ifspa 2017

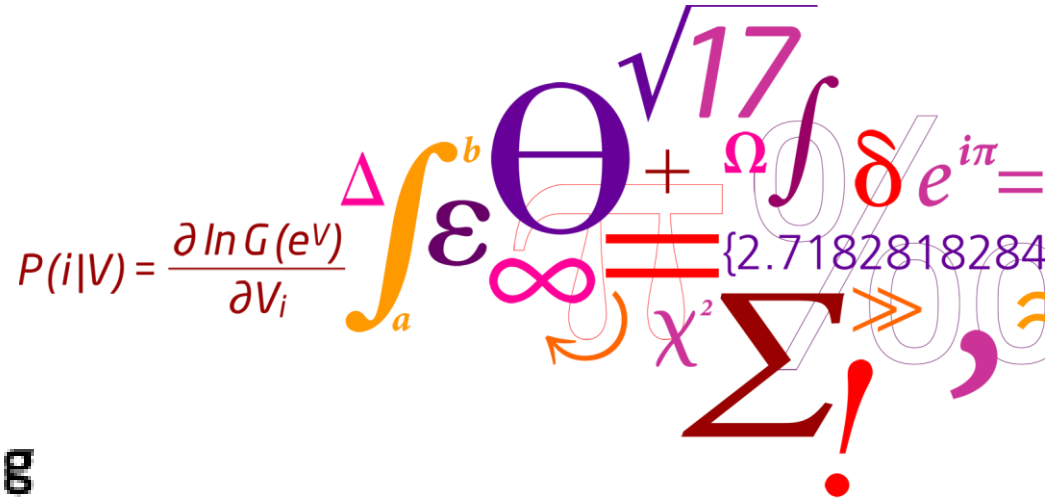
HONGKONG

DTU

Measures to mitigate and reverse the negative implications of the low-sulphur limit on the Short Sea Shipping sector

Thalis Zis — Postdoctoral Researcher

Harilaos N. Psaraftis — Professor



DTU Management Engineering

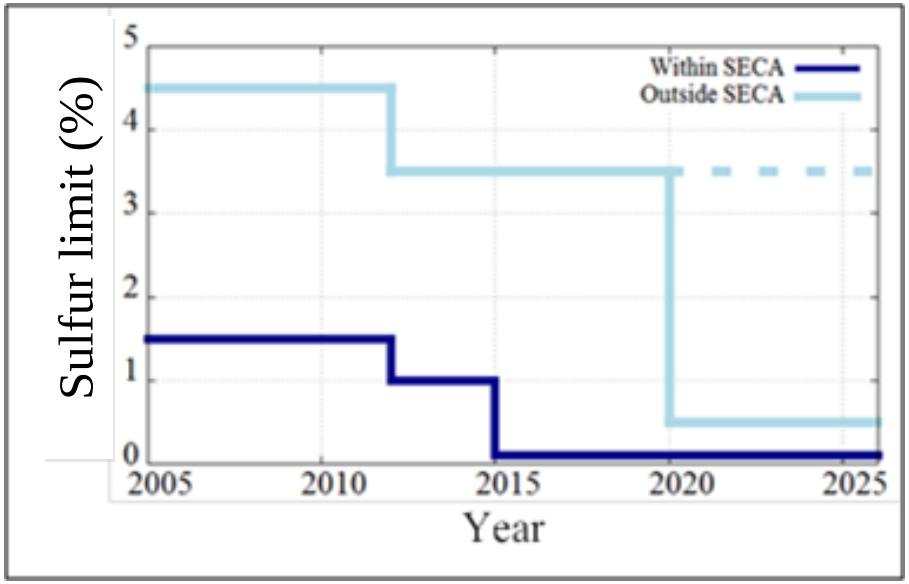
Department of Management Engineering

Presentation Outline

- Background
  - Short Sea Shipping in Northern Europe
  - The Sulphur Emission Control Areas
  - Anticipated Impacts
  - Effects to Ro-Ro operators
- Methodology
  - Route Selection Criteria
  - Modelling modal shifts
  - Environmental efficiency
  - Profitability of a service
- Measures from the Ro-Ro operator
  - Speed reduction
  - Sailing frequency
  - Technology
- Policy measures
  - Internalization of external costs
  - Reimbursing the BAF surcharges
  - Tax levy on landbased modes
- Conclusions

Background

- As of January 1st 2015:



	Year			
Areas	2005-2012	2012-2015	2015-2020	2020 (or 2025)-
Within SECA	1.5	1	0.1	0.1
Outside SECA	4.5	3.5	3.5	0.5

Anticipated impacts from studies

Figure 23: Percentage cost increase in sea-based costs due to SECA and NECA in 2015 for ro/ro routes

Up to 20% increases in sea-based costs

Source:(North Sea Consultation Group, 2013)

Press releases before the new limit

SECA SHUTS DOWN TRANSFENNICA IBERIAN SERVICE

The Dutch-owned short-sea shipping line Transfennica (part of the Spliethoff Group) has announced that it is to cease its "Motorways of the Sea" ro-ro service between Bilbao, Portsmouth and Zeebrugge at the end of this month (December).

The decision is a direct result of the introduction of stricter new low-sulphur emission controls from 1 January 2015 in the Baltic Sea, the Kattegat, the North Sea and English Channel. A further SECA extends in a 200 nautical miles wide belt along the coasts of the USA and Canada.

SECA requirements lead to new European rail link

CARRIERS: Railway company ERS is opening a new route in Europe in light of rising customer demand following the implementation of new sulphur regulations. Many customers and countries are willing to change their mode of transport in order to save money.

DFDS closes Sassnitz-Klaipeda connection

Publication date: 2013-08-30
Tags: maritime, germany, denmark, lithuania

DFDS Seaways has decided to close the ferry service between Sassnitz, Germany and Klaipeda, Lithuania with effect from the end of September.

