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Fuel surcharge practices of container shipping lines: Is it about cost recovery or revenue-making?

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**IAME 2009 conference
Copenhagen, 24-26 June 2009**



Theme setting

- Focus of the paper: container shipping lines' practices of levying fuel surcharges (BAF) on shippers.
- Diverging views:
 - Shipping lines: argue that the increase in bunker prices, especially in the short term, is only partially compensated through surcharges to the freight rates.
 - Shippers: the way BAFs are determined is opaque, without uniformity, and involves a significant element of revenue-making.
- End of liner conferences: new methods for calculating fuel surcharges



Research questions

- Objective of paper:
 - To analyse relationship between fuel costs fluctuations and fuel surcharging practices.
- Research questions:
 - How have shipping lines changed their practices regarding BAF, considering the end of the liner conference era in Europe?
 - How can bunker costs be estimated for a specific service?
 - Can it be concluded, as stated by shippers, that BAFs are used by shipping lines to generate additional revenue or are they only, as stated by shipowners, used to recover bunker costs and to cope with their unexpected fluctuations?



Structure of the paper

1. Viewpoints of shippers and shipping lines
2. Past and current practices of fuel surcharges.
3. Model aiming at calculating the bunker cost for a specific service.
4. Application: comparison of estimates on fuel costs with the observed BAFs on a set of port-to-port liner services
5. Conclusions and avenues for further research.



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The principle of the Bunker Adjustment Factor (BAF)

- BAF: introduced in 1974 following the first oil crisis
- Surcharges were jointly fixed by conference members and abided by outside operators as well.
- Principle: carriers cover basic bunker costs, while BAFs only apply to changes above a certain level.

IFO 380 price level (euro per ton)	BAF surcharge	IFO 380 price level (euro per ton)	BAF surcharge
140 (Base level)	2.00%	216-220	6.50%
141-155	2.50%	221-230	7.50%
156-165	3.00%	231-240	8.00%
166-180	3.50%	241-250	8.50%
181-190	4.50%	251-255	9.00%
191-200	5.00%	256-265	9.50%
201-205	5.50%	266-279	10.50%
206-215	6.00%	271-280	11.00%



The controversy surrounding BAF

- Source of contention in shipping circles.

'Shippers do not accept the ocean carriers' claim that they operate in a unique environment and they are a special case deserving special protection from market forces. Shippers face similar business risk when trading in global markets; they are unable to pass on additional costs incurred through the use of surcharges. [..]

The absence of transparency in the imposition of surcharges has led shippers to call for their abolition. The method by which surcharges are calculated is complex and because of averaging of surcharges within a conference, surcharges are unrelated to the actual costs experienced by individual shipowners. Surcharges are used as a means of obtaining additional revenues.'

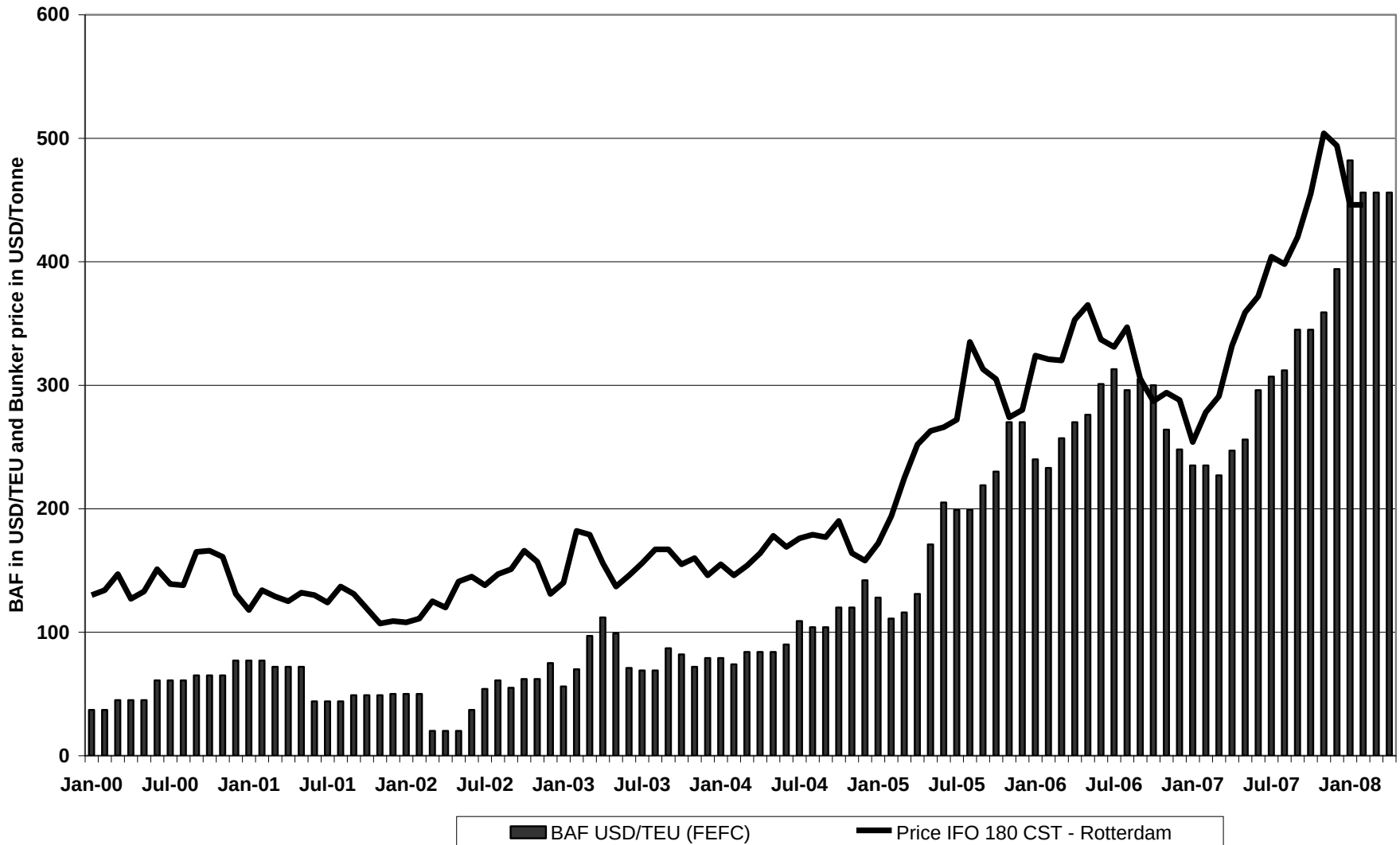
(ESC, 2003: 20).



