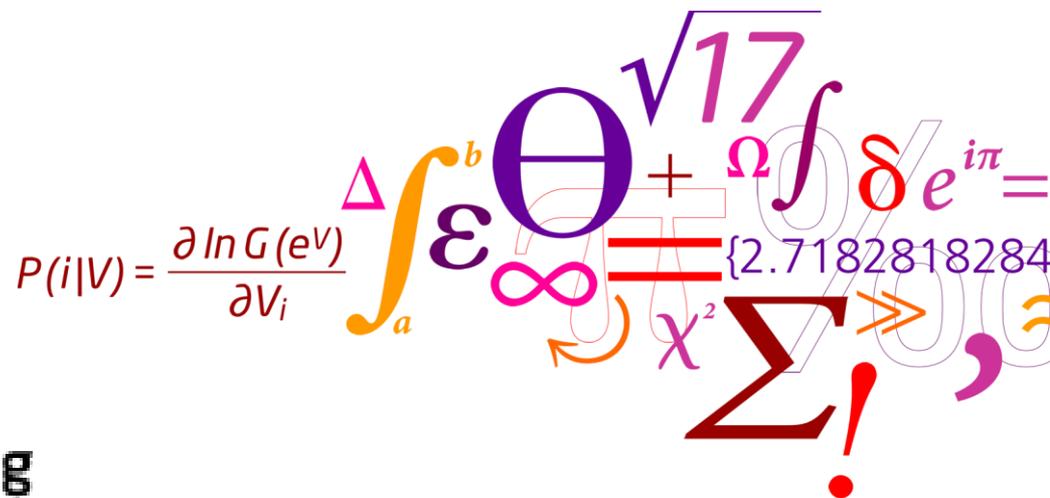


# The implications of the new sulfur limit in the European Ro-Ro sector

Thalis Zis  
Harilaos N. Psaraftis

Postdoctoral Researcher  
Professor



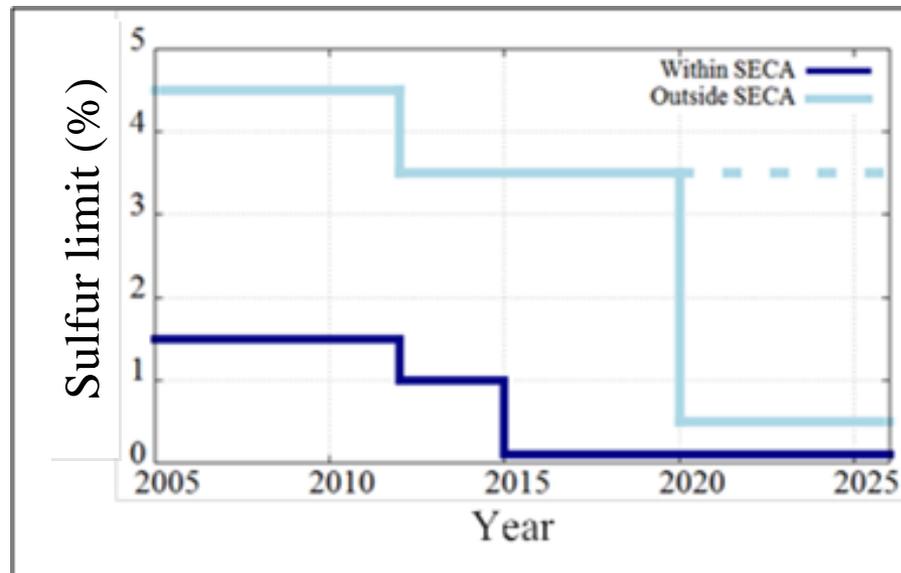
$$P(i|V) = \frac{\partial \ln G(e^V)}{\partial V_i}$$

## Presentation Outline

- Background
  - Anticipated Impacts
  - Market picture and Fuel Prices
  - Effects to Ro-Ro operators
- Modelling Modal shifts
  - Objectives
  - Route Selection Criteria
  - Methodology
- Initial findings
  - Case studies
  - Environmental implications of new limit
- Next Steps

# Background

- As of January 1st 2015:



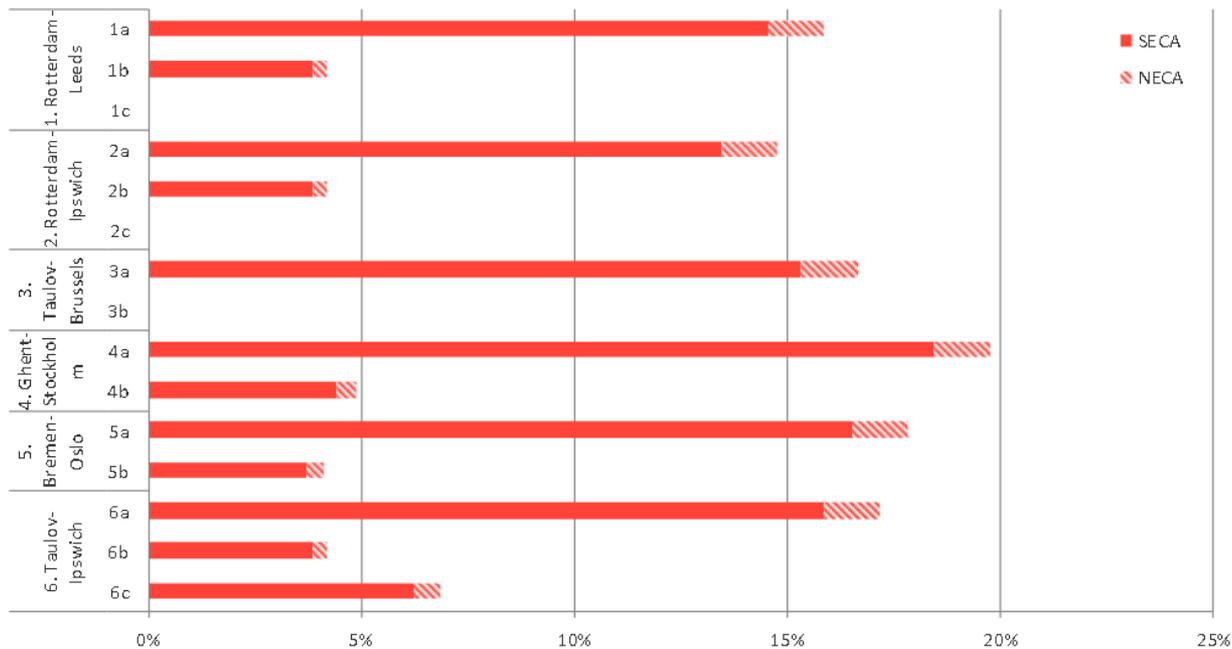
	<b>Year</b>			
Areas	2005-2012	2012-2015	2015-2020	2020 (or 2025)-
Within SECA	1.5	1	0.1	0.1
Outside SECA	4.5	3.5	3.5	0.5

