, the main species caught by trawl fishing in the North Pacific has been highlighted as an important national source of protein supply, but its fishing grounds have been gradually decreasing; the quota-fishing and Korea-U.S.A joint fishing projects of the Alaska Pollock in the Bering Sea were already closed in the late 1980's. Thereafter the trawl fisheries of Alaska Pollock retired in the high seas and only the Russian waters have been expedited since 1989.

Third, the Arctic fishery is expected to contribute to a steady growth of Korean fisheries in a long-term perspective and to activate the new growth engine in the fishery sector. Developing the Arctic fishery can ensure Objective 7, exploring new industries by actively adapting climate change, and Objective 8, making agricultural, forestry and fishing

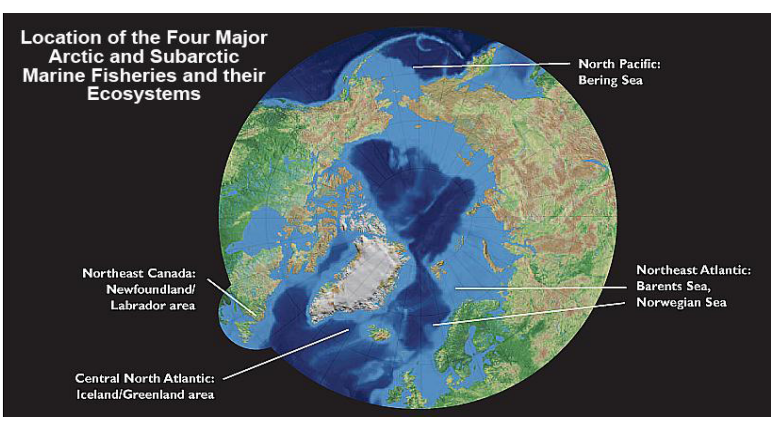
industries generate more profits.

3. An overview of the Arctic fisheries

3.1 The spatial scope of the Arctic fishing area[1]

3.1.1 Ecosystem Based Scoping

The spatial scope of the Arctic fishing area varies among the relevant institutions and reports. It is mainly because no universally accepted definition is currently available for the spatial scope of the Arctic or the Arctic Ocean. Different criteria cause inconsistency in defining the geographical scopes of Arctic fishing areas, leading to different borders and difficulties in analysis. Based on the characteristics of the ecosystem, Arctic Climate Impact Assessment (ACIA) scientific report focuses on the four major Arctic and subarctic fishing areas (Figure 1), namely (i) the Northeast Atlantic (Barents and Norwegian Seas) (ii) the Central North Atlantic (waters around Iceland and off East Greenland), (iii) Northeast Canada (Newfoundland and Labrador Seas) and (iv) the North Pacific (Bering Sea).



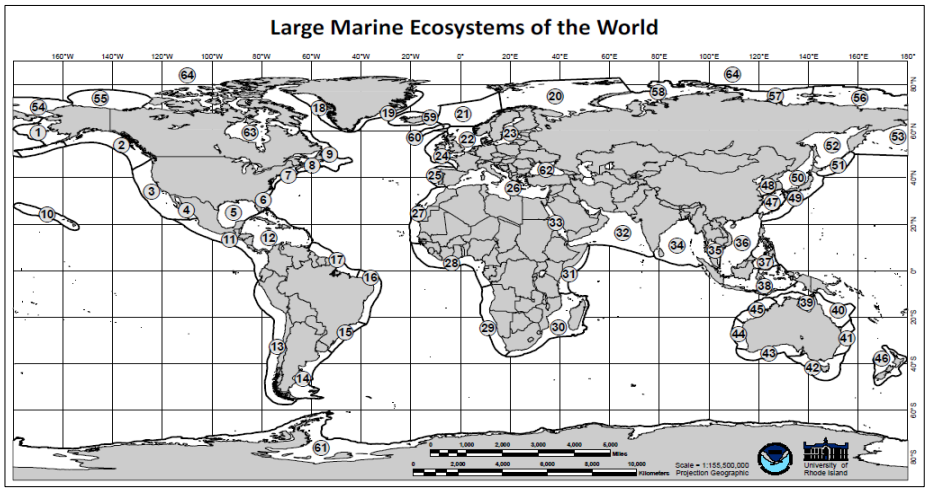
Source: ACIA, Scientific Report, Chapter 13 'Fisheries and Aquaculture', 2005, p. 693

Figure 1. The Arctic Fishing grounds by ACIA

NOAA identified the Arctic area as one of even more detailed 17 large-marine ecosystems[2] (LME). (See Figure 2)

1 Bettina Rudloff, The EU as fishing actor in the Arctic, working paper, FG2, 2010/02, July 2010, SWP Berlin.

2 The physical extent of the LME and its boundaries are based on four linked ecological, rather than political or economic, criteria. These are: (i) bathymetry, (ii) hydrography, (iii) productivity and (iv) trophic relationships. Based on the 4 ecological criteria, 64 distinct LMEs have been delineated around the coastal margins of the Atlantic, Pacific and Indian Oceans. These are 200,000㎢ or greater, adjacent to the continents in coastal waters, where primary productivity is generally higher than in open seas. This mapping refers to the UN goal to implement such approaches as general principle by 2010 and has been integrated already in some Agreement, like the Convention for Biodiversity.

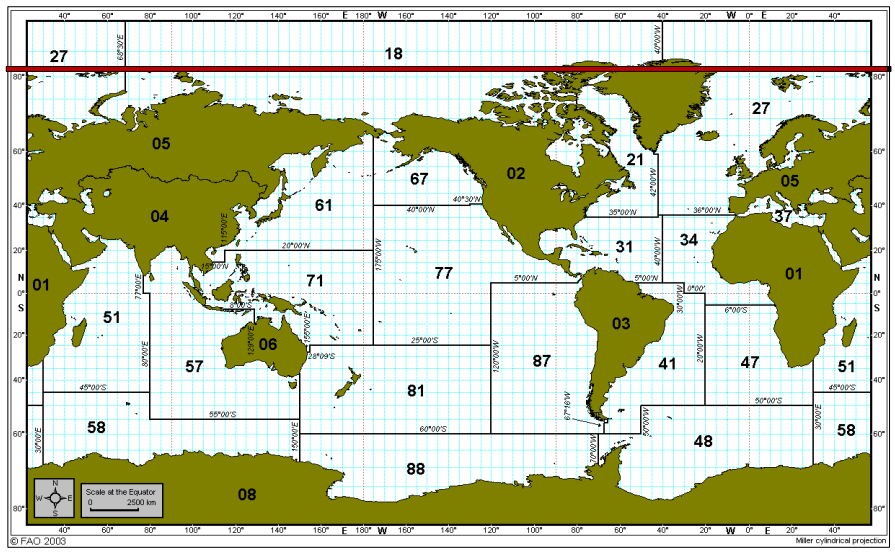


Source: NOAA

Figure 2. Ecosystem Based Arctic Waters by NOAA

3.1.2 Statistically defined identification

The FAO defines statistically relevant Arctic areas and explicitly includes only area No.18 as Arctic waters. This paper proposes to define the fishing area of the Arctic to include the Arctic Sea (FAO Area No.18) and parts of North Atlantic and North Pacific sides (FAO Area No. 21, 27, 61 and 67) to the Arctic Circle. To be more exact, the proposed border includes waters just over the Arctic Circle, the red line in Figure 3.



Source: FAO

Figure 3. The Arctic fishing areas by FAO statistical definition

The definitions of the Arctic fishing areas mentioned above are compared in the following table.

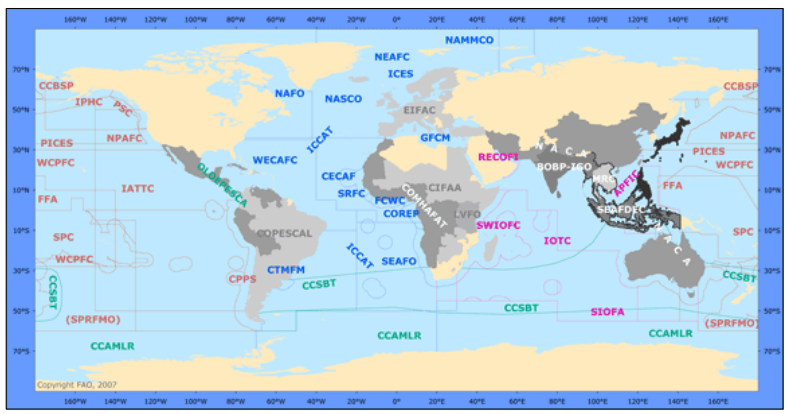
Table 1. Definition of the Arctic fishing area

Ecosystem based Areas (ACIA)	Geographical specification	Statistical Area (FAO)	Applied Arctic Definition (Arctic Circle)
Northeast Atlantic	Barents Sea	Area 27 I, IIb	completely covered
	Norwegian Sea	Area 27 IIa	completely covered
Central North Atlantic	Waters around Iceland	Area 27 Va	completely covered
	East of Greeland	Area 27 XIVa, XIVb	completely covered
Northeast Canada	Labrador and Newfoundland	Area 21 2,3	partly covered
	Eastern coast Iceland, Western coast Greenland	Area 21 0A, 0B, 1A-F	completely covered
Bering sea	Bering Sea	Area 67, 61	partly covered
-	Northern marine areas	Area 18	completely covered

3.1.3 Institutional based area

The regional fishery management organizations identify the Arctic fishing areas; the institutional coverage of marine areas may be different from or overlap with other geographical borders and statistically defined areas. The Arctic waters that belong to the high seas, if existing, are to be ruled under customary laws or by RFMOs.

The Arctic fishing areas are defined by various institutions like the North Atlantic Marine Mammal Commission (NAMMCO), the North Atlantic Salmon Conservation Organization (NASCO), the Northwest Atlantic Fisheries Commission (NAFO), the Northeast Atlantic Fishery Commission (NEAFC), and the tuna and migrating species-related RFMOs such as the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Western and Central Pacific Fisheries Commission (WCPFC).



Source: FAO

Figure 4. Arctic Sea with the regional fisheries management organizations

3.2 The Species and Production of the Arctic Fisheries

The broad spatial extension causes large disparities in defining the local ecosystems and fish species, especially comparing the Atlantic and the Pacific site of the area. Capelin, Greenland halibut, northern shrimp, and polar cod or northeast cod are specifically defined as the circumpolar species. Species that are defined as non-Arctic, but commercially relevant species are Atlantic cod, Alaska Pollock, haddock, Pacific cod, snow crab, herring, Atlantic salmon and red king crab.[3]

In 2008, the amount of catches from the Arctic fishing areas (FAO Area No. 21, 27, 61 and 67) mentioned above was approximately 33.9 million ton accounting for about 42.1% of the world's total catches.[4] Until the 1980s, the same areas produced over 50% of the total catches, but it has been gradually decreasing ever since. The production of the Arctic Sea (FAO Area No. 18) was not large in 2008, recording 480 tons, 0.5 % of the total.

Table 2. The Amount of Catches of the Arctic Fishing Areas

(Unit: 1,000 ton, %)

	FAO Area No.					Sub Total (a)	World Total (b)	a/b(%)
	18	27	21	61	67			
1950	0.0	5,335	2,262	598	4,487	12,681	17,293	73.3
1960	0.0	7,469	3,068	767	8,761	20,066	31,626	63.4
1970	0.8	10,601	4,203	2,613	12,058	29,476	59,222	49.8
1980	0.0	11,717	2,896	1,945	17,410	33,969	63,145	53.8
1990	0.0	8,837	3,309	3,332	22,467	37,946	79,556	47.7
2000	0.0	11,362	2,103	2,478	21,489	37,432	86,155	43.4
2005	0.0	9,875	2,223	3,210	20,094	35,402	83,870	42.2
2008(c)	0.5	8,650	2,065	2,573	20,616	33,905	80,580	42.1
c/b(%)	0.0	10.7	2.6	3.2	25.6	42.1	100.0	-

Source: FAO, Total Fisheries Production Statistics

4. The Fisheries Regime of the Arctic

4.1 The Arctic Fisheries Regime

The major international fishery instruments like the UNCLOS, the Agreement, and the FAO Code as well as other instruments like the bilateral and multilateral Agreements can be applicable to the Arctic fishery regime (Table 3).

3 Ibid.

4 It would be 13.3% without the North Pacific Ocean (Area No. 61and 67). It is noteworthy that the very small part of North Pacific area (Bering Sea) is included within the Arctic Circle and the fishery production in this area cannot be known.

Table 3. The instruments of the Arctic fisheries regime

	Instruments	
Major Instruments	UNCLOS	
	The Agreement	
	FAO Code of Conduct for Responsible Fisheries	
Other instruments	UN	Resolutions of the United Nations General Assembly
	FAO	FAO Compliance Agreement, FAO International plans of action: IPOAs, IPOA-IUU
	RFMO	NAFO Convention, NEAFC Convention, Convention on the Conservation and Management of Pollock Resource in the Central Bering Sea(CBSPC) and etc.
	Bilateral Agreement	Norway-Russian Federation Loophole Agreement and Protocols, and etc.

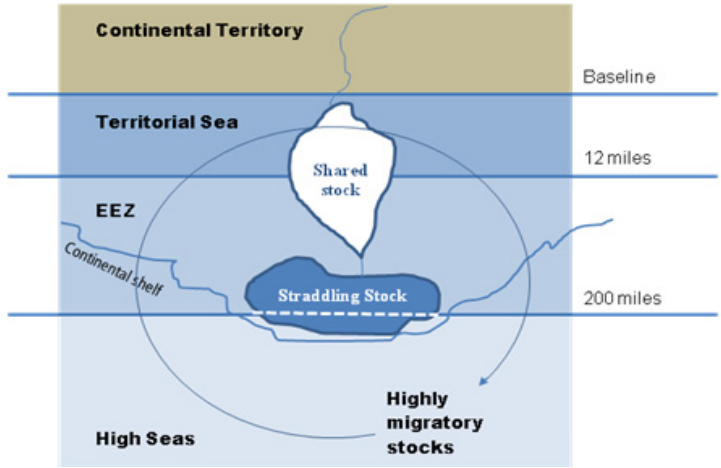
4.1.1 United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea (UNCLOS) was adopted in 1982 and took effect in 1996. UNCLOS ascertains a comprehensive legal regime covering all aspects of the seas and oceans.[5] One of the most important features of UNCLOS is to settle the issues regarding the extent of national sovereignty over the oceans and seabed. Subsequently the UNCLOS can be applied to the Arctic Ocean. Table 4 shows the major provisions according to the contents and related activities in the EEZ and high seas of the Arctic Ocean.

Table 4. The articles of UNCLOS related with the Arctic matters

Part	Section	Article	Contents	Related Activities
Part II	Section 3	17-28	Innocent passage in the territorial sea	Navigation
Part V		61-75	Living resources in the exclusive economic zone	Fisheries
Part VI		76-85	Continental Shelf	Resource developing
Part VII	Section 1	89-94	Navigation of the high seas	Navigation
	Section 2	116-120	Conservation and management of the living resourced of the high seas	Fisheries
Part XI	Section 3	150-155	Development of resources of the Area	Resource developing
Part XII	Section 8	234	Ice-covered areas	Environment

5 FAO. © 2005-2011. Fisheries and Aquaculture topics. The United Nations Convention on the Law of the Sea. Topics Fact Sheets. Text by William Edeson. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 27 May 2005. [Cited 4 January 2011]. http://www.fao.org/fishery/topic/14839/en



Source: FAO / Fisheries Department

Figure 5. Maritime zones and distribution of fishery stocks as defined by UNCLOS

With regard to fisheries, the UNCLOS establishes a regime for the conservation and management of fishery resources based on the areas and types of fish stocks within the area. Coastal states are required to conserve and manage living marine resources in the territorial seas and the EEZ. They are also required to cooperate to conserve and manage specific stocks, particularly straddling fish stocks and highly migratory species in the high seas. See Figure 5 for the maritime zones for fishing defined by the UNCLOS. In this context, it is meaningful to examine the application of this law to the Arctic fishery regime.