The controversy surrounding BAF: some results from previous studies

- Meyrick (2008) for European Shippers' Council (ESC)
 - BAFs were found to be higher than actual fuel costs in some cases.
 - BAF applied by the FEFC and TACA in early 2008 involves a significant element of revenue-making.
 - Shippers are being overcharged when it comes to fuel surcharges set by liner conferences.
- Cariou and Wolff (2006)
 - An increase in fuel price by 1 would lead to an increase in BAF by 1.5.

Bunker price in Rotterdam (US\$ per ton) and FEFC's BAF (US\$ per TEU)





Fuel charge practices after the liner conference era

- October 18, 2008: liner shipping conferences outlawed in Europe
- Container shipping lines calling at European ports were banned from discussing freight rates and other additional surcharges such as bunker surcharges
- Disappearance of liner conferences coincided with a period of declining traffic and tumbling freight rates
- Each carrier came with its own decisions on whether or not to charge a BAF and if so, on how the calculation method and resulting quantum will be.
 - Many factors included (bunker price, vessel type, distance, load factor, vessel speed, etc..)
 - Shipping lines argue BAF is now much closer related to actual fuel costs
 - All-in prices apply on a number of routes



Impact of crisis on pricing strategy of shipping lines

Table: Base freight rate and BAF for the maritime transport of one forty foot container (FEU) from Shanghai to Antwerp

	Typical freight rate	Typical BAF
Q1 2007	2100 US\$	235 US\$
Q2 2008	1400 US\$	1242 US\$
September 2008	700 US\$	1440 US\$
February 2009	250 US\$ (all in)	-
April 2009	550 US\$ (all in)	-

Source: based on market figures



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Estimating fuel costs

- Earlier work:

Buxton (1985); Cullinane and Khanna (1999); Endersen et al. (2003); EPA (2000); Corbett and Koehler (2003); MAN B&W Diesel A/S, 2008.

- Proposed formula:

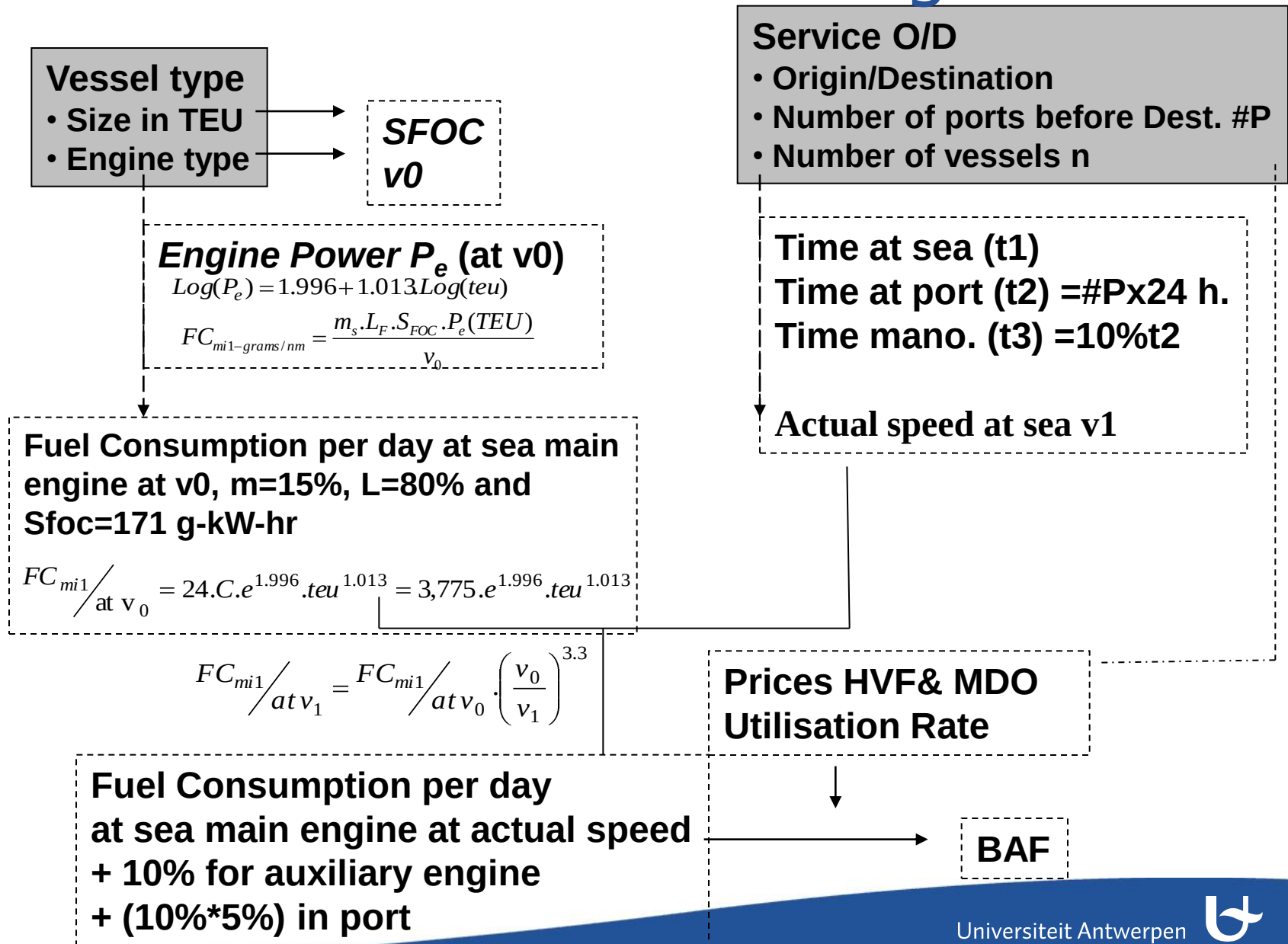
$$TFC_j = \sum_{i=1}^n \sum_{t=1}^3 (P_m \cdot FC_{mit} + P_a \cdot FC_{ait})$$