## 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

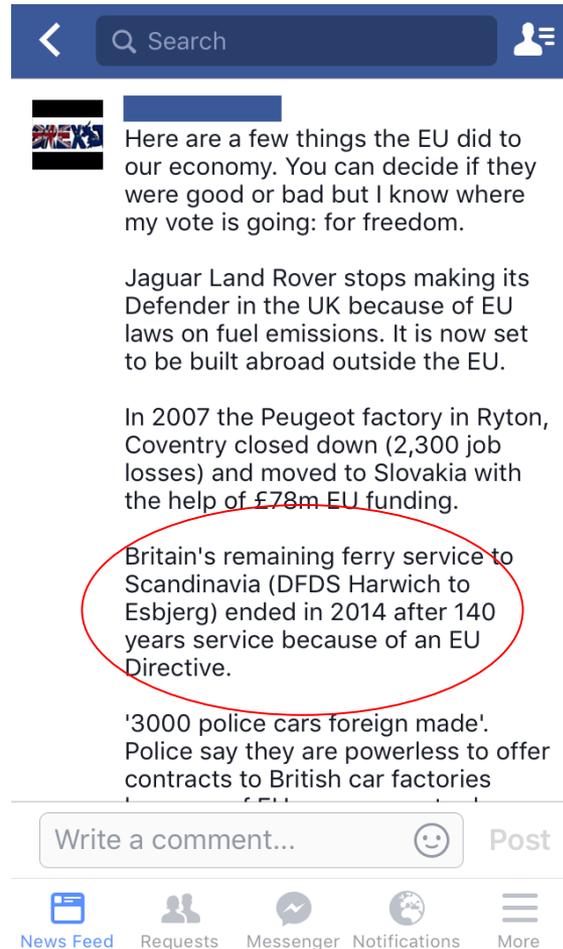
Tags: maritime, germany, denmark, lithuania



**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.

# Some surprising evidence just before the Brexit referendum...



A screenshot of a Facebook post. The post is from a user whose profile picture is a small image of the UK and EU flags. The text of the post is as follows:

Here are a few things the EU did to our economy. You can decide if they were good or bad but I know where my vote is going: for freedom.

Jaguar Land Rover stops making its Defender in the UK because of EU laws on fuel emissions. It is now set to be built abroad outside the EU.

In 2007 the Peugeot factory in Ryton, Coventry closed down (2,300 job losses) and moved to Slovakia with the help of £78m EU funding.

Britain's remaining ferry service to Scandinavia (DFDS Harwich to Esbjerg) ended in 2014 after 140 years service because of an EU Directive.

'3000 police cars foreign made'. Police say they are powerless to offer contracts to British car factories

The post is displayed on a mobile interface with a search bar at the top, a comment box at the bottom, and a navigation bar at the very bottom with icons for News Feed, Requests, Messenger, Notifications, and More.

# 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

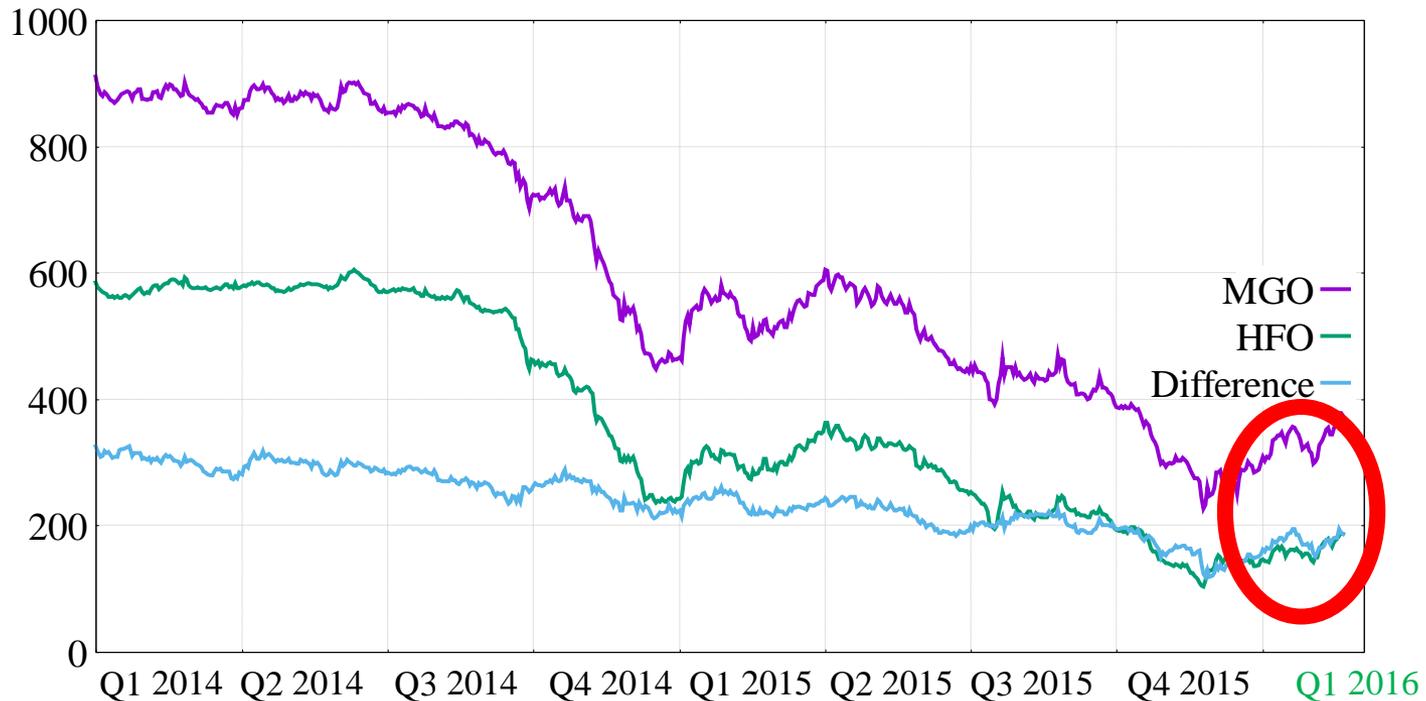
P&O Ferries transported more freight between Dover and Calais in 2015 than any other year in its "modern history," amounting to 1,340,317 trucks.