Previously a busy connection, the route has over the years become economically unviable. As Vice President of DFDS, Anders Refsgaard, stated: "We have fought hard to get new customers and improve revenue and profit, but unfortunately without success". He added, that with the outlook on continued decline in profits, and in light of the new sulphur regulations to be introduced from 1 January 2015, the company does not believe that it will be possible to turn the tide on the crossing.

But were they right in predicting?

Stena Line records 16% yearly growth on North Sea route

Stena Britannica sails between the UK port of Harwich and the Hook of Holland in the Netherlands

DFDS Wraps Up Record Year, Expects Higher Revenue in 2016

Image Courtesy: DFDS

Danish shipping and logistics company DFDS posted a profit of DKK 1.07bn (USD 151m), up by 89pct when compared to last year's DKK 571 million.

For the full-year 2015, the group reported revenue increase of 5% to DKK 13.5bn. Organic revenue growth, adjusted for route closures and acquisitions, was 7% mainly driven by 7% higher freight shipping volumes and 8% more passengers. In the fourth quarter, organic revenue growth was 10%.

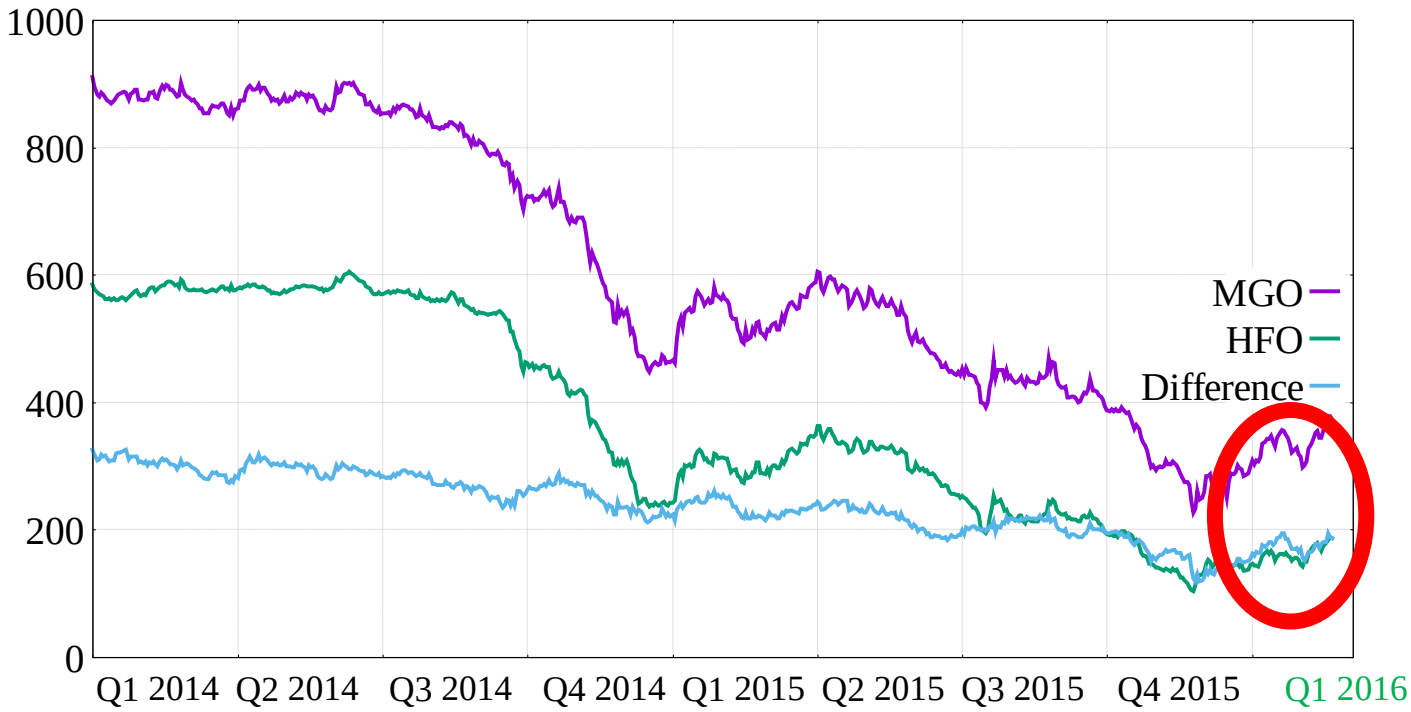
P&O breaks Channel freight record in 2015

By Charlie Bartlett from London

P&O Ferries transported more freight between Dover and Calais in 2015 than any other year in its "modern history," amounting to 1,340,317 trucks.

The result is a 22% year-on-year increase over 2014, and is due in part to disruptions at the channel tunnel, which caused a 172% year-on-year increase in HGVs on is separate Teesport to Zeebrugge route throughout the month of July. The group pressed a sixth ship back into service on the English Channel that month in order to increase capacity.

Actual Fuel prices



The absolute price differential would gradually decrease
Fuel prices have started going up in 2016

Effects to Ro-Ro operators

- Ship operators can either use low-sulphur fuel, or retrofit vessels with scrubber systems
- MGO is more expensive, while scrubbers increase overall fuel consumption, and require significant capital costs
- Increased operating costs could lead to changes in
  - vessel deployment
  - frequency of service
  - sailing speed
  - existence of certain routes
- Some of the additional costs will be passed over to clients through the Bunker Adjustment Factor (BAF – fuel surcharges)

Objectives:
Understand the wider implications of the new limit..

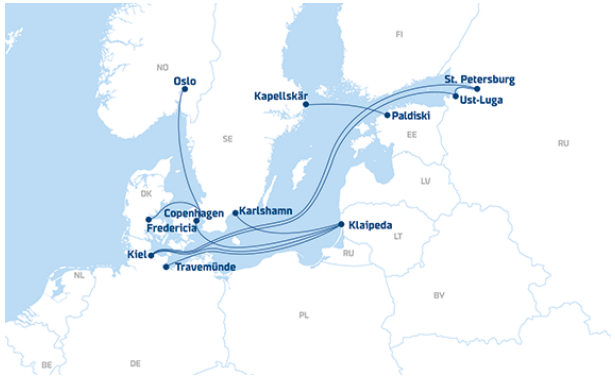
- On SECAs (is the environmental improvement significant?)
- How is Short Sea Shipping affected
- Model modal shifts
- Identify the negative impacts of the regulation
- Propose measures to mitigate and reverse these

The RoRoSECA project

- 2 year project – ending June 2017
- Funded by the Danish Maritime Fund (DMF)
- Case studies with DFDS
- New decision making tools

DFDS network

- 18 Routes (22 links)
- ~38 vessels
- Up to 535 departures/week, 13 countries, 30 ports
- 4 main areas
  - North Sea (9 Routes, 20 vessels)
  - Baltic Sea (5 Routes, 7 vessels)
  - Cross-Channel (3 Routes, 6-7 vessels)
  - Mediterranean (1 Route, 1-2 vessels)



Presentation Outline

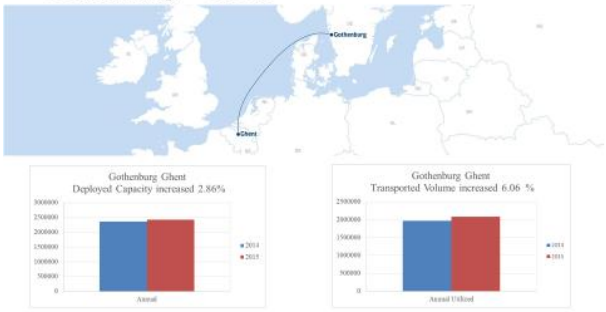
- Background
  - Short Sea Shipping in Northern Europe
  - The Sulphur Emission Control Areas
  - Anticipated Impacts
  - Effects to Ro-Ro operators
- Methodology
  - Route Selection Criteria
  - Modelling modal shifts
  - Environmental efficiency
  - Profitability of a service
- Measures from the Ro-Ro operator
  - Speed reduction
  - Sailing frequency
  - Technology
- Policy measures
  - Internalization of external costs
  - Reimbursing the BAF surcharges
  - Tax levy on landbased modes
- Conclusions

Route selection criteria

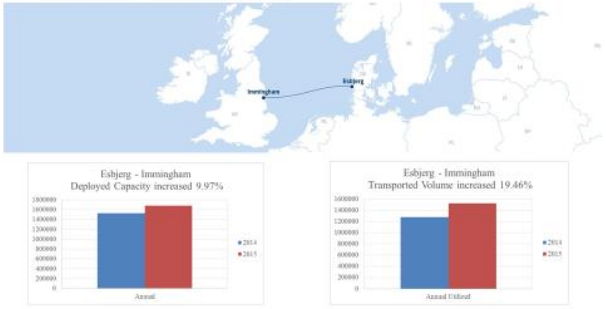
- Geographical balance → Proportion by Region
- Chain configuration → By Sailing Distance & Frequency
- Volume → By Vessel and Route Capacity
- Commodity mixture → Cargo type and value
- Vessel types → Ro-Ro, Ro-Pax, Cruise, abatement
- Data availability

Transported volume and deployed capacity 2014 vs 2015

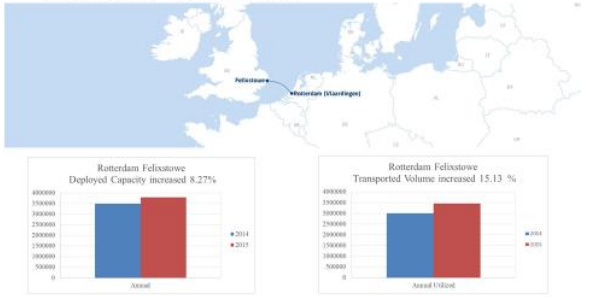
Gothenburg – Ghent



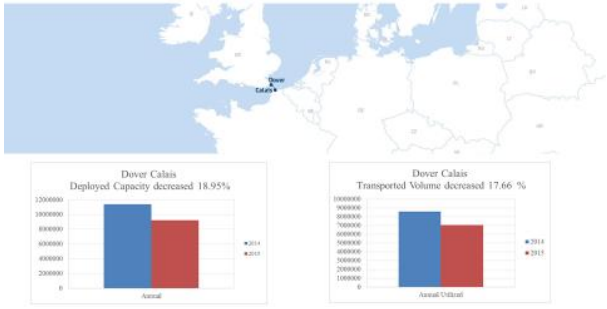
Esbjerg – Immingham



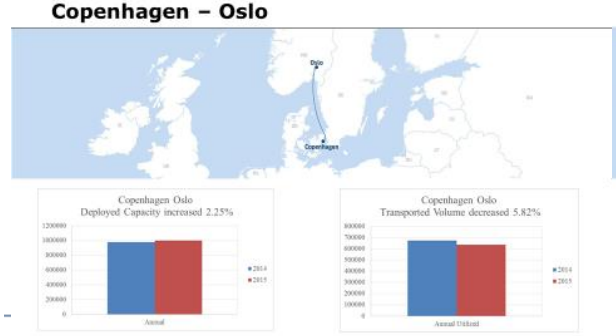
Rotterdam – Felixstowe



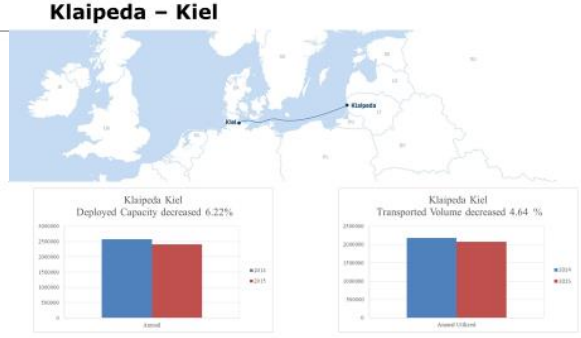
Dover – Calais



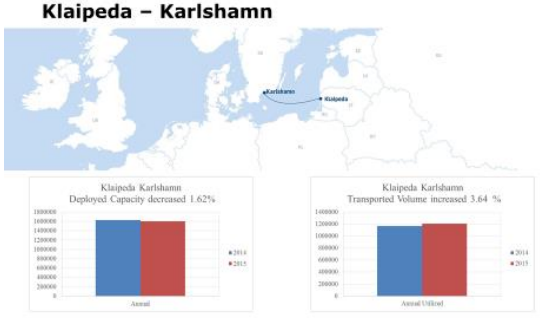
Copenhagen – Oslo



Klaipeda – Kiel



Klaipeda – Karlshamn

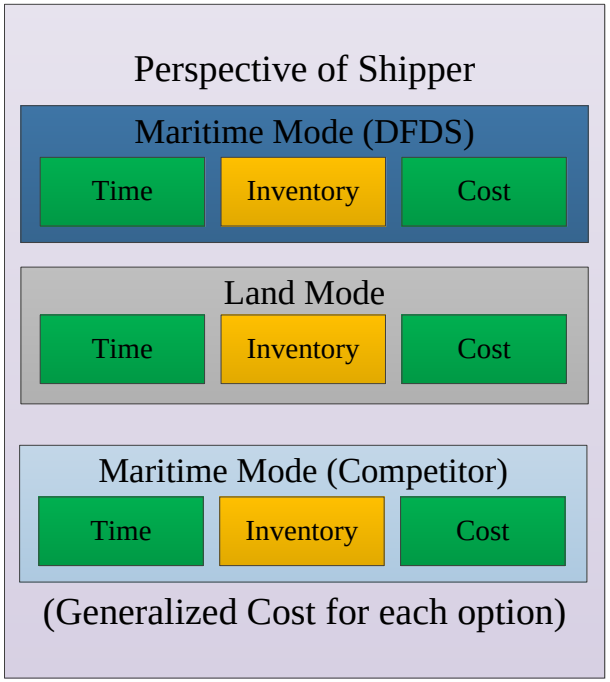


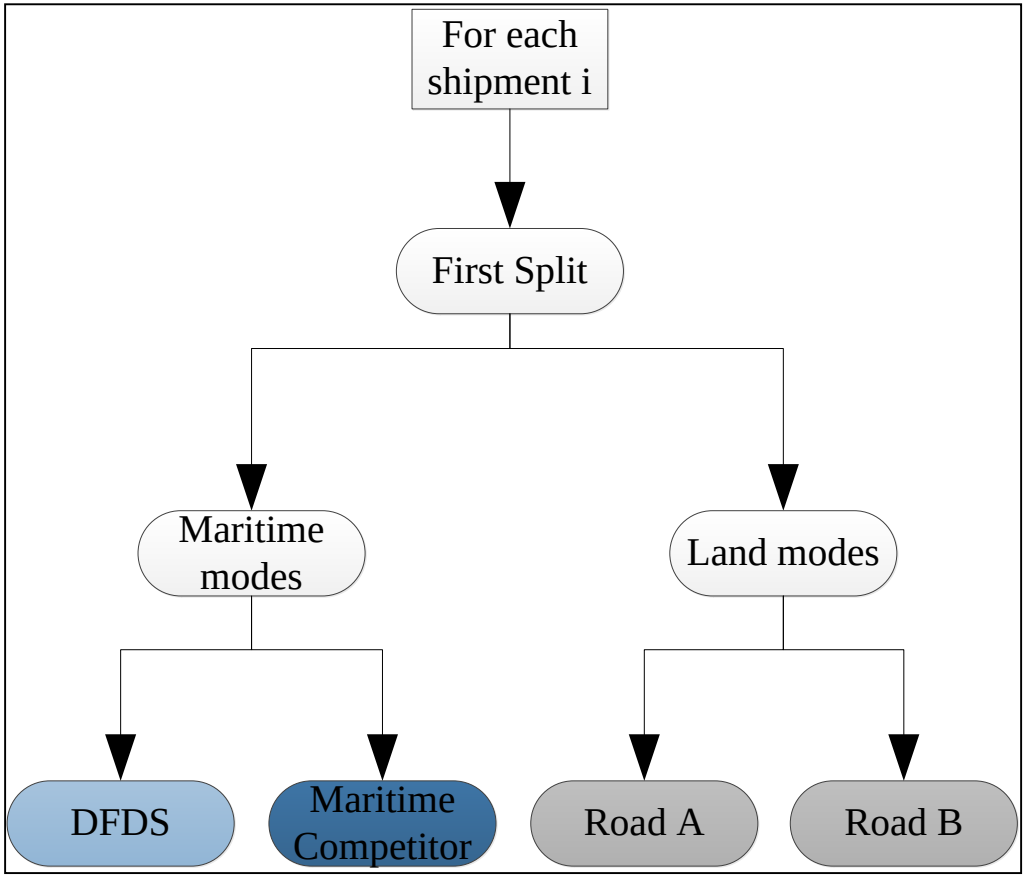
Summary of new market picture

Route	Year	Trips Total	Transported Cargo Volume change (%)	Cargo Rate change (%)	Revenue Change (%)	Annual Fuel Cost Change (%)
Gothenburg Ghent*	2014 2015	553 569	6.06	-5.62	0.09	-52.89
Esbjerg Immingham	2014 2015	512 580	19.46	-0.5	18.85	-15.29
Rotterdam Felixstowe	2014 2015	1514 1637	15.13	0.5	15.71	-24.34
Copenhagen Oslo	2014 2015	687 702	-5.82	1.58	4.28	-9.36
Klaipeda Kiel*	2014 2015	611 615	-4.64	-7.71	-8.89	-30.05
Klaipeda Karlshamn	2014 2015	717 710	3.64	-2.32	3.73	-22.99
Dover Calais	2014 2015	6210 4994	-17.66	9.36	-18.04	-50.35