With:

TFC_j	Total Fuel Cost for a specific service j in US\$
t_1	Time when the vessel is at sea
t_2	Time when the vessel is maneuvering or transiting through canals
t_3	Time when the vessel is hotelling (waiting and when at berth)
P_m	Bunker price for the main engine (m)
P_a	Bunker price for the auxiliary engine (a)
FC_{mit}	Fuel consumption for main engine (m) per day for vessel i under status t
FC_{ait}	Fuel consumption for auxiliary engine (a) per day for vessel i under status t



Estimating fuel costs





Example – 2,259 containerships

	2000-3000	3000-4000	4000-5000	5000-6000	6000-7000	7000-8000	8000-9000	9000-10000	10000 +
Number of vessels #	764	350	469	285	146	60	122	46	17
Mean size (TEU)	2530	3432	4385	5491	6505	7372	8293	9307	11660
Mean design speed (nm) - v_0	21.2	22.4	23.9	24.5	25.3	25.1	24.9	25.1	23.6
Mean age (year)	10.1	11.6	6.5	5.2	4.4	4.7	1.9	1.4	0.6
Mean main engine (kW)	20699	26741	38616	49243	57764	61436	64353	67259	66580
Engine type									
- Two Stroke/Slow speed (%)	93	98	99	97	99	98	99	100	100
- Other (a) (%)	7	2	1	3	1	2	1	0	0
Fuel consumption in tonnes/day (b)	80	102	142	199	229	233	255	N/A	N/A
Fuel consumption in grams//teu/mile	62	55	56	62	58	52	51	N/A	N/A
FC_{mi1} in tonnes/day (c)	78.1	106.4	136.4	171.3	203.4	230	260	292	367
Vessel speed (knots)									
18	47.0	54.9	52.8	57.9	68.8	77.8	87.9	98.8	124.1
19	56.1	65.6	63.1	69.3	82.2	93.0	105.1	118.1	148.4
20	66.5	77.7	74.7	82.0	97.4	110.1	124.5	139.8	175.7
21	78.1	91.3	87.8	96.4	114.4	129.4	146.2	164.2	206.4
22	-	106.4	102.4	112.3	133.4	150.8	170.5	191.5	240.7
23	-	-	118.5	130.1	154.5	174.7	197.5	221.8	278.7
24	-	-	136.4	149.7	177.8	201.0	227.2	255.2	320.7
25	-	-	-	171.3	203.4	230.0	260.0	292.0	367.0

Estimating fuel costs

- Total fuel consumption at sea for the main engine in grams/day and at a given speed v_0 can be estimated as:

$$FC_{mi1} / \text{at } v_0 = 24.C.e^{1.996}.teu^{1.013} = 3,775.e^{1.996}.teu^{1.013}$$