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 its 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

## Presentation Outline

- Background
  - Anticipated Impacts
  - Market picture and Fuel Prices
  - Effects to Ro-Ro operators
- **Modelling Modal shifts**
  - Objectives
  - Route Selection Criteria
  - Methodology
- Initial findings
  - Case studies
  - Environmental implications of new limit
- Next Steps

## **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

# 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)



## Route selection criteria

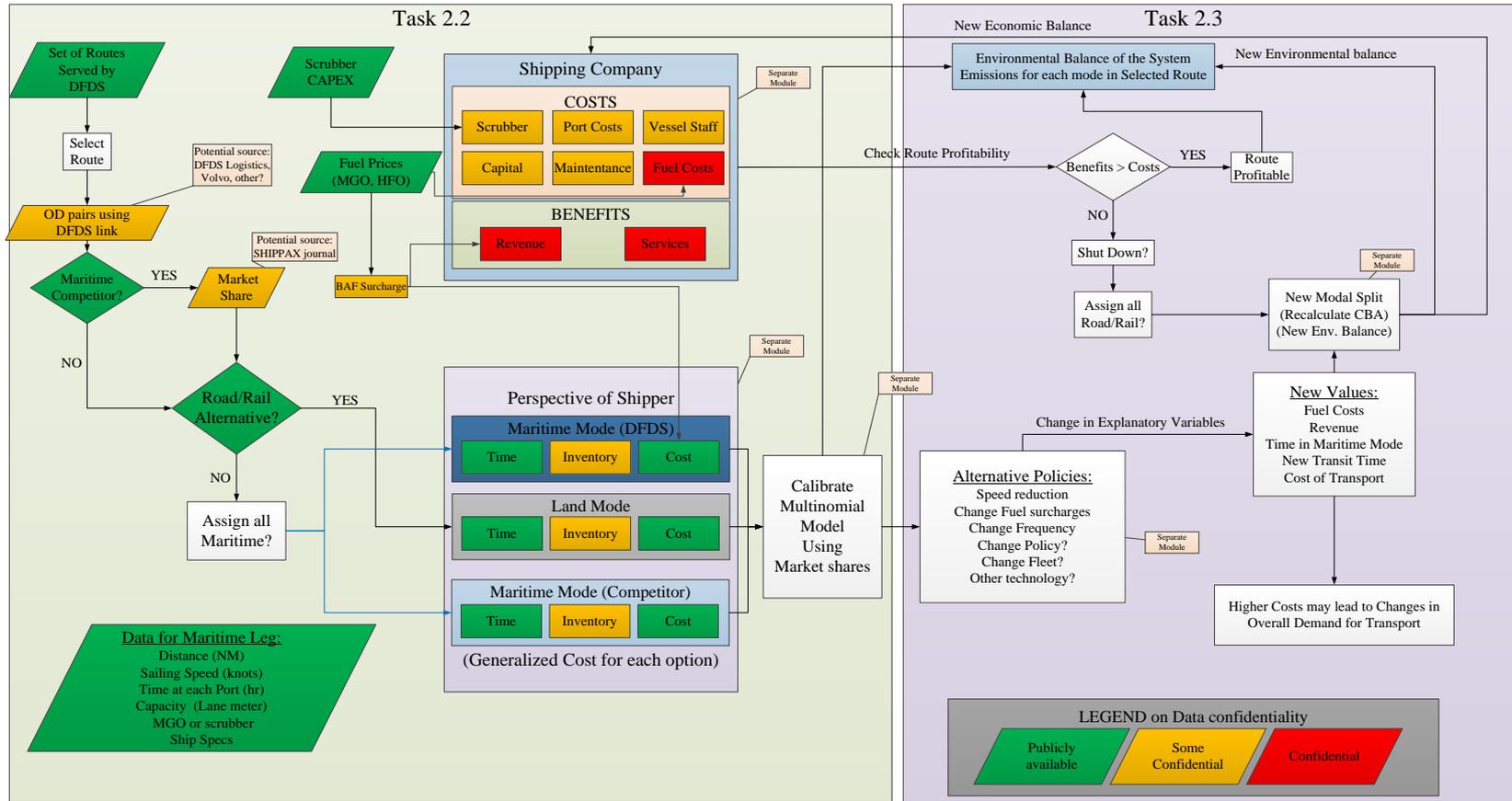
- Geographical balance  Proportion by Region
- Chain configuration  By Sailing Distance & Frequency
- Volume  By Vessel and Route Capacity
- Commodity mixture  Cargo type and value
- Vessel types  Ro-Ro, Ro-Pax, Cruise, abatement
- Data availability

