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Volume 3

姜旭朝　主编

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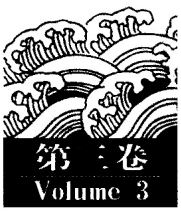

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Route Choice by the VLCCS from Middle East Gulf to North Atlantic

Risto Laulajainen *

[**Abstract**] Three alternatives for round voyages between the Middle East Gulf and North Atlantic, Cape/Cape, Suez/Cape and Suez/Suez (laden/ballast), are compared from actor perspective. Ship owners benefit from long routes when rates are not rising steeply. Refineries minimize logistics costs by selecting short routes. Traders also should opt for them, provided that their investment horizontal equals the laden leg. In the real world, Northwest Europe selects 10 pct Suez and the US Gulf 10 pct Cape. East Coast Canada is route neutral. Cargos from West Africa tilt this equation in favor of the Cape/Cape alternative.

[**Key Words**] actor perspective, detailed calculations, market homogeneity, netback pricing.

JEL Classification: L92, F23

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1. Introduction

This report deepens a previous study about route choice by crude oil tankers between the Atlantic and Pacific/Indian Ocean basins (Laulajainen 2007a). The focus was on the Suez Canal and particularly vessels below 200, 000 dwt, able to pass the canal with full cargo AND discouraged to round the Cape of Good Hope because of high operating cost per cargo tonne (metric ton, mt). Vessels exceeding the size limit were left in relative shadow because of their opposite logistics. These VLCCs must unload partcargo to the parallel Sumed Pipeline before entering the Canal and reload it after passing, which raises costs. In compensation, they can profitably round the Cape for a range of port pairs. These features put VLCCs into a genuine choice situation: the Canal with Pipeline or the Cape. Since the crude oil flow is overwhelmingly from Indian Ocean to Atlantic there should be, somewhere in the Atlantic, a breakeven line for cargos selecting the Suez or Cape routes, respectively. Vessel movements suggest that the Caribbean and possibly the east coast of North America (ECNA) tilt for the Cape route whereas northwestern Europe (NWE) and possibly the northernmost parts of ECNA prefer the Suez alternative (Laulajