The implications of the lower sulphur limits on Ro-Ro shipping in Northern Europe

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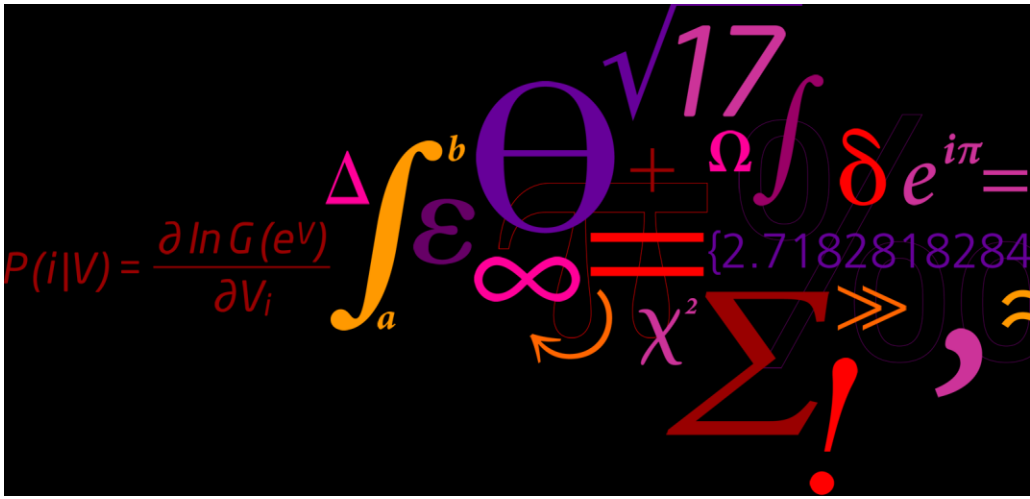


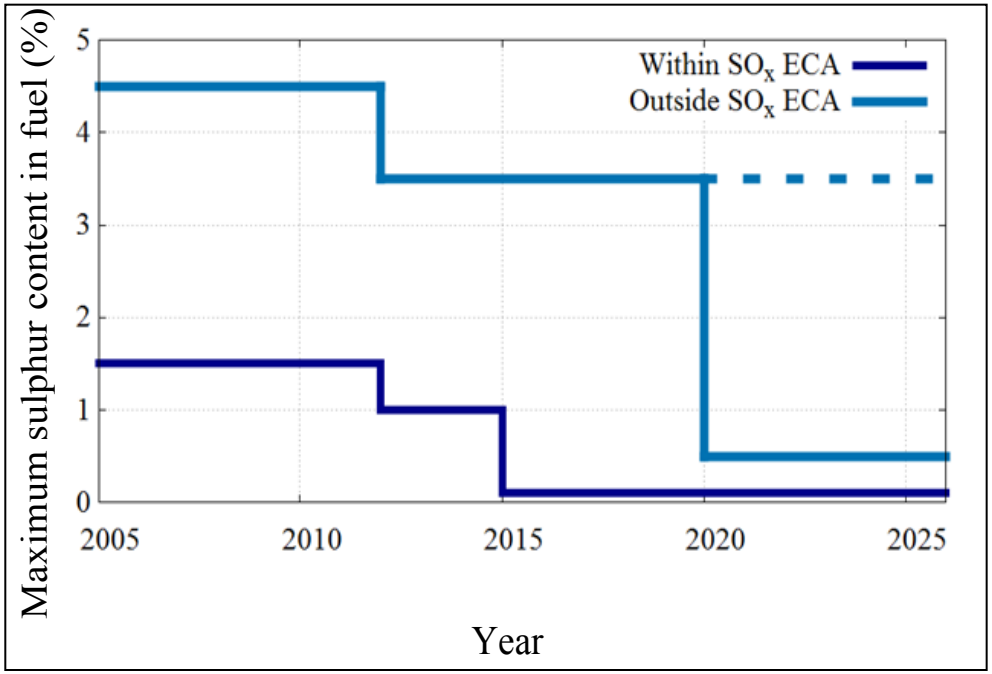
DTU Management Engineering
Department of Management Engineering

Presentation Outline

- Background
  - Objectives
  - Anticipated Impacts
  - Market picture and Fuel Prices
  - Effects to Ro-Ro operators
  - Costs for shippers
- Modelling Modal shifts
  - Objectives
  - Route Selection Criteria
  - Market picture after the limit
  - Methodology
- Initial findings
  - The most important component
  - Case studies
- Next Steps

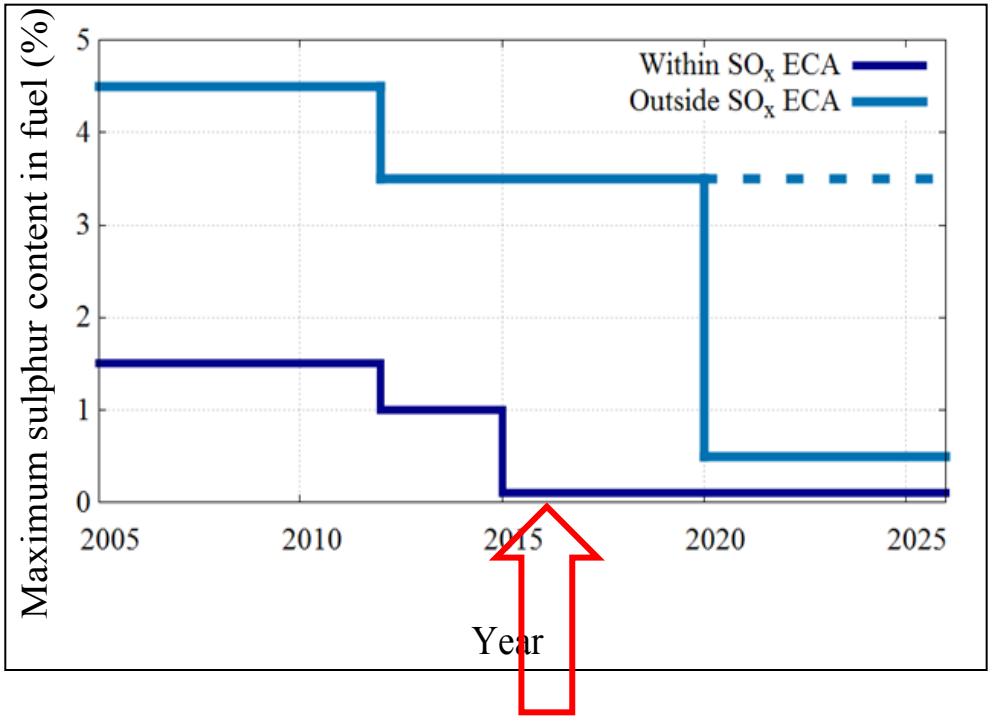
Background

- 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

We are here..