## 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%)

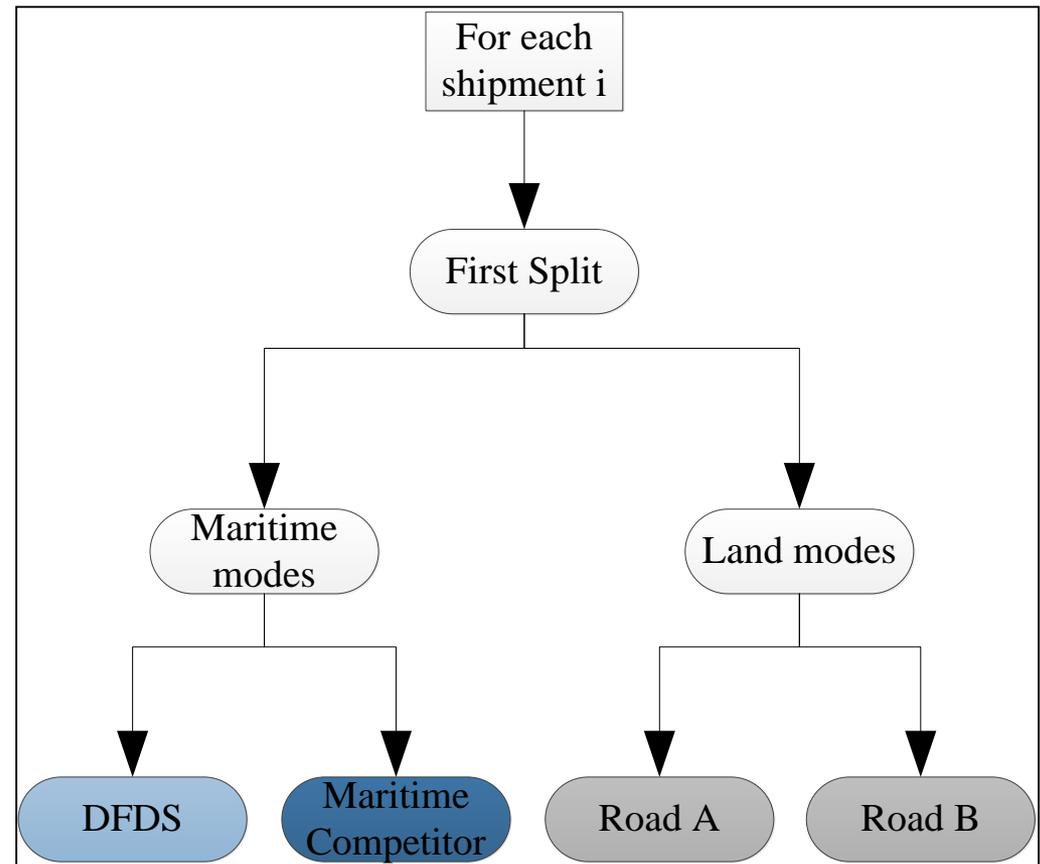
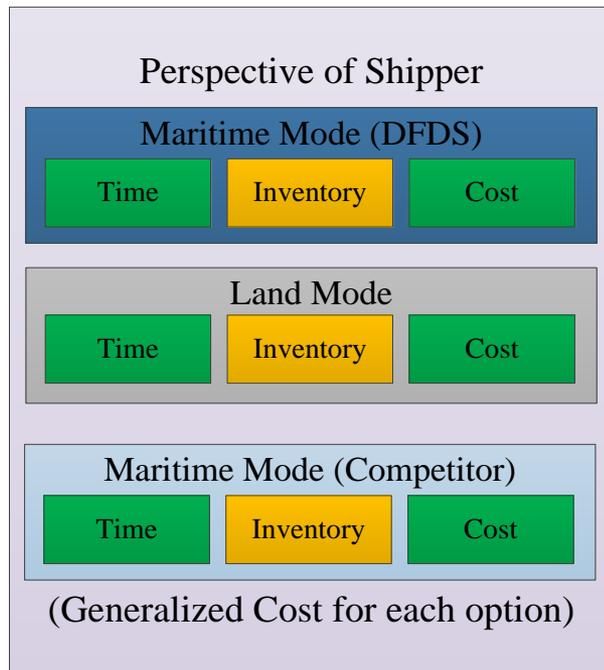