4.1.2 United Nations Fish Stocks Agreement (The Agreement)

After the drastic decrease in the resources due to the highly risen fishing intensity in the 1980s, the need for manning the fish resources of the high seas has been formally raised. Consequently, 'the United Nations Agreement for the Implementation of the Provisions of the UNCLOS was passed for the conservation and management of straddling fish stocks and highly migratory fish stocks'[6] in 1995 and took effect in 2001. The agreement mainly contains basic rules for preserving and managing the straddling and highly migratory fish stocks of the high seas by international and regional cooperation. It supports the establishment of the RFMOs and will influence international collaborations for the Arctic fisheries.

6 The Agreement contains 50 clauses and 2 annexes with the preamble and articulates the principle of the scope and the provisions for long-term preservations and sustainable development of fishing resources in high seas.

4.1.3 FAO Code of Conduct for Responsible Fishing

While the concerns about the over exploitations in the high seas have been growing since 1980s, the FAO tried to bridge the instruments of fisheries with general regimes of the ocean environment preservation. In recognition of environmental impacts and other important developments in world fisheries, the FAO governing bodies recommended the formulation of a global Code of Conduct for Responsible Fisheries which would be consistent with the UNCLOS, the Agreement, and the non-mandatory standards for conservation, management and development of all the fisheries. Subsequently the FAO Code provides a necessary framework for national and international efforts to ensure sustainable development of aquatic living resources in harmony with the environment. Korea has ratified and accepted those instruments.

4.2 Major Institutions for the Arctic Fishery Regime

4.2.1 RFMOs

The regime in fishing in the Arctic Ocean would take an important role in the related RFMOs. RFMOs can be divided into two types of institutions: one with explicit jurisdiction including the Arctic Ocean and the other with implicit jurisdiction. The former would be NAFO, NEAFC, the Norway-Russia Fishing Commission, NASCO, Yukon River Panel and etc., and the latter would represent WCPFC and ICCAT, which are the tuna or tuna-like species related RFMOs. Meanwhile, the North Atlantic Marine Mammal Commission (NAMMCO) is a regional body for conservation and management of all the species of cetaceans (whales and dolphins) and pinnipeds (seals and walruses) in the region, many of which have not been covered before by such an international agreement. Recently, due to growing concerns about IUU and climate changes, RFMOs are taking various measures to protect fishing resources in each jurisdiction. This trend will be adopted in fishing in the Arctic Ocean.

There are international science organizations such as ICE, PICES, IASC, which are the supporters for the RFMOs. Also, the CCAMLR is noteworthy in the preservation of polar life. Korea is a member of the NAFO, the WCPFC, the ICCAT, the NPAFC, the PICES, and the CCAMLR (See Table 5).

Table 5. The Institutions of the fisheries Regime in the Arctic Ocean

	Institutions	membership of Korea
Institutions of Fisheries (RFMOs)	The North Atlantic Marine Mammal Commission (NAMMCO)	
	International Commission on the Conservation of Atlantic Tunas (ICCAT)	√
	Northwest Atlantic Fisheries Organization (NAFO)	√
	North Atlantic Salmon Conservation Organization (NASCO)	
	North East Atlantic Fisheries Commission (NEAFC)	
	North Pacific Anadromous Fish Commission (NPAFC)	√
	Western and Central Pacific Ocean Fisheries Commission (WCPFC)	√
Arctic Council	Working Group (CAFF, SDWG)	
Science Institutions	The Oslo and Paris (OSPAR) Commissions	
	International Council for the Exploration of the Sea (ICE)	
	North Pacific Marine Science Organization (PICES)	√
Others	Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)	√

4.2.1.1 Northwest Atlantic Fisheries Organization (NAFO)[7]

The NAFO Convention Area encompasses a very large portion of the Atlantic Ocean and includes the 200-mile zones of Coastal States jurisdiction (USA, Canada, St. Pierre et Miquelon and Greenland). The NAFO Management, however, applies only to the areas straddling and outside the EEZs (Exclusive Economic Zones). The NAFO in fishing in the Arctic Ocean is important because the members are the major fishers close to the Arctic Ocean with extended roles in the development of the Arctic Ocean. Currently, the NAFO has twelve members including South Korea, Japan, United States, Russia, EU, Norway and Denmark.

4.2.1.2 Northeast Atlantic Fisheries Commission (NEAFC)[8]

Established in 1980, the NEAFC has control over parts of the Barents Sea and serves as an important bridgehead in the development of the fisheries in the Arctic Ocean. The NEAFC Convention Area covers the Atlantic and Arctic Oceans east of a line south of Cape Farewell - the southern tip of Greenland (42° W), north of a line to the west of Cape Hatteras - the southern tip of Spain (36° N) and west of the line touching the western tip of Novya Semlya (51° E). The Baltic and Mediterranean Seas are excluded. Most of these area is under the jurisdiction of the NEAFC's contracting Parties, as they are defined as their national waters. However, three large areas are defined as international

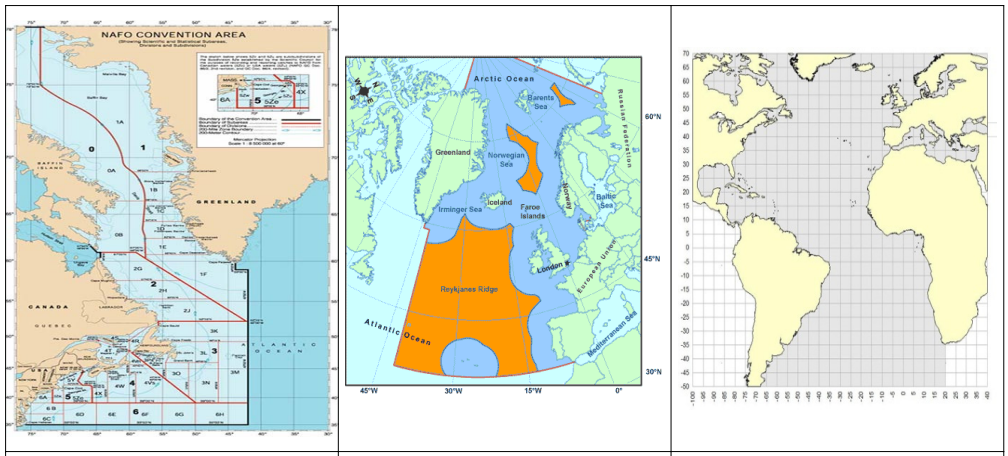
7 www.nafo.int

8 www.feafc.org

waters and constitute the NEAFC Regulatory Area. This institution has two types of membership status; one with contracted status including Denmark (Faeroe Island and Greenland), EU, Iceland, and Norway, and the other with cooperating status including Belize, Japan, Canada, and New Zealand. Typical fish found in their jurisdiction waters are red croaker, hake, and mackerel.

4.2.1.3 International Commission on the Conservation of Atlantic Tunas (ICCAT)[9]

The regions subject to the ICCAT agreement include the waters of the Atlantic Ocean and its adjacent waters. While no agreement is made on the northern region of the Atlantic Ocean, the ICCAT has authority over the Arctic Sea waters (FAO Area No.18) for tuna and other similar species. Although its regulating activity is not currently active in the Arctic Ocean, the ICCAT can exercise greater authority in fishery management when tuna and its similar species get included in the southern region of the Arctic Ocean in the near future.



NAFO	NEAFC	ICCAT

Sources: The website of each organization

Figure 6. The convention area of NAFO, NEAFC and ICCAT

4.2.2 The Arctic Council

Regarding the Arctic regime, the Arctic Council is recognized as a primary institution that can serve as one of the key players in the Arctic fishery regime. The council is a forum of Arctic region countries that was launched on September 19, 1996. The goal of the establishment is to promote the welfare of habitants near the Arctic by conserving

9 www.iccat.es

traditions and communities of the natives in the region, to protect the environment of the ecosystem of the Arctic region, the health of its habitants and the preservation of biological diversity. It also aims to allow sustainable use of the natural resources in the Arctic, and to support sustainable development to integrate the regions' economical/sociological development along with the realization of cultural welfare.

The Arctic Council, however, was not explicitly established to function as a governing body of the Arctic Ocean. Currently, it does not have a legal binding force to establish any detailed vision or plan. Nonetheless, the many reports and guidelines that the council has provided on the environment of the Arctic for the past 20 years have great influences on formulating rules or principles related to the future of the Arctic. Thus, it is meaningful to examine the current roles of Arctic Council as a primary institute of the Arctic Ocean regime in relation to the Arctic fisheries.

The members of the council are the eight Arctic coastal countries: Russia, Canada, Greenland, Iceland, Norway, Finland, Sweden and the USA. In addition to the member countries, there are regularly participating groups such as the organizations of the Arctic indigenous peoples representing the majority of Arctic indigenous constituents: ICC, SAAMI, RAIPON, AIA, AAC and GCI.[10] The participating groups regularly raise Arctic related issues and serve as consultants. There are also observers who participate without any decision-making privileges, which include non-Arctic coastal countries, international organizations, and various NGOs who have stakes related to the Arctic. The Chairmanship of the Arctic Council rotates every two years, and the Arctic Council Ministerial Meetings are held biannually in the country holding the chairmanship. The Senior Arctic Officials Meeting is held twice a year, as shown in Figure 7. So far, Korea has not yet been recognized as a permanent observer of the Arctic Council. Considering the critical role of the Arctic Council, it would be beneficial for Korea to take strategic actions to earn this title as soon as possible.

With regards to the Arctic fisheries, the Arctic Council has taken passive actions compared with other environment and shipping matters. As of today, the council has published the ACIA in collaboration with the International Arctic Science Committee. The report differentiates the fisheries of the Arctic Ocean in four regions and presents the analyses of each fishery on its ecosystem, fishing resources, and productions. It also closely examines the effects of fishing and climate changes in each fishery. The report, however, fails to provide a specific policy such as fishing policies or international cooperation. In addition, due to its focus on environmental issues, it does not deal with fishing in the Arctic Ocean in depth.

10 Aleut International Association (AIA), Arctic Athabaskan Council (AAC), Gwich'in Council International (GCI), Inuit Circumpolar Council (ICC), Saami Council(SAAMI) , Russian Arctic Indigenous Peoples of the North (RAIPON)

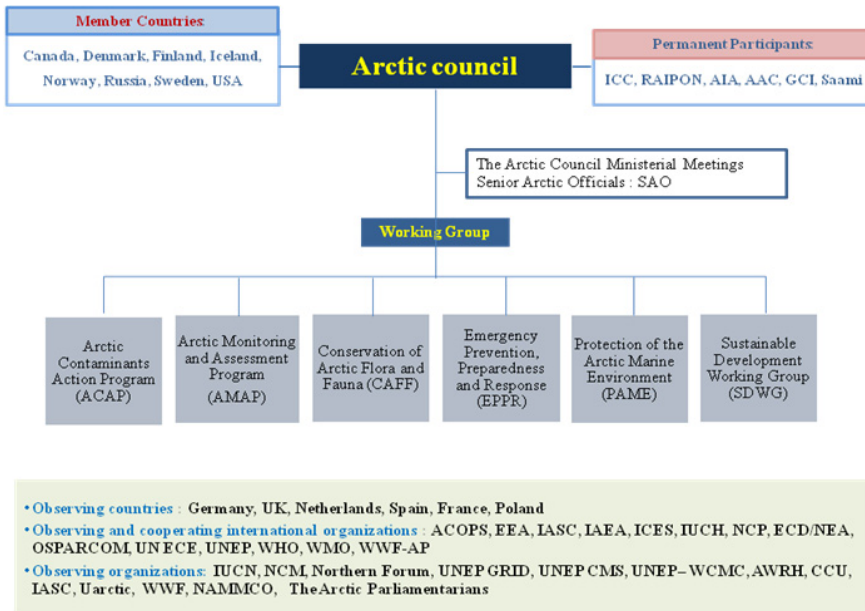


Figure 7. The Organization Chart of Arctic Council

5. Conclusion and Implications

The Arctic Ocean is emerging as an attractive new business opportunity to Korean fishing industries. Due to the melting ice of the (Arctic) Ocean, the feasibility of the Arctic fishing is rapidly growing. As a consequence, the Arctic Ocean coastal states and other states like China, Japan, and EU have competitively established and announced their development policies for the Arctic including those related to fisheries. Despite the uncertainties in developing the Arctic fisheries and the lack of scientific data or statistics, the Arctic fisheries can become one of main pillars of global fisheries in the near future.

Given these circumstances, the followings are suggested for development of the Arctic fishery policies of Korea.

- ✓ It is important for Korea to strengthen the liaisons with the regional fishery bodies such as NAFO, NEAFC, and ICCAT since their supervisory systems are employed to establish the regime of the Arctic fisheries. This can be actively implemented in connection with the distant water fishery policy in Korea.
- ✓ The Korean government has to be recognized as a permanent observer as soon as possible in the Arctic Council. To achieve this goal, Korea should have more interest and conduct more research on the Arctic matters by establishing

joint research with the arctic coastal states as well as actively participating in various group projects of the Council.

- ✓ Scientific research and investigations should take place to assess the fish resources in the Arctic Ocean. The research needs to be based on international cooperation for securing credibility and objectiveness. Cooperation with China and Japan may be considered in discussing the exploitation of the Arctic fishing grounds.
- ✓ In coping with the ramifications of climate changes, it is critical to establish the multilateral and bilateral cooperative relation with the Arctic Council and its member states.

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NOAA: www.lme.noaa.gov
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China's Maritime Security Policy in the Indian Ocean: Assessment and Implication for Korea

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ABSTRACT

China became the second largest economic power. But the gigantic growth of China has triggered another concern that it will project its influence around the Oceans in order to have maritime hegemony. Actually, China recently provoked conflicts with the Japan, Philippines, Vietnam as well as the U.S in South and East China Sea. However, it would be premature to decide that Chinese maritime security policy is quite offensive for securing maritime hegemony. This is because maritime environment in the Indian Ocean is quite different from that of the Pacific Ocean. First, in the Indian Ocean, there is no dominant maritime power, unlike in the Pacific Ocean where bilateral military alliances led by the U.S are playing a key role in maritime status quo. Second, there is much room for cooperation among nations because non-traditional security issues such as piracy, armed robbery against ships and illegal transportation of WMD cannot be tackled by one or some nations. Third, Africa becomes an attractive region to China for its national resources. Against this backdrop, China is pursuing 'tailored strategy' by becoming 'multilateral' and 'cooperative' in the Indian Ocean, while staying 'unilateral' and 'conflicting' in the Pacific Ocean. For example, China is trying to make a positive contribution to peacekeeping, disaster relief and count-piracy operations in the Indian Ocean.

Considering this, Korea should prepare multi-leveled maritime policy. At a bilateral level, Korea should consolidate military alliances with the U.S and Japan. At a multilateral level, it needs cooperation among nations to fight against non-traditional security threats like piracy. Finally, at a unilateral level,

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it should strengthen capability of navy forces by equipping with modernized equipment with cutting-edge technologies.

Key words: maritime security, SLOC, piracy, Law of the Sea Convention, WMD

1. Introduction

China passed Japan to become the world's second-largest economy behind the United States in the second quarter of 2010.[1] This is not surprising because the international community has already predicted China would become one of the most powerful 'economic giant'. However, around the time of the news release, maritime environment surrounding China has become worse and raised concerns. First of all, China planted the national flag deep beneath the South China Sea, where Beijing has tussled with Southeast Asian nations over territorial disputes.[2] Also, on Aug 16, the United States Department of Defense issued its annual report on China's military power. It warned that China's military development will affect the balance, security and stability in the Asia-Pacific region and this has evoked protests from Beijing. To make matters worse, China-Japan's deep-rooted conflict over territorial claims on the Senkakus or Diaoyu islands has recently hotly reignited. Tensions arose from collisions between a Chinese fishing boat and two Japanese coast guard ships near islands in the East China Sea on 7 Sep 2010.

