STATISTICAL ANALYSIS OF FOREIGN TRADE FLOWS AND MARITIME TRANSPORT

EnviSum Project WP 5.2

by

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Contents

0 Summary

The International Maritime Organization (IMO) Regulations for the Prevention of Air Pollution from Ships set limits on SOx and NOx emissions from ship exhausts. In the Baltic Sea, a Sulphur Emission Control Area (SECA), the sulphur content of fuel oil used on board ships must not exceed 0.1%, or ships must fit technologies to achieve equivalent SOx emissions starting 1st January 2015. Because of the subsequent cost increase, a modal shift from sea to land transport, with negative consequences for shipping companies, was widely expected.

This study analyzes a sample of trade flows with intense intermodal competition between Baltic Sea and Western European countries - for possible modal shift in the period 2015 - 2017. The study uses EUROSTAT statistics on foreign trade and maritime transport.

The results from the analysis do not clearly support the initial hypothesis - that the cost increase caused by the introduction of lower sulphur limits in ship fuels results in a shift from sea transport to land transport. While for imports of the Baltic Sea countries studied such a shift could be confirmed, the results for exports and total flows indicate the contrary – an increasing share of maritime transport. The most probable explication of this result is the drastic decline of fuel prices in the 2014/15, remaining at a low level until 2017.

1 Introduction

The International Maritime Organization (IMO) Regulations for the Prevention of Air Pollution from Ships were adopted in the MARPOL 73/78 Protocol of 1997 and are included in Annex VI of the Convention, in force since May 2005. Limits are set on SOx and NOx emissions from ship exhausts:

- A global cap of 4.5% by mass on the sulphur content of fuel oil.
- In Sulphur Emission Control Areas (SECAs) the sulphur content of fuel oil used on board ships must not exceed 1.5% m/m, or ships must fit technologies to achieve equivalent SOx emissions.
- Limits on emissions of NOx from diesel engines are also set.
- The Baltic Sea was designated as a SECA in the Protocol. The North Sea was adopted as a SECA in July 2005 (later implemented on 22nd November 2007).

The European Union introduced, with Directive 2005/33/EC, a 1.5% sulphur limit for fuels used by all ships in the SECAs of the Baltic Sea, effective from 11th August 2006, and a 0.1% sulphur limit on fuel used by ships at berth in EU ports in force since 2010. The Directive allows the use of equivalent abatement technologies.

In October 2008, a revised version of Annex VI of the MARPOL Convention was adopted by the IMO member states reducing the limit of sulphur contents in fuels in global shipping to 3.5% as from year 2012, and setting for 2020, respectively 2025 (depending on later assessment), a limit of 0.5% sulphur contents in ship fuels. The limit for SECA was reduced to 0.1% from 1.0% previously as from year 2015.

SECA regulation increases the cost of sea transport relative to other modes of transport. In a competitive world, rational shippers should select always the most economical transport chain for their products (all other decision criteria being equal). Therefore, the introduction of SECA limits should result for a certain part of transports in a shift from sea transport to alternative modes of transport or to transport chains with shorter sea legs.

The establishment of the SECA areas with stricter emission limits in the Baltic and the North Sea caused concerns among shipowners and port operators that trade flows in the area would be affected. Several studies were conducted that arrived at similar conclusions forecasting a shift in the modal split unfavourable for sea transport as well as competitive disadvantages for industries in the Baltic Sea region compared to competitors in non-SECA regions.

ISL Bremen, in 2010, concluded: "There are very tangible shifts in container shipping as well as truck/trailer traffic (RoRo shipping). On the basis of the 2008 figures for the simulated routes and corridors totalling around 1.9 million transported trailers/trucks, and information on the size of the total market, as well as moderate growth assumptions, the basic volume at risk of a shift to road transport in 2015 was estimated to be around 2.7 million units… It can be concluded overall that the medium-length to long routes will suffer significantly from the new SECA regulations, and that the proportion of sea transport in the whole transport service will decline ("from Sea to Road")." [1]

Entec reviewed six studies and summed up their findings: "This (expected higher fuel cost) represents an average increase in fuel costs per tonne of around 80%… the revised regulations will lead to some shift away from short sea shipping to road and rail freight. This shift is expected to be between 3-50% in volume and varies significantly between different routes and fuel price projections.[2]

The COMPASS study[3] on short sea shipping as well the Swedish Maritime Administration[4] arrived at similar conclusions.

The much-discussed sulphur limits are now over three years in force. Considerable reductions of sulphur emissions from shipping were recorded already in 2015. This study tries to answer the question: Considering that not all good flows are likely to be affected, is there a noticeable change in maritime transport flows in the Baltic Sea following the introduction of SECA regulation?

2 The hypothesis tested

The investigation tries to answer the following question: Is there a change in the growth patterns of foreign trade and maritime transport in the Baltic Sea region that could be attributed to the introduction of SECA rules?

A shift from sea transport to land transport caused by increasing cost of sea transport as a consequence of the use of low sulphur fuel oil (LSFO) should result in lower growth of sea transport then growth of the respective foreign trade flows.

3 Method

The basic idea of the study is to compare the development of corresponding flows of goods in foreign trade and sea transport. For the analysis Eurostat data representing trade and transport in metric tons were used. It concentrates on the forecasted modal shift in selected competitive trades, not addressing the question of competitive disadvantages for exporters or importers of goods relative to non-SECA based producers or buyers.

