

An aerial photograph of the NHH building, a tall, modern structure with a clock tower, situated on a hillside overlooking a large body of water and mountains in the background. The building is surrounded by greenery and a paved courtyard with some people walking. A dark blue overlay is positioned on the left side of the image, containing the NHH logo and text.

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Voyage calculations. L5

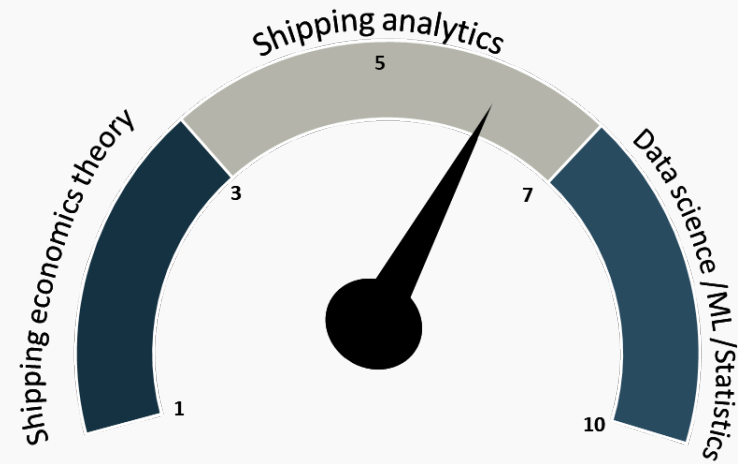
Gabriel Fuentes

gabriel.fuentes@nhh.no

This lecture

Before break (45 min)

- Fuel optimization
- Voyage calculations



Learning outcomes

This lecture will help with the following learning outcomes:

Knowledge

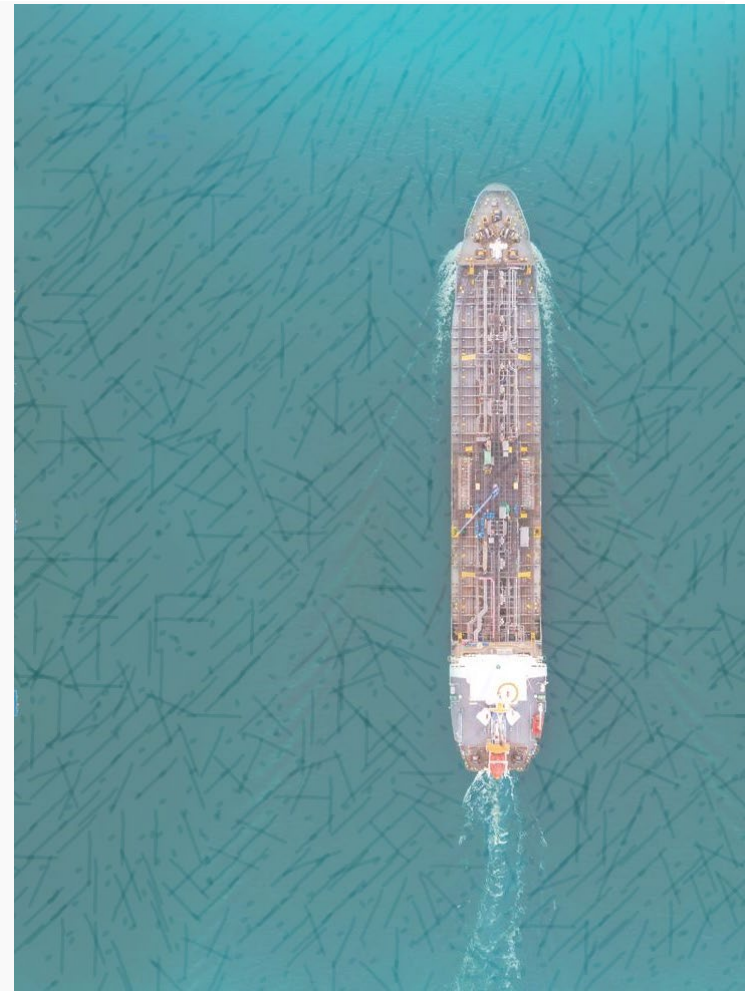
- Understands how to apply advanced economic models and concepts in international shipping

Skills

- Finds, synthesizes, and presents information on the international shipping
- Can communicate with industry practitioners using correct terminology
- Can apply economic theory to varied strategic issues and practical problems facing shipping companies