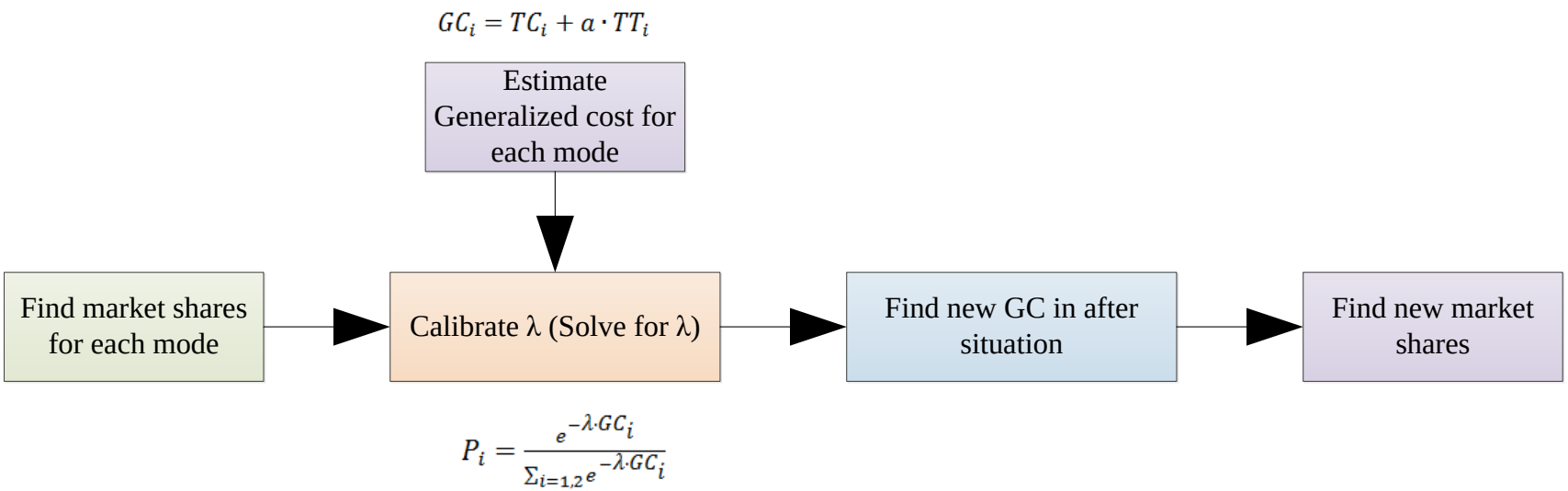
Modal Shifts based on generalized cost of transport

- General Case – Hierarchical Structure





Process of estimating the impacts of SECA



For more on model calibration..