# Methodological Framework

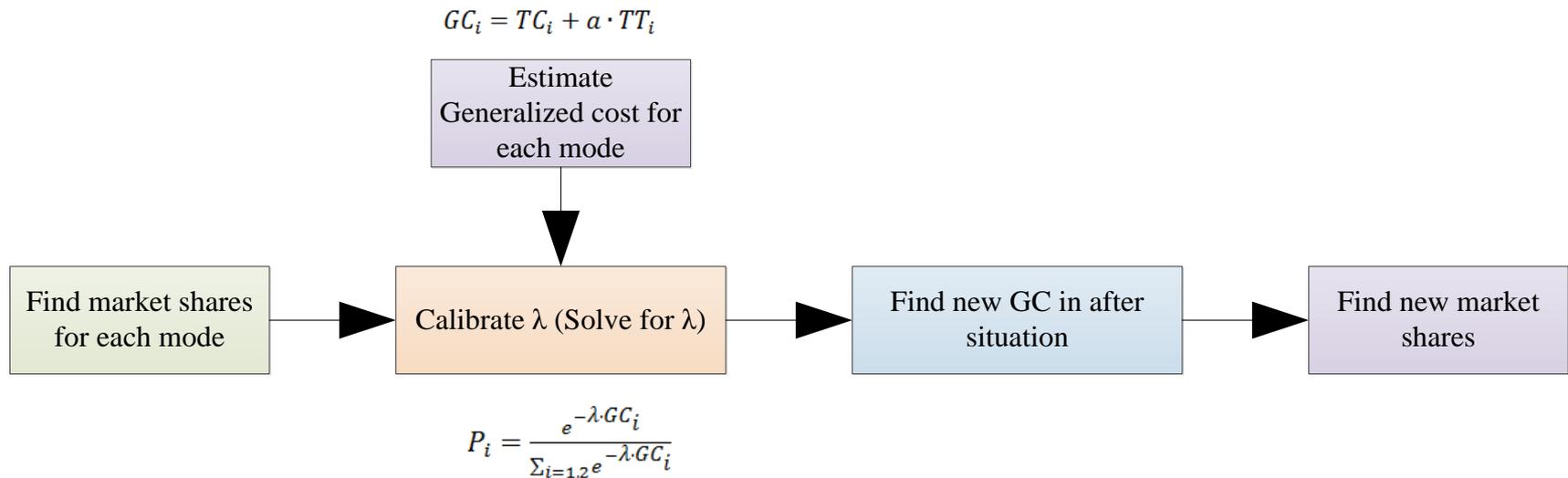


# Perspective of the Shipper – a Bi-level model

- General Case – Hierarchical Structure

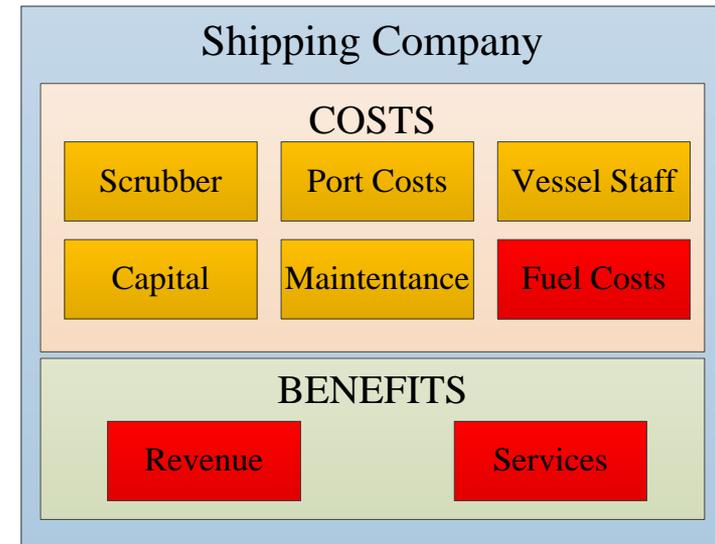


# Process of estimating the impacts of SECA

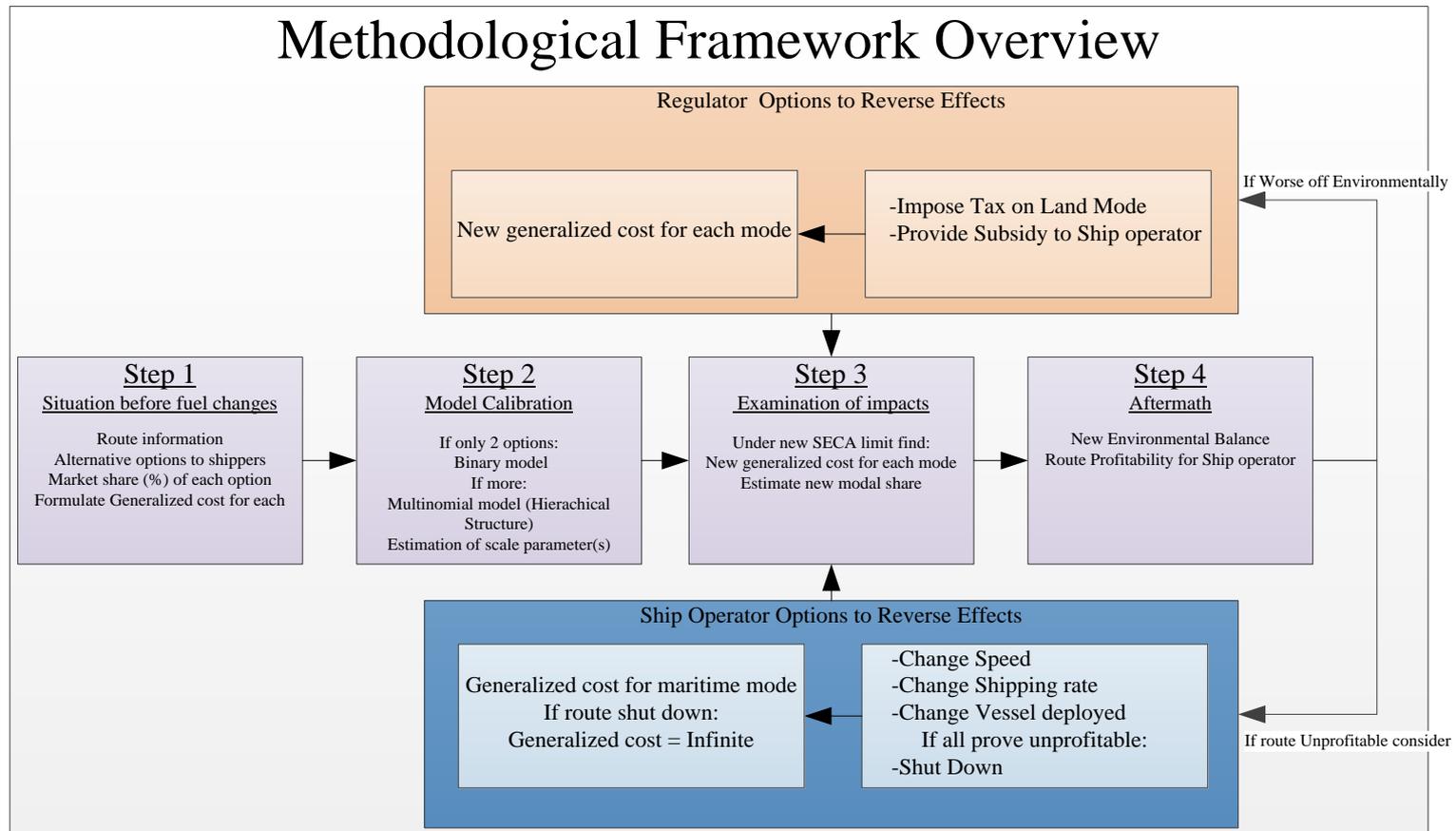


# Perspective of the Shipping Company

- 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



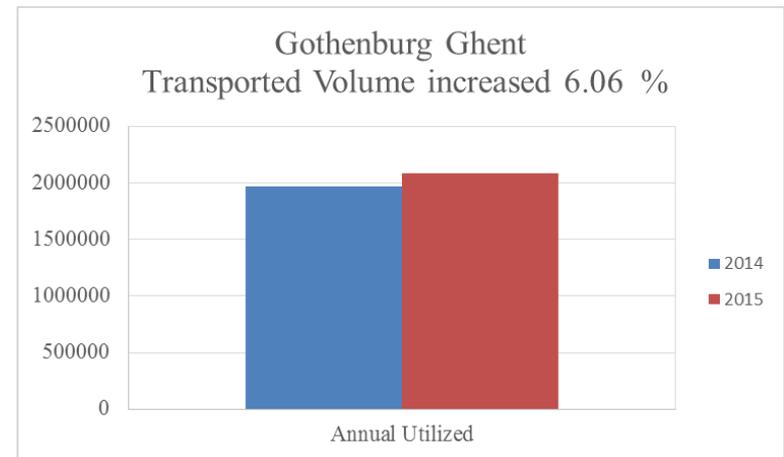
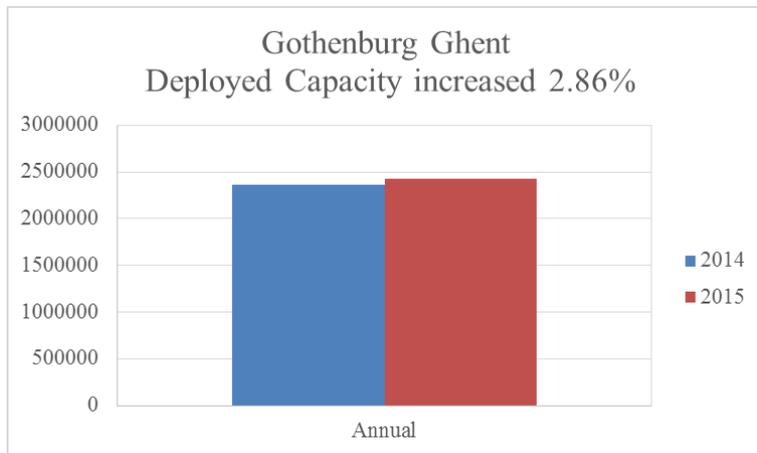