[1] Reducing the sulphur content of shipping fuels further to 0.1 % in the North Sea and Baltic Sea in 2015: Consequences for shipping in this shipping area Final report Institut für Seeverkehrswirtschaft and Logistik Institute of Shipping Economics and Logistics Bremen, September 2010, p.1f.
[2] Entec UK Ltd. 2010: Study To Review Assessments Undertaken Of The Revised MARPOL Annex VI Regulations, p. IV
[3] COMPASS - The COMPetitiveness of European Short-sea freight Shipping compared with road and rail transport, TML, Nautical Enterprise, 2010
[4] SWEDISH MARITIME ADMINISTRATION: CONSEQUENCES OF THE IMO'S NEW MARINE FUEL SULPHUR REGULATIONS, 2009

To find the answer, in a first step, cargo flows in sea transport with a clear competition situation between sea transport and land transport were identified. With respect to transport geography cargo flows between the Baltic countries Denmark, Sweden, Finland, Estonia, Latvia and Lithuania as reporting countries with Western European partner countries are in a clearly competitive situation to land transport (Table 1). In this study, Germany is not included in the group of Baltic countries nor among the Western European countries due to its geographic situation. Poland was excluded from the Baltic Sea countries sample, as the share of maritime transport in the transport of the goods considered is small - due to the transport geographic position of the country. The lack of ro-ro liner services between Polish ports and Western Europe is a consequence of this situation.

Table 1: Geographic flows analysed

Reporting countries	Partner countries in sea transport	Trading partners
Denmark	Belgium	Belgium
Estonia	Germany	Germany
Latvia	Spain	Spain
Lithuania	France	France
Finland	Italy	Italy
Sweden	Netherlands	Netherlands
	Portugal	Portugal
	Denmark	Austria
		Switzerland
		Czech Republic
		Luxemburg

For the selection of the corresponding foreign trade flows hinterland countries without sea access are added.

Goods likely to be found in the selected groups of cargoes were identified in the foreign trade statistics. The following groups of goods traded were selected:

Table 2: Foreign trade: Product groups analysed (2017)

Product groups	Mill. tons	Mill. EUR
0 FOOD AND LIVE ANIMALS	18,5	26.518
1 BEVERAGES AND TOBACCO	1,9	3.867
21 HIDES, SKINS AND FURSKINS, RAW	0,1	385
22 OIL-SEEDS AND OLEAGINOUS FRUITS	0,8	362
25 PULP AND WASTE PAPER	5,0	2.259
26 TEXTILE FIBRES (OTHER THAN WOOL TOPS AND ....)	0,1	155
29 CRUDE ANIMAL AND VEGETABLE MATERIALS, N.E.S.	2,0	2.268
4 ANIMAL AND VEGETABLE OILS, FATS AND WAXES	1,3	1.328
51 ORGANIC CHEMICALS	2,6	3.980
52 INORGANIC CHEMICALS	2,7	1.255
53 DYEING, TANNING AND COLOURING MATERIALS	0,6	1.565
54 MEDICINAL AND PHARMACEUTICAL PRODUCTS	0,1	9.641
55 ESSENTIAL OILS AND RESINOIDS AND PERFUME MATERIALS; TOILET....	0,7	2.396
57 PLASTICS IN PRIMARY FORMS	3,3	5.207
58 PLASTICS IN NON-PRIMARY FORMS	0,7	2.758
59 CHEMICAL MATERIALS AND PRODUCTS, N.E.S.	2,3	5.191
60 COMPLETE INDUSTRIAL PLANT APPROPRIATE TO SECTION 6	0,0	3
61 LEATHER, LEATHER MANUFACTURES, N.E.S., AND DRESSED FURSKINS	0,0	193
62 RUBBER MANUFACTURES, N.E.S.	0,3	1.943
63 CORK AND WOOD MANUFACTURES (EXCLUDING FURNITURE)	2,6	2.018
64 PAPER, PAPERBOARD AND ARTICLES OF ...	10,8	8.556
65 TEXTILE YARN, FABRICS, MADE-UP ARTICLES, N.E.S., AND RELATED ...	0,5	2.773
66 NON-METALLIC MINERAL MANUFACTURES, N.E.S.	4,0	2.683
68 NON-FERROUS METALS	1,2	5.039
69 MANUFACTURES OF METALS, N.E.S.	2,2	9.013
7 MACHINERY AND TRANSPORT EQUIPMENT	8,2	102.026
8 MISCELLANEOUS MANUFACTURED ARTICLES	3,2	28.697

Group “6 Manufactures ... (without iron and steel)” has a share of 23% of the tonnage analyzed whereof “Paper, paperboard ...” alone represent 11.5%. “0 Food and live animals” amount to 20% (thereof cereals and cereal preparation 6%) and “7 Machinery and transport equipment” to 9% of the selected tonnage, but 39% of respective value.

Cargo classification in sea transport statistics is less detailed than foreign trade goods classification. Cargo groups in sea transport corresponding to foreign trade product groups were analyzed. Groups unlikely to be carried by land transport were excluded, i.e., liquid and dry bulk cargoes. Container transport was also excluded, because most containers carried between the countries studied are feeder transports originating from or destined for overseas countries transiting via Western European hub ports. In inner-European trade, containers are little used. The exclusion of container transport matches with the exclusion of overseas trading partners such as United States of America or China.

Match between foreign trade and sea transport statistics analyzed is far from perfect and cannot be better due to the rather rough classification of goods in sea transport. Sea transport group of “others” comprises also products not included in the product groups selected, as well as some chemicals and food products may be carried as liquid bulk or dry bulk cargoes. However, this will not affect the validity of the conclusions to be drawn.

In the following step, the development of the selected sea transport cargo flows was set in relation to corresponding foreign trade growth and the resulting indicators was analyzed. In order to adjust for

longer term developments, a trend function was estimated. The differences between the real values and the estimated values following the trend function serve as indicators for the proof of the established hypothesis.

4 Foreign trade flows in the BSR

4.1 Total Baltic Sea Region Foreign Trade

In a first step, the dynamics of foreign trade flows volume in the Baltic Sea Region was depicted based on statistical data provided by Eurostat. All considerations in this chapter refer to Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Poland and Germany.