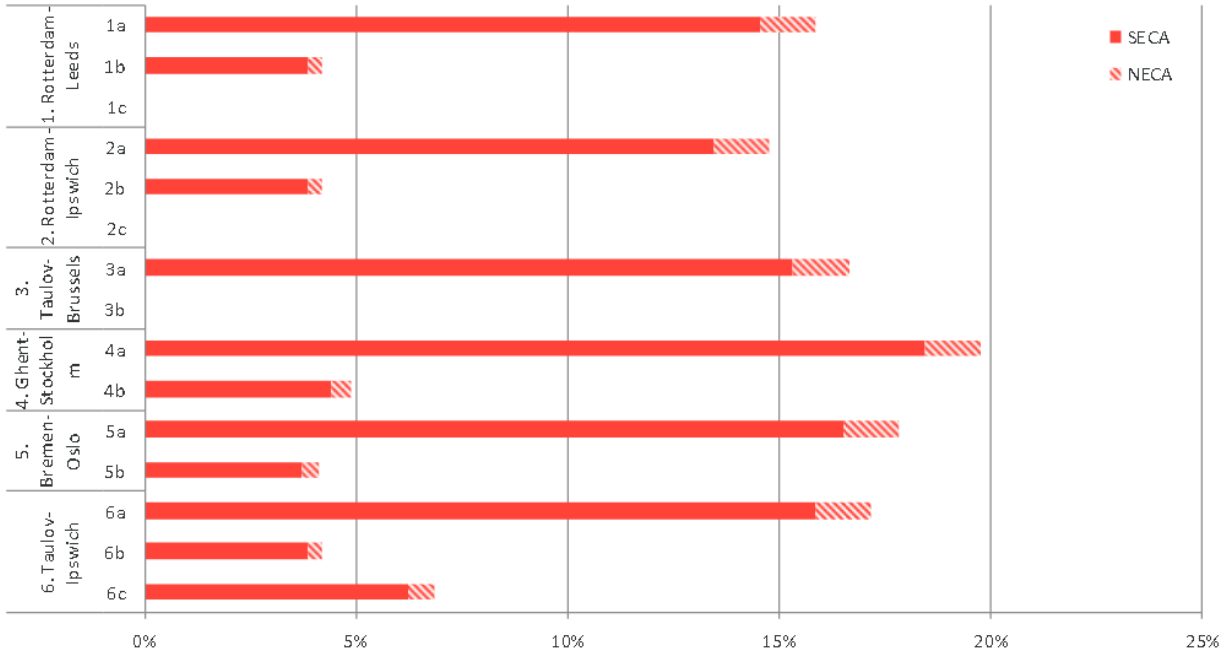

Maximum sulphur content in fuel (%)
5
4
3
2
1
0
2005
2010
2015
2020
2025
Year
Within SO_x ECA
Outside SO_x ECA

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)

Anticipated impacts from studies

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



Source: The impact on short sea shipping and the risk of modal shift from the establishment of a NOx emission control area in the North Sea (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%.

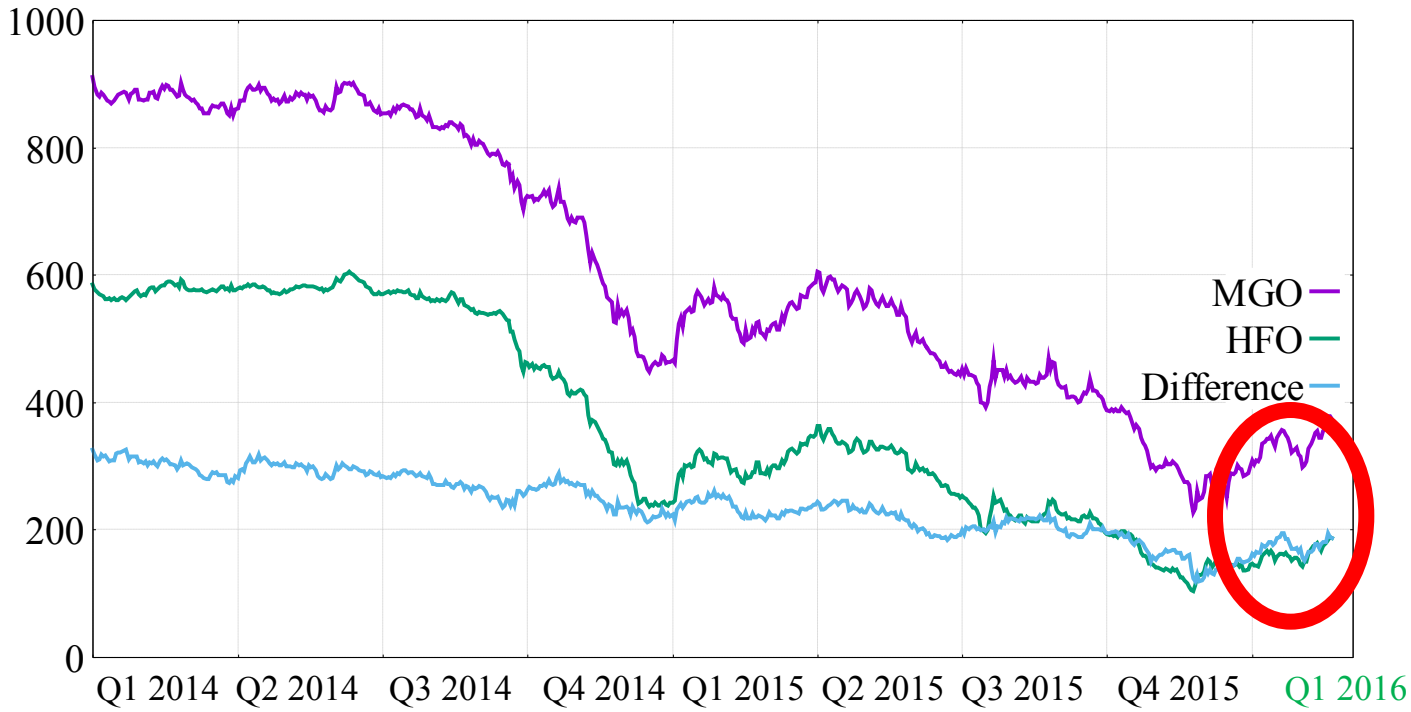
P&O breaks Channel freight record in 2015

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

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

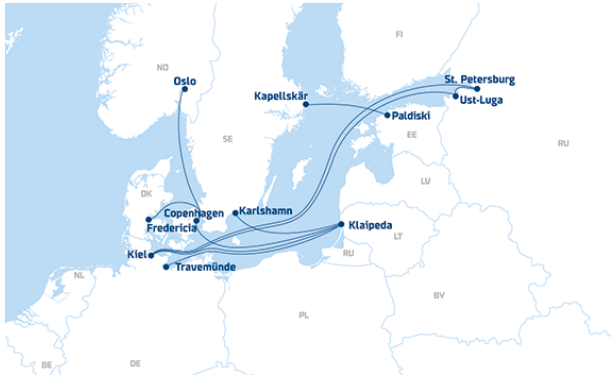
- On SECAs (is the environmental improvement significant?)
- How is Short Sea Shipping affected
- External effects on modal shifts?
- Identify the negative impacts of the regulation
- Propose measures to mitigate and reverse these

The RoRoSECA project

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

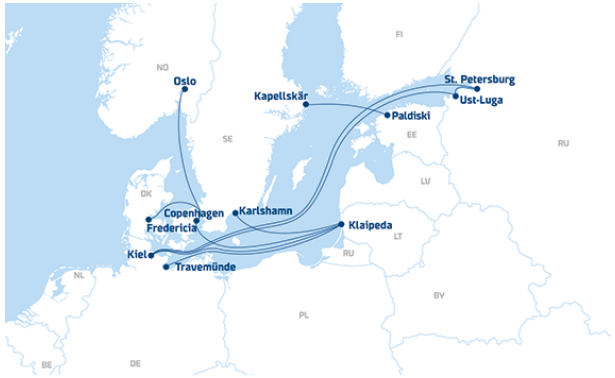
Current DFDS network

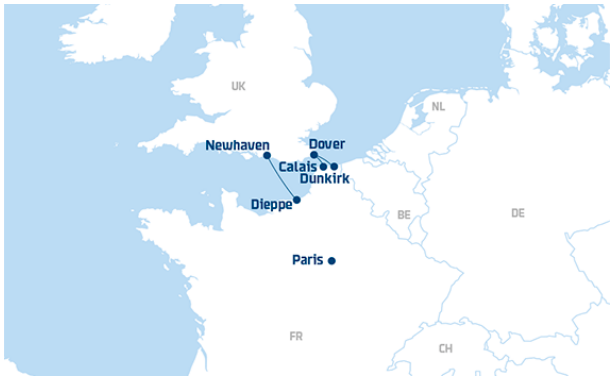
- 18 Routes (22 links)
- ~38 vessels
- Up to 535 departures/week, 13 countries, 30 ports
- 4 main areas
  - North Sea (9 Routes, 20 vessels)
  - Baltic Sea (5 Routes, 7 vessels)
  - Cross-Channel (3 Routes, 6-7 vessels)
  - Mediterranean (1 Route, 1-2 vessels)