# Linking the various modules together



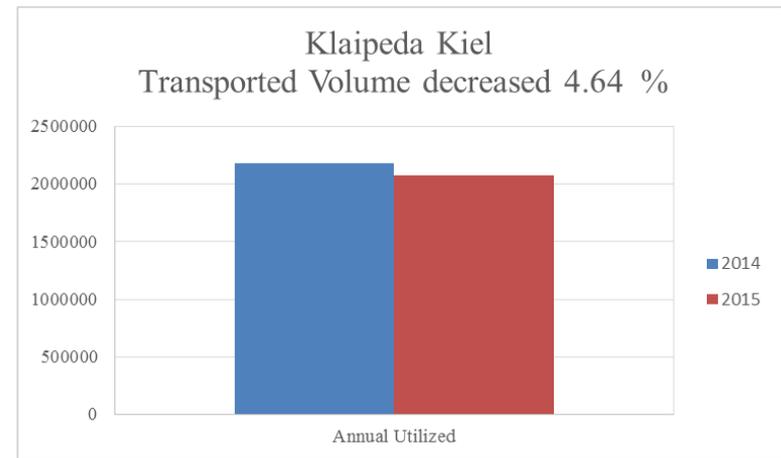
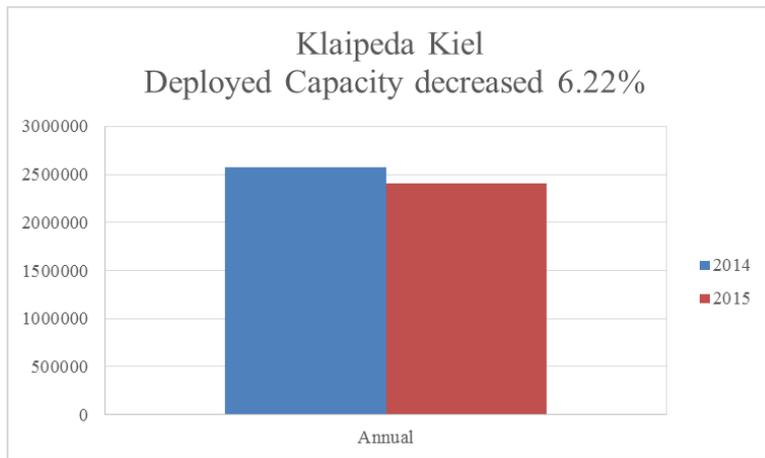
## Presentation Outline

- Background
  - Anticipated Impacts
  - Market picture and Fuel Prices
  - Effects to Ro-Ro operators
- Modelling Modal shifts
  - Objectives
  - Route Selection Criteria
  - Methodology
- **Initial findings**
  - Case studies
  - Environmental implications of new limit
- Next Steps

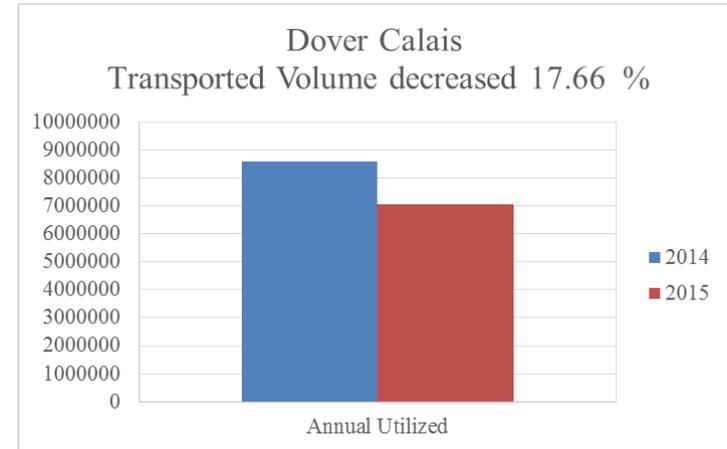
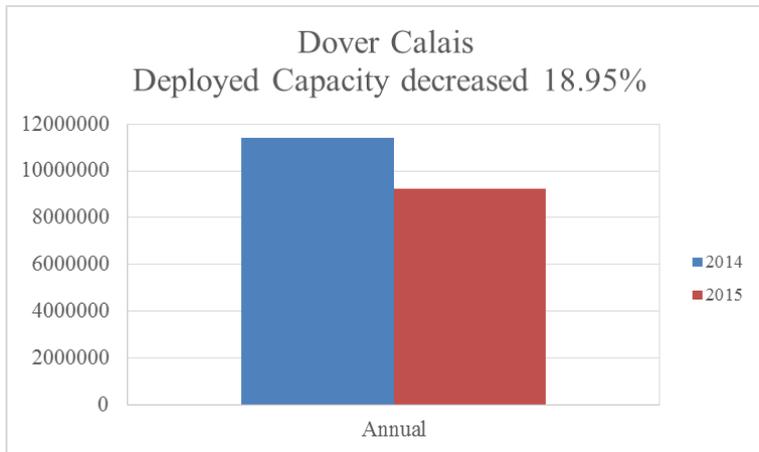
# Gothenburg – Ghent