Foreign trade of BSR countries (see Figure 1) in 2017 totaled 1.83 billion tons, thereof 765 million tons export and 1.062 million tons import. The average growth rate in the period 2005-2017 was 1.7%. Main product groups are mineral fuels (41%), crude materials (19%) and manufactured goods (14%). Total volume growth in the period considered is caused by 22% by crude materials, 21% by manufactured goods and 18% by chemicals.

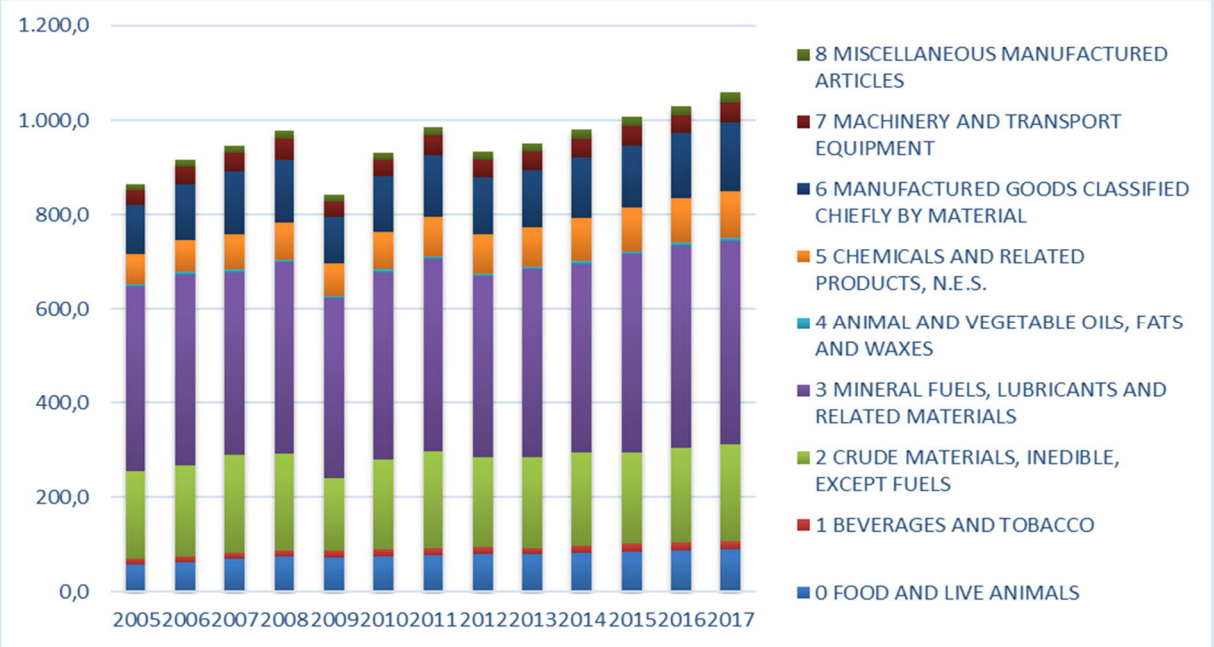
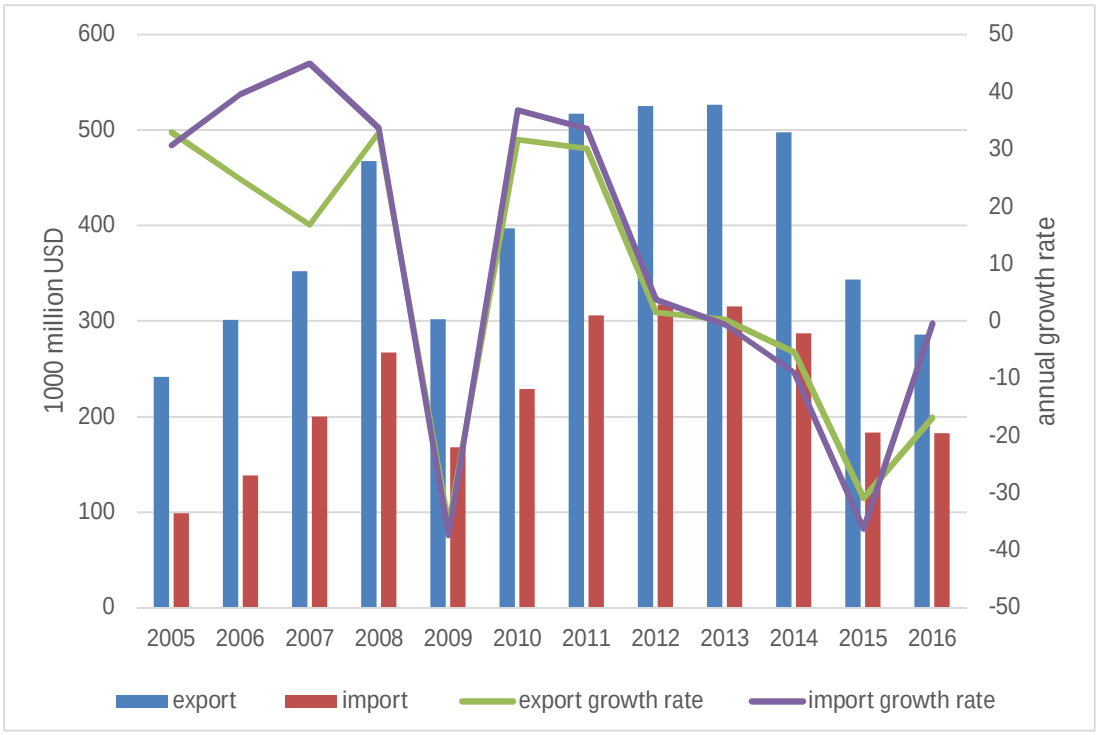


Figure 1: Foreign trade volume of Baltic Sea countries 2005-2017 (million tons, without Russia)

The geographical structure of total trade shows the enormous weight of Germany in the region's foreign trade, followed by Poland, Sweden and Finland. The tonnage of the Russian Federation´s foreign trade was not reported. Based on published data concerning the volume of main foreign trade goods (without natural gas), it can be estimated to be of about 800 million tons[5], abt. 75% of the German volume. In both cases, only part of the foreign trade passes through Baltic Sea ports - in Germany 5% of total foreign trade and in Russia about one fourth of the estimated foreign trade volume.