Figure 3. Fuel consumption with vessel size

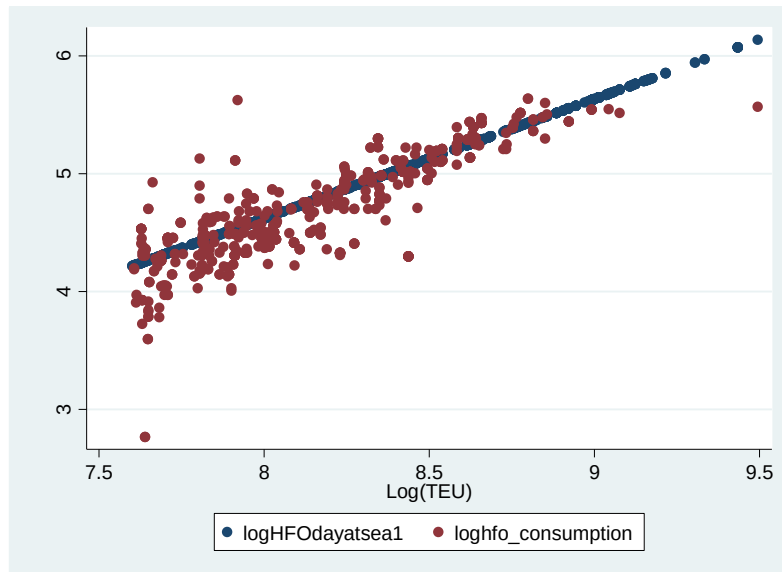
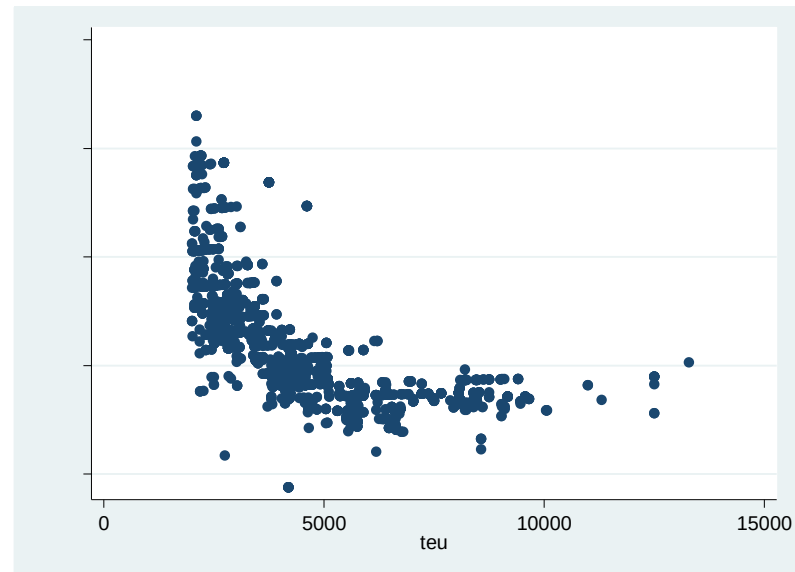
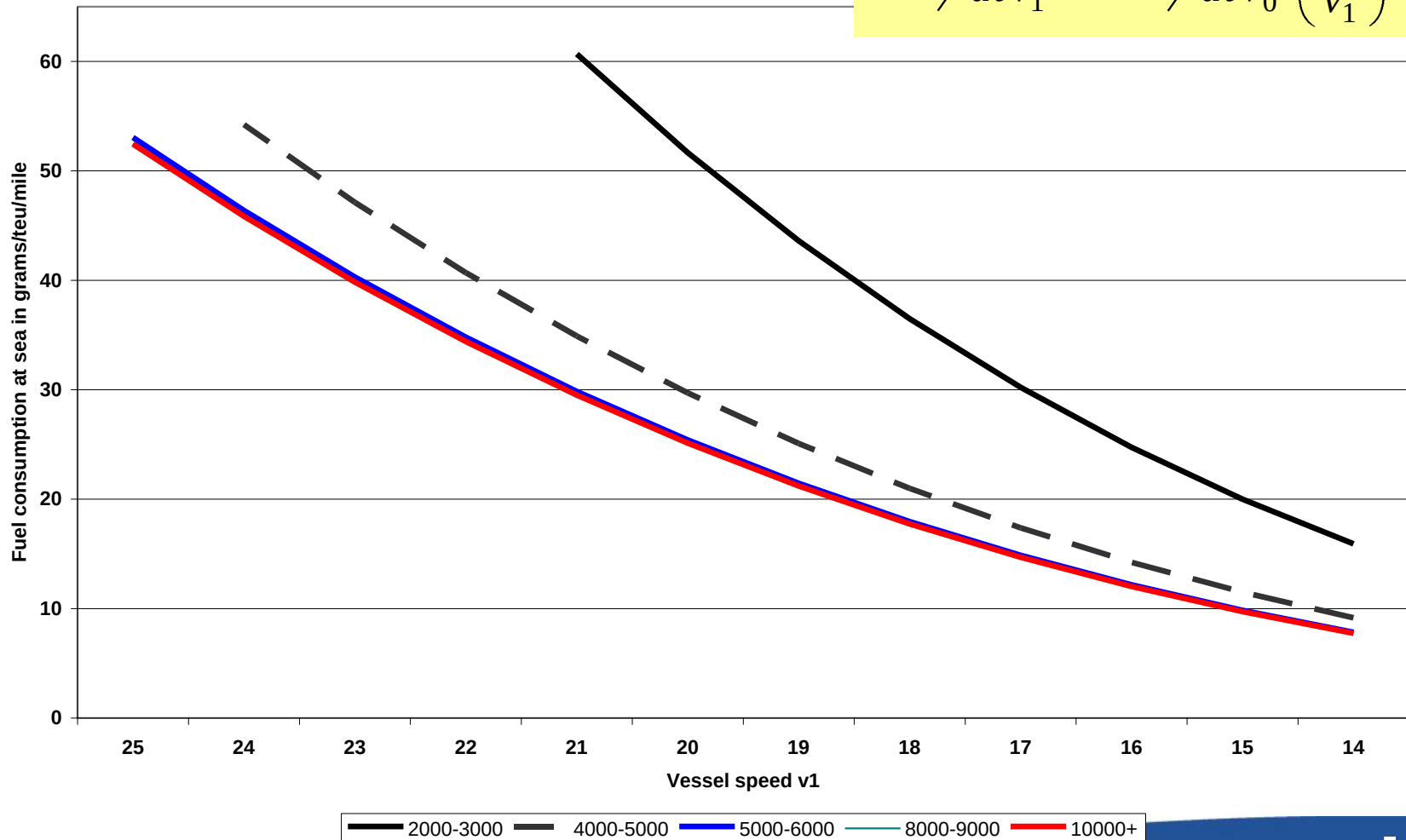