Summary of selected routes

- 7 Routes (+1 recently shut down, +1 not affected by SECA)
- Analysing data of up to 38 vessels (due to changes in deployment)
- 240 out of a maximum 535 departures/week
- Significant proportion of total travel distance (43.4%)
- Significant proportion of total maximum capacity (43.48%)

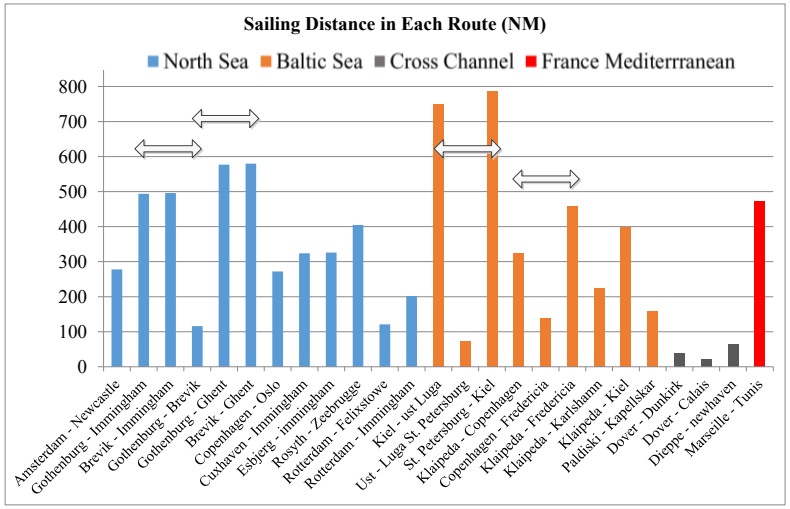




Snapshot of main route statistics

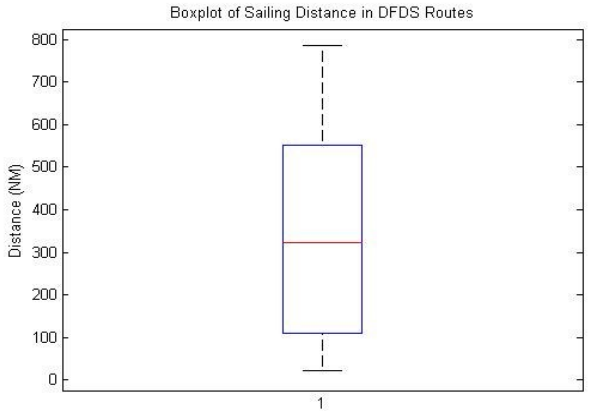
Volume

- The selected routes account for approximately 43% of the total DFDS lane meters capacity



Vessel Type and Technology

- 2 Cruise Ships (1 MGO, 1 scrubbers)
- 8 Ro-Ro (3 MGO, 5 scrubbers)
- 6 Ro-Pax (4 MGO, 2 scrubbers)

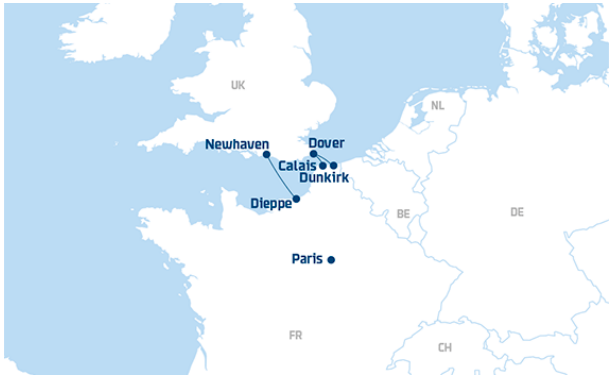


Distance of Proposed Routes
577*
326
272
121
397
223
22

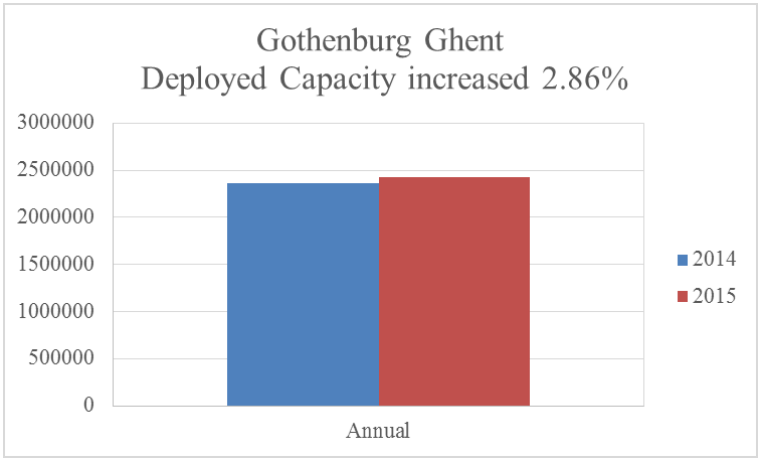
Summary of Routes

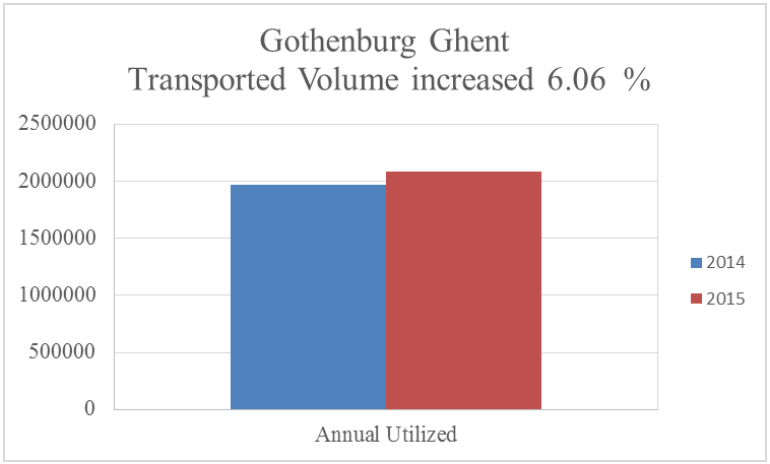
Route	Distance	Vessel		Vessel Capacity	
	(NM)	Type	Tech	Lane meters	Pax
NORTH SEA					
Gothenburg – Ghent	577	RoRo	Scrubber	3831	12
		RoRo	Scrubber	3831	12
		RoRo	Scrubber	3831	12
Copenhagen – Oslo	272	Cruise	Scrubber	(450 cars)	1790
		Cruise	MGO	(320 cars)	1989
Esbjerg – Immingham	326	RoRo	Scrubber	3000	12
		RoRo	MGO	3000	12
Rotterdam – Felixstowe	121	RoRo	Scrubber	2772	12
		RoRo	Scrubber	2772	12
		RoRo	MGO	1680	12
BALTIC SEA					
Klaipeda – Kiel	397	RoPax	Scrubber	2115	328
		RoPax	Scrubber	2240	328
Klaipeda – Karlshamn	223	RoPax	MGO	2490	600
		RoPax	MGO	2496	600
CROSS CHANNEL					
Dover – Calais	26	RoPax	MGO	1784	1100
		RoPax	MGO	1949	405