Competency

- exchanges opinions and experiences with others with a background in the field
- Translates statistics into managerial insight

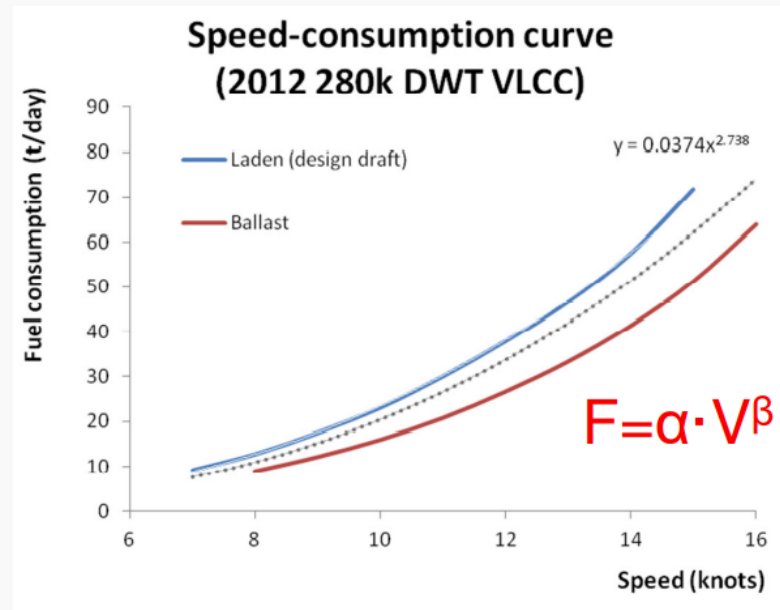


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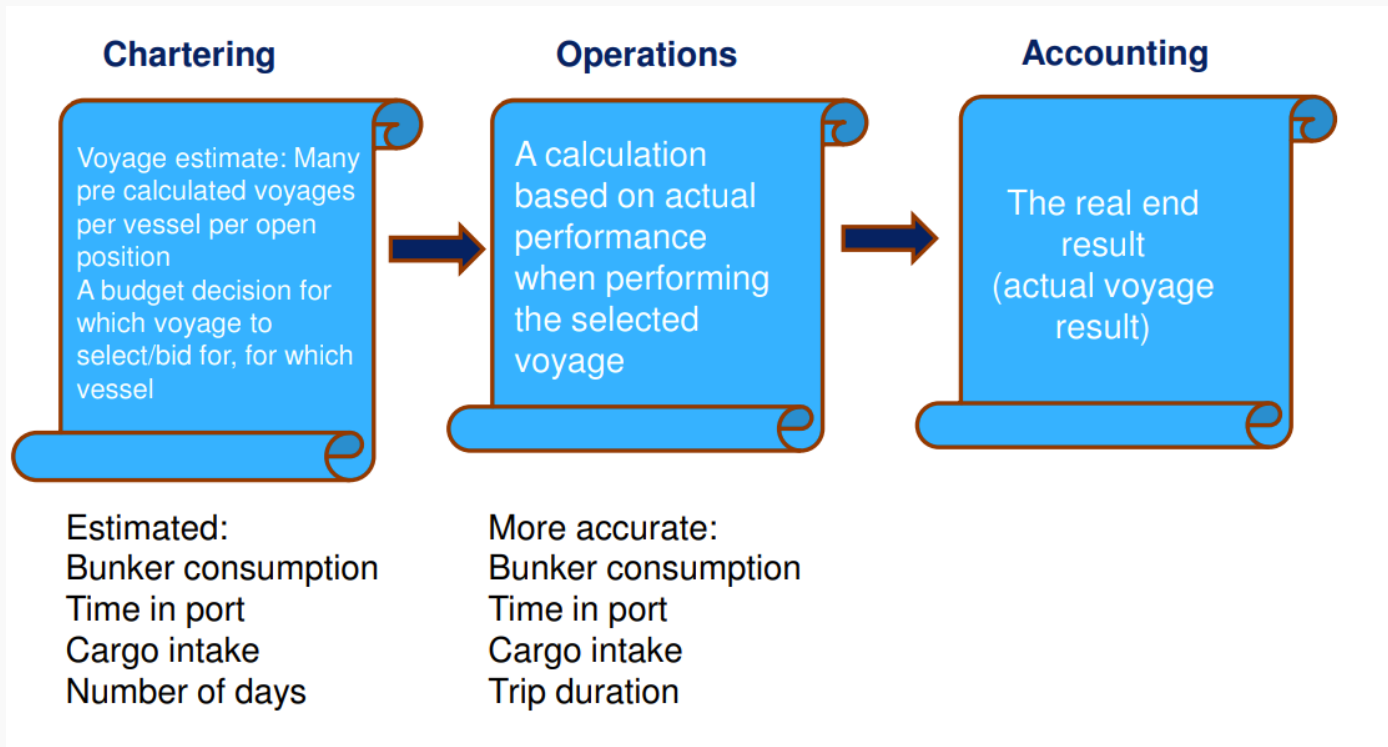