ELSEVIER

Transportation Research Part D: Transport and Environment

Volume 52, Part A, May 2017, Pages 185–201

The implications of the new sulphur limits on the European Ro-Ro sector

Thalis Zis, Harilaos N. Psaraftis

Department of Management Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

Available online 16 March 2017

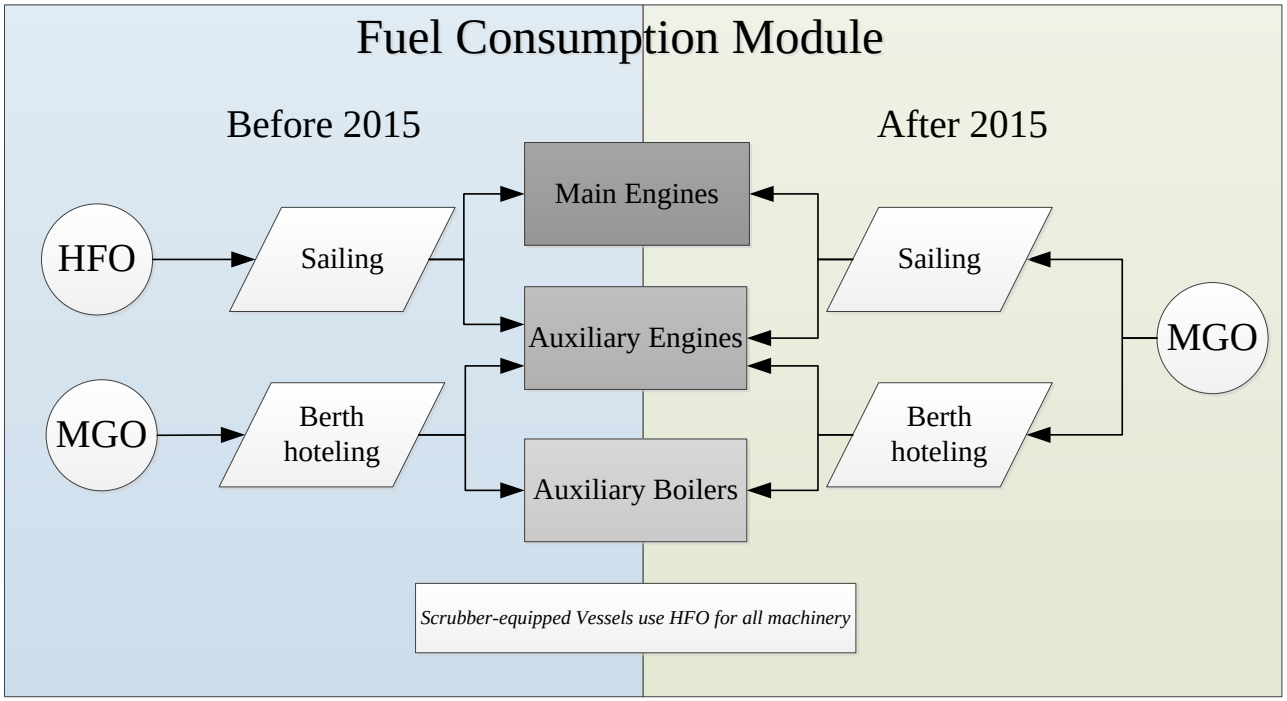
CrossMark

Show less

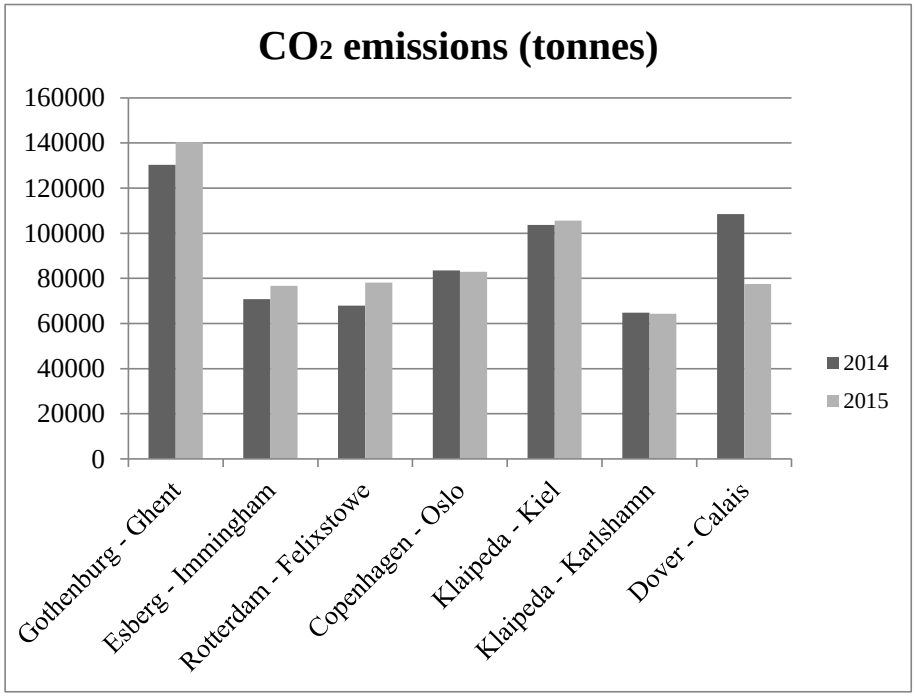
https://doi.org/10.1016/j.trd.2017.03.010