This consecutive incidents show that global maritime powerhouses such as the U.S and Japan are worrying that China will flex its muscles more directly in the Asia-Pacific region. Furthermore, they are also trying to get their bilateral military alliance more tightly tied. However, this movement can stimulate China and escalate military tensions in the region. This confrontation seems as a kind of vestige of Cold-War. However, this can put a stress on the negative evaluation of Chinese navy missions, apart from its positive contribution to peacekeeping, disaster relief and count-piracy operations around the world. So I think that it is better to analyze China's maritime strategy from the broader perspective. This is why I am focusing on the Chinese maritime strategy in the Indian Ocean.

Against this backdrop, China's maritime security strategy in Indian Ocean in its history will be looked into. Then I will shed light on strategic importance of maritime security in Indian Ocean for China. Also, comparing with that in the Asia-Pacific region, China's maritime security policy in Indian Ocean will be analyzed at three dimensions; diplomatic, political/military and economic ones. Finally, based on the analysis, I will issue some suggestions for Korean maritime security policy.

1. China Passes Japan as Second-Largest Economy. *The New York Times* (2010.8.15).
2. The South China Sea covers an area of more than 648,000sq miles (1.7 million sq km) with more than 200 mostly uninhabitable small islands, rocks and reefs. ABS-CBN News(2010.8.26), 'China plants flag in South China Sea amid Disputes'.

2. History of Chinese Maritime policy

China's interest in ocean has evolved with the changing times. During the past, some of China's rulers have realized maritime potential, while others have knowingly refused to do so. It has often been pointed out that the Chinese navy during the year 1000-1500 has been almost certainly the world's largest and technologically most advanced maritime force. Zheng He's voyage in Ming Dynasty from 1405 to 1433 was a notable example of China's pursuit of ocean interests.[3] Yet this great voyage was China's sole effort to construct a large, oceangoing fleet from the early fifteenth century through the early twenty-first century, underscoring dynastic China's preoccupation with its continental frontiers.[4]

During the era of 'Cold War', China has focused on consolidating sovereignty over disputed territory and strengthening military security in maritime area, since the 1950s when Mao stated that China should develop a strong fleet. However, despite the recognition of increasing importance of fostering naval force, the lack of resources and time has led China's navy fleet to remain oriented toward coastal defense against neighboring states including Taiwan. In 1979, however, Deng Xiaoping delivered an important speech encouraging to develop a powerful navy and in 1985 he reiterated this point by calling for navy with 'real fighting capacity'(Thomas, 2002). This perception has changed China's stance. China started to move toward Oceans beyond coastal region and began to prepare for competition with other maritime powers.

Since the end of the Cold War, China's interests in oceans have been intensified and diversified. For its maritime national security, China has pursued 'blue water' maritime strategy which can be quickly available and actively operational in the Pacific and Indian Ocean, in order to become a strong maritime power. To realize this goal, China has made substantial changes since 1980s in its maritime strategy, training methods and technical equipments.[5] China started to enhance its maritime security in the context of international strategy.

Meanwhile, with the advent of the 'Post-Cold War' era, China began to see ocean from the globalized perspective. There are mainly two reasons. One is internal driving force. For its economic growth, China needs to secure more marine resources. Recently, the land-based resources are running out, thus the global interest is shifting to development

3. The Voyage has proclaimed the virtue and majesty of his emperor wherever he went and numerous foreign kings offer submission to China (Thomas M. Kane (2002) *Chinese Grand Strategy and Maritime Power*, Frank Cass Publishers).
4. Robert, S. Ross (2009) China's Naval Nationalism: Source, prospects and the U.S Response. *International Security*, Vol 34 No. 2, pp.55-56.
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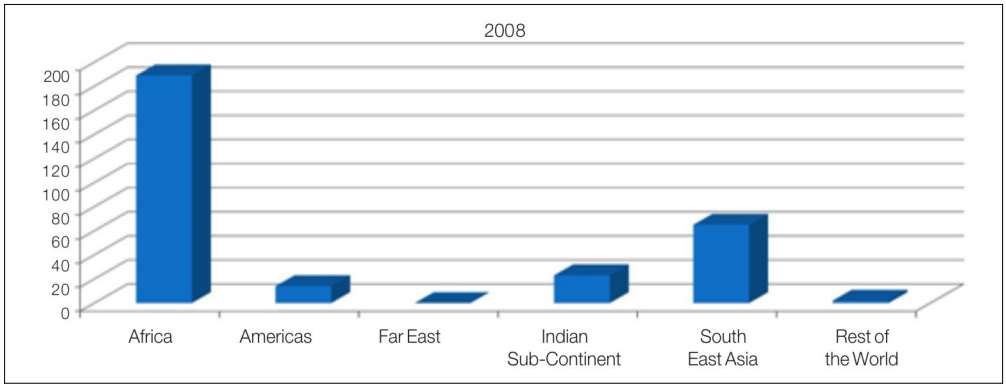
of ocean-based resources for the sustainable supply. In addition, Law of the Sea Convention, concluded in 1982 and took effect in 1994, has guaranteed coastal states for their sovereign right over marine resources in EEZ[6] and Continental Shelf. Also, as marine technologies for oil drilling and gas exploitation advanced, marine resource has become a more attractive alternative for economic growth engine to China.

The other is external driving force. Recently, maritime security environment has changed for non-traditional security reasons. Piracy issue in Gulf of Aden as well as in Malacca Strait becomes a threat to international community. Others such as unlawful acts against the safety of navigation, armed robbery against ships, illegal transportation of WMD are also threatening maritime security. This background has brought China to come on the international stage as one of major maritime actors to deal with non-traditional maritime security issues. Of course, China's international effort seems to be strategic approach because China recognizes that it can't cope with piracy and terrorism alone for protection of sea lane of communication for its transportation of resources.

3. Maritime Security Environment in the Indian Ocean and China's Interests

In the era of the post-Cold War, the scope of issues of maritime security in the Indian Ocean persists with continued assortment of traditional inter-state (or bilateral) competitive security and the non-traditional international issues of cooperative security. In particular, asymmetric challenges such as maritime terrorism, piracy, shipping of WMD are on the rise. In the case of piracy, out of total 293 piracy accidents that happened in 2007, 277 cases(Africa-189, Indian Sub-Continent-23, South East Asia-65) took place in or around Indian Ocean, while Americas has 14, Far East Region has nothing and rest of the world has just 2. This amounts to 94.5% of total accidents (see Figure 1). These challenges are essentially part military, part economic and part human welfare and leave much room for maritime security cooperation.

6. According to UNCLOS, coastal states can declare EEZ(exclusive economic zone), which shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured(Art. 57). In EEZ, the coastal state has sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds (Art. 56).



Source: International Maritime Organization(2009)

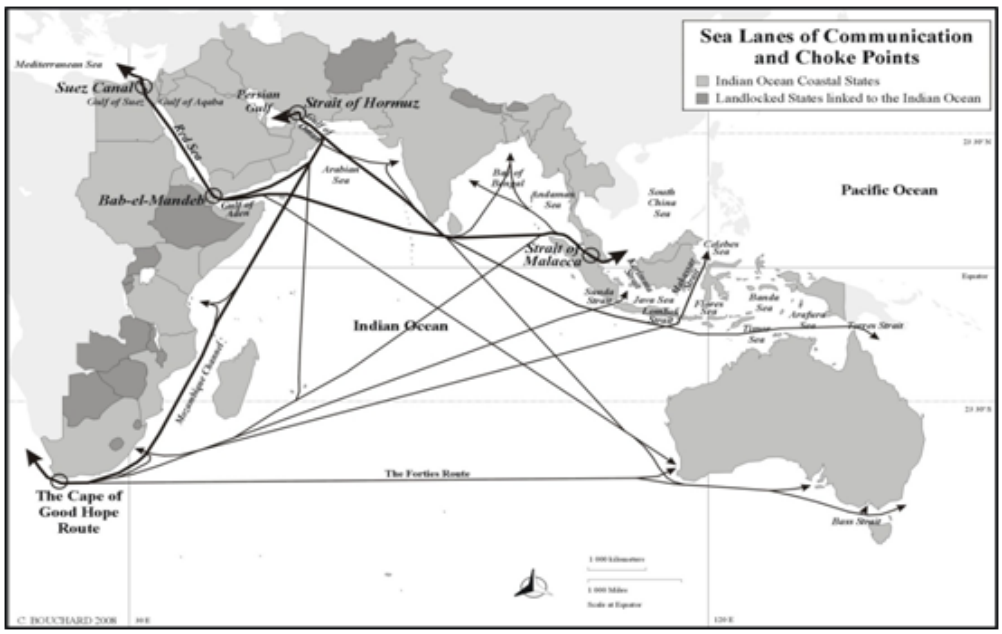
Figure 1. The Number of Piracy Accident in 2008

In addition, most of the states of the Indian Ocean as well as external actors such as China and the United States are characterized by a mix of maritime security concerns and motives.[7] However, there is no dominant maritime force in the Indian Ocean comparable to the U.S.-Japan alliance in the Pacific Ocean. In this sense, the Indian Ocean has more 'anarchic' feature than the Pacific Ocean. Therefore it is necessary to seek cooperation between states for the enhancement of maritime security, the effective law enforcement, and the maintenance of maritime order against challenges in the maritime sphere. Of course, there are several maritime security regimes in the Indian Ocean, although they are not enough to control the Indian Ocean effectively. For example, the Indian Ocean Rim Association for Regional Cooperation (IOR-ARC)[8] was formed in March 5, 1997, in Mauritius. The mandate of this international body of littoral states was to boost economic cooperation amongst its member states. Meanwhile, Australia's efforts to introduce a security agenda have not been successful; indeed, the organization has ignored issues of maritime cooperation. The charter of the association does not even mention the issue, and only one of the projects of the works program examines the subject of development, upgrading and management of ports.[9] Also, the Bay of Bengal Initiative for Multi Sectoral Training and Economic Cooperation (BIMST-EC)[10], which was launched in 1997 and

7. Donald L. Berlin (2008) *The Evolving Trends in Maritime Security, Maritime Security in the Indian Ocean Regions; Critical Issues in Debate*, pp.29-30, Center for Security Analysis.
8. There are 19 full members, which are littoral states such as Australia, India, South Africa, Singapore, Indonesia, Malaysia, Kenya, Mauritius etc. and 5 dialogue partners, which consist of China, Egypt, France, Japan, United Kingdom. The U.S doesn't join in IOR-ARC (Wikipedia Dictionary, As of 5 June 2010).
9. Cdr. P K Ghosh (2004) Maritime Security Challenges in South Asia and the Indian Ocean: Response Strategies, A paper prepared for the Center for Strategic and International Studies – American-Pacific Sea lanes Security Institute conference on Maritime Security in Asia, Honolulu, Hawaii.
10. Aims and purposes of BIST-EC/BIMST-EC are to create an enabling environment for rapid economic development, accelerate social progress in the sub-region, promote active collaboration and mutual assistance on matters of common interest, etc. See details at http://www.bimstec.org

Southern Africa Development Cooperation (SADC)[11] devoted a limited amount of attention to marine and coastal issues and are ill-equipped to deal with newly-emerging maritime security threats.

The post-Cold War era has also heralded a strategic shift in thought for maritime policy from the economic perspectives. Globalization dominates strategic considerations. This has led to enhanced maritime security concerns, since most regional trade is sea-borne. However, the Indian Ocean is home to many choke points, such as the Straits of Hormuz, Gulf of Aden, Straits of Malacca, Lombok and the Sunda Straits. Any disruption in traffic flow through these points can have disastrous consequences. The disruption of energy flows in particular would be a grave security concern for littoral states, as the majority of their energy lifelines are sea-based. Since energy is critical in influencing the geo-political strategies of a nation, any turbulence in its supply has serious security consequences (Ghosh,



Source: Sanjay Chaturvedi (2009) A presentation on International Conference on Piracy and Crime at Sea, Kuala Lumpur, 18-19 May

Figure 2. SLOC and Choke Points in Indian Ocean

11. The Southern African Development Community (SADC) has been in existence since 1980, when it was formed as a loose alliance of nine majority-ruled States in Southern Africa known as the Southern African Development Coordination Conference (SADCC), with the main aim of coordinating development projects in order to lessen economic dependence on the then apartheid South Africa. The founding Member States are: Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, United Republic of Tanzania, Zambia and Zimbabwe. See details at http://www.sadc.int/

2004). Given the spiraling demand for energy from India, China and Japan, it is inevitable that these countries are sensitive to the security of the sea lines of communication (SLOCs) and choke points of the region.[12]

Also, as climate change has increasingly affected marine environment, marine disasters such as tsunami can be a newly emerging threat on maritime security in the Indian Ocean. In order to response tsunami, navy coalitions led by the U.S have played a key role at a bilateral and multilateral level. For example, U.S navy and Japan's Self-Defense Force(SDF) have worked together on disaster relief operations following the December 2004 tsunami in the Indian Ocean. Also, talk of a quadrilateral group — the United States, Japan, Australia, and India — has emerged. Advocates for expanding quadrilateral cooperation have pointed to the "Regional Core Group" that formed in the aftermath of the 2004 Indian Ocean Tsunami.[13] Also, The United States and the ASEAN launched the U.S.-ASEAN Enhanced Partnership Initiative in November 2005 to foster cooperation. One of the key components of the Enhanced Partnership is about political and security cooperation, and its initial projects have included post-tsunami assistance.[14]

Against this backdrop, China has growing interests in the Indian Ocean and seeks strategic influence due to the following reasons. First of all, there is increasing burden from the existence of Indian Navy (IN). Although the Indian Navy is medium-size blue-water force and the fourth largest in Asia (after Russia, China and Japan)[15], its presence in the Indian Ocean has seemed as a block to China's advance toward the Indian Ocean. As has been the case with virtually all great powers, India which has consolidated power in its own region would be tempted to exercise power farther (Berlin, 2008). Under these circumstances, China has interests in preventing India from enlarging the Indian security perimeter and achieving a position of influence in the Indian Ocean region overall.

Also, as China's economy is remarkably growing, Africa becomes more attractive region to China for its potential for natural resources. China's development activities for offshore oil and gas resources are facing increasing blockage from neighboring countries. For example, in South China Sea, it confronts history old territorial disputes with Vietnam, Philippines, Brunei, and Malaysia. In the Yellow Sea (East China Sea), China, Japan and Korea have not reached a 'maritime boundary agreement' to draw EEZs and Continental Shelf lines. In addition, China's expansive strategy into overseas oil and gas field in the Pacific Ocean has been blocked by Japan's extension movement backed up by the

12. Security of transport of oil and gas has become a growing element of energy security. For sea lanes, various choke points around the world are seen as vulnerable-/some 40 percent of all seaborne oil goes through the Hormuz Strait and almost 40 percent goes through the Malacca Straits (Harris, Stuart (2004) Global and regional orders and the changing geopolitics of energy. *Australian Journal of International Affairs*, p.170).
13. Emma Chanlett-Avery and Bruce Vaughn (2008) Emerging Trends in the Security Architecture in Asia: Bilateral and Multilateral Ties Among the United States, Japan, Australia, and India. *CRS Report*.
14. Bruce Vaughn (2007) U.S. Strategic and Defense Relationships in the Asia-Pacific Region. *CRS Report*.
15. Rahul Roy-Chaudhury (2000) *India's Maritime Security*. Institute for Defence Studies and Analyses.

U.S.-Japan alliance. Faced with eastern boundary conflicts and disputes, China inevitably changed its way toward Indian Ocean, and accordingly, toward Africa for securing natural resources.