Deployment and transported volumes 2014 vs 2015

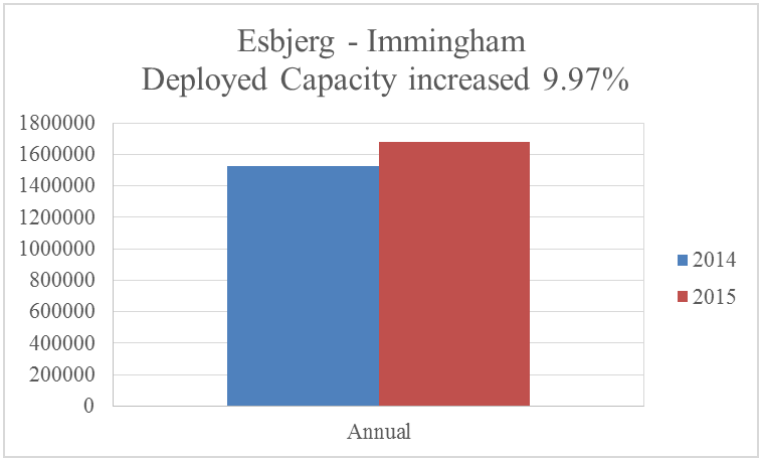


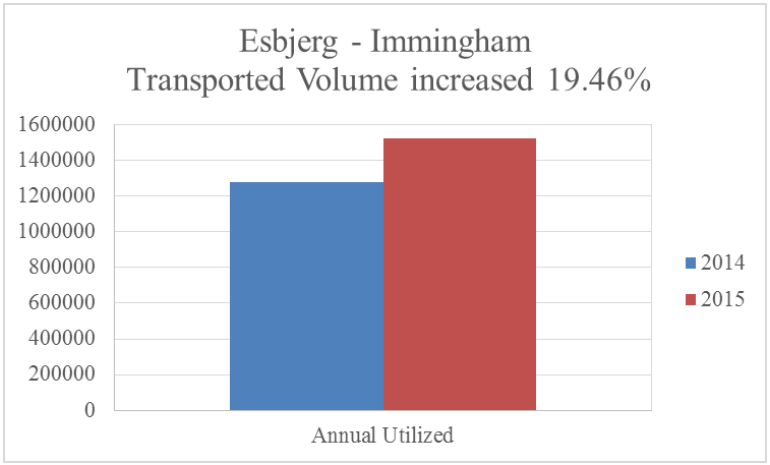
Gothenburg – Ghent



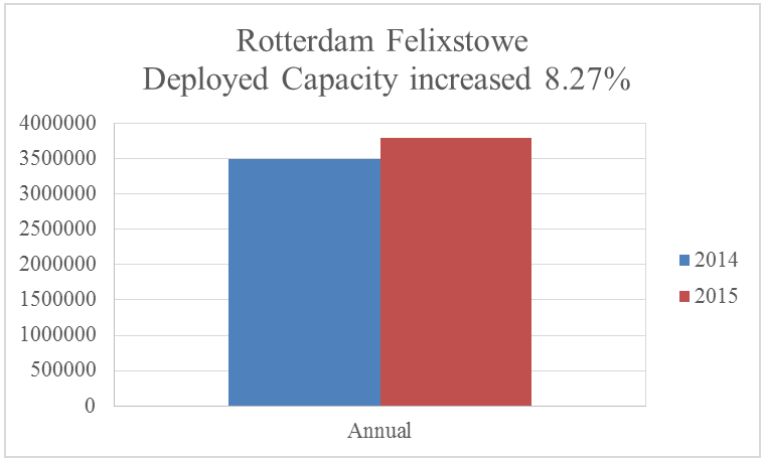


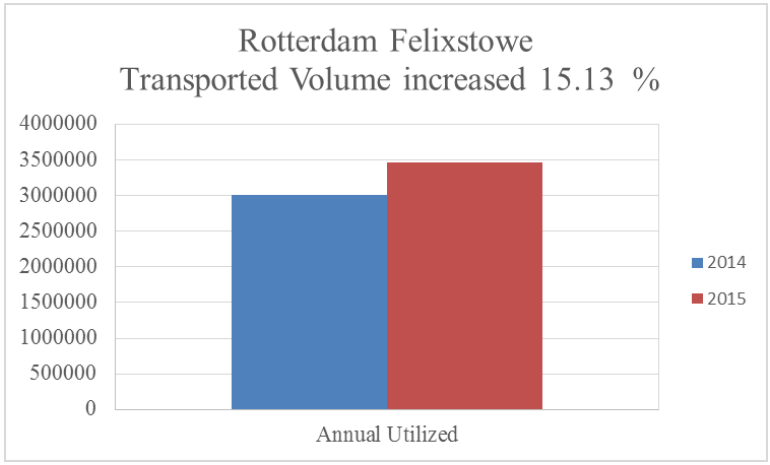
Esbjerg – Immingham



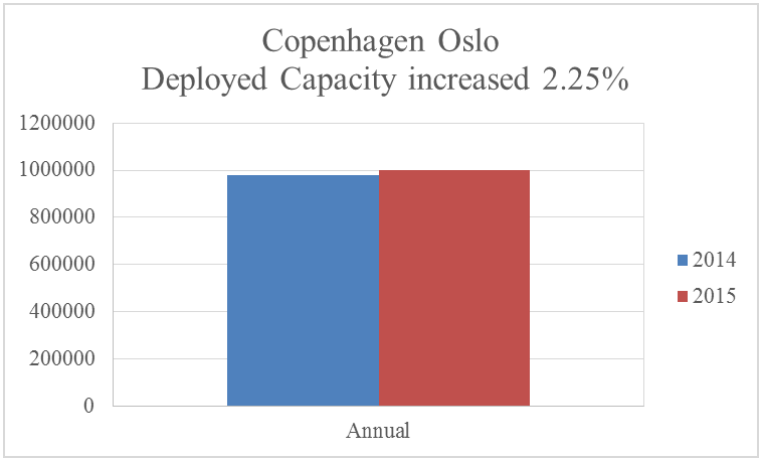


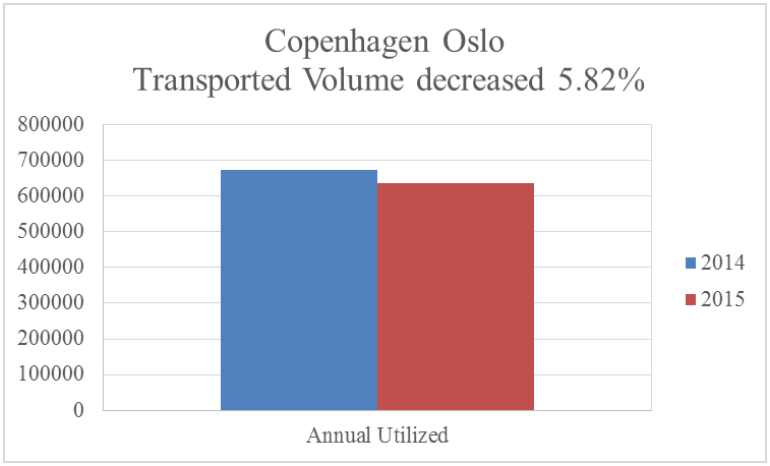
Rotterdam – Felixstowe



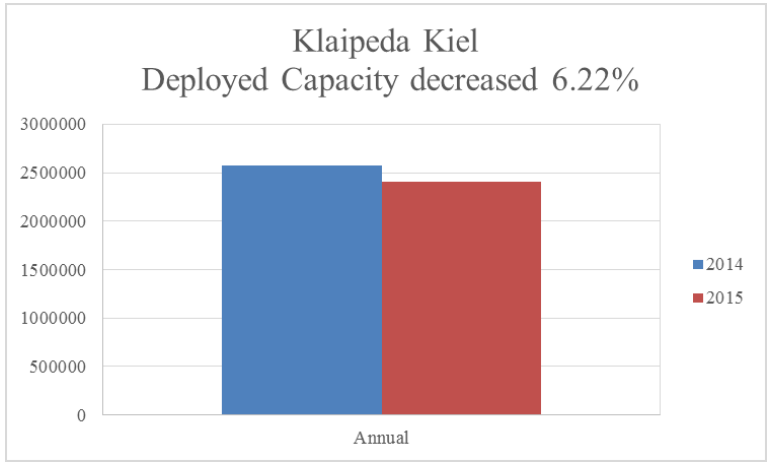