In order to complete the pictures of Baltic Sea Region´s foreign trade, figure 2 presents the development of Russian foreign trade.

[5] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/ftrade/#



Source: Goskomstat

Figure 2: Russia - foreign trade 2005-2016

4.2 Characteristics of the Foreign Trade Flows Studied

The relation of the selected trade flows to total foreign trade of the analyzed countries and trade with Western Europe, by volume and value, is summarized in Table 3. A share of 45% of the value and 20% of total trade volume means that a considerable part of the countries´ foreign trade is covered.

Table 3: Characteristics of the trade flows selected by volume and value

	TOTAL TRADE	TOTAL with W.Europe	Selected flows
million tons	505,2	220,2	101,3
share of selected flows	20%	46%	
billion EUR	677,3	356,6	302,0
share of selected flows	45%	85%	

Table 4 presents the volume and value of the trade selected by country. Swedish trade dominates the trade with more than one third of the total.

Table 4: Characteristics of selected trade flows by country 2017

Country	million tons	million EUROS
DENMARK	25,6	79.661
SWEDEN	39,1	123.338
FINLAND	18,7	55.631
ESTONIA	3,6	12.394
LATVIA	5,9	10.488
LITHUANIA	8,5	20.502
Total	101,3	302.014

Table 5 shows the product structure of the trade flows analyzed. Manufactured goods make up for 30% of the tonnage, followed by food with 23%, and chemicals with 19%. The most important positions on the 2-digit level are paper and paperboard with 13.3 million tons (13.1%) and non-metallic mineral manufactures with 7.6 million tons (7.6%). In value terms, machinery and transport equipment amount to 43.4% of the total analyzed.

Table 5: Selected good flows by product structure in 2017

SITC group	million tons		billion EUROS	
0 FOOD AND LIVE ANIMALS	23,1	23%	33,8	11%
1 BEVERAGES AND TOBACCO	2,4	2%	4,7	2%
2 CRUDE MATERIALS, INEDIBLE, EXCEPT FUELS	9,8	10%	6,6	2%
4 ANIMAL AND VEGETABLE OILS, FATS AND WAXES	1,6	2%	1,6	1%
5 CHEMICALS AND RELATED PRODUCTS	19,0	19%	40,6	13%
6 MANUFACTURED GOODS	30,5	30%	43,0	14%
7 MACHINERY AND TRANSPORT EQUIPMENT	10,2	10%	131,0	43%
8 MISCELLANEOUS MANUFACTURED ARTICLES	4,7	5%	40,7	13%
Total	101,3	100%	302,0	100%

The average annual growth rate of the selected good flows was 0.9% while total trade tonnage increased in average by 0.4% per year. It took until 2014 to recover from the effects of crisis in volume terms, while the value reached pre-crisis level already in 2013 (Figure 3).

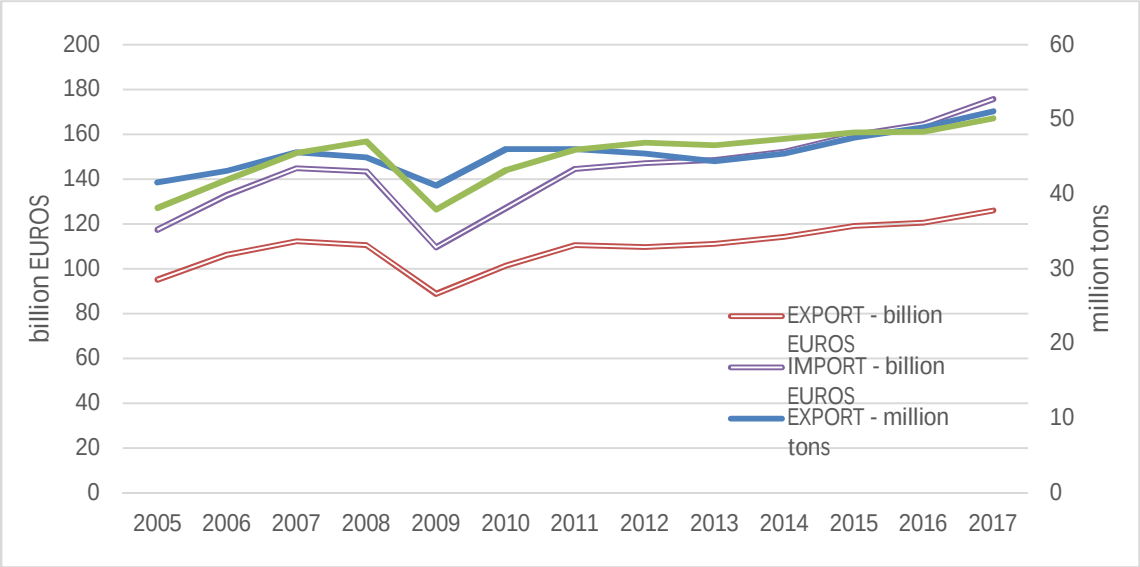


Figure 3: Dynamics of trade flows studied

5 Maritime transport flows in the BSR

5.1 Overview of maritime transport flows in the BSR

Total Baltic Sea maritime transport in 2017 amounted to 904 million tons, thereof 884 million tons traffic with main ports as defined by the European Union. The average annual growth rate in the period 2005 – 2017 was 2.5%, driven mainly by growing Russian port cargo handling (Figure 4).