Figure 4. Economies of scale on fuel consumption



Example of the impact of the decrease in vessel speed from the initial design speed v_0 to v_1

$$FC_{mi1} / \text{at } v_1 = FC_{mi1} / \text{at } v_0 \cdot \left(\frac{v_0}{v_1} \right)^{3.3}$$





*Comparison of estimates with Germanischer Lloyd (GL)
figures on fuel costs per day at sea - July 2006*

IN USD	5000 teu		8000 teu		12000 teu	
Speed	Estimates	GL	Estimates	GL	Estimates	GL
14	8,848	12,200	13,430	16,000	18,956	20,700
16	13,747	16,800	20,866	21,600	29,453	27,500
18	20,278	23,100	30,778	29,000	43,444	36,500
20	28,709	31,800	43,575	39,400	61,508	48,700
22	39,320	43,700	59,681	52,200	84,242	64,400
24	52,399	59,300	79,531	69,400	112,261	83,600
26	68,239	82,800	103,574	96,100	146,199	114,700



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Case-study

- Comparison of estimated fuel costs and applied BAF for containers exported via the port of Antwerp to 117 ports of discharge.
- Port bundles aggregated to eight service areas of the port of Antwerp

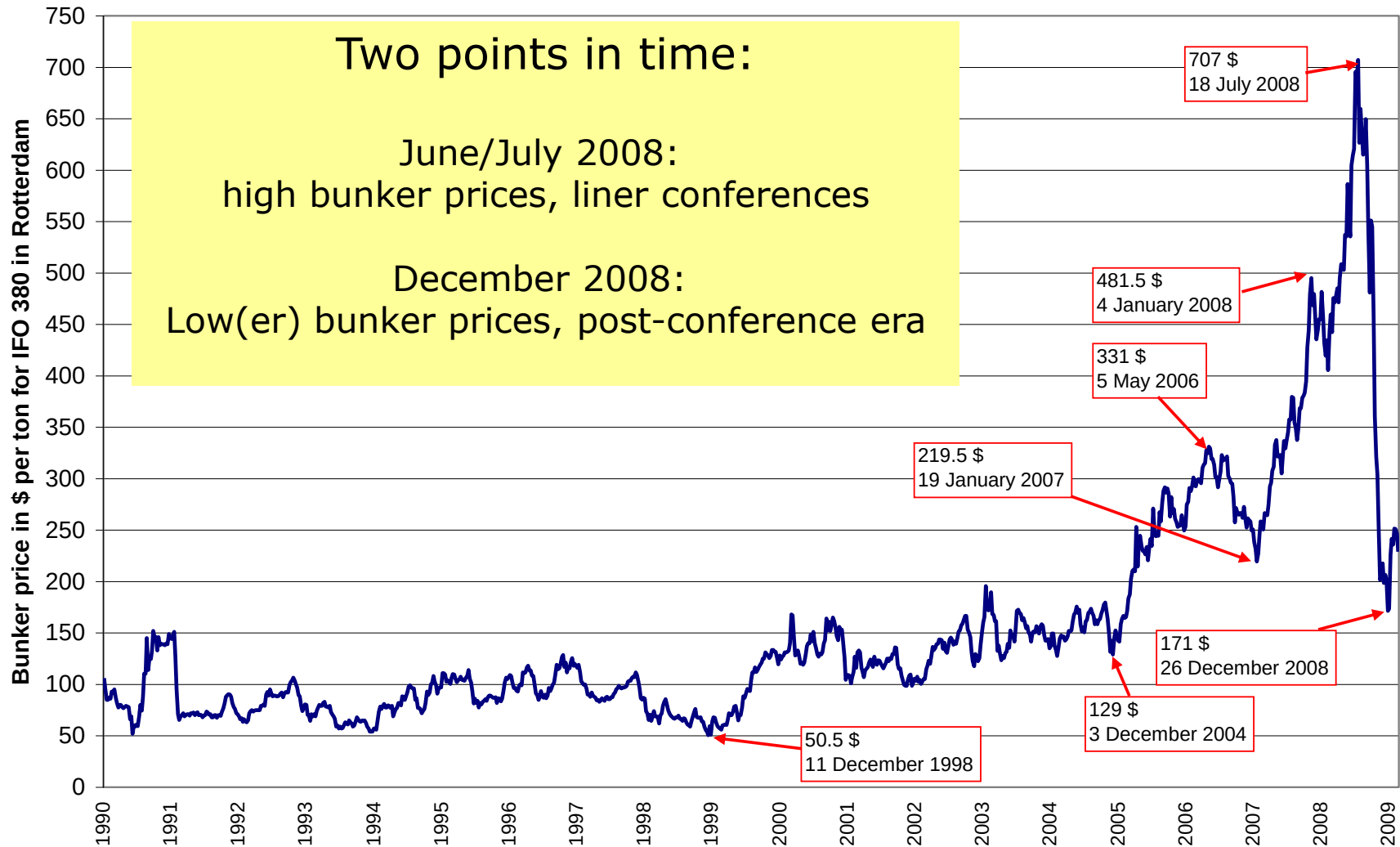
Port of loading = Antwerp	Observations	Average one-way distance (a)	Average transit time (in days) (b)	Average vessel size
Region of port of discharge				
	no.	nm	days	TEU
Africa	15	4731	17	2525
Baltic - Iberian Atlantic feeder	10	1314	5	1350
Far East	24	11183	28	7563
India / Pakistan	9	7165	21	3963
Latin and South-America	23	5765	17	3700
Near East / East Med	17	3488	13	3535
North America	12	5096	17	3242
Oceania	7	13136	43	2922