Last but not least, one of China's important interests in the Indian Ocean is securing SLOC for energy security. China's oil import dependence has placed energy security issue high on China's foreign security policy agenda. In response, it pursues political relationships with oil and gas-exporting countries in the Middle East and Africa. China has become the largest new investor, trader, buyer and aid donor in African countries. Chinese trade with sub-Saharan Africa is growing at 50 percent a year. Already that trade has jumped in value from $10 billion in 2000 to about $50 billion in 2007. Out of China's roughly $1.5 billion investment in Africa in 2006, about half of it went to resource-rich nations for building infrastructure and for securing resources including oil and gas.[16] And at current levels of consumption, the oil import dependence of China is expected to reach 61 percent by 2010 and 76.9 percent by 2020. For securing transportation security of resources and trade goods, China views SLOCs as its very lifelines. For China, the strategic significance of the Indian Ocean region as a source of energy and as a transit route increases every year(Berlin, 2008). However, China has a strong fear of a blockage of the Hormuz, Gulf of Aden or Malacca Straits by pirates and terrorists. It wants to reduce its vulnerability to sea lane threats.[17]

4. China's Practices for Maritime Security in Indian Ocean: comparative approach with Pacific Ocean

China is facing the Pacific Ocean and the Indian Ocean seaward. As seen above, although China used its maritime potential only for coastal security before the advent of post Cold-War era, it has pursued 'blue water' maritime strategy almost for two decades. However, its eminent navy presence in the Oceans has often been regarded as a threat to neighboring adversaries such as India, the U.S and its military alliances. This means there is a limit to pursue 'hard sea power' and it can bring 'maritime security dilemma', under which arms race in navy force among nations can be accelerated. This situation necessitates a consideration of the pursuit of 'soft sea power' for China. Soft power policy can be a more useful tool for the enhancement of China's maritime influence in maritime security, both in the Pacific Ocean where US-Japan alliance remains strong as a vestige of Cold-War era and in the Indian Ocean where non-traditional threats to maritime security

16. Robert I. Rotberg (2008) *China into Africa : Trade, Aid and Influence*. World Peace Foundation.
17. Harris, Stuart (2010) Global and regional orders and the changing geopolitics of energy. *Australian Journal of International Affairs*, pp.174-175.

has newly emerged.

Based on this assumption, I will assess China's practices in maritime security in the Indian Ocean from the diplomatic, political/military and economic perspectives, in comparison with those in the Pacific Ocean, with a consideration of maritime security environment and Chinese interests in Indian Ocean that I discussed above.

4.1 Diplomatic Perspective

In the Pacific Ocean, US-led sea interdictions have been ongoing in maritime security sector since the outbreak of the 9.11 terrorist attacks of 2001. One of the interdictions is PSI, which is a strategy calls for a comprehensive approach to prevent hostile states and terrorists from obtaining WMD. The U.S has also expanded PSI westward from Pacific Ocean. Possibly related to the PSI are the annual Southeast Asia Co-operation Against Terrorism (SEACAT) organized by the US Navy in the Philippine and the South China Seas. During the 2005 exercise the Indonesian, Philippine, Singaporean and Thai navies conducted visit, board, search and seizure (VBSS) exercises on 'rogue ships'. Meanwhile, the US and Singaporean navies launched the first phase of the annual Cooperation Afloat Readiness and Training (CARAT), conducted from June through August 2005 with six Asian nations including, Indonesia for the first time since 2002. For the first time, search and seizure were introduced into the CARAT exercise.[18]

Also, in maritime security sector, U.S has actively promoted a series of voluntary trade programs in order to enhance security of trade into U.S. seaports.[19] The two principal voluntary programs are the Container Security Initiative (CSI) and the Customs-Trade Partnership against Terrorism (C-TPAT). CSI is implemented by entering into bilateral agreements which allowed both nations to send inspectors to each other's ports. The

18. Valencia, Mark J. (2005) The proliferation security initiative. *Adelphi series*, pp.25-38.
19. After the 9.11 terrorist attacks in 2001, security assurance across international trading system is becoming a critical factor for international business managers and governments. While the initial concern of crisis management was on vulnerability to the air transportation system, the attention moved to security in the maritime sector and then regarding inland transport. Accordingly, the international organizations and United States have actively developed a number of initiatives focusing on global security issues. Certain international organizations such as International Maritime Organization (IMO), World Customs Organization (WCO), and International Organization for Standardization (ISO) have supported enhancing regulatory coverage of safety and security within the world trading system. In the maritime sector, IMO implemented the new security plans set out in International Ship and Port Facility Security (ISPS) Code, which contained detailed security related requirements for governments, port authorities, and shipping companies together with a series of guidelines to meet these requirements. ISPS is one of a number of amendments to the 1974 Safety of Life at Sea Convention (SOLAS). WCO also developed a regime in order to enhance the security and facilitation of international trade, which was the WCO Framework of Standards to Secure and Facilitate Global Trade. And ISO developed the Publicly Available Specification (PAS 28000) for a security management standard to improve the security of supply chains. (Korea Maritime Institute (2008), Study on Establishing Logistics Security System (in Korean)).

inspectors have the authority to inspect containers being shipped by sea. C-TPAT seeks to develop cooperative relationships between the companies in the global supply chain and the U.S. authorities.

In sum, in the Pacific Ocean, there are some security regimes led by the U.S for maritime security: PSI and CSI/C-TPAT. These regimes are the product of cooperation among nations. But the underlying aim is to protect U.S national security from sea-originated threats, rather than to protect international maritime interests.

Environment of marine security in the Indian Ocean is unlike that in the Pacific Ocean. There is the lack of a dominant actor like the U.S and non-traditional threats on maritime security are more prevalent. This environment can give more strategic chance for China to dispel the 'China threat'[20] concern from neighboring states including India. This can lead China's growing initiatives in the Indian Ocean for peaceful purposes and facilitate the regional perceptions that China's intent in the region is benign. Let me introduce a good case. In December 2008, the Chinese cargo ship 'Zhenhua 4' was seized by pirates. Taking this opportunity, China dispatched three warships to Gulf of Aden in Africa.[21] Although China's underlying purpose is to secure sea route for transportation of resources from Africa, it was clearly done as a compliance with Resolutions of United Nations Security Council[22] to cooperate with international community. This Chinese Navy's activity of entering the Indian Ocean for anti-piracy and escort missions can be evaluated as opening a new chapter in the naval history of the nation.[23]

At a bilateral level, China in cooperation with Russia tries to expand its presence in the Gulf of Aden and conducted Blue Peace Shield 2009, a joint exercise involving counter piracy operations (Vijay Sakhuja, 2009). However, at a multilateral level, China seems to be less influential in the Indian Ocean because established multilateral maritime security initiatives are mainly led by India, which is worrying about China's military expansion in Indian Ocean. Among them is the Indian Ocean Naval Symposium (IONS)[24], which is a brain child of Indian navy and meets every two years. The Second meeting of IONS was held in Dubai from 10-12 May 2010 with 32 littoral nations in the Indian Ocean. Among other security issues concerning the Rim area, this year's meeting largely focused on piracy, smuggling and terrorism affecting the Indian Ocean region(IOR)[25]. This

20. Vijay Sakhuja (2009) Maritime Multilateralism: China's Strategy for the Indian Ocean. *Journal of Analysis and Information*, p.12.
21. China to Aid in Fighting Somali Pirates. *The Washington Post* (2008.12.18).
22. For more details, see UNSC S/RES/1816, S/RES/1838, S/RES/1846, S/RES/1851. http://www.un.org/Docs/sc/unsc_resolutions08.htm
23. Ye Hailin (2009) Safe Seas; As China relies more on the ocean, maritime security becomes a greater concern. *Beijing Review.*
24. IONS is an initiative by 33 Indian Ocean littorals wherein their navies or the principal maritime security agencies discuss issues of maritime security, including Humanitarian Assistance and Disaster-Relief. For more details, see at http://indiannavy.gov.in/.
25. Joshy M. Paul (2010) Cooperative Security in the Indian Ocean Region: The IONS Way. *RSIS*

clearly shows that IONS is well operated as one of the most effective devices to address non-traditional threats without China.

Nonetheless, in the Indian Ocean, China can choose 'cooperative' and 'multilateral' methods to combat non-traditional threats including piracy. This can be one of the best policies for maritime security on diplomatic perspective, based on the concept that non-military methods, instead of military methods, are fit to tackle non-traditional threats. Of course, there are some issues ahead to tackle, among which are to clear concerns of 'military presence' and to take advantage of established multilateral cooperative body such as IONS.

4.2 Political/Military Perspective

In the Pacific Ocean, the United States has played a pivotal role as a dominant power. It has begun to respond to the shifts and challenges in several ways[26]. It has sought to reinvigorate its bilateral alliances and security ties with regional states such as Australia, Japan, and Singapore; launched an ASEAN-U.S. Enhanced Partnership Agreement; reopened military-to-military ties with Indonesia; and raised the profile of the Trilateral Security Dialogue with Japan and Australia. It also has embarked on a major initiative to develop a strategic security relationship with India. Currently, the Pentagon seems to be in front of the rest of the U.S. government in fostering actual multi-national security cooperation among the major democratic states of Asia.[27]

Especially, to U.S. policymakers, the key challenge is to develop a strategic posture in the region that can accommodate China's peaceful economic rise while sending the signal that the United States is not leaving a geopolitical vacuum for China to fill. Developing joint capabilities through enhanced defense partnerships with likeminded states may discourage China from asserting itself in ways that harm U.S. interests (Chanlett-Avery and Vaughn, 2008). Actually, US-led alliance has succeeded in blocking China and China seems to be satisfied with the status quo.

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26. The U.S. hopes that engagement and economic development will lead China to become increasingly democratic and a stakeholder in global economic and political affairs. While the United States is hedging against the possibility that China's rise will be less benign, it welcomes a peaceful and prosperous China. In this context, the U.S. has sought to strengthen existing alliances and develop new strategic and defense relationships in the region while better positioning its regional military capabilities by restructuring and redeploying its forces in the region (Bruce Vaughn, *CRS* (2007)).
27. Kerry Dumbaugh (2008) China-U.S. Relations: Current Issues and Implications for U.S. Policy. *CRS Report.*

Source: U.S. Strategic and Defense Relationships in the Asia-Pacific Region, *CRS* (2007)

Figure 3. U.S Treaty Allies in the Pacific Region

In the Indian Ocean region, China's position has been a little different from that in the Pacific Ocean. China has used 'bilateral relations' with Iran as a regional partner to offset the U.S's influence[28] and 'Sino-Pakistan relations' to counterbalance the influence of India.[29] This policy, however, is also close to 'continental-based' and 'antagonistic' one. Considering the changing maritime security environment in the Indian Ocean, China doesn't need to stick to the 'balancing strategy'. Also, China has no territorial claims and the paramount concern. Animating Chinese interests in the Indian Ocean is energy security, which requires cooperation with other nations. Therefore, for now, soft power can offer China an inexpensive way to project influence into new geographic domains without a need to back up its diplomacy with large military forces. For instance, China doesn't hope to repeat its erraneous blunder of 2004/05, when it remained conspicuously aloof from the tsunami relief effort − allowing India, Japan, and the United States, its chief rivals at sea, to harvest goodwill from their naval diplomacy. Cooperation in the areas such as disaster relief, piracy and counterterrorism could lay the groundwork for a more durable partnership in maritime affairs in Asia, alleviating the concerns about sea-commerce security that could prod China in a more ominous direction.[30]

28. International Crisis Group (2010), The Iran Nuclear Issues: The View from Beijing. *Update Briefing.*
29. Bruce Reidel and Pavneet Singh (2010) U.S.-China Relations: Seeking Strategic Convergence in Pakistan. *Foreign Policy At Brookings.*
30. Holmes, James R. and Yoshihara, Toshi (2008) China's Naval Ambitions in the Indian Ocean. *Journal of Strategic Studies*, pp.390-391.

At a political/military level, there is a need for China to utilize 'soft power' based on cooperation with other nations including India and the U.S with a consideration of maritime environment in the Indian Ocean, even though it may stick to naval presence strategy against military alliances against China's advance toward the Pacific Ocean.

4.3 Economic Perspective

China's seeking and securing national resources are omnidirectional because it doesn't care whether they are in the Pacific Ocean or in the Indian Ocean. If there is a difference to China, developing natural resources in Africa is ongoing (for now), while that in Pacific region is a willing (for the future). Also, threats on SLOC are bigger in the Indian Ocean, mainly due to piracy in Malacca and Gulf of Aden. This shows China's maritime security policy for economic purpose should focus more on the Indian Ocean than on the Pacific Ocean.

However, despite China's high dependence on imported oil from the Indian Ocean region and the strong interest in SLOC security for its seaborne trade, there is a criticism that China has made to date only limited attempts to contribute to regional cooperative efforts in tackling piracy or maritime terrorism threats.[31] This should be changed because the geopolitics of energy security for Indian Ocean energy stakeholders must also involve different forms of regional cooperation with neighboring states as well as a variety of aspects of a resource diplomacy strategy both with near neighbors and especially with distant suppliers.[32]

In short, China can choose maritime security policy for regional and international cooperation, through which the safety of its SLOCs can be ensured. <Table 1> shows SWOT analysis on the opportunity and threat in maritime environment in the Pacific and Indian Ocean for China, and the strength and weakness of China's practices in the Indian Ocean.

Table 1. Maritime Security in Indian Ocean and China's Policy

		Diplomatic Level		Political/Military Level		Economic Level	
		O	T	O	T	O	T
Pacific Ocean	Environ-ment	Anti-Terrorism cooperation Regime(PSI, C-TPAT, CSI)	Westward expansion of military alliances led by the U.S	Western Pacific Naval Symposium (WPNS)	Military Alliances (U.S-Japan, trilateral..)	Natural resources in Pacific Islands	Competition with economic powers for securing resources

31. Rosenberg, David and Chung, Christopher (2008) Maritime Security in the South China Sea: Coordinating Coastal and User State Priorities. *Ocean Development & International Law*, pp.51-68.
32. Sanjay Chaturvedi (2008) Securing Energy Flows: Social Constructions of Indian Ocean-Space, Maritime Security in the Indian Ocean Region: Critical Issues in Debate, Center for Security Analysis.

		Diplomatic Level		Political/Military Level		Economic Level	
Indian Ocean	Environment	O	T	O	T	O	T
		Lack of dominant power, prevailing non-traditional threats(pirate, maritime terrorism)	India-led Cooperative Maritime security regime (IONS) Prevailing Distrust on China's military presence	Traditional allies(Iran, Pakistan) Cooperative climate (dispatch of navy for combating piracy)	Increasing U.S navy's activities (tsunami relief activities)	Core Supplier of Natural resource	Threats on SLOC Lots of Choke Points
	China's Practices	S	W	S	W	S	W
		Leading Cooperative bodies with African Countries (FOCAL, NEPAD)	Lack of participation in the cooperative multilateral bodies	Dispatch of PLA to fight piracy, Navy modernization according to Blue water strategy	Lack of cooperative activities with other joint navy activities	Donate enough aids and investment in Indian Ocean countries including Africa	Lack of cooperative policy for secure SLOCs

Note: S(Strength), W(weakness), O(opportunity), T(Threat), PLA(People's Liberation Army)

5. Prospect for Korea's Maritime security policy

At present, China's maritime security policy seems different according to its stage. In the Pacific Ocean, China pursues expanding its maritime prowess with standing against the bilateral U.S-Japan(or trilateral Korea-U.S-Japan). This is often revealed as a challenging and threatening behavior, which causes warlike response from neighboring states spearheaded by the U.S. On the other hand, in the`Indian Ocean, there remains much room for China to pursue strategic harmony with other states including the U.S. China prefers multilateral cooperation to unilateral military operation for its national core interest; securing resources and SLOC.

Considering its practices, China's maritime security policy has meaningful implications for Korea maritime security policy. First, Korea also should establish different maritime security policy according to where it is applied because it also has different national maritime interests in coastal, offshore area and the far oceans. Korea is surrounded by China, Japan, Russia and North Korea. Even in the Post-War period, Korea has been thought of as the last frontline between democracy and communism. In particular, as seen from the sinking of a South Korean Navy warship by strike from North Korean submarine off its western coast, the potential threat from North Korea has kept South Korea still on alert. So in coastal and offshore area, it is a matter of course that the prior national maritime interest is 'national security'. On the other hand, Korea remains flexible in pursuing its maritime interest in the Oceans. Korea has interrelated 'national interest' of securing raw

materials, natural resources and their SLOC from pirates rather that 'security' alone. However, although Korea prefers bilateral alliance with the U.S and Japan in Pacific Ocean, it can focus on multilateral cooperative mechanism in Indian Ocean.