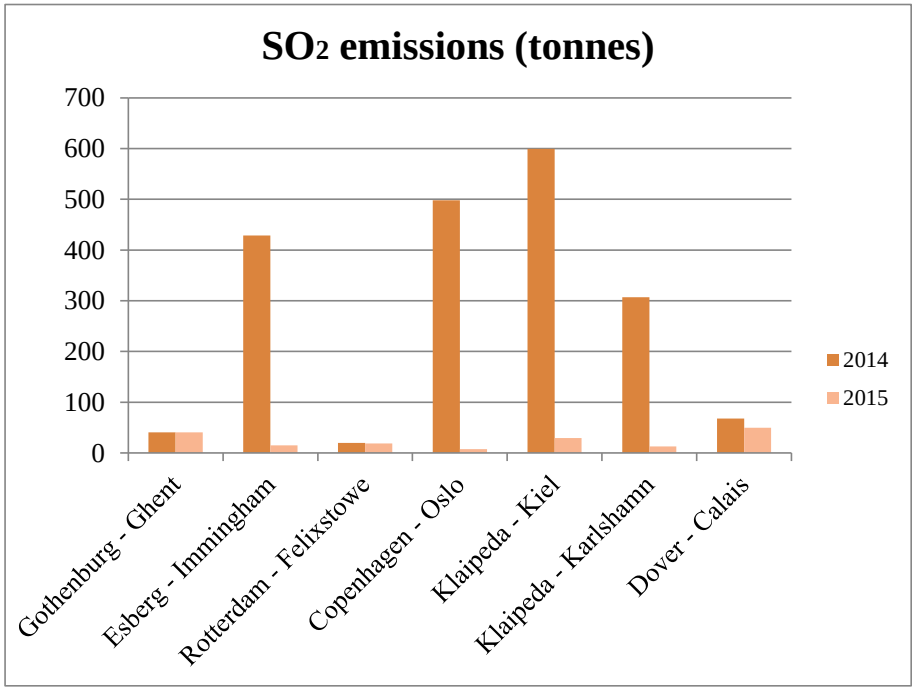
Get rights and content

Emissions modelling based on actual fuel consumption Data

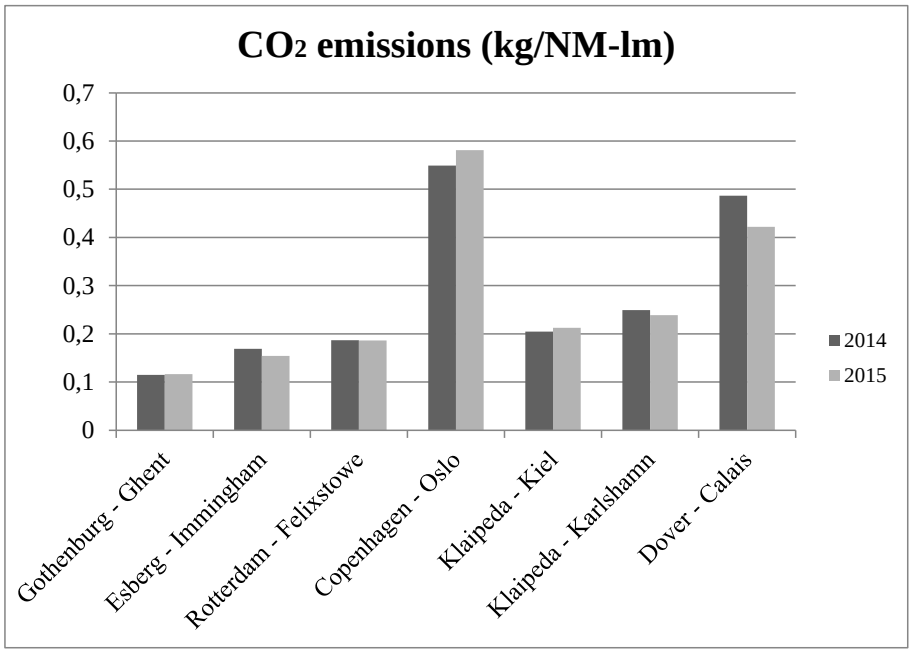


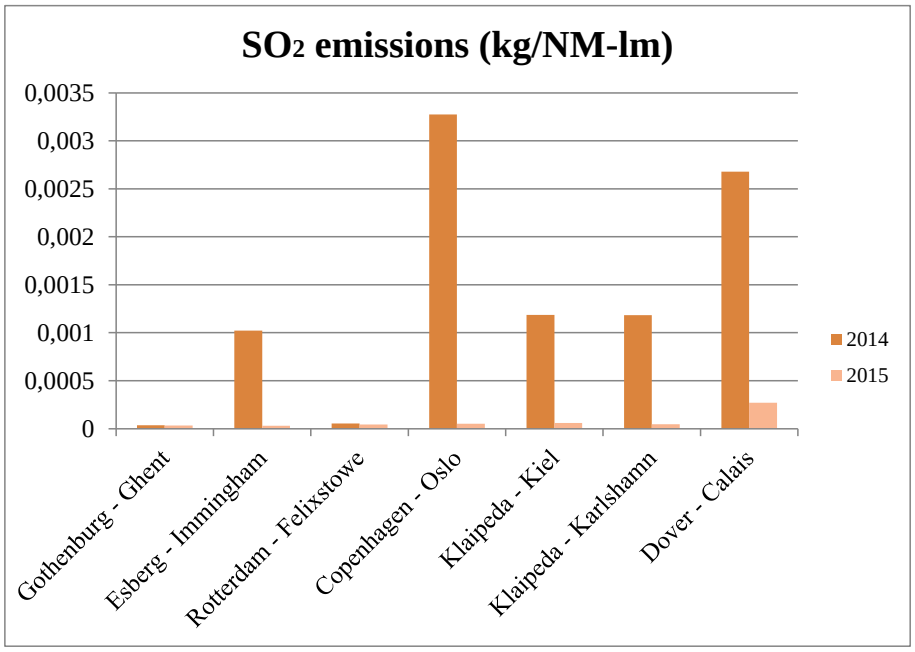
Emissions of the fleet (tonnes per year)





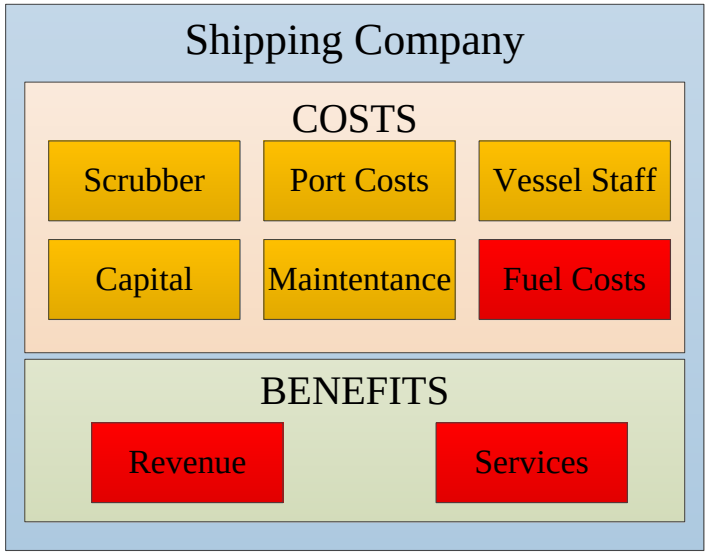
Emissions per transported unit (kg/lm-NM)





Profitability indicator for the Ro-Ro operator

- Revenue
  - Passengers
  - Freight Rate for Cargo
  - Miscellaneous (Food, Drinks, Casino etc.)
- Costs
  - Fuel
  - Port
  - Staff
  - Maintenance
  - Other
- Aftermath
  - If Route non-profitable, consider shut down
  - Re-run modal split



Presentation Outline

- Background
  - Short Sea Shipping in Northern Europe
  - The Sulphur Emission Control Areas
  - Anticipated Impacts
  - Effects to Ro-Ro operators
- Methodology
  - Route Selection Criteria
  - Modelling modal shifts
  - Environmental efficiency
  - Profitability of a service
- Measures from the Ro-Ro operator
  - Speed reduction
  - Sailing frequency
  - Technology
- Policy measures
  - Internalization of external costs
  - Reimbursing the BAF surcharges
  - Tax levy on landbased modes
- Conclusions

Effects of Speed on fuel consumption

Gothenburg – Ghent (Normal sailing time 32 hours)

Ship	Hours at berth	Hours sailing	Weekly fuel consumption (tonnes)	Reduction (%)
Baseline Sailing Speed **18.06 knots**				
Ship A	38	130	294.354	NA
Ship B			305.564	
Ship C			270.198	
Ship D			277.407	
Increase Trip by **1 hour**, New Sailing Speed **17.26 knots**				
Ship A	32	136	264.585	-10.11
Ship B			273.453	-10.51
Ship C			245.181	-9.26
Ship D			253.777	-8.52
Increase Trip by **2 hours**, New Sailing Speed **16.53 knots**				
Ship A	26	142	240.315	-18.36
Ship B			247.638	-18.96
Ship C			222.784	-17.55
Ship D			231.167	-16.67
Increase Trip by **3 hours**, New Sailing Speed **15.86 knots**				
Ship A	20	148	191.740	-34.86
Ship B			196.167	-35.80
Ship C			177.715	-34.23
Ship D			185.196	-33.24

Effects on cargo volumes, revenue, fuel cost

Gothenburg – Ghent (Normal sailing time 32 hours)