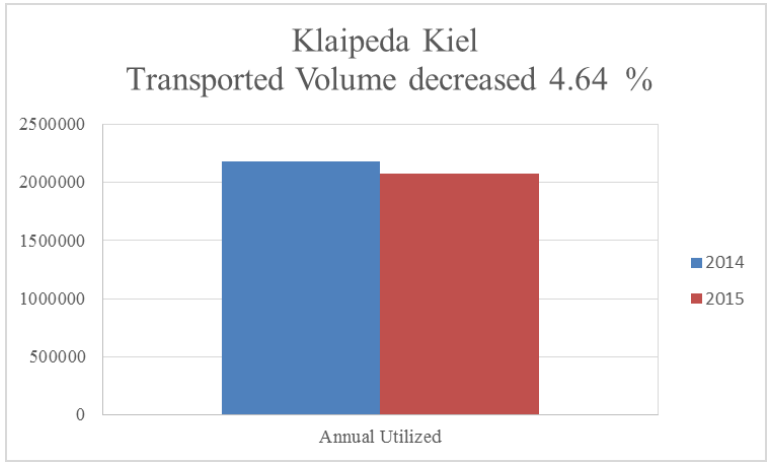
Copenhagen – Oslo



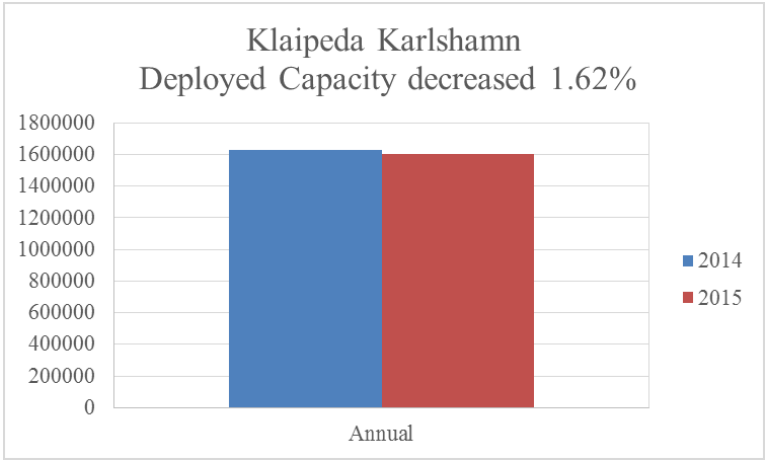


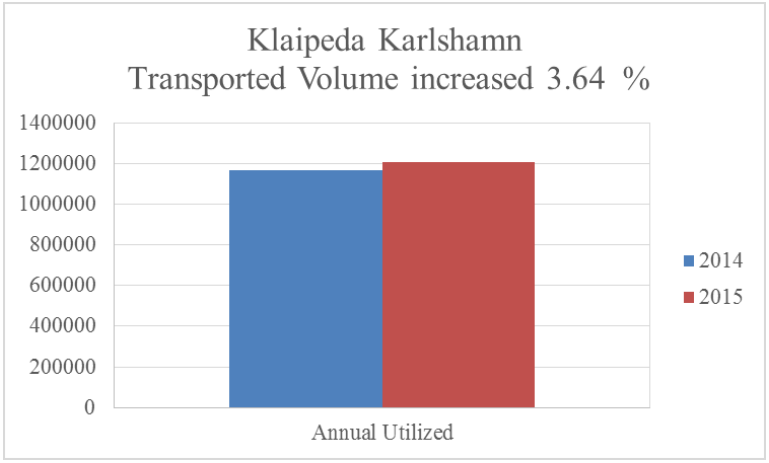
Klaipeda – Kiel



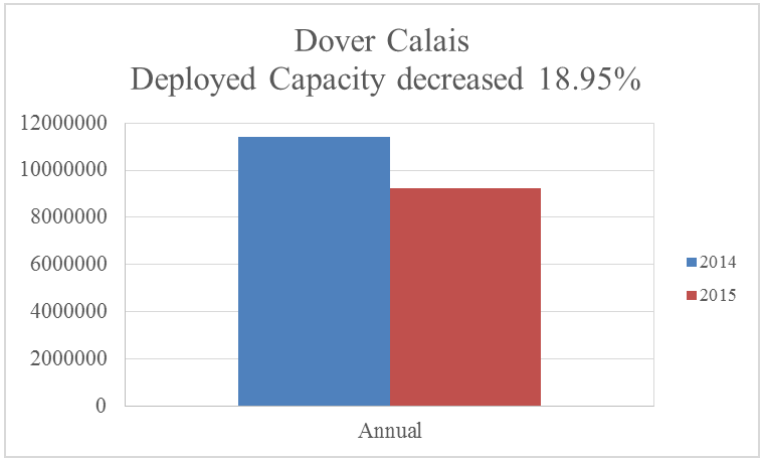


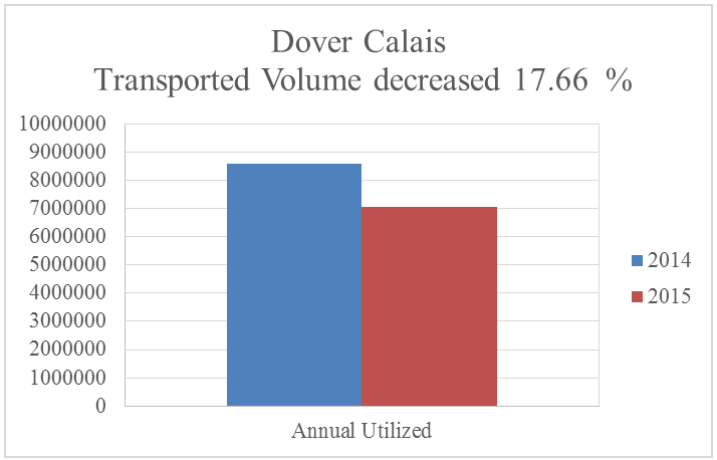
Klaipeda – Karlshamn





Dover – Calais

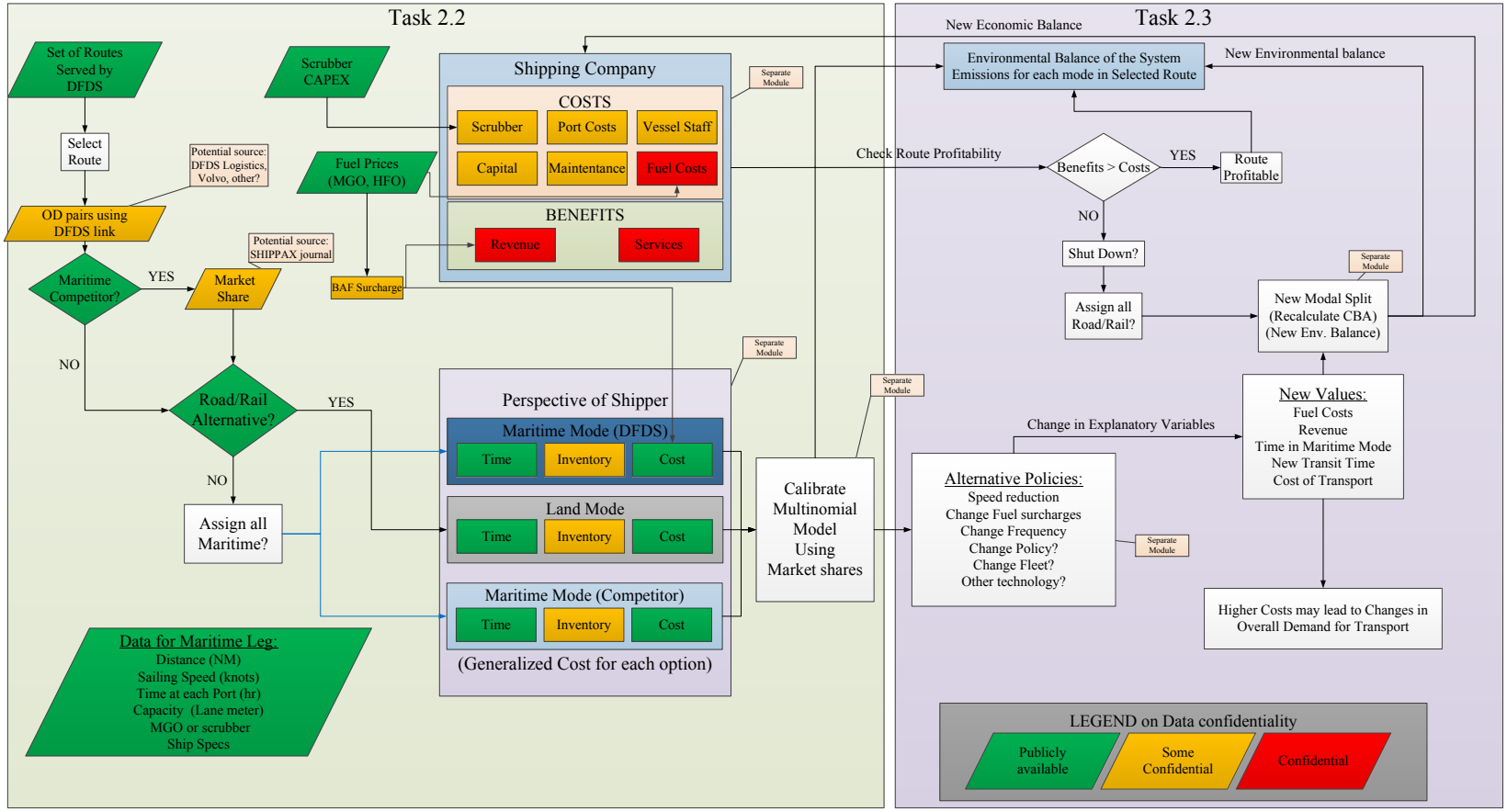




Market picture and first conclusions

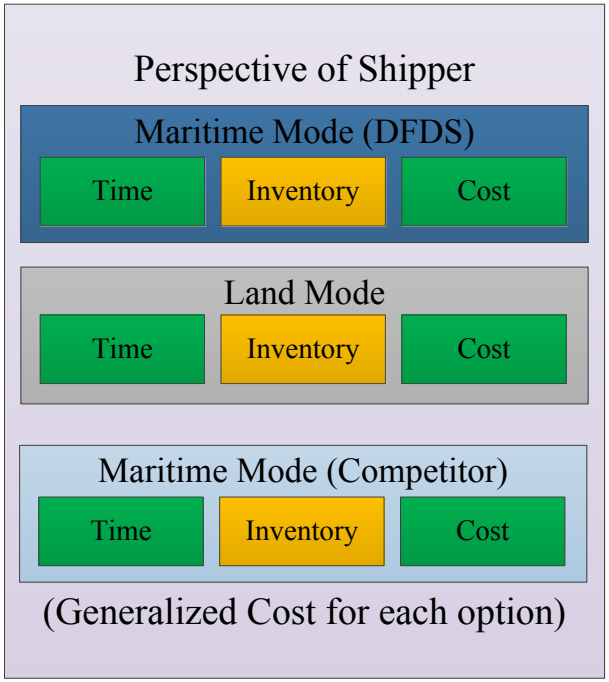
- Fleet deployment has improved for all routes, even when transported volumes decreased
- Marseille – Tunis route (unaffected by SECA) also shows increase in traffic
- Increases in travel demand of some routes can be attributed to closures of competing services
- Lack of precise data requires certain sensitivity analyses to be conducted
  - Market Shares
  - Breakeven Distance
  - Freight Rates for Road Transport