A review

- Fuel consumption in ships increases exponentially with speed
- More speed less time, then less fix cost, but higher variable cost
- The tradeoff of the speed depends on the market condition. Does the freight rate compensates the cost of increasing speed?



A voyage calculation is behind every chartering decision in shipping



Source: Roar Adland

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A voyage calculation is behind every chartering decision in shipping

$$TCE = \frac{\text{voyage income} - \text{voyage costs}}{\text{round trip duration in days}}$$

$$TCE = \frac{R \times m - C_p - (p_f \times FC \times \frac{d}{24 \times s})}{T_p \times \frac{d}{24 \times s}}$$

Variable	Description
R	Freight rate dollar per tonne
m	Cargo in metric tones
p_f	Bunker HFO price in dollar per tonne
FC	Fuel consumption
T_p	Port Time
d	Roundtrip distance
s	Speed of the vessel
TCE	Time Charter Equivalent
C_p	Port cost

TCE: Time charter equivalent

Other voyage costs:

- Canal costs
- War risk insurance

$$\frac{\partial TCE}{\partial s}$$

$$T_p = 0$$

$$s^* = \left(\frac{24 \times (R \times m - C_p)}{\beta \times p_f \times \alpha \times d} \right)^{\frac{1}{\beta-1}}$$

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I have created a Jupyter Notebook where you could reflect (practically) on the implications of speed and speed optimization. Uses concepts from Adland et al. (2020)

Download the notebook for the exercise here

https://ene431.logistikk.io/lectures/files/speed_optimization.zip

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PAUSE



Why is needed a voyage calculation pre fixture?

- Calculate TCE for various vessels for ONE cargo
- Calculate TCE on one vessel for various cargoes
- Calculate TCE for many consecutive cargoes
- Compare a trip charter with a voyage charter for the same vessel
- Calculate TCE for one vessel and many discharge ports. Should I allow for flexibility in the charterparty?

And etc.

Shows the time charter \$ per day earnings from a given voyage \$ per ton freight

Vessel's name	BPI	Ballast speed	14	Draft restriction	n/a
Year of build		IFO consumption	34	Winter allowance	n/a
Deadweight	76,600	Laden speed	14	Cargo lift	65000
Draft	14.14	IFO consumption	36		
TPC	66	MDO at sea	0		
Grain cubic	90,700	MDO in port	0.1		
Bunkers/Constants	2,000	IFO in port	3		
IFO price	609	Speed allowance (B)	0.98	7 % sea margin	
MDO price	911	Speed allowance (L)	0.98	7 % sea margin	

	Distance	Sea days	Port days	Port costs
Rotterdam				
Santos	5,412	17.32	9.625	65,000
Singapore (bunkers)	8,956	28.66	0.5	3,500
Qingdao	2458	7.87	9.63	60,000
Totals	16,826	53.85	19.75	128,500

Ballast days	17.32
Laden days	36.53
Port days	19.75
Total days	73.60

IFO at Sea	1,159,439
MDO at Sea	0
IFO in Port	36,083
MDO in Port	1,799
Port costs	128,500
Misc	15,000

Total Expenses 1,340,821

Cargo lift	Gross freight pmt	Commission	Total net freight	Equivalent net t/c
65,000	40.00	5%	2,470,000	15343