117

Notes:

(a) Including the deviation distance to call at en-route ports of call on liner service

(b) Including total sailing time, total port time at intermediate ports of call on liner service and canal transits



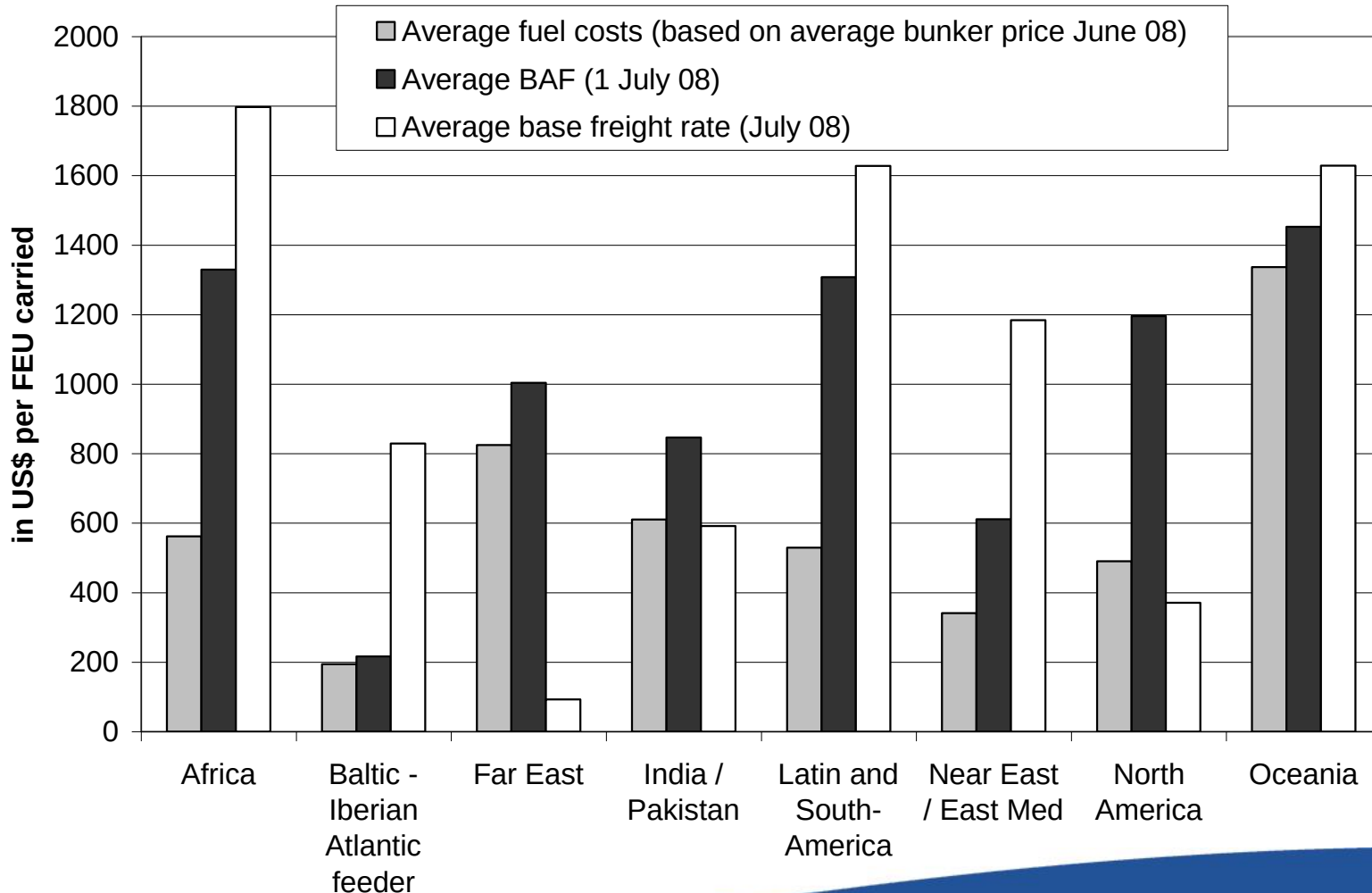


Case-study

- **Commercial speed of the vessels:** determined using shipping lines' information on total transit times and port time.
- **Real transit time on a port-to-port basis** decomposed into total sailing time, average port time per intermediate port of call and canal transit time.
- **Total vessel consumption for each port-to-port relation:** combination of sailing time, vessel speed and vessel size with figures provided earlier and by adding fuel consumption linked to total port time (also in intermediate ports of call) and canal transit time.
- Average **degree of utilization** for all observed liner services out of Antwerp: 75% in June/July 2008 and 71% in December 2008.