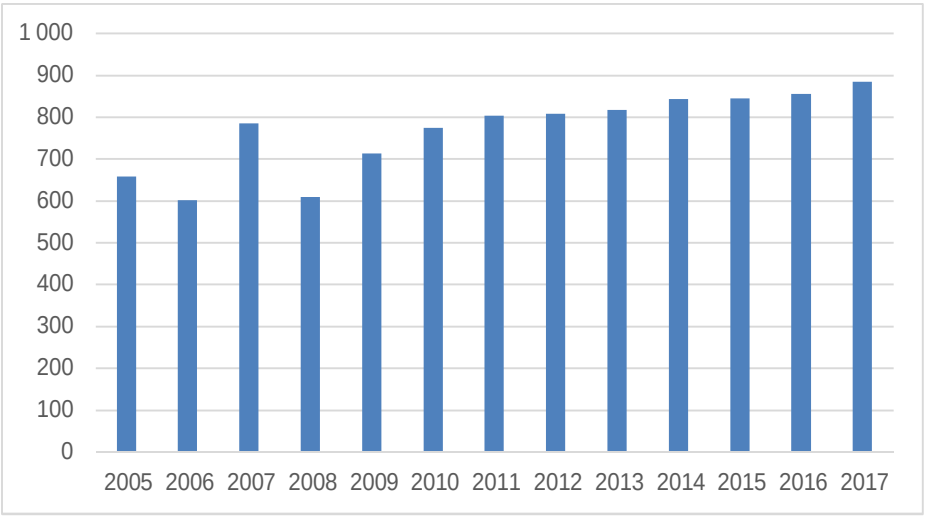


Figure 4: Development of total cargo handling of Baltic Sea Region ports 2005-2017

Traffic flows between Baltic Sea countries in 2016 are depicted in Table 6- main inner-Baltic flows are highlighted. The biggest traffic flows originate from Russian ports to destinations outside the Baltic Sea, consisting mainly of Russian liquid fuel, coal and grain exports.

In inner-Baltic traffic, Sweden has the biggest share followed by Denmark and Finland. Leaving cabotage traffic aside, the biggest cargo flows observed were Sweden - Denmark, Sweden – German Baltic, Finland – Russia and Finland - Sweden. Traffic between Sweden, Denmark, Germany and Finland is largely ferry and ro-ro traffic.

Table 6: Baltic Sea Maritime transport flows 2016 (million tons, main ports)

Berichtsland: Partner:	Germany Baltic	Denmark Baltic	Sweden	Finland	Estonia	Latvia	Lithuania	Poland	Russia Baltic	Sum
Germany Baltic	431	10.190	16.555	7.868	398	1.771	1.929	742	2.268	42.152
Denmark Baltic	8.019	13.712	16.646	1.416	1.042	2.811	1.974	1.420	5.226	52.266
Sweden	15.727	14.604	18.469	12.947	2.375	4.925	2.074	9.680	11.138	91.939
Finland	8.096	1.052	12.712	6.215	6.170	1.935	694	1.618	14.264	52.756
Estonia	994	729	3.148	6.538	87	1.549	2.009	431	2.902	18.387
Latvia	1.444	2.356	4.974	2.121	1.099	295	890	1.474	900	15.553
Lithuania	1.917	706	2.489	538	1.174	804	40	1.469	9.352	18.489
Poland	814	874	9.727	1.566	386	1.460	1.976	1.314	8.275	26.392
Russia Baltic	2.268	5.226	11.138	14.264	2.902	900	9.352	8.275	k.A.	54.325
inner-Baltic	39.710	49.449	95.858	53.473	15.633	16.450	20.938	26.423	54.325	372.259
out-of-Baltic	12.629	33.475	71.404	45.285	14.563	42.899	25.298	45.319	182.274	473.146
Total	52.339	82.924	167.262	98.758	30.196	59.349	46.236	71.742	236.599	845.405

The cargo structure in Baltic Sea maritime transport (Figure 5) is dominated by liquid and dry bulk cargos, mainly exported from Russian ports. Their combined share increased slightly from 64% to 66% during the last 10 years. A characteristic feature of Baltic Sea traffic is the comparatively big share of ferry and ro-ro traffic. It decreased from 18% to 16%, while container traffic increased from 8 to 10%.