# Klaipeda – Kiel

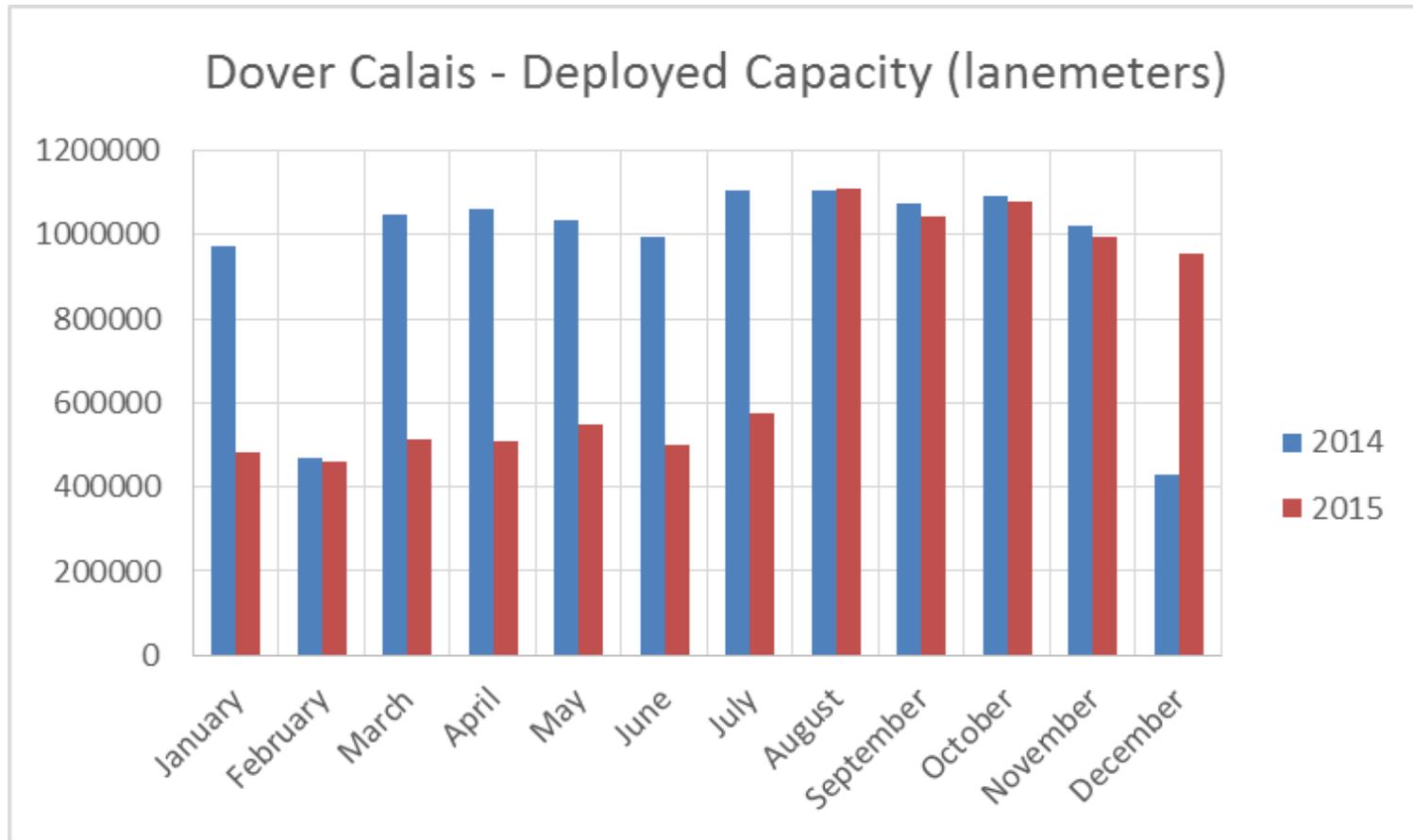


# Dover – Calais



# 2014 vs 2015

## Dover Calais



## Summary of new market picture

Route	Year	Trips Total	Freight Utilization Rate (%)	Transported Cargo Volume change (%)	Cargo Rate change (%)	Revenue Change (%)
Gothenburg	2014	512		19.46	-0.5	18.85
Ghent	2015	580				
Klaipeda	2014	611	Improved in 2015	-2.27	-7.71	-8.89
Kiel	2015	615				
Dover	2014	6210		-17.66	9.36	-18.04
Calais	2015	4994				

## Market picture and first conclusions

- Marseille – Tunis route (unaffected by SECA) also shows increase in traffic
- Routes that benefitted most from low fuel prices, are also more susceptible to a fuel increase
- Increased 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

# Baseline Case and Calibration results

<b>Gothenburg - Ghent</b>									
	Ship Operator			Competitor			Road only		
Baseline (2014)	Share (%)	Road Distance (km)	Total time (hr)	Share (%)	Road Distance (km)	Total time (hr)	Share (%)	Road Distance (km)	Total time (hr)
	24-30	100-300	38±2	21-29	600-800	22±2	39-49	1600±300	23±2
Dispersion parameters	Average			Standard Deviation			Interquartile Range		
$\lambda_l$ (Maritime-Land)	0.0272			0.2393			0.0017:0.0088		
$\lambda_M$ (Maritime - Mar)	0.0252			0.1031			0.0165:0.0337		
<b>Klaipeda – Kiel</b>									
	Ship Operator				Road only				
Baseline (2014)	Share (%)	Road Distance (km)	Time (hr)	Share (%)	Road Distance (km)	Total time (hr)	Share (%)	Road Distance (km)	Total time (hr)
$\lambda$	51-61	100-300	28 ±2	39-49	1600±200	21±2	Interquartile Range: 0.0038:0.0164		
	Average: 0.0189								
<b>Dover – Calais</b>									
	Ship Operator				Road only				
Baseline (2014)	Share (%)	Road Distance (km)	Total time (hr)	Share (%)	Road Distance (km)	Total time (hr)	Share (%)	Road Distance (km)	Total time (hr)
$\lambda$	39-49	10	3±0.5	51-61	10	2±1	Interquartile Range: 0.01:0.02		
	Average: 0.015								