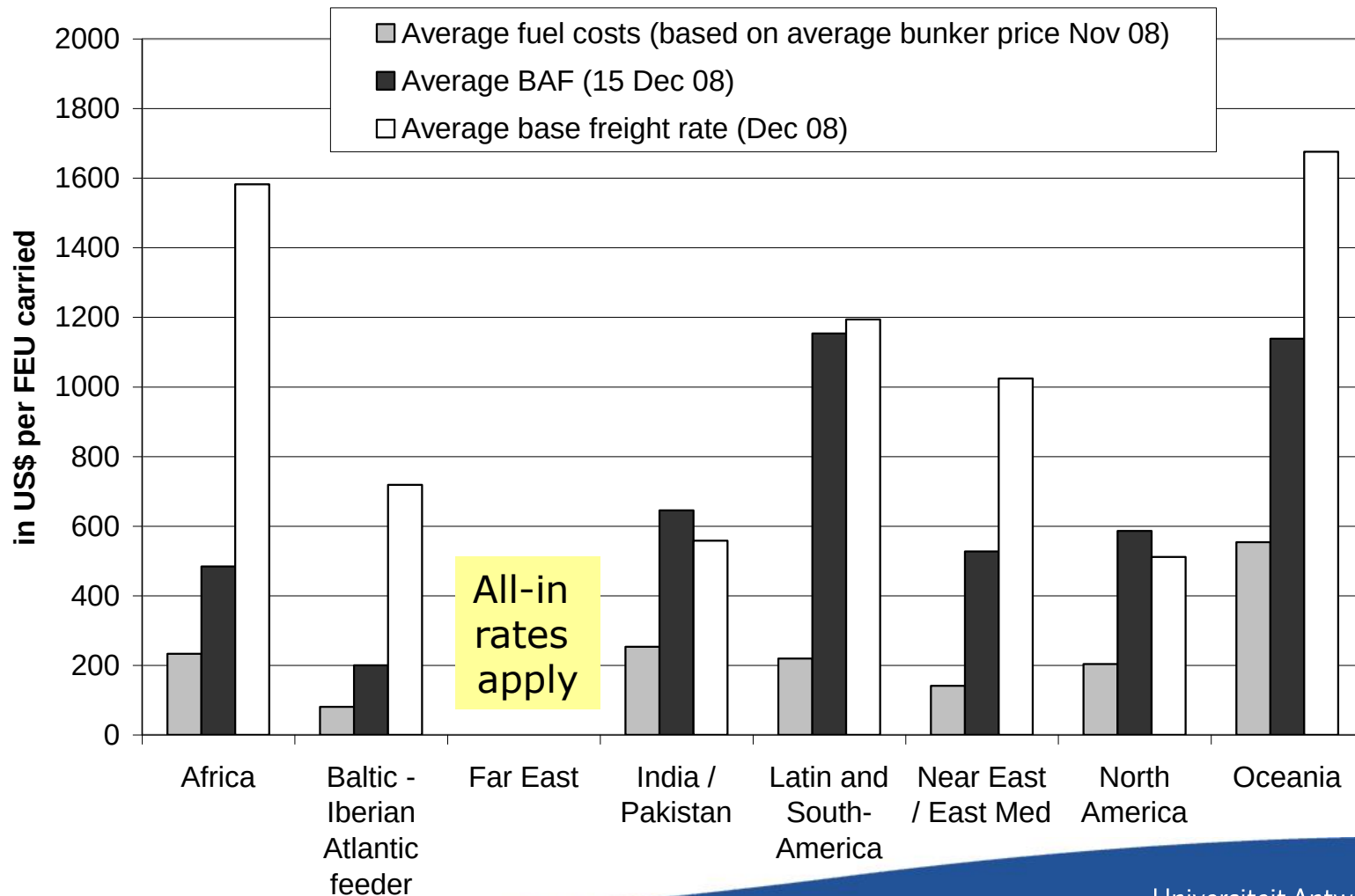


BAF, fuel costs and base freight rate per FEU – port-to-port relations with loading port Antwerp – **June-July 2008**