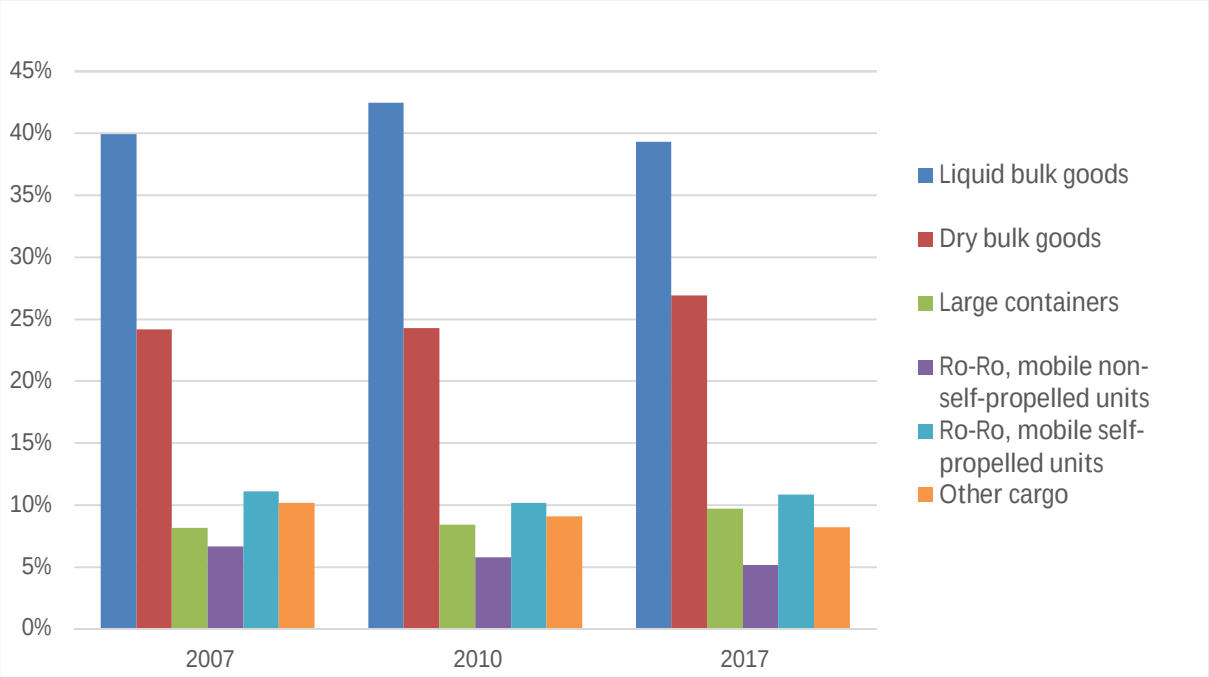


Figure 5: Baltic Sea maritime transport by cargo groups (in per cent)

5.2 Characteristics of maritime transport flows studied

The total volume of the cargo flows selected amounted in 2017 to 23.5 million tons while total Baltic Sea traffic of the selected cargo groups stood at 213 million tons.

The dynamics of the maritime transport flows analysed is shown in Figure 6. Total transport volume increased yearly in average by 0.6%, while exports followed a slightly declining path with -0.4% yearly. This is chiefly the effect of declining export volumes of forest products. Average yearly incoming traffic growth amounted to 2.7%.

The share of exports in total traffic in 2017 was 61.8% while ten years earlier it stood at 66%. Thus, the gap between exports and imports tended to become smaller.

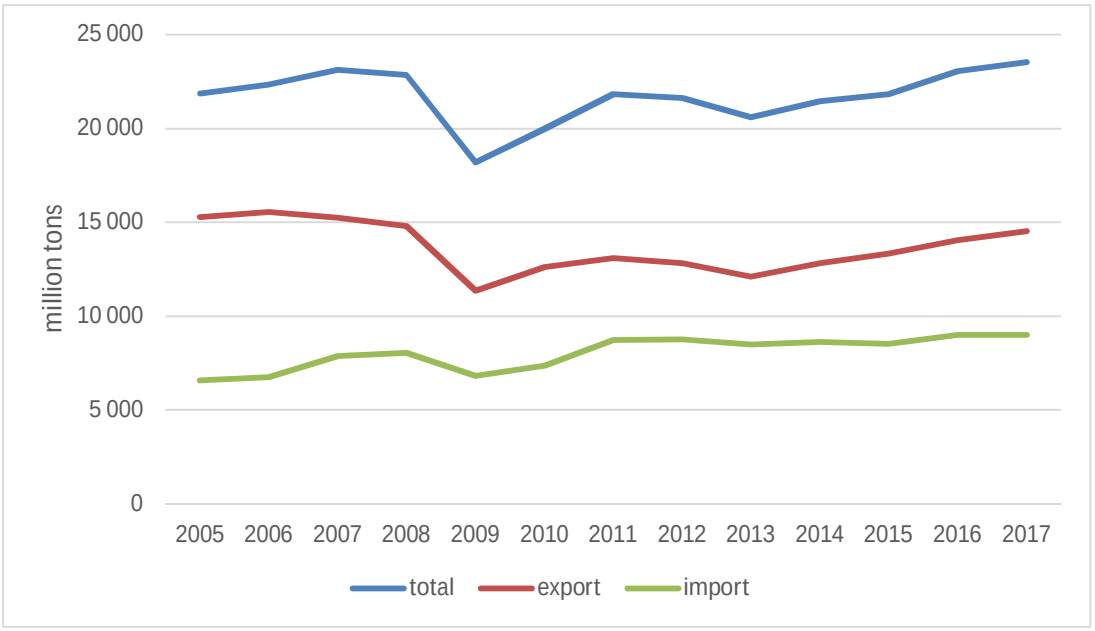


Figure 6: Dynamics of maritime transport flows analysed

Composition by cargo groups is characterized by the dominance of self-propelled ro-ro units with 33% in 2017, unchanged in relation to 2007, while non self-propelled ro-ro units share increased slightly from 26% to 28% and other cargo fell back correspondingly from 41% to 39%.

6 Analysis of the relation between maritime transport and foreign trade flows in the study area

Following the methodology explained in chapter 3, in Table 7, the relation between sea transport and foreign trade volume is calculated. It was expected to be of limited variation as it was mainly determined by the commodity structure of foreign trade and the structure of transport chains serving the trade. Both are parameters with little short term variance. Of greater variance is the export modal share showing a decreasing tendency.