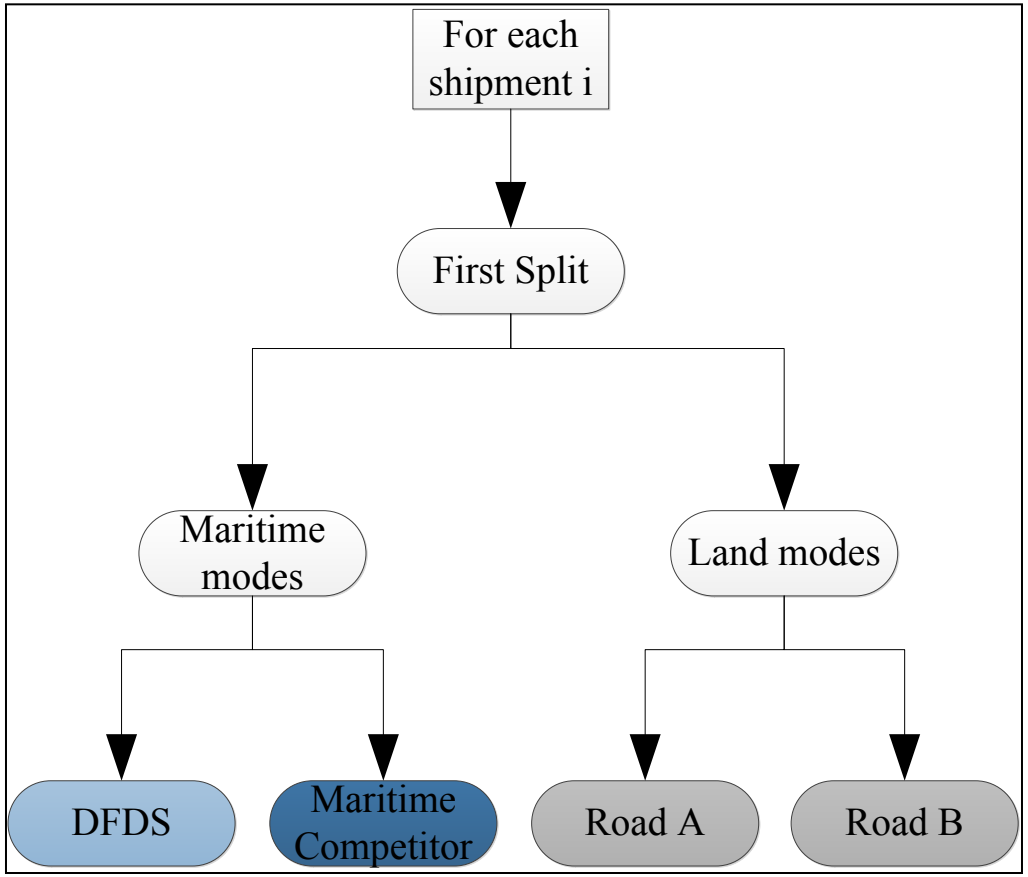
Methodological Framework



Perspective of the Shipper – a Bi-level model

- General Case – Hierarchical Structure





Generalized Cost and probability of choice

- Probability of selecting mode i is

$$P_i = \frac{e^{-\lambda \cdot GC_i}}{\sum_{i=1}^{2} e^{-\lambda \cdot GC_i}}$$

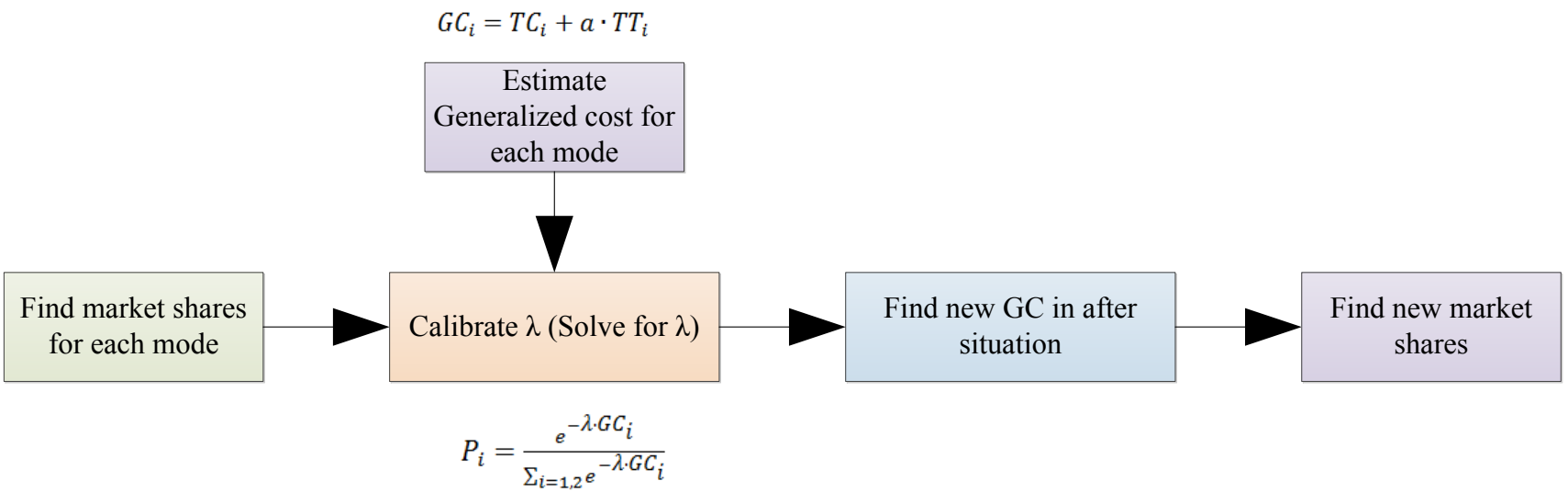
Where GCi is the Generalized Cost of mode i:

$$GC_i = TC_i + \alpha \cdot TT_i$$

Where TCi is the Travel Cost (€/lm), TTi is the Travel Time (hours), α is the value of time (€/lm*hours)

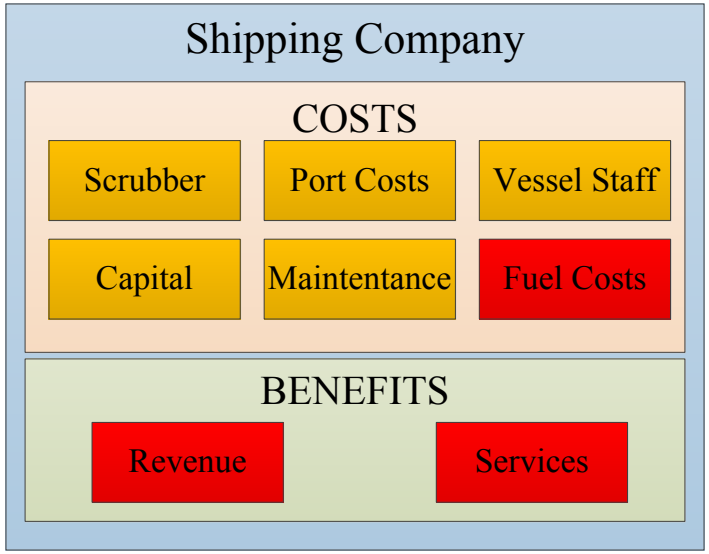
- λ is a scale parameter that acts as a weight attached in the choice. The larger the value, the greater the implication of a change in cost in one of the modes