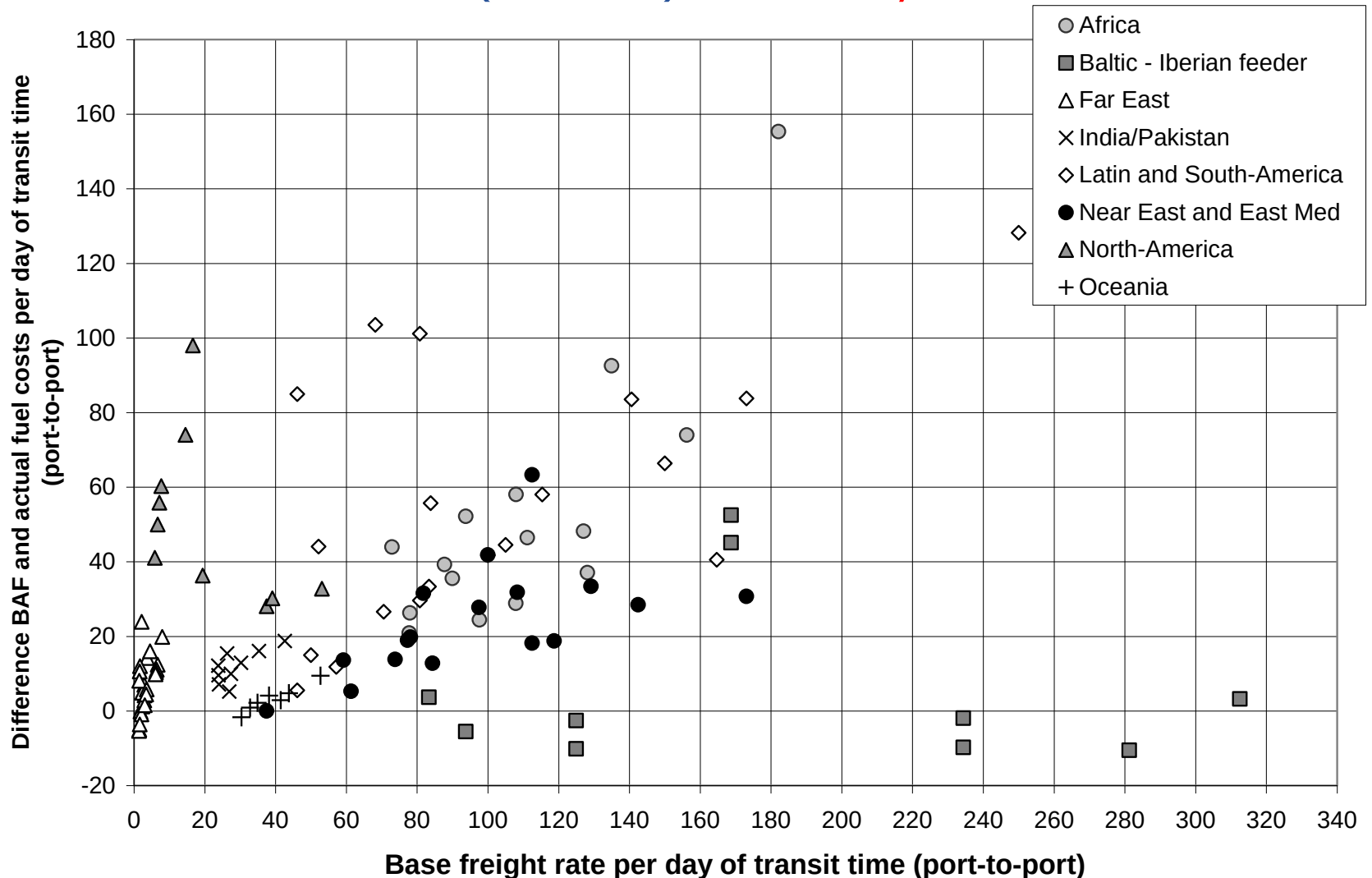


BAF, fuel costs and base freight rate per FEU – port-to-port relations with loading port Antwerp – **December 2008**





Base freight rate per day of transit time (port-to-port) and difference between BAF and actual fuel costs per day of transit time (n = 117) – June/July 2008





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Case-study results

- BAF per FEU carried is typically (much) higher than the average fuel costs per FEU => BAF appears to involve a moderate to elevated element of revenue-making.
- The revenue-making characteristic of the BAF is significant on the shipping routes from Antwerp to Latin and South-America, Africa and North America.
- Observed variation in the difference between BAF and the actual fuel costs per FEU is mainly the result of differences in the shipping lines' BAF policies for specific ports of discharge.
- Revenue-making character of BAF has not disappeared after the abolition of liner conferences. On the contrary, most trade routes see an even larger gap between BAF and actual fuel costs.



Case-study results

- The relationship between the base freight rate and the BAF is weak.
- The correlation between the base freight rate and the difference between BAF and the actual fuel costs is typically low and, in cases where some correlation exists, positive. The hypothesis that low freight rates would give an incentive to shipping lines to increase the revenue-making character of the BAF is not confirmed.
- However, a combination of decreasing freight rates and decreasing fuel costs seems to give an incentive to shipping lines to stall the downward correction of the BAFs. Such a pricing strategy allows shipping lines to (partly) compensate a decline in freight revenues by keeping the BAF disproportionately high.



Conclusions

- Better understanding of shipping lines' strategies with respect to the incorporation of fuel costs in their pricing strategies.
- Room for further in-depth and comparative research on the relationship between BAF and the actual fuel costs:
 - Broadening the scope of the case-study to other regions and other base ports.
 - Analysis of the relationship between BAF and fuel costs on port pairs that are not linked to each other via direct services, but for which transshipment in another port is needed before reaching the port of discharge (i.e. interlining, relay or hub-feeder systems).
- Ongoing research: development of a fuel cost calculator



Thank you for your attention !