Table 7: Modal share of sea transport in the selected trades

	Foreign trade (mln t)			sea transport (mln t)			Relation sea transport / trade		
Year	export	import	total	export	import	total	export	import	total
2005	41,6	38,1	79,8	15,3	6,6	21,9	36,7%	17,2%	27,4%
2006	43,2	41,9	85,1	15,6	6,8	22,3	36,0%	16,2%	26,2%
2007	45,6	45,6	91,2	15,3	7,9	23,1	33,4%	17,3%	25,4%
2008	45,0	47,1	92,1	14,8	8,0	22,9	33,0%	17,1%	24,8%
2009	41,2	38,0	79,1	11,4	6,8	18,2	27,6%	18,0%	23,0%
2010	46,1	43,3	89,3	12,6	7,4	20,0	27,4%	17,0%	22,4%
2011	46,0	46,0	92,0	13,1	8,7	21,8	28,4%	19,0%	23,7%
2012	45,5	46,9	92,4	12,8	8,8	21,6	28,2%	18,7%	23,4%
2013	44,5	46,6	91,1	12,1	8,5	20,6	27,3%	18,2%	22,6%
2014	45,5	47,4	92,9	12,8	8,6	21,5	28,2%	18,2%	23,1%
2015	47,6	48,3	95,8	13,3	8,5	21,8	28,0%	17,6%	22,8%
2016	49,0	48,4	97,4	14,1	9,0	23,1	28,7%	18,6%	23,7%
2017	51,1	50,2	101,3	14,5	9,0	23,5	28,4%	17,9%	23,2%
CAGR.	1,7%	2,3%	2,0%	-0,4%	2,6%	0,6%			
						average	30,0%	17,8%	23,9%
						standard deviation	3,2%	0,7%	1,4%

For both flow directions, as well as their total, a linear trend is estimated using data until 2014 (Figure 7). Trends for exports and “total” are descending while the values for imports follow an ascending line. A polynomial curve provides a better fit for exports, but it cannot be reasonably justified.

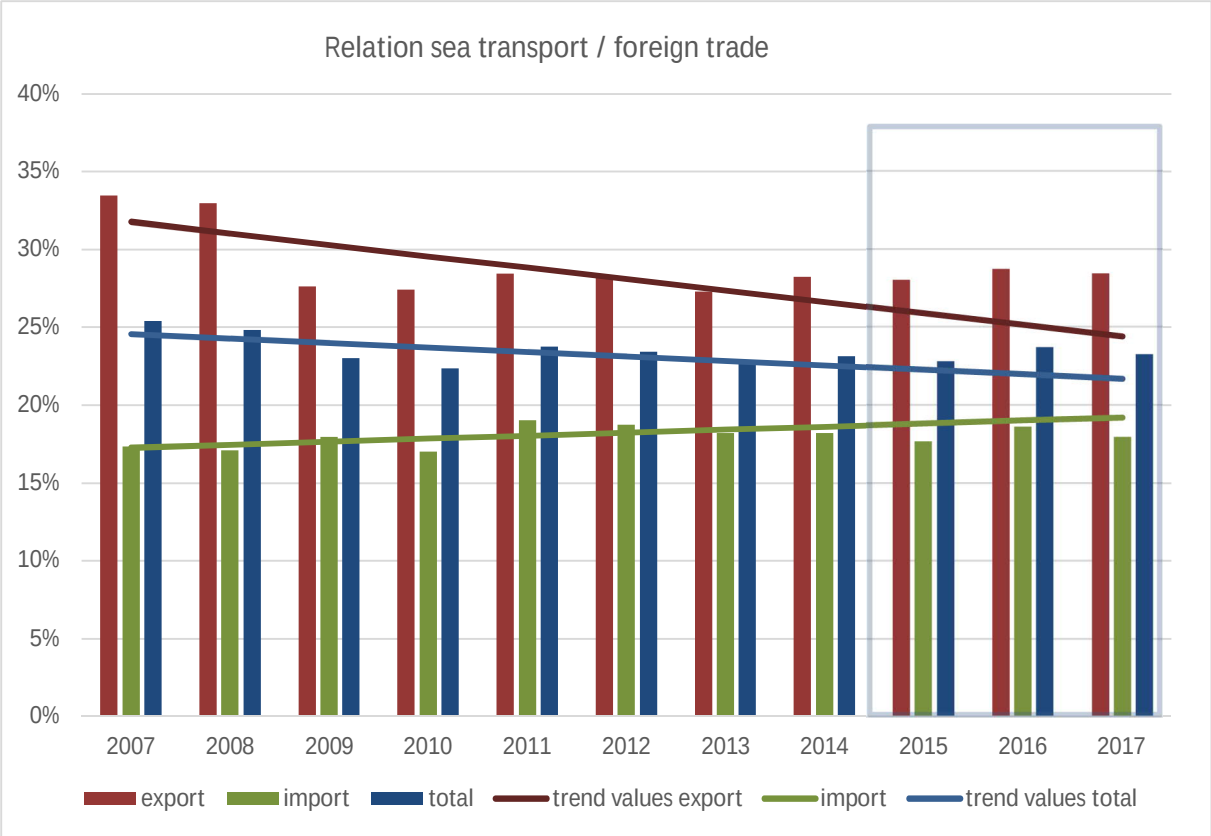


Figure 7: Relation maritime transport to foreign trade - real values and trend values

In the next step, the deviation of real values from trend values was calculated (Table 8). Positive values indicate a higher participation of maritime transport in foreign trade flows than expected following the trend function.

For the years following the introduction of strict limits for the sulphur content in ship fuels in the Baltic Sea and North Sea SECAs, the real values in total trade and exports were – other than expected - higher than the estimated trend values. Only import trades showed a lower participation of maritime transport than predicted by the trend function.