Second, Korea should prepare for the possibility of China's pursuit for the global maritime hegemony by breaking balance of power with the U.S and Japan in the Pacific region. If China provokes the U.S and neighboring nations, it can come into conflict or limited warfare, even though the chance is very low. In this case, Korea can be 'chain-ganging'[33] into the conflict or military confrontation according to the 'paradox of alliance'. Also, Korea has issues of maritime delimitation and exploitation of marine resources in East China Sea to be solved with China. Furthermore, if the military conflict between the U.S and China is escalated in South China Sea, it can lead to blockade of SLOC and do detrimental harm to Korean economy. In reality, the U.S navy ship called 'Impeccable' conducted 'scientific surveillance' in the EEZ of China in March last year and it caused strong criticism from Beijing that the U.S. activity in the Chinese EEZ violated its jurisdiction seriously. The U.S also conducted joint navy exercise with Vietnam in South China Sea for the first time in 35 years after the end of Vietnam War. Most of navy experts evaluated that the joint exercise was intended to show the U.S willingness to deter Chinese military expansion in South China Sea. In this regard, I think Korea can play a coordinator's role of preventing conflicts between the U.S and China from escalating into disputes.

Third, Korea should beef up its navy's capability in a modern way. Recently, the average growth of military budget has been over 7% since 2000, which exceeds the global average. In particular, China spent total 85 billion dollar in 2008(17.1 % of annual growth rate), compared with Japan(46 billion dollar, 0.6%) and South Korea(24 billion dollar, 5%).[34] Also, the expenditure for navy forces has mainly been used to secure brand-new ships such as submarines or aircraft carriers and develop cutting-edge technology for surveillance. In order to maintain minimal navy deterrence in East Asia and to expand cooperative navy support in the Oceans including in Indian Ocean, Korea needs to increase its budget for modernized navy forces.

In short, like China, Korea needs to set up balanced maritime security policy considering its national interest in coastal, offshore region and the Oceans. From the point of foreign policy, Korea should prepare for the 'hegemonic dispute' between China and the U.S. Also, Korean navy needs to evolve into modernized forces equipped with high tech equipments.

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33. 'Chain ganging' is a jargon term in the field of international relations describing the elevated probability for inter-state conflict or conflagration due to several countries having joined together in alliances or coalitions (Wikipedia, as of 17 Sep 2010).
34. Lee Suh-Hang (2009) *Implication for Strengthening of Navy Forces in East Asia*, Institute of Foreign Affairs National Security (in Korean).

6. Conclusion

China is dramatically changing. Economically, China became the second largest economic power and almost all the developing nations want to attract investment from China. Politically, it also became enormously powerful in the international stage. But the gigantic growth of China has triggered another concern that it will project its influence around the Oceans in order to have maritime hegemony. Actually, China recently provoked conflicts with Japan, Philippines, Vietnam as well as the U.S in South and East China Sea. However, it would be premature to conclude that Chinese maritime security policy is quite offensive for securing maritime hegemony because it has made its positive contribution to peacekeeping, disaster relief and count-piracy operations specially in the Indian Ocean.

In the Indian Ocean, there is no dominant maritime power, unlike in the Pacific Ocean where bilateral military alliances led by the U.S are playing a key role in maintaining the maritime status quo. Also, there is much room for cooperation among nations because non-traditional security issues such as piracy, armed robbery against ships and illegal transportation of WMD cannot be tackled by one or some nations. In particular, Africa and Middle East region are strategically important because they are major source of raw materials and natural resources for its economic growth. Thus China's maritime security policy will pursue better ways of multilateral cooperation to secure the resources abroad and their SLOC.

For Korea's sake, multi-leveled maritime policy will be needed. At a bilateral level, Korea should consolidate military alliances with the U.S and Japan. This is very crucial to 'national security' against North Korea's provocation. At a multilateral level, it needs cooperation among nations to fight against non-traditional security threats like piracy, armed robbery., etc. This will be also conducive to secure natural resources abroad and their SLOC. Finally, at a unilateral level, it should strengthen capability of navy forces and play a coordinator's role between the U.S and China in case of their hegemonic dispute.

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An Application of Dynamic Factor Model to Dry Bulk Market

- Focusing on the Analysis of Synchronicity and Idiosyncrasy in the Sub-Markets with Different Ship Size -

Byoung-wook Ko*

ABSTRACT

BDI actually has weighed more on larger-size market. So, calculating the synchronicity of dry bulk sub-markets by using BDI as reference indicator could lead to mistake. Therefore, for the analysis of synchronicity and idiosyncrasy of dry bulk markets, this paper constructs a dynamic factor model of the change rate of BDI's constituting indices and then it performs maximum likelihood estimation. One important finding is that, for such larger ships as Capesize and Panamax, there has been a significant increase in their synchronicity with global common factor after the 2008 global financial crisis, but for the other smaller ships, the opposite phenomenon has been observed.

This paper suggests two important future research topics. One is extending the suggested dynamic factor model with the structural change (regime switching). The other is constructing a new index for the level, not the change rate, of the status of global dry bulk market. The author believes that the combination of these issues could produce an alternative index to BDI.

Key words: Dry Bulk Shipping, Dynamic Factor Model, Synchronicity and Idiosyncrasy, Structural Change

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1. Introduction

The Baltic Dry Index (BDI, hereafter) has been used widely as a representative barometer for the global dry bulk market. The history of the emergency of BDI is as follows: At first, in 1985 the Baltic Exchange developed the daily freight index, Baltic Freight Index (BFI, hereafter) as a settlement mechanism for the then newly established Baltic International Freight Futures Exchange (BIFFEX) futures contract. In 1999 BDI replaced BFI. However, as the underlying asset of the BIFFEX contract, the Baltic Panamax Index (BPI, hereafter) superseded the BFI. In July 2008 Imarex (International Maritime Exchange) launched derivative contracts on the BDI as well.[1]

BDI is a composite index consisting of some indices of sub-markets with different ship size, e.g., Capesize, Panamax, Supramax and Handysize. It is calculated as an equally weighted average of the sub-market indices.[2] So, one who is interested in the status of global dry bulk market (esp., its freight rate) may use BDI as an indicator. However, because the sub-market indices usually increase as the ship size increases, BDI actually has weighed more on larger-size market. Therefore, if we want to know the status of global dry bulk freight rate without larger-size bias, we should search for an alternative.

This paper attempts to satisfy this need of finding another indicator for the status of global dry bulk freight market. For this purpose, it adopts so-called (unobserved) dynamic (common) factor model which was introduced by Geweke (1977). This dynamic factor model usually handles a large set of time series data and extracts some small number of unobserved dynamic common factors. This technique has been used widely in macroeconomics and economic forecasting. This paper attempts to extract the virtual global dry bulk factor which would affect the dry bulk sub-markets. After measuring the common factor, the idiosyncratic component of each sub-market can be calculated.

However, the limitation of this paper is large, in the sense that it cannot suggest an alternative (level) index. This paper only focuses on the change rate of the indices of sub-markets. So, it can suggest the common component of their change rates, which is assumed to exist in the global dry bulk markets. Given its limitation, this paper provides some important information for the dry bulk market participants. By analyzing a dynamic factor model, it can measure the synchronicity and idiosyncrasy of the sub-markets in a unified framework. Furthermore, rolling the estimation over the sample period after 1 July 2009 picks up a potential structural change in their synchronicity.

This paper is organized as follows: Section 2 briefly reviews some recent literature studying the dry bulk market. Section 3 explains the data set and provides the dynamic factor model of the paper. Section 4 suggests the empirical results and their interpretations.

1 Alizadeh and Nomikos (2009), pp.108-113.

2 For the modifications of the BDI calculation, see the <Table 1> below.

Finally, the section 5 summarizes the paper and suggests the future research topics.

2. Literature Review

In the below paragraphs, the paper reviews two distinct strands of literature. One studied the BDI, focusing on its determination mechanism (See Chung and Ha, 2010a; Chung and Ha, 2010b; Rim *et al.*, 2010). The other was about the dynamic properties of dry bulk markets (See Chen *et al.*, 2010; Ko, 2010a; and Ko, 2010b).

Chung and Ha (2010a) analyzed the effect of the 2008 global financial crisis on the BDI. It adopted the error correction model in the form of ARDL (AutoRegressive Distributed Lag) suggested by Pesaran, *et al*. (2001). Among their empirical results, it is an important finding that there has been a co-integration relationship between the BDI and some explanatory variables such as China's iron import, Eurodollar interest rate and U.S. stock price. Chung and Ha (2010b) further investigated the time-varying effect of China's iron import, Eurodollar interest rate and U.S. stock price on the BDI by using the Kalman filter method.[3] Rim, *et al*. (2010) studied the dynamic relationship among the demand, supply and freight rate variables by using a recursive VAR model. They showed that the positive shock of the transport demand increases the future ship capacity and the BDI level. However, the positive shock of ship capacity does not influence the transport demand but does decrease the BDI level.

Chen, *et al*. (2010) investigated the interrelationship in daily returns and volatilites between Capesize and Panamax markets using the co-integration method of VECM (Vector Error Correction Model) and ECM-GARCH model. They split the sample period around the end of 2002 (or the start of 2003). Among the findings, an interesting fact is that in the second period Capesize prices tend to reflect new information more rapidly than Panamax prices. In summary, they insisted that this kind of research provides useful information for both shipowners and charterers to mitigate risks or to make extra profits by switching between the two markets.

Ko (2010a) analyzed the effect of the term structure of time-charter rates on the time-varying volatilities in the sub-markets with different ship size of dry bulk market. Inter alia, the hypothesis that there is bimodality in the supply curve of shipping freight markets is strongly supported and the fact that the market participants consider the backwardation shock in low uncertainty as more important than in high uncertainty is derived empirically. Ko (2010b) studied the change of the dynamics of dry bulk markets

3 Compared with the fact that Chung and Ha (2010b) uses the Kalman filter with time-varying coefficient model, this paper uses the Kalman filter with state-space model. For more explanation of this issue of Kalman filter, see pp.19-57 of Kim and Nelson (1999).

before and after the 2008 global financial crisis, comparing with that of pre-July 2003 when China effect was supposed to emerge. It adopted the method of 'counterfactual analysis with VAR' and showed that the main factor for the volatility reduction in some markets is the reduction of the shock itself but the main factor for the volatility increase in other markets is the increase of the shock persistence.

Among a large number of important articles on the dynamic factor models, I would like to mention a few following ones: Dynamic factor analysis in econometrics was introduced by Geweke (1977) and Sargent and Sims (1977) analyzed the main co-movement of postwar U.S. macroeconomic time series by using dynamic factor model. Stock and Watson (2008) addressed the instability issue of the dynamic factor model. This instability problem emerges due to the structural change of the considered economic system. For example, technology, policy regime and changes in the survey instruments may bring out the change of the model parameters. As shown in <Figure 1> and <Figure 2> of this paper, this instability issue is also applicable to dry bulk market. However, more in-depth analysis of the instability will remain as a future research topic. Stock and Watson (2006) explained the dynamic factor model with principal components analysis which are both interrelated closely. This work also presented some other approaches to forecasting economic variables by using a large number of dataset, for example, forecast combination (i.e., forecast pooling), Bayesian model averaging, etc. Stock and Watson (2005) examined VAR methods by using the dynamic factor models which are used to handle hundreds of economic time series. Inter alia, they provided a unifying framework that explains the implications of dynamic factor models for VAR.

In summary, the above mentioned works of Stock and Watson on dynamic factor model focuses on the macroeconomic phenomena, however. So, the application of dynamic factor model to shipping freight market in this paper can be differentiated from the previous literature.

That is, the contribution of this paper differentiated from the previous literature is that it analyzes the dynamics of BDI using the dynamic factor model, which has not been tried yet. Then, it suggests an alternative to BDI change rate as a representative index. This alternative framework makes us evaluate the synchronicity and idiosyncrasy of dry bulk markets in a unified model.

3. Data and Dynamic Factor Model

As mentioned earlier, BDI was introduced in November 1999 as the substitute for BFI. However, the calculation method changed over time. The table below shows a short history of BDI calculation.

Table 1. Modifications of BDI Calculation

Time	Modifications
1 Nov. 1999	BDI replaced BFI. BDI was calculated as an equally weighted index of BPI, BCI and BHI. The factor of BDI was 0.998007990.
2 Jan. 2001	BHMI replaced BHI. So, BHMI was used for the calculation of BDI.
3 Jan. 2006	BSI replaced BHMI. So, BSI was used for the calculation of BDI.
2 Jan. 2007	BHSI was used for the calculation of BDI. The multiplier of BDI changed from 0.998007990 to 1.192621362.
1 July 2009	BDI calculation procedure changed. - BDI has been comprised solely of timecharter routes, no longer including capsize voyage routes. - So, the formula has become as follows: BDI = {(CapesizeTCavg + PanamaxTCavg + SupramaxTCavg + Handy sizeTCavg) / 4} × 0.113473601, where TCavg = Time Charter average. The multiplier (0.113473601) was first applied when the BDI replaced BFI, and has changed over the years as the contributing indices and the methods of calculation have been modified.

Source: The Baltic Exchange (2010). The author excerpted and summarized.

This paper uses two data sets. One is from January 2007 to August 2008. The other is from 1 July 2009 to 18 October 2010. As shown in <Table 1>, the constituting indices of BDI differ across the two samples. For the first sample, the values of BCI, BPI, BSI and BHSI can be used as the indices. But for the second sample, the time charter averages of Capesize, Panamax, Supramax and Handysize should be used for the indices. The Clarkson website provides these averages, which were used in this paper. As a result, the data set of this paper is summarized in the following table.

Table 2. Data Set Description

Period	Data Set
Jan. 2007 to Aug. 2008	BCI, BPI, BSI, BHSI
July 2009 to Oct. 2010	Average of the 4 T/C Routes for Baltic Capesize Index Average of the 4 T/C Routes for Baltic Panamax Index Average BSI - Average of the 5 T/C Routes BHSI: Time Charter Average

Source: Clarkson

Using the above data set, this paper considers the following dynamic factor model:[4]

4 The dynamic factor model of this paper is based on the model suggested in p.35 of Kim and Nelson (1999).

For i = 1, 2, 3, 4,

$$y_{i,t} = \gamma_i \times c_t + z_{i,t}, \quad \cdots\cdots 1)$$

$$c_t = \varnothing \times c_{t-1} + v_t, \quad \cdots\cdots 2)$$

$$z_{i,t} = \varphi_i \times z_{i,t-1} + e_{i,t}, \quad \cdots\cdots 3)$$

where $|\varnothing| < 1$,

$$v_t \sim i.i.d.N(0, \sigma_v^2), \quad \cdots\cdots 4)$$

$$e_{i,t} \sim i.i.d.N(0, \sigma_{et}^2), \quad \cdots\cdots 5)$$

We assume that v_t and $e_{i,t}$ are all independent of one another. For the notation of i, i=1 represents Capesize, i=2 Panamax, i=3 Supramax (or Handymax), i=4 Handysize ship variable respectively. The variable, y, is the percentage change rate (measured by 100×the log difference) of the freight values, which are time-charter averages of Capesize, Panamax, Supramax and Handysize from 1st July 2009. But before 1st July 2009 they were the percentage change rate of the values of BCI, BPI, BSI, BHSI, respectively. In this model, the common factor is c_t, whose variance is set to be one for the normalization.[5] Therefore, γ_i measures the degree of synchronicity of the individual sub-market with the common component. In contrast, $z_{i,t}$ measures the idiosyncrasy of each market.