Process of estimating the impacts of SECA

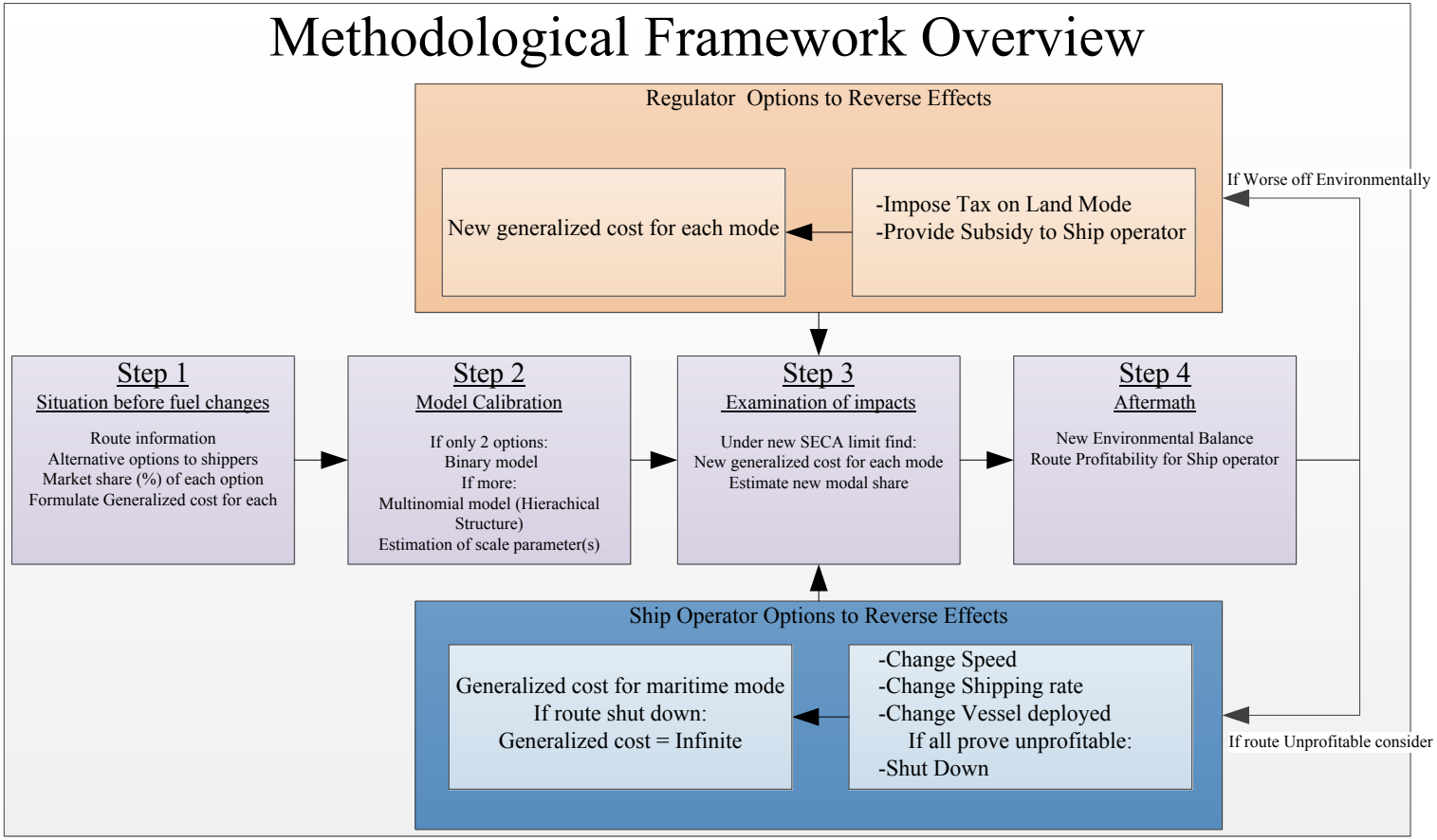


Perspective of the Shipping Company

- Identify Revenue with a given Transport Demand
  - Passengers
  - Freight Rate for Cargo
  - Miscellaneous (Food, Drinks, Casino etc.)
- Identify Costs
  - Fuel
  - Port
  - Staff
  - Maintenance
  - Other
- Formulate Profitability Function
  - If Route non-profitable, consider shut down
  - Re-run modal split



Linking the various modules together



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Sensitivity Analyses – Variations on:

- Market Share for each Option (range varies up to 10%)
- Cargo Value (from very cheap to very expensive)
- Depreciation rate (1-7%)
- Change in Haulers' Transport Cost
- **Fuel Case 1: What actually happened (MGO with actual prices)**
- **Fuel Case 2: What would happen if HFO allowed (2015 prices)**
- **Fuel Case 3: What would happen if prices increase (2014 MGO)**

Calibration results for all routes low value of λ indicates big shift potential

Route	Market Share (%)			Road distance (km)			Average scale parameter	
	DFDS	*Maritime competitor*	*Landbased*	*DFDS*	*Maritime competitor*	*Landbased*	λ	λ_{mar}
Gothenburg – Ghent	24-30	21-29	39-49	200±100	700±100	1600±300	**0.0272**	**0.0252**
Esbjerg – Immingham	60-70		30-40	100±50		1500±200	0.08	NA
Rotterdam – Felixstowe	30-40		60-70	100±50		500±100	0.14	
Copenhagen – Oslo	20-25	NA	75-80	100±50	NA	600±100	0.108	
Klaipeda – Kiel	51-61	NA	39-49	200±100	NA	1600±200	**0.0189**	
Klaipeda – Karlshamn	67-77	23-33	NA	100±50	200±100	NA	0.08	
Dover – Calais	39-49	NA	51-61	NA			**0.015**	

Gothenburg - Ghent

Gothenburg - Ghent												
	Road only				*via Maritime I - DFDS*				*via Maritime II (Gothenburg – Kiel)*			
	Share (%)	Distance (km)	Total Time (h)		Share	Road Distance (km)	Total Time (h)		Share	Road Distance	Total Time (h)	
Baseline (2014)	39-49	1600±300	23±2		24-30	100-300	38±2		21-29	600-800	22±2	
	New Road Share	% Change	$\lambda_{1(road-Maritime)}$		New DFDS Share	% Change	$\lambda_{2(DFDS-Maritime)}$		New Mar 2 Share	% Change		
Fuel Case 1 (Base 2015)	-0.22% IQ: -0.37:-0.06	-0.47%			+1.23% IQ: 1.09:1.56	+3.98%			-1.02% IQ: -1.21:-0.95	-4.71%		
Fuel Case 2 (HFO 2015)	-0.63% IQ: -0.44:-0.08	-1.38%	0.0052±0.0035		+1.68% IQ: 1.38:2.15	+5.56%	0.018±0.007		-1.05% IQ: -1.67:-0.76	-4.73%		
Fuel Case 3 (MGO 2014)	+0.58% IQ: 0.05:0.25	+1.35%			-1.02% IQ: -1.05:-0.49	-3.34%			+0.44% IQ: 0.37:0.80	+2.04%		

Klaipeda – Kiel

Klaipeda Kiel							
	Road only				*via Maritime - DFDS*		
	Share (%)	Distance (km)	Time (h)		Share	Road Distance (km)	Time (h)
Baseline (2014)	39-49	1600±300	23±2			100-300	28±2
	New Road Share	%Change		$\lambda_{(road\text{-}Maritime)}$	New DFDS Share	%Change	
Fuel Case 1 (actual 2015)	-0.29% IQ: -0.29:-0.08	-0.62%			+0.29% IQ: 0.08:0.29	+0.55%	
Fuel Case 2 (HFO 2015)	-0.73% IQ: -0.64:-0.16	-1.56%		0.012±0.05	+0.73% IQ: 0.16 :0.64	+1.31%	
Fuel Case 3 (MGO 2014)	+0.93% IQ: 0.18:0.96	+2.12%			-0.93% IQ: -0.96:-0.18	-1.65%	

Dover - Calais

Dover Calais							
	Maritime DFDS				*Eurotunnel*		
	Share (%)	Distance (km)	Time (h)		Share	Road Distance (km)	Time (h)
Baseline (2014)	39-49	1600±300	23±2			100-300	28±2
	New DFDS Share	%Change			New Eurotunnel Share	%Change	
Fuel Case 1 (actual 2015)	-3.6% IQ: -6.9:-1.7	-6.91%		$\lambda_{(road\text{-}Maritime)}$	+3.6% IQ: 1.7:6.9	+7.81%	
Fuel Case 2 (HFO 2015)	-4.8% IQ: -8.3:-3.3	-8.95%		0.015±0.05	+4.8% IQ: 3.3:8.3	+10.78%	
Fuel Case 3 (MGO 2014)	-5.3% IQ: -9.1:-3.6	-9.74%			+5.3% IQ: 3.6:-9.1	+11.71%	

Additional analyses

- Comparison of fuel savings for ships using MGO vs scrubbers
- The current low fuel prices have affected the payback period of scrubbers
- Comparisons of actual fuel consumption with predicted outputs
- Estimation of fuel consumption under different circumstances for year 2 (e.g. Change of sailing speed, change vessel deployment, etc.)
- Initial findings show that there are negative repercussions to ship operators, even if these are not as obvious as anticipated 2 years ago

Conclusion

- Maritime shares **increase** due to **observed low prices**
- Maritime shares **would increase** further if **HFO was still allowed**
- Maritime shares **would drop** at fuel levels of **2014 using MGO**
- **Freight Rate** is the most important component
- **Time** is **not crucial**, except for high-value cargoes. Slow steaming could be an option
- **Profitability** of ship operator is **masking the negative effects** of the regulation – a happy coincidence

Further Work

- Reverse the negative changes: Introduce changes in the explanatories

- E.g. Change the GC of transport for maritime and competitive modes

- Ship operator measures:
  - Speed reduction in certain routes
  - Change of sailing frequency
  - Changes in fleet deployment
  - Alternative technologies including LNG as fuel
  - Changes in nominal capacity of a vessel

- Policy measures
  - Internalization of external costs
  - Adaptation of ECO bonus systems for hauliers choosing SSS modes
  - Subsidies for retrofits
  - Tax levy on competing modes

Thank you - Questions?

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