Baseline Sailing Speed **18.06 knots**		
	Transported lm	Cost of Fuel (€)
Fuel Case 1	42331	Confidential
Fuel Case 2	39533	
Fuel Case 3	43724	
Increase Trip by **1 hour**, New Sailing Speed **17.26 knots**		
	ΔTransported lm (%)	ΔCost of Fuel (%)
Fuel Case 1	-0.05	-9.98
Fuel Case 2	-0.36	
Fuel Case 3	-0.11	
Increase Trip by **2 hours**, New Sailing Speed **16.53 knots**		
Fuel Case 1	-0.1	-18.32
Fuel Case 2	-0.7	
Fuel Case 3	-0.15	
Increase Trip by **3 hours**, New Sailing Speed **15.86 knots**		
Fuel Case 1	-0.16	-34.99
Fuel Case 2	-0.76	
Fuel Case 3	-0.21	

Scenarios on Fuel Price

- **Case 1: What actually happened (MGO with actual prices)**
- **Case 2: What would happen if MGO prices returned to 2014 levels**
- **Case 3: What would happen if HFO still allowed (Actual prices)**

Effects of new sailing frequency

Esbjerg – Immingham (Normal frequency 6 sailings per week)

	New sailing frequency	New Transported lm	New capacity utilization	ΔRevenue (€)	ΔFuel Cost (€)
Fuel Case 2	5	29060	96.86	-112273	-33579
Fuel Case 3	7	34475	82.02	39897	16569

Klaipeda – Kiel (Normal frequency 7 sailings per week)

	New sailing frequency	New Transported lm	New capacity utilization	ΔRevenue	ΔFuel Cost
Fuel Case 1	6	26900	97.36	-32419	-28172
Fuel Case 2	6	25950	96.19	-25082	-57093

Dover – Calais (Normal frequency 99 sailings per week)

	New sailing frequency	New Transported lm	New capacity utilization	ΔRevenue	ΔFuel Cost
Fuel Case 1	75	131724	94.63	-56039	-58844
Fuel Case 2	75	130760	Conf	-74580	-119255

Payback period of scrubbers

- DFDS has retrofitted 18 of its vessels.
- In the examined routes there are 9 vessels running on low-sulphur fuel
- Assumed a retrofit on the ship with the highest fuel consumption (Ro-Ro)

Fuel prices	*HFO (€/ton)*	*MGO (€/ton)*	*Annual Savings (M€)*	*Payback period (years)*
December 2015	135	304	1.21	4.3
October 2015	237	480	1.731	2.9
November 2014	590	880	1.998	2.4
February 2014	803	1212	2.825	1.3

- Considering the global cap coming in 2020, perhaps waiting is an option
  - Different fuel price differential
  - Newer technologies
  - New subsidies to operators may come

Presentation Outline

- Background
  - Short Sea Shipping in Northern Europe
  - The Sulphur Emission Control Areas
  - Anticipated Impacts
  - Effects to Ro-Ro operators
- Methodology
  - Route Selection Criteria
  - Modelling modal shifts
  - Environmental efficiency
  - Profitability of a service
- Measures from the Ro-Ro operator
  - Speed reduction
  - Sailing frequency
  - Technology
- Policy measures
  - Internalization of external costs
  - Reimbursing the BAF surcharges
  - Tax levy on landbased modes
- Conclusions

Internalization of External Costs

- External Costs of transport are associated with Emissions, Noise, Accidents

- Two studies are used:
  - COWI/DTU (Danish Ministry of Transport) – Value per km
  - External Costs Handbook (EU Commission) – Value per km
  - Damage costs (€/ton of emissions)

Route	Freight Rate (€/lm) – 2015	External Cost of emissions (€/lm)
Gothenburg – Ghent	47.4	4.48
Esbjerg – Immingham	40.8	6.25
Rotterdam – Felixstowe	17.97	2.01
Copenhagen – Oslo	27.2	16.71*
Klaipeda – Kiel	34.8	7.35*
Klaipeda – Karlshamn	36.5	5.14*
Dover – Calais	9.3	0.23*

* Ships that also carry Passengers. Emissions attributed fully to cargo

Reimbursing the BAF

Route	Freight Rate (€/lm) – 2015	BAF surcharge		
		FC1	FC2	FC3
Gothenburg – Ghent	47.4	1.37	5.13	-2.57
Esbjerg – Immingham	40.8	1.19	4.30	-2.07
Rotterdam – Felixstowe	17.97	0.44	1.58	-0.76
Copenhagen – Oslo	27.2	1.19	4.30	-2.07
Klaipeda – Kiel	34.8	1.76	6.34	-3.04
Klaipeda – Karlshamn	36.5	1.01	3.65	-1.75
Dover – Calais	9.3	0.33	1.20	-0.59

- Esbjerg – Immingham (FC1)
  - If BAF was paid by policy
  - 2.22% increase in transport
  - Total Cost of 1.8M€ (for 2015)

Adding a Landbased Tax Levy

- The amount depends
  - on road distance travelled
  - BAF surcharge on maritime leg
  - Average cargo value

- Klaipeda – Kiel (FC1)
  - Route that practically competes only with landbased modes
  - Maritime freight rate was decreased compared to 2014
  - Would have been further decreased without the regulation
  - The landbased cost of transport should increase by 7.05% (affecting also maritime option)

Conclusions

- Freight Rate is the most important component for the shipper
- Time is not crucial, except for high-value cargoes
- Speed reduction can help in times of high fuel prices
- Changes in sailing frequency can help with capacity utilization rates
- Technology investments depend on fuel prices. Returns are currently delayed
- Requirements for policy measures to mitigate potential modal shifts
- Policies sensitive to fuel prices. BAF, eco-bonus, external costs. **But who pays?**

Thank you - Questions?

The work presented has been in the context of the project:

"Mitigating and reversing the side-effects of environmental legislation on Ro-Ro shipping in Northern Europe"

funded by the Danish Maritime Fund.

See more: www.roroseca.transport.dtu.dk

Contact: tzis@.dtu.dk