Equations 1) ~ 5) can be expressed in the following state-space model:

$$\tilde{y_t} = H \times \beta_{t,} \quad \cdots\cdots 6)$$

$$\beta_t = F \times \beta_{t-1} + \tilde{v_t},\ \tilde{v_t} \sim i.i.d.N(0, Q), \quad \cdots\cdots 7)$$

where $\tilde{y_t} \equiv (y_{1,t}\ y_{2,t}\ y_{3,t}\ y_{4,t})'$,

$\beta_t \equiv (c_t\ z_{1,t}\ z_{2,t}\ z_{3,t}\ z_{4,t})'$,

$\tilde{v_t} \equiv (v_t\ e_{1,t}\ e_{2,t}\ e_{3,t}\ e_{4,t})'$,

$$H \equiv \begin{pmatrix} \gamma_1 & 1 & 0 & 0 & 0 \\ \gamma_2 & 0 & 1 & 0 & 0 \\ \gamma_3 & 0 & 0 & 1 & 0 \\ \gamma_4 & 0 & 0 & 0 & 1 \end{pmatrix}, \quad F \equiv \begin{pmatrix} \varnothing & 0 & 0 & 0 & 0 \\ 0 & \varphi_1 & 0 & 0 & 0 \\ 0 & 0 & \varphi_2 & 0 & 0 \\ 0 & 0 & 0 & \varphi_3 & 0 \\ 0 & 0 & 0 & 0 & \varphi_4 \end{pmatrix},$$

$$Q \equiv \begin{pmatrix} \sigma_v^2 & 0 & 0 & 0 & 0 \\ 0 & \sigma_{e1}^2 & 0 & 0 & 0 \\ 0 & 0 & \sigma_{e2}^2 & 0 & 0 \\ 0 & 0 & 0 & \sigma_{e3}^2 & 0 \\ 0 & 0 & 0 & 0 & \sigma_{e4}^2 \end{pmatrix}.$$

5 This assumption of normalization means that there has been a virtual common component in the four dry bulk markets, whose variance is assumed to be $1/(1-\varnothing^2)$. If this variance varies across the sub-samples, the difference should come from the different value of $\varnothing$, which captures the persistence of the common component.

Equation 6) is the measurement equation and equation 7) the transition equation (or state equation). These measurement and transition equations consist of the state-space model of this paper.

4. Empirical Results and Implications

The estimation procedure of the proposed state-space model for the dynamic factor model is well explained on pp.22-29 of Kim and Nelson (1999). A short explanation of using Kalman filter as the estimation method of the above state-space model can be provided as the consecutive two steps (i.e., prediction and updating) in the following way:

Prediction:

Given the dynamics of the system (i.e., equations 6) and 7)), predict the unobserved variable, β_t, by using the information up to the last period. In the model of the paper, there is one uncertainty from the nature of the unobserved variable. That is, because this variable cannot be observed directly, there is always uncertainty. So, calculate its (co-)variance which indicates the degree of the uncertainty.

Updating:

As the observed variable, $(\tilde{y_t})$, is realized, the new information is available. That is, from the realization of $(\tilde{y_t})$, the prediction error can be calculated and this can be used for a more accurate inference on β_t. In this step of updating, so-called 'Kalman gain' is used. However, this estimate of β_t will be used as an input for the prediction in the next period.

This prediction and updating procedure will be iterated until the estimated parameters maximize the likelihood function which is a function of the prediction errors and their (co-)variances.

For the information on the change of synchronicity after the 2008 global financial crisis, see the estimates of γ_i (i = 1, 2, 3, 4) in <Table 3>. For such larger ships as Capesize and Panamax, the synchronicity with the common factor becomes larger. Especially, Panamax shows that its synchronicity has doubled. But for Supramax (or Handymax) and Handysize, there has been a remarkable decrease in their synchronicity with common factor. However, note that the persistence of the shock of common factor, $\varnothing$, has decreased a little.

Table 3. Estimates of Suggested Dynamic Factor Model

Classification	Jan. 2007 ~ Aug. 2008		July 2009 ~ Oct. 2010	
	estimates	standard errors	estimates	standard errors
γ_1	0.65	0.255	0.93	0.092
γ_2	0.53	0.114	1.09	0.038
γ_3	0.40	0.064	0.10	0.023
γ_4	0.19	0.059	0.08	0.021
$\varnothing$	0.93	0.025	0.80	0.030
φ_1	0.65	0.044	0.61	0.039
φ_2	0.79	0.039	0.73	c.n.
φ_3	0.74	0.060	0.91	0.022
φ_4	0.79	0.056	0.91	0.021
$\sigma_{\varepsilon 1}^2$	13.98	-	3.32	-
$\sigma_{\varepsilon 2}^2$	1.22	-	1.62	-
$\sigma_{\varepsilon 3}^2$	0.41	-	0.20	-
$\sigma_{\varepsilon 4}^2$	0.23	-	0.17	-

Note: c.n. means complex number
Source: Author

For the idiosyncrasy, see the estimates of φ_i and $\sigma_{\varepsilon i}^2$. For the two larger ships, the persistence of idiosyncratic shock has decreased a little. For the other smaller ships, the opposite phenomenon is observed. An interesting result is that the variance of idiosyncratic shock in Capesize market has decreased by about 76%. As a result, there is a significant reduction of the variance of idiosyncratic component in Capesize market, which is compared with the results that there have been little changes in the other markets with respect to the variance of idiosyncratic component. (See <Table 4> below.)

Table 4. Change of the Variance of Idiosyncratic Component

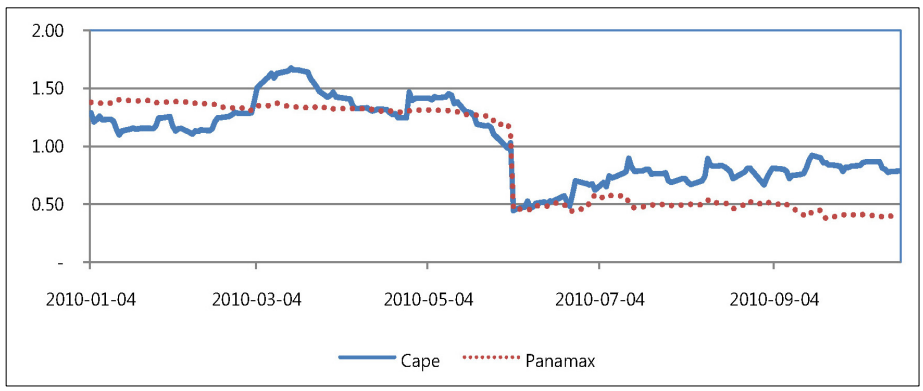
Classification	Jan. 2007 ~ Aug. 2008	July 2009 ~ Oct. 2010	Change
Capesize	24.21	5.29	-18.92
Panamax	3.25	3.47	0.22
Supramax	0.91	1.16	0.26
Handysize	0.61	0.99	0.38

Source: Author

Up to now, the paper assumes that the parameters of the model don't change in the considered sample period. However, if we relax this assumption for the second period, there emerges an interesting phenomenon. For a concrete example, given the possibility

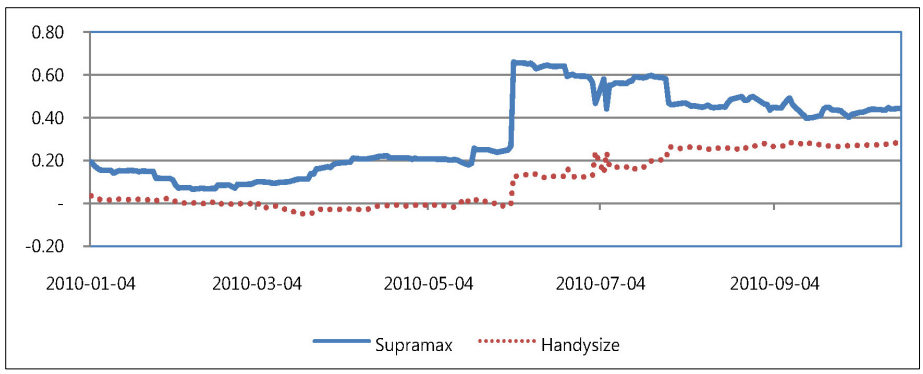
that there could be an instability of the coefficients, γ_i, rolling the estimation in the way, in which the sample consists of 7 months and thus depleting the first observation and adding the new last one, gives us the estimates of γ_i from 1st week Jan. 2010 to now (18 Oct. 2010). The plotted estimates for the four markets are shown in the following two figures (<Figure 1> and <Figure 2>).

The dynamics of γ_i's estimates in all the four markets strongly implies that there has been a structural change in the synchronicities of the markets. The time of a striking change is thought to be the beginning of June 2010. As of now, exceptionally the Capesize market shows a relatively high synchronicity (0.80 point) but the other three markets seem to converge to around 0.40 point in their synchronicities.



Source: Author

Figure 1. Evolution of Synchronicity (Cape & Panamax)



Source: Author

Figure 2. Evolution of Synchronicity (Supramax & Handysize)

Furthermore, as a bold statement, the fact that the BDI calculation simply assumes larger-ship bias could make the BDI not represent the underlying common status of global dry bulk market consisting of various sub-markets. That is, since the degree of synchronicities of individual markets could evolve, not proportionally in their ship size (or their relative level of time charter rate), there is a possibility that the equally weighted index of time charter averages of four sub-markets could not be a reference indicator to which the indices of sub-markets can be referred for the calculation of synchronicity. <Figure 3> shows that this possibility might exist in the sense that in occasion BDI change rate overestimates or underestimates the underlying common factor, given the virtual common factor suggested in this paper is the real factor governing the dynamics of global dry bulk market.

However, in spite of the above argument, the fact that the correlation between them is 0.64[6] and their means and standard deviations are almost the same implies that the BDI is a good indicator, although the underlying dynamics is the system of equations 1) ~ 5). Or as a reverse interpretation, we can say that the model of dynamic common factor captures well the properties of dry bulk markets.

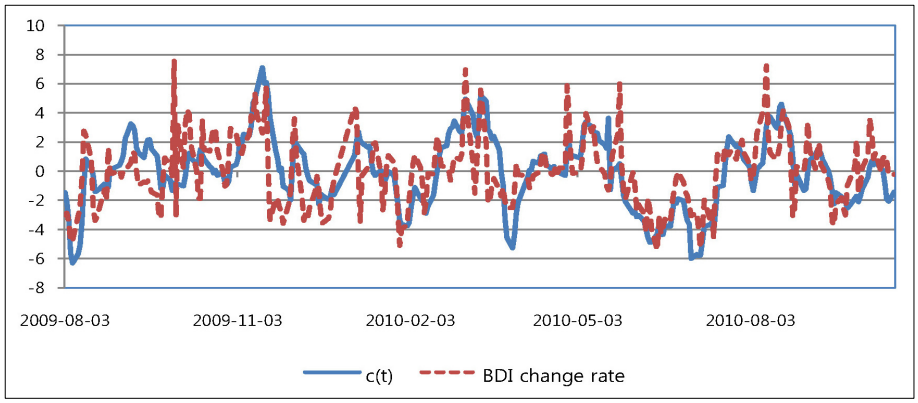


Figure 3. Comparison of estimated c_t and BDI change rate

5. Conclusion

This paper suggests an alternative measure for the status of global dry bulk market, especially focusing on the change rate, not the level, by using a dynamic factor model. For the estimation of the factor over time, it uses a state-space model and then performs the maximum likelihood estimation with the Kalman filter. Among the empirical findings,

6 Note that the correlation is not close to one. This implies that there is room for developing an alternative index representing the global dry bulk market.

the following three facts are worthy of mentioning: First, for such larger ships as Capesize and Panamax, there has been a significant increase in their synchronicity with global common factor after the 2008 global financial crisis, but for the other smaller ships, the reverse phenomenon has been observed. Second, the dynamics of the measures for synchronicity of considered markets shows that there has been a remarkable structural change around the beginning of June 2010. Third, there have been some occasions in which the BDI change rate overestimates or underestimates the underlying common factor, given that the virtual common factor suggested in this paper is the real factor governing the dynamics of global dry bulk market.

By the way, there are two important future research topics, which are interrelated with each other. First, modeling the structural change will be productive in that, as shown in <Figure 1> and <Figure 2>, this kind of research provides useful information on the dynamics of dry bulk market. For example, there are derivatives on BDI, BCI, BPI, etc, so this information helps the participants of these derivatives market to make more rational decision. This line of research will be the marriage of state-space models and regime switching.[7] Second, developing an alternative to BDI as an indicator for the level of the status of global dry bulk market will be fruitful. That is, as shown in <Table 3>, because there have been some cases of divergence between the BDI rates and the virtual common factors developed in this paper, there is room for developing a new index representing the global dry bulk market. This topic can be dealt with well by the approaches of Stock and Watson (1991) and Macho, *et al*. (1987). The former paper deals with the topic of developing a coincident index using 4 macroeconomic variables without co-integration relationship among the considered variables but the latter paper is on the estimation of the relationship among the variables that have a common stochastic trend component, which means that there is a co-integration relationship among them.

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7 For this issue, Kim and Nelson (1999) will be very helpful.

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Land-locked Country and Port Accessibility
- Mongolian Case -

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ABSTRACT

Land-locked countries tend to have bottlenecks and problems of high transport costs, complicated cross border procedures, long distance and remoteness to the global market, and limited accessibility to the sea.

Mongolia as a land-locked country recorded comparatively low economic growth rate in the 1980s and 1990s but it could obtain a new momentum of economic growth from the late 2000s due to a continual price increase of mineral resources and other export goods. However, high transport costs and low accessibility to the sea prevent Mongolia from diversifying its trading partners and export goods. This paper examines elemental factors of transport costs between Mongolia and trading partner countries through regression of transport costs, particularly using the ratio of cost, insurance and freight (CIF) amounts to free on board (FOB) amounts and container transport costs. This also scrutinizes the deciding variables of trade volume between Mongolia and trading partner countries by using the gravity model.

In a transport cost analysis, transport costs of less than container load (LCL) cargo are affected directly by the distance of land transport and shipping transport, and common border sharing with Mongolia. The effects from the density of transport infrastructures in a transit country and a partner country which were thought to be decisive in the paper by Limao and Venables (2001) are not clear in the analysis. In the gravity model on trade volume between Mongolia and trading partners, decisive factors are Gross Domestic Product (GDP) of a trading partner, and distance from Mongolia to trading partners.

Key words: Land-locked country, transport costs, accessibility, port, gravity model, trade

Journal of Economic Literature classification: Q2, O1, R3

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1. Introduction

Land-locked countries have bottlenecks and problems of high transport costs, complicated cross border procedures, long distance and remoteness to the global market which hinder these countries from promoting foreign trade and diversifying traded goods and trading partners. Nearly all of the land-locked countries except Western and Central Europe are poor and face high transport costs with low port accessibility (Gallup *et al*., 1999). On the contrary, coastal regions and coastal countries with geographic advantages could enjoy high economic growth due to low transport costs of export and import goods. The coastal regions are widely exposed to the trend of globalization and containerisation, and can get advantage of low transport cost from the competition among regional ports.

Mongolia is located at the intermediate area between North-East Asia and Europe and surrounded with China and Russia. Since Mongolia should transport its mining resources and traded goods to third countries via transit routes in China and Russia, transport costs and trade volume of Mongolia seem to be affected by transport infrastructure of China and Russia due to its geographical landlockedness. After the adoption of free market system in 1991, Mongolia has tried to raise its economic potential through diversification of export goods and trading partners. Due to the low accessibility to the sea with a few gateways such as Tianjin in China and Vostochny in Russia, Mongolia is barred from diversifying her trading partners and prolonging spatial range of export goods.

Mongolia needs new types of international cooperation and partnership in order to diversify its traded goods and trading partners. It also could propel maritime conventions with other nations as a mid and long term cooperation strategy in order to improve port accessibility in China and Russia. Especially, it needs close discussion and knowledge sharing on logistics policy development with the North-East countries.

This paper aims to examine the effects of accessibility of land-locked countries to a port through analysing transport costs of foreign trade in Mongolia, using the gravity model for explaining trade amounts and contents with trading partners, and adopting the models of Limao and Venables (2001) and Celine and Christopher (2008).