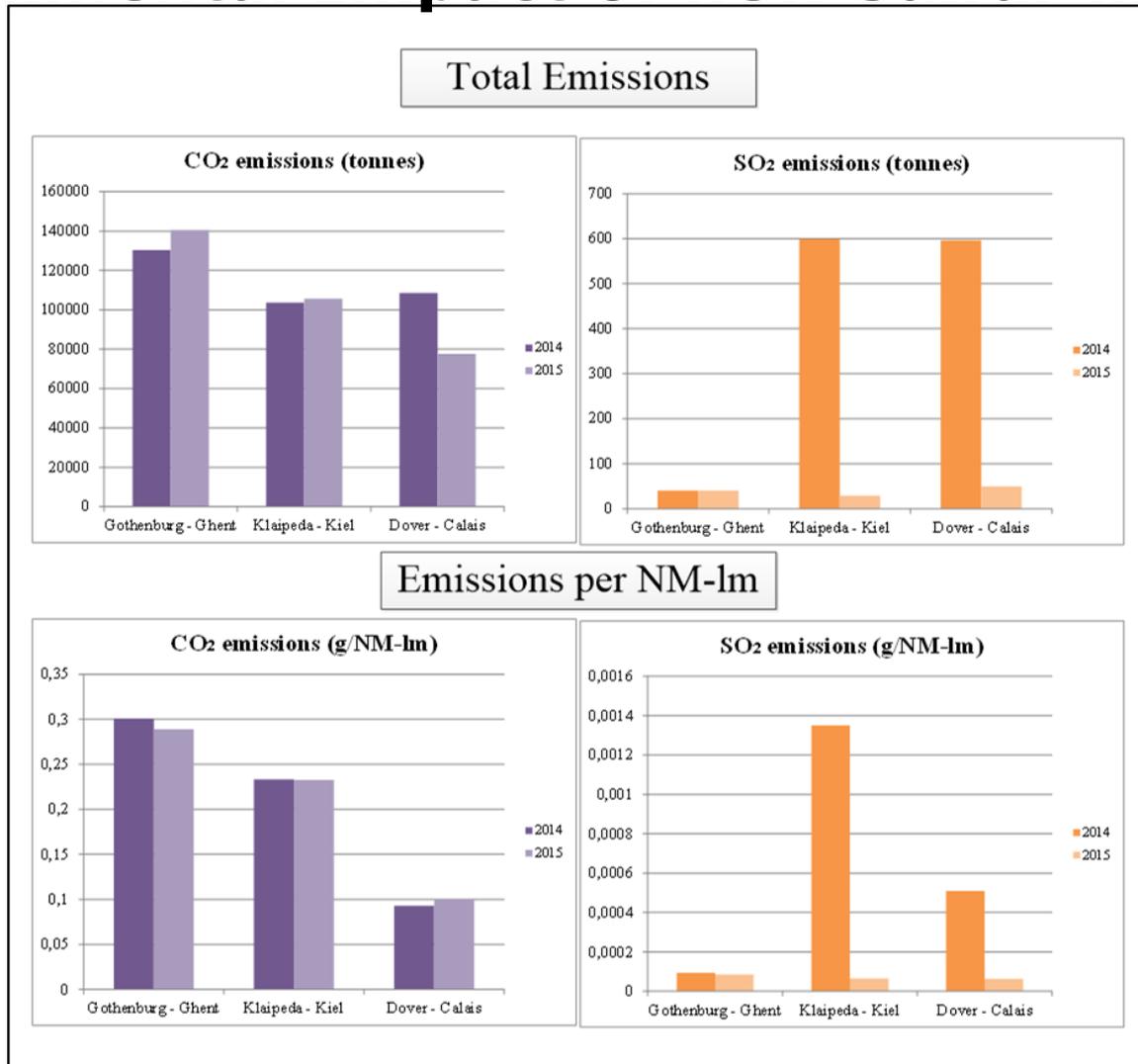
## Sensitivity Analyses – Variations on:

- Market Share for each Option
- Cargo Value
- Depreciation rate
- Freight rate per Im
- Change in Haulers' Transport Cost
- **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)**

# Modal shifts in the three Fuel Case Scenarios

	Gothenburg Ghent			Klaipeda Kiel		Dover Calais	
	New Shares						
	Ship Operator	Competitor	Fully Landbased	Ship Operator	Fully Landbased	Ship Operator	Fully Landbased
	<b>Fuel Case 1</b>						
Share change (%)	1.23	-1.02	-0.22	-0.29	0.29	-4.8	4.8
Probability change (%)	3.98	-4.71	-0.47	-0.62	+0.55	-8.95	10.78
	<b>Fuel Case 2</b>						
Share change (%)	-1.02	0.44	0.58	-0.73	0.73	-5.3	5.3
Probability change (%)	-3.34	2.04	1.35	-1.56	+1.31	-9.74	11.71
	<b>Fuel Case 3</b>						
Share change (%)	1.68	-1.05	-0.63	0.93	-0.93	-3.6	3.6
Probability change (%)	5.56	-4.73	-1.38	+2.12	-1.65	-6.91	7.81

# Environmental Impact of new sulfur limits



## Presentation Outline

- Background
  - Anticipated Impacts
  - Market picture and Fuel Prices
  - Effects to Ro-Ro operators
- Modelling Modal shifts
  - Objectives
  - Route Selection Criteria
  - Methodology
- Initial findings
  - Case studies
  - Environmental implications of new limit
- Next Steps

## 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?

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.**

Contact: [tzis@dtu.dk](mailto:tzis@dtu.dk)