Result is a net Timecharter of \$15,343 per day over 73.60 days

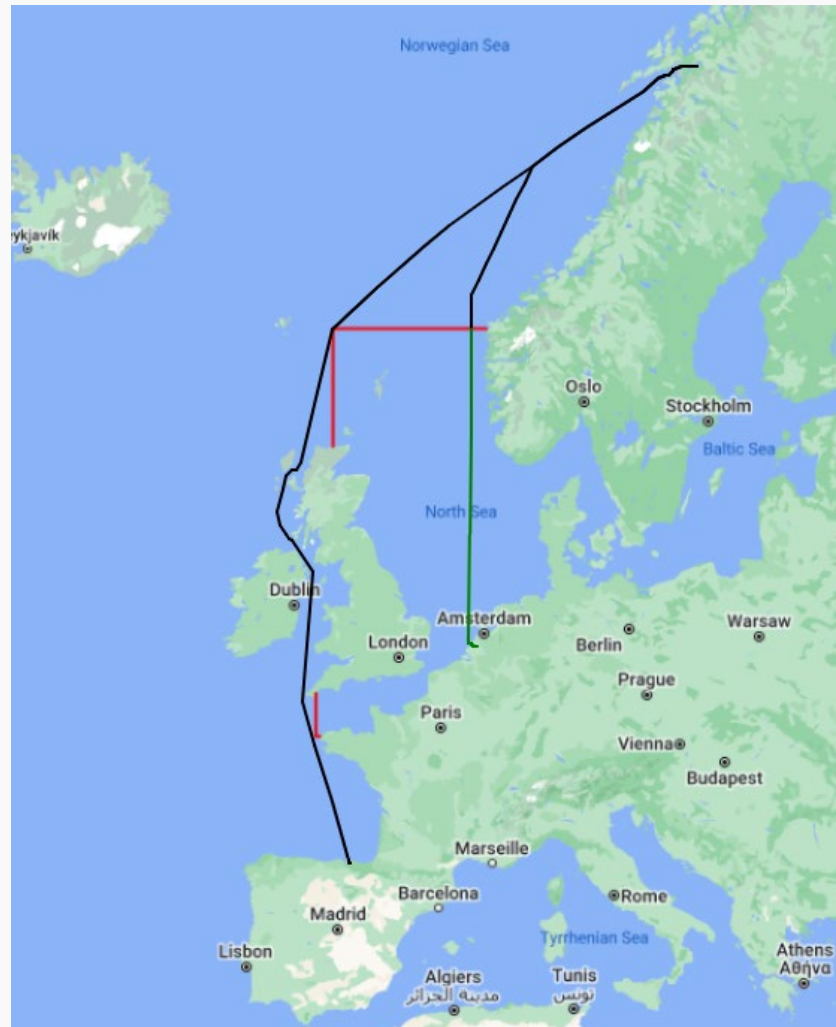


Voyage calculation example

• Account LKAB	72700	Summer DWT
• 70000 MT Iron Ore	13.9m	Summer Draft
• Load Narvik	14.0 knots	Speed
• Terms: 2 days SHINC	37.0/40.0t/day	Consumption Ballast/Laden
• Discharge Rotterdam		Consumption MDO (diesel daily)
• Terms: 30 000 SHINC (discharge rate in tonnes/day)	1.0 t/day	
• LayCan Nov 20 th – 30 th		
• Broker commission 5%	Vessel Open	Bilbao
• Rate (USD/mt): Between 13 - 15,00 according to the broker		

- Bunkers prices USD 600/tonne for IFO and USD 900 for MDO
- Steaming Bilbao/Narvik 1 802 nm at 14 knots
- Steaming Narvik/Rotterdam 1 137nm at 14 knots
- Port Cost Narvik NOK 310.000 @ 0,18182
- Port Cost Rotterdam EUR 40.000 @ 1,500
- Extra Insurance USD 2000

Voyage calculation example



Revenue

- Freight 70 000 * 15.00 = USD 1 050 000
- Less commission 5% = USD 52 500

Expenses

- Bunkers			
- Steaming-B	1 802nm / (24 x 14) = 5.36 days	*37.0 * \$600 * 5.36 days	USD 118 992
- Steaming-L	1 137nm / 24 x 14) = 3.38 days	*40.0 * \$600 * 3.38 days	USD 81 120
- MDO consumpton	8.74 days	* 1.0 * \$900 * 8.74 days	USD 7 866
			USD 207 978
- Port Cost Load Narvik		UDS 56 364	
- Days in load port		2 days	
- Port Cost Discharge Rotterdam		USD 60 000	USD 116 364
- Days in discharge port (70 000 mt / 30 000 c)		2, 35 days	
- Various cost	(extra insurance/SUPERCARGO)		USD 2 000
- Extra days	10 % = 1,3 days		

Total days: 14.39 days
Revenue – costs = USD 671 158
TCE: USD/day 46 640

Remember the TCE shall also cover:
Operating costs (OPEX) USD / day 10 000
Financial costs USD/ day 30 000
Profit USD / day 6 646



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