Table 8: Deviation of real values from trend values

Year	export	import	total
2007	5,2%	0,2%	3,3%
2008	6,1%	-2,1%	2,3%
2009	-8,9%	1,7%	-4,2%
2010	-7,4%	-4,6%	-5,6%
2011	-1,4%	5,5%	1,4%
2012	0,5%	2,6%	1,2%
2013	-0,3%	-1,1%	-0,9%
2014	6,1%	-2,2%	2,5%
2015	8,2%	-6,2%	2,4%
2016	14,3%	-2,1%	7,9%
2017	16,6%	-6,5%	7,2%

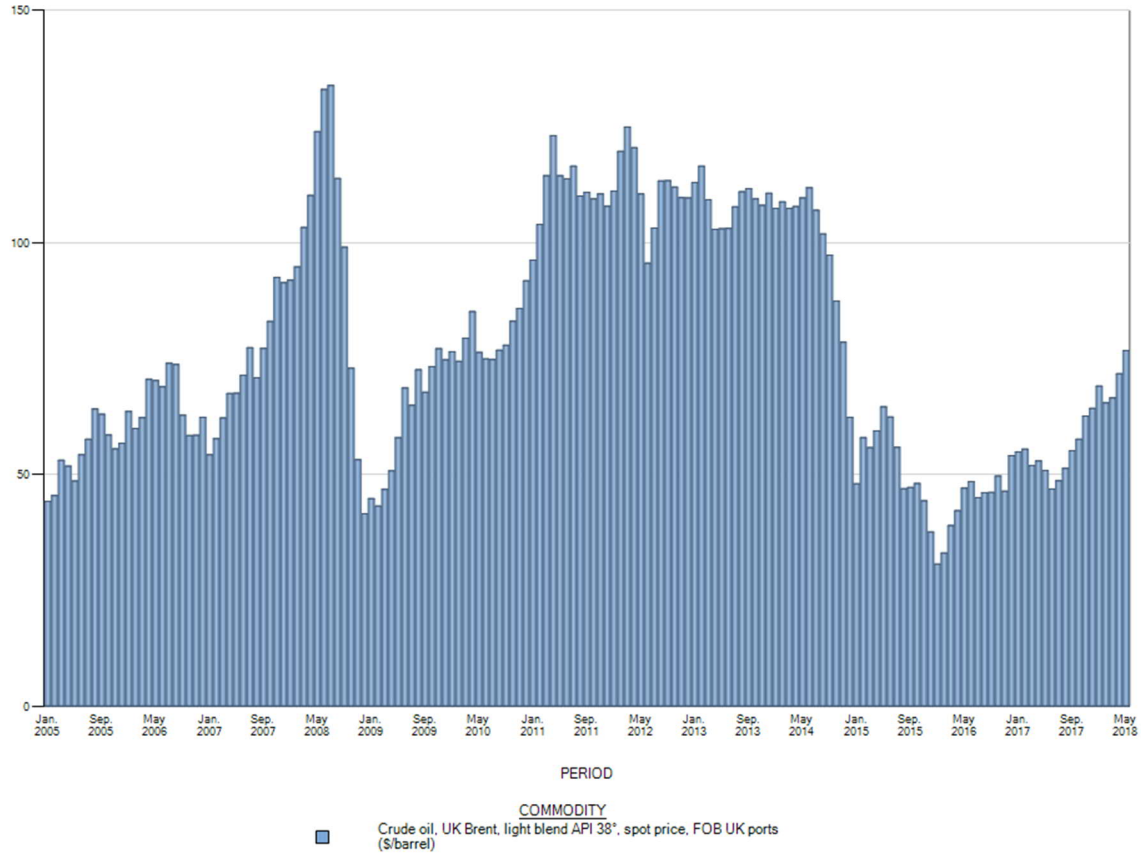
7 Conclusions

The analysis conducted does not clearly support the initial hypothesis - that the cost increase caused by the introduction of lower sulphur limits in ship fuels would result in a shift from sea transport to land transport. While for imports of the Baltic Sea countries studied such a shift could be confirmed, the results for exports and total flows indicate the contrary – an increasing share of maritime transport. In the case of imports, it should be considered that the previous general trend was one of increasing participation of maritime transport. This trend was not completely reversed - participation of sea transport was also in 2016 and 2017 higher than the period average.

Even as the costs of water and land transport in Europe have fallen in 2015 due to falling fuel prices, the cost of sea transport in SECAs has risen 5–10%, according to interviews conducted in a Swedish study.[6] This increase in cost seems to be insufficient to induce shippers to change transport modes. Furthermore, it is not known, whether this cost increase resulted in higher freight rates.

The development of oil prices (Figure 8) and the subsequent development of fuel prices acted as a buffer and absorbed most of the change in relative prices, thus reducing the impact of SECA-rules on modal split in the Baltic Sea region. In 2017 a market review summed up: "… the introduction of the North European and Baltic SECA area has had much less effect than many predicted, possibly because bunker prices sank dramatically at the same time.."[7]

[6] Implementation of the Sulphur Directive – industry preparations, Transport Analysis, Summary Report 2015:11
[7] SHIPPAXMARKET17, Halmstad 2017, p.147



Source: UNCTADstat

Figure 8: Price of Crude oil UK Brent 2005 - 2018

In addition, a review of ferry and ro-ro services operating in the Baltic does not indicate deeper going changes in the market structure and operations of shipping companies. A market review focussed on ferry and ro-ro traffic summarized: "Though the relative price difference between heavy oil (HFO) and distillates has remained unchanged, in absolute terms, the last named grade of fuel, which can be used in the emission control area without the use of scrubbers, has become so much cheaper that the expected business failures did not materialise."[8]

To summarize, the impact of more stringent sulphur limits introduced in 2015 was of much less importance then previously feared. There was no clear statistical evidence of modal shift from sea to land transport in the years 2015 – 2017. This result further confirms earlier reports from the EnviSuM project on the economic impact of SECA Regulations in the BSR (i.e. Olaniyi 2017; Olaniyi, Prause & Boyesen, 2018; Olaniyi, Atari & Prause 2018). Results of these studies showed that the impact on the modal shift or increased costs of sea transportation expected to cascade down to the cost of goods has not been as disadvantageous as was anticipated before the SECA take-off.

[8] SHIPPAXMARKET16, Halmstad 2016, p.134

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