The next section of this paper reviews the disadvantage and economic barriers in land-locked countries, addresses main features of Mongolian trade, logistics system and transport characteristics. The section three presents data collection on foreign trade statistics and transport costs of Mongolia trade, and addresses regressions on transport costs and trade volume. When analysing effects of transport characteristics on transport costs, this uses different types of transport costs: the ratio of cost, insurance and freight (CIF) to free on board (FOB) by the foreign trade statistics of the International Monetary Fund (IMF), which informs transport costs of trade including all types of cargoes; the transport costs of less than container load (LCL) cargo between Mongolia and trading partners, which measures per ton costs for general cargoes and container cargoes. This also adopts the

gravity model in order to estimate the effects on trade volume between Mongolia and trading partners from GDP of partner countries, distance from Mongolia to partner countries, and other variables. The section four concludes this paper.

This tries to investigate a significant implication of port accessibility and its role for land-locked countries. This can also give answer to basic questions about the function of a port in a region. The effects and changes of port accessibility improvement of a land-locked country may bring broad positive effects into the country.

2. Challenges of Mongolia as a land-locked country

2.1 Background

Transport is essential to link countries and regions in spatial distance, and various economic activities. The flow of goods in transport networks is promoted by economic factors such as GDP, population, employment, and facilities; it is hindered by impediments, i.e., distance, transshipment between various transport modes, and additional processing for border crossing (Hesse and Rodrigue, 2004; Ng and and Gujar, 2009). Hence transport costs are affected by the characteristics of transport activity from origin to destination. Even though transport development promotes supply and demand, and enlarges accessibility to markets and opportunities for employment and business, it puts burden of costs for transporting goods and passengers.

The land-locked countries such as Nepal, Mongolia, and Swiss do not have coastal areas where a port can be built. Since they are blocked by other countries from approaching the sea, the United Nations Convention on the Law of the Sea (UNCLOS, 1982) defines the right of access of land-locked countries to and from the sea and freedom of transit transport.

Nevertheless, many land-locked countries have a few foreign ports and transit corridors for them. Generally, land-locked countries have lower accessibility to the global market due to the blockade to the sea, which burdens additional transport costs and border crossing costs on them, and also limits the usage of marine resources (Sarup, 1972; Bowen, 1986; Gallup *et al*., 1999; Rodrigue and Notteboom, 2010). The non-existence of port facilities prevents them from moving traded cargoes through the maritime transport, the cheapest form of international transportation, and reaching various markets (Bowen, 1986). From the view of neoclassical theory, the landlockness is thought to raise the price of imports, reduce the price of exports net of transaction costs, and deteriorate the terms of trade of land-locked countries (MacKellar *et al*., 2000). In addition, irregularity of delivery time in transit transport may bar the potential customers from concluding long-term export contracts and foreign investors from establishing plants in land-locked countries (MacKellar

et al., 2000). A small and land-locked country has the characteristics of inability to exploit economies of scale in production, vulnerability to external economic fluctuation, low accessibility to the global market, and difficulties in obtaining private foreign capital (Srinivasan, 1986).

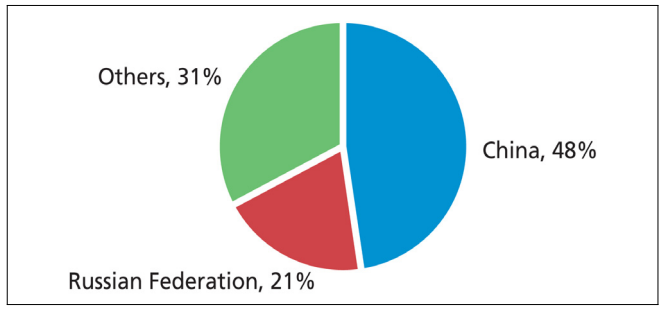
If a land-locked country is so remote from the sea, it would be hard to expect service quality competition by container ports in transit countries for enlarging their hinterlands (Rodrigue and Notteboom, 2010; Ferrari *et al*, 2011). Though a land-locked country with high density of population in a region may face high demand of agricultural products and low income level, a coastal country with population density can enjoy high income due to its reliance on foreign trade (Bloom *et al*., 2000).

However, remoteness and landlockedness may give an advantage of agglomeration to domestic firms, protecting them from the challenge of foreign firms through building an entry barrier due to higher transport costs (Behrens, 2006). The regional accessibility to the global market affects on the volume of trade and firm's location decision (Behrens, 2006). Improvements of the transport infrastructures in land-locked countries and transit countries will increase bilateral trades between land-locked country and trading partners (Limao and Venables, 2001; Celine and Christopher, 2008).

Differently from the existing papers, this paper tries to focus on examination of effects of transport characteristics − especially port accessibility − on transport costs and trade volume in Mongolia, which is a land-locked country in North-East Asia. This considers port accessibility of Mongolia as the inland distant from Mongolia to a main and exclusive gateway − the port of Tianjin-, adding the inland distance from a port in a trading partner country to the main city of the country. Even though the basic approach to the analysis of effects of landlockedness in this paper starts from the model by Limao and Venables (2001), this particularly focuses on the transport costs and volume of Mongolian foreign trade, while considering its excessive reliance of trading on China and Russia.

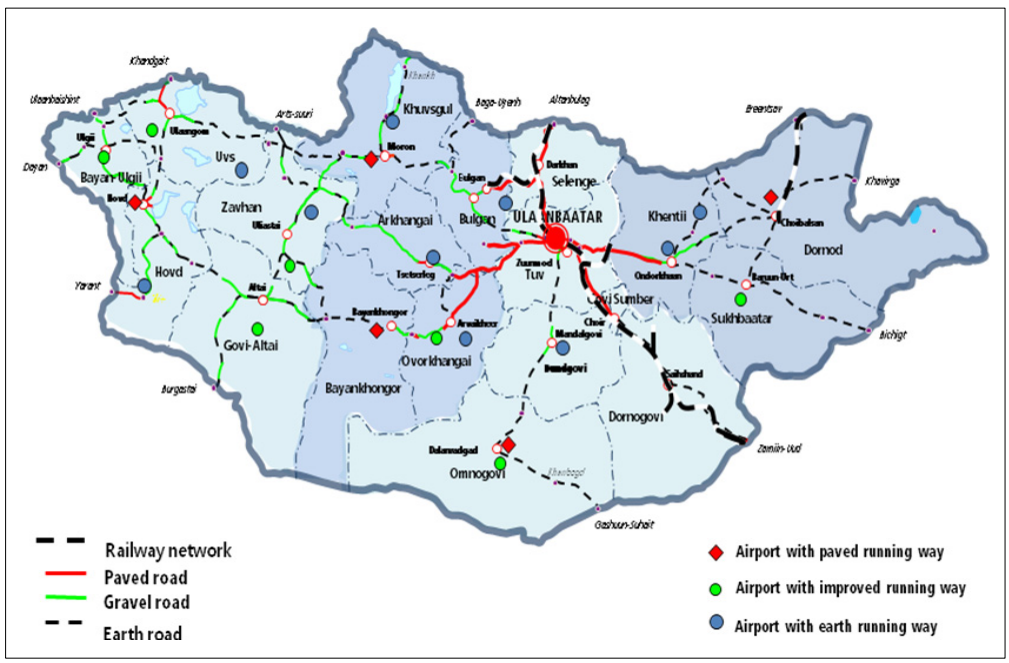
2.2 Main features of Mongolian trade

Total amount of Mongolian trade is about 4 billion US dollar in 2009, composed of 1.9 billion US dollar of export and 2.1 billion US dollar of import. Mongolia main trading partners are China and Russia, sharing about 70% of Mongolian total trade amounts (Customs General Administration of Mongolia, 2009). China shares 74% of Mongolian export; 25% of Mongolian import. Russia, which was the biggest trading partner of Mongolian in the 1990s, shares about 8% of Mongolian export; 36% of Mongolian import. Previously the shares of Russia for Mongolia export and import were respectively about 78% in 1990 (Kim and Yoon, 2010). After the adoption of market system in economy in 1991, Mongolia has tried to diversify its trading partners and to secure access to the sea through China and Russia (Jargalsaikhan, 2008).



Source: Customs General Administration of Mongolia (2009) International Merchandise Statistics.

Figure 1. Trading partner countries of Mongolian (2009)



Source: Ministry of Road, Transport, Construction and Urban Development of Mongolia, Road and Transport Sector (2010) Regional Cooperation in Road, Transport Sector.

Figure 2. Transport networks in Mongolia

The main export goods of Mongolia are mineral products including copper concentrate, coal, iron ore, and molybedenum concentrate, and main importing countries for Mongolian exports are China, Russia, U.K., USA, and Canada; the main import goods are petroleum products, gasoline, machinery and mechanical appliances, vehicles, aircrafts and parts of thereof, prepared foodstuffs, base metals and articles, products of the chemical or allied industries, vegetable products, and others from China, Russia, Korea, USA, Japan,

Germany, and other countries (Customs General Administration of Mongolia, 2009)

2.3 Logistics system and transport characteristics

Mongolia has key borders such as Zamyn Uud for China, Suhbaatar and Altanbulag for Russia, and minor borders i.e. Tseg and Gantsmaodao for coal export to China, and Chuluunhoroot for Russia. Zamyn Uud, Suhbaatar, and Chuluunhoroot have railway linkage with neighboring countries (Park, 2011). Railway borders can be divided into two types according to transshipment methods. It does not need to transship between the borders with Russia since two countries have the same size of railway tracks. However, the railway borders for Mongolia with China need transshipment due to the different sizes of railway racks.

Mongolia has access to the sea mainly through Tianjin port in China and seldom through Vostochny port in Russia. Mongolia government has tried to diversify gateway ports in order to lower transport costs and to secure the safety of access to the sea. New gateway ports would be those with handling facilities for containers, coal and others such as iron ore. Dandong, Dalian, Qinghuangdao, Tangshan, Tianjin, and Huanghua port in China can be considered as new gateways in North-East Asia for traded Mongolian goods. Meanwhile, Nakhodka, Vladivostok, and Vostochny of Russia, and Najin-Sunbong in North Korea could serve as gateway ports for the Pacific region.

The trunk line in Mongolia is composed of railway links. Through railways, shippers of Mongolia move container, coal, iron ore, copper concentrate, molybdenum concentrate, and other import and export goods (Park, 2011). In Mongolia, major railway stations are scattered along mining deposits: Erdenet station for copper, molybdenum, carpet, and other export goods; Baganuur station for domestically consumed coal; Eruu gol station at Selenge region for iron ore; Choyr station for coal from surrounding areas (Park, 2011).

The main container yards of railway station in Mongolia are located at Ulaanbaatar and Zamyn Uud. The gateway port for handling the containers of Mongolia is Tianjin port in China. The logistics paths of containers for imported goods entail Tianjin port, railway transport to Erenhot in China, border crossing to Mongolia, customs clearance process and transshipment at Zamyn Uud, allotment of locomotives and wagons by Mongolian railway company at Zamyn Uud, and railway transport to Ulaanbaatar in Mongolia; the logistics paths of export containers are vice versa. Most of the imported containers in Mongolia are stored at the container yards around the Ulaanbaatar railway station. Repositioning points of containers are scattered around the port of Tianjin. Almost 90% of empty import containers should be repositioned to Tianjin. The throughput at Zamyn Uud station in 2008 is about 98 thousand twenty -foot equivalent unit (TEU) as shown

in the table 1 including transit containers of trading goods between China and Russia (KMI, 2009).

Table 1. Container movement of Railway transport at Mongolian borders

(unit: TEU)

Item	Trading partner countries	Border Station	2007		2008	
			Inbound (Transit)	Outbound (Transit)	Inbound (Transit)	Outbound (Transit)
Mongolia	China	Zamyn Uud-Erenhot	28,892	27,221	47,451 (511)	50,531 (401)
	Russia	Suhbaatar-Naushki	4,045	2,994	4,270 (401)	1,948 (511)

Note: Including empty containers

Source: 1) Korea Maritime Institute (2009) Operationalization of International Intermodal Transport Corridors in North-East and Central Asia.

2) Chinese Ministry of Railways and Economic & Planning Research Institute (2009) The Latest Development of International Railway Transport Corridors in China, Expert Group Meeting on Operational International Intermodal Transport Corridor in North-East and Central Asia 4-5 November 2009, Kyrkyzstan.

The Erdenet Station is a key railway facility for export of copper concentrate, molybedenum concentrate, and other goods (Park, 2011). The Erdenet Mining Company gathers copper raw ores from strip mining and concentrates the ores from 0.5% purity to 20-25% purity. The company packs copper concentrate into a bag container on the open top wagons; it packages molybedenum concentrate into an wooden boxes and a bag container, and loads boxes and bag containers in a container. The final destination stations in Mongolia are different according to importing countries: Zamyn Uud for China and the third countries such as Korea, Japan, and Canada, and Suhbaatar for Russia. The foreign border stations of railway transport are Erenhot in China and Nauski in Russia. In 2009, Mongolia exported 5.0 thousand tons of molybedenum concentrate and ores to China; 1.5 thousand tons to Korea; and 126 tons to Germany[1].

The Eruu gol railway station at Selenge region is the main departing station for exporting iron ores. The Ulaanbaatar Railway Joint Venture transports iron ores from the Eruu gol railway station to Erenhot in China via the Zamyn Uud station. At the Erenhot station the iron ore is discharged and transshipped to Chinese railway wagons and lorries. In 2009, Mongolia exported 1.60 million tons of iron ore to China and 0.3 tons to Australia.[2]

Lorry and trailer carry cargoes in short distance and export coal from the Southern Gobi Desert to Chinese cities. Main borders for export coal are Tseg and Gantsmaodao.

1 Customs General Administration (2010) International Merchandise Trade Statistics 2009.

2 Op. cit.

3. Regression of transport costs and trade volume

3.1 Data collection and input

3.1.1 Data collection

IMF's Direction of Trade Statistics Yearbook (IMF, 2010(a)) informs us records of exports and imports of each country in the world. Exports are based on the term of free on board (FOB); imports on the basis of cost, insurance and freight (CIF). However, the statistics of Mongolian exports and imports and the corresponding record of imports and exports in trading partner countries are widely different in some cases.

The data of LCL transport costs from the main city or main port of other 31 countries to Ulaanbatar, capital city of Mongolia is supplied by the Korean forwarding company which supplies shippers with intermodal logistics services for Mongolia export and import goods. However these costs are calculated on the assumption of intermodal transport for LCL cargo by combining inland transport from Ulaanbatar of Mongolia and Tianjin of China, shipping from Tianjin to Busan in Korea, and then shipping to main ports in the world. Since there is no available data on the ratio of LCL and full container load (FCL) cargoes in Mongolia, this paper uses these transport costs for LCL cargo as proxies for transport costs of FCL and general cargoes. In addition, the costs for China and Russia should be recalculated due to efficient and direct logistics paths from Mongolia to the two countries. Since the regression model of LCL transport costs without considering the optimal routes for China and Russia which can transport cargoes through directly crossing borders, not using Busan port as a transhipment hub, has lower explanation power and is unrealistic, this analysis adjusts the transport costs for China and Russia through calculating transport costs of LCL cargo for the two countries as being half of the LCL transport costs for Korea.

We also use the data of population and gross domestic products (GDP) from the IMF (IMF, 2010(b)). The data on transport infrastructure such as length of paved road and railway length is collected from the transportation information at the web site of the Central Intelligence Agency (CIA). The mileage distance is calculated by the information of Maritime Distance Table (Japan Navigation Officer's Association, 1982). The density of transport infrastructure in each country is calculated as an average of the density of the paved road network and the railway network per person (Limao and Venables, 2001)

3.1.2 Input data

The trading partner countries on the list of the LCL transport costs by the Korean forwarding company could be main partners for Mongolia. Therefore, this chooses 31 countries as main trading partner countries for Mongolia. However the three countries among

the main trading partners-Portugal, Norway and Vietnam- don't have trade statistics with Mongolia as shown in the table 2.

The ratio of CIF to FOB ranges from 0.4 for Romania to 5.3 for Thailand, and is less than one at those countries: Belgium, Czech Republic, Japan, Korea, Singapore, Switzerland, and China.

The transport costs of LCL cargo between trading partner and Mongolia measures transport costs per ton from main ports or main cities of trading partners to Ulaanbatar via Busan port in Korea and Tianjin port in China. The transport costs ranges from 95 US dollar for China and Russia to 330 US dollar for Romania.

The shipping distance and the inland distance between its trading partners and Mongolia are measured from the gateway port, Tianjin port, to the departure port, from Ulaanbatar to Tianjin, and from the origin to the departure port. The longest shipping distance is 19,037 km for Hungary; the shortest is 507 km for Korea. The inland distances vary from 1700 km for those countries such as Korea, France, Italy, Germany, and Japan to 3,560 km for Romania.

The transport infrastructure density per person ranges from 0.11 in India to 31.6 in Sweden.

Table 2. Major transport characteristics of trading partner countries (2009)

Country / Item	CIF / FOB	Freight (US$ / ton)	Shipping Distance (km)	Inland Distance (km)	Transport Infrastructure Density
Austria	2.28	275	18,825	2,643	6.79
Belgium	0.60	245	17,849	1,700	5.74
Finland	1.20	250	19,386	3,204	5.32
France	1.70	240	11,338	1,700	8.47
Germany	1.26	275	18,243	1,700	4.18
Italy	1.27	260	14,355	1,700	4.24
Netherlands	1.09	220	17,882	1,700	4.21
Portugal	-	280	15,183	1,700	3.46
Austraila	1.91	250	18,785	1,700	8.91
Canada	1.87	235	9,173	1,700	6.89
Czech Republic	0.89	275	18,606	2,424	6.66
Denmark	1.10	250	18,329	1,786	6.93
Japan	0.92	190	2,311	1,700	3.88
Korea	0.93	190	507	1,700	0.87
New Zealand	1.19	255	10,034	1,700	7.73
Norway	-	245	18,603	2,421	7.92
Singapore	0.54	190	4,505	1,700	0.35

Sweden	1.20	260	18,680	2,498	31.60
Switzerland	0.62	275	18,413	2,231	5.04
United Kingdom	1.78	240	18,180	1,700	3.34
United States	2.53	315	10,085	1,700	7.31
China,P.R.: Mainland	0.50	190	-	1,700	1.16
India	2.89	275	8,441	1,700	0.11
Thailand	5.30	185	4,677	1,700	1.36
Vietnam	-	195	3,717	1,700	0.73
Bulgaria	2.17	320	14,616	3,701	2.90
Hungary	1.57	270	19,037	2,855	4.21
Poland	1.03	275	19,014	2,832	4.17
Romania	0.40	330	14,481	3,566	1.82
Turkey	0.99	250	13,879	1,700	2.15
Russia	1.18	175	-	1,700	3.06

Source: IMF (2010a) Direction of Trade Statistics Yearbook.
IMF (2010b) International Financial Statistics Yearbook.
Japan Navigation Officer's Association (1982) World-wide distance chart, Tokyo.

3.2 Transport costs

3.2.1 IMF's transport costs – the ratio of CIF to FOB

Transport costs in foreign trade will be decided by the characteristics of each intermodal transport network (Gallup *et al*., 1999), composed of the corridors from a factory in a country to another factory in a trading partner country. Specifically, this uses respectively the ratio of CIF to FOB for Mongolia and her trading partners and the transport cost of LCL cargo from trading partners to Mongolia as indicators of transport costs.

The ratio of CIF to FOB provides the measure of transport costs on trade between Mongolia and each trading partner country, and is used to measure the costs of the imports and all charges incurred in placing the goods abroad a carrier in the exporting port (Limao and Venables, 2001). The amounts of export and import at the statistics of trading partners for Mongolia do not exist at some cases due to the small portion and ratio of Mongolian trade from the view of trading partner countries (IMF, 2010(a)). Generally, the amounts of CIF term will be more than that of FOB. Nevertheless, the rates of CIF to FOB for Mongolian imports are less than one for some countries: Korea, Japan, Singapore, and others as presented in the table 2.

Hence the regression between the ratio of CIF to FOB and the transport characteristics such as distance of sea transport, distance of land transport, and border sharing with Mongolia could have lower explanation power. As a result of the regression, the distance of inland transport from Ulaanbatar to Tianjin and from the port near the

capital city to the capital city of trading partner country represents a proxy for port accessibility of Mongolia.

The function of transport costs is as in the following:

$$CFR = f(DISS, DISL, INFP, INFT, BOR) \quad (1)$$

Where:
CFR: ratio of CIF to FOB
DISS: shipping distance from Tianjin of China to the port near the main city of trading partner country
DISL: distance of inland transport from Ulaanbatar to Tianjin and from the port near the main city to the main city of trading partner country
INFP: density of transport infrastructures of trading partner country
INFT: density of transport infrastructures of transit country, China
BOR: dummy variable of border sharing with Mongolia: BOR =1 if the trading partner country is China or Russia, which is sharing boarders with Mongolia

This paper assumes that the ratio of CIF to FOB (CFR) can be measured by log linear function (Limao and Venables, 2001) and linear function.

The Model 1 is the log linear function as in the following,

$$\ln CFR = a1 + a2 \ln DISS + a3 \ln DISL + a4 \ln INFP + a5 \ln INFT + a6 \ln BOR \quad (2)$$

Specifically, the second estimation equation for Model 2 is,

$$CFR = a1 + a2\ DISS + a3\ DISL + a4\ INFP + a5\ INFT + a6\ BOR \quad (3)$$

The estimation equation of Model 3 is,

$$CFR = a1 + a2\ DISS + a3\ DISL + a4\ INFT + a5\ BOR \quad (4)$$

The regression models of bilateral transport costs factor between Mongolia and trading partners are estimated with the data in 2009.

Regressions of Model 1, 2, and 3 have very weak explanation power with low R^2 as shown in the table 3. Furthermore, the signs for shipping distance and for distance of inland transport are negative and they are statistically insignificant. In addition, the coefficients of all independent variables having low t-statistics are statistically insignificant. These are caused by the incorrect ratios of CIF to FOB for Mongolia and trading partners.

Table 3. Regression results of bilateral transport costs factor between Mongolia and trading partner (2009)

Variable / Model	1	Variable / Model	2	3
Constant	2.56	Constant	1.80 (1.55)	1.80 (1.58)
Ln DISS	0.06 (0.35)	DISS	-0.00004 (-0.99)	-0.00004 (-1.09)
Ln DISL	-0.39 (-0.83)	DISL	-0.00006 (-0.17)	-0.00005 (-0.17)
Ln INFP	-0.02 (-0.19)	INFP	-0.002 (-0.06)	
Ln INFT	1.25 (0.92)	INFT	0.34 (0.45)	0.34 (0.46)
BOR (Dummy)	-0.87 (-1.20)	BOR (Dummy)	-1.57 (-1.37)	-1.56 (-1.40)
Sample Size	28	Sample Size	28	28
R^2 F	0.12 0.63	R^2 F	0.11 0.52	0.16 0.67

3.2.2 Transport costs between Mongolia and trading partners

The LCL cost per ton is calculated for LCL cargo and is based on the assumption that LCL cargo would be transshipped at the port of Busan in Korea.

We can assume that the transport costs per ton are dependent on transport characteristics of international logistics paths from Mongolian to trading partners.

The function of transport costs is as in the following:

$$LC = f\ (DISS,\ DISL,\ INFP,\ INFT,\ BOR) \quad (5)$$

Where:

LC: transport costs per ton from trading partners to Mongolia

DISS: shipping distance from Tianjin port in China to the ports near the main city of trading partner country

DISL: distance of inland transport from Ulaanbatar to Tianjin and from a port near the main city to the main city of trading partner country

INFP: density of transport infrastructures of trading partner country

INFT: density of transport infrastructures of transit country, China

BOR: dummy variable of border sharing with Mongolia

The transport costs per ton from trading partners to Mongolia can be estimated by log linear function and linear function. First, we can adopt the following log linear function:

$$LC = a1\ DISS^{a2}\ DISL^{a3}\ INFP^{a4}\ INFT^{a5} \quad (6)$$

The natural logarithm function adding dummy variable is used for regression,

$$\ln LC = a1 + a2 \ln DISS + a3 \ln DISL + a4 \ln INFP + a5 \ln INFT + a6\ BOR \quad (7)$$

Then this assumes that transport costs can be estimated by linear function (Limao and Venables, 2001) as shown in the equation 8.

$$LC = a1 + a2\ DISS + a3\ DISL + a4\ INFP + a5\ INFT + a6\ BOR \quad (8)$$

By selecting different combinations of independent variables, there are three models of the log linear functions: Model 1, 2, 3; one linear function: Model 4, as shown in the table 4.

In all models, transport costs are strongly affected by the distance of inland transport from Ulaanbatar to Tianjin and from a port near the main city to the main city of trading partner country (DISL). And Model 1 shows us the ranges of effects serially by DISL, DISS, BOR, INFT, and INFP. In Model 2 excluding the variable of INFP, regression results are similar to those of Model 1. In Model 3, transport costs are estimated by DISL, DISS, and BOR. In this model, the sign of coefficient of BOR is consonant with intuition. All log linear models have explanation power with R^2 over 0.8 as shown in the table 4. Model 4 in linear function has lower R^2 than the log linear models.

Table 4. Regression results of transport costs between Mongolia and trading partner (2009)

Variable / Model	1	2	3	Variable / Model	4
Constant	2.97 (4.82)***	3.02 (5.07)***	5.17 (66.3)***	Constant	165 (5.08)***
ln DISS	0.11 (3.57)***	0.10 (3.92)***	0.00001 (3.19)***	DISS	0.003 (2.46)**
ln DISL	0.20 (2.35)**	0.20 (2.39)**	0.00009 (2.28)**	DISL	0.03 (2.48)**
ln INFP	-0.009 (-0.42)	-	-	INFP	-0.33 (-0.31)
ln INFT	0.009 (0.06)	0 0	-	INFT	0.33 (0.02)
BOR (Dummy)	0.09 (0.30)	0.04 (0.15)	-0.76 (-7.9)***	BOR (Dummy)	-111 (-3.44)***
Sample Size	31	31	31	Sample Size	31
R^2 F	0.88 35.8	0.88 46.2	0.86 54.6	R^2 F	0.75 15.1

Note: ** significant at the 5 percent level; *** significant at the 1 percent level.

All models imply that the distance of shipping routes has lower effect on transport costs than the inland distance (Cullinane, 2005). Hence, the easier access to the sea for a land-locked country plays a decisive role in lowering the transport costs for the foreign trade with the third countries except transit countries sharing common borders.

However, the effect from the level of infrastructure density in partner countries and transit countries is a little uncertain. At the Model 1 and 4, the estimators for the level of infrastructure densities in partner countries and transit countries are not significant and the estimators for the transit countries have adverse signs to intuition.

3.3 Trade volume

When we consider cargo flows between two countries and among countries, transport costs between the two countries and from an origin country to a destination country can affect the amounts of foreign trade: export and import (Gallup *et al*., 1999; Ng and Gujar, 2009). Economic indicators also vary trade amounts. This also examines the effects of GDP of partner countries, distance from Mongolia to partner countries, and per capita GDP of partner countries, common borders with partner countries, density of transport infrastructure in partner countries, and density of transport infrastructure in transit countries on trade volume between Mongolia and trading partners, using gravity model (Limao and Venables, 2001; Malo, 2008; Ferrari *et al*, 2011).

The gravity model of estimating trade volumes between Mongolia and trade partners will use variables GDP, per capita GDP, density of transport infrastructure, and common border as attractive variables, and distance from Mongolia to trading partners as disadvantageous variable.

Hence, the function of trade volume between Mongolia and trading partners will be as in the following,

$$M_{jm} = g(GDP, DIS, INFP, INFT, CGDP, BOR) \quad (9)$$

where,

M_{jm}: trade volume in thousand dollars between country j and Mongolia
GDP: GDP of country j
DIS: distance of inland and shipping from Mongolia to country j
INFP: density of transport infrastructure of country j
INFT: density of transport infrastructure of transit country, China
CGDP: per capita GDP of country j
BORD: dummy of common border

We can build the following log linear function, adopting the model by Limao and Venables (2001):

$$M_{jm} = a1\ GDP^{a2}\ DIS^{a3}\ INFP^{a4}\ INFT^{a5}\ CGDP^{a6} \quad (10)$$

After including dummy variable, we get the log linear function:

$$\ln M_{jm} = a1 + a2 \ln GDP + a3 \ln DIS + a4 \ln INFP + a5 \ln INFT + a6 \ln CGDP + a7\ BORD \quad (11)$$

The table 5 gives us four models: Model 1 including all variables; Model 2 excluding variable of INFP, INFT, and CGDP; Model 3 excluding INFP, INFT, CGDP, and BOR; Model 4 excluding INFT and CGDP.

Table 5. Regression results of trade volume between Mongolia and trading partner (2009)

Variable/Model	1	2	3	4
Constant	6.09 (1.35)	-0.86 (-0.18)	1.06 (0.24)	6.42 (1.48)
ln GDP	0.86 (4.98)***	0.87 (5.59)***	0.89 (5.69)***	0.84 (5.01)***
ln DIS	-0.90 (-2.53)**	-0.78 (-2.54)**	-1.03 (-4.41)***	-0.88 (-2.55)**
ln INFP	0.04 (0.14)	-	-	0.13 (0.66)
ln INFT	1.39 (0.88)	-	-	-
ln CGDP	0.02 (0.42)	-	-	-
BOR (Dummy)	0.36 (0.26)	1.22 (1.17)		1.11 (1.05)
Sample Size	28	28	28	28
R^2 F	0.78 13.8	0.77 26.6	0.76 38.7	0.77 19.6

Note: ** significant at the 5 percent level; *** significant at the 1 percent level.

The third and fourth columns in the table 4 show us coefficients of GDP of trading partner country j (GDP) and distance in km of inland transport and shipping from Mongolia to country j (DIS). The positive effects from GDP of partner countries and border sharing would be reasonable as expected by intuition. Also the negative effects from distance from Mongolia and trading partners can be accepted. The signs of other three variables - INFP,

INFT, and CGDP - are consonant with intuition but statistically insignificant. All models have explanation power with R^2 over 0.75 as shown in the table 5.

4. Conclusion

Mongolia, an economy of small economic scale and land-locked country, has been trying to diversify trading partners and traded goods. Mongolia suffered from comparatively low economic growth and even economic recession in the 1990s after the adoption of market economy. The higher transport costs between Mongolia and the third countries not sharing common borders hinders trade volume from growing and expansion in trading partner countries.

Following the context of effects of landlockedness to a country, this specifically tries to examine the effects of remoteness of Mongolia on transport costs and foreign trade. This uses two different transport costs: the ratio of CIF to FOB for all types of cargoes; the transport costs for general cargo and LCL cargo. In the analysis of the ratio of CIF to FOB, we found that the regressions have very weak explanation power due to the incorrect ratios of CIF to FOB for Mongolia and trading partners. In the regression models of transport costs for LCL cargo of Mongolia import, the distance in inland transport has higher average effect on transport costs than the shipping distance. Hence we can surmise that the access to the sea for land-locked country plays a decisive role in lowering the transport costs of foreign trade with the third countries except transit countries. Differently from the results of the other papers on transport costs of land-locked countries, the effect of the level of infrastructure density in partner countries and transit countries is not statistically significant. The factor of border sharing with trading partners lowers transport costs at the two models.

At the gravity model for trade volume, the positive effects from GDP of partner countries would be reasonable as expected by intuition. The negative effects from distance between Mongolia and trading partners can be acceptable. Other variables have sometimes adverse signs to intuition and are statistically insignificant.

Even though the improvement of accessibility of land-locked countries to the sea gives them new opportunity to approach the global market, they can face high transport costs for export goods. Hence the access to the sea should be accompanied with the efficiency improvement of transport networks, border crossing process, and transit transport toward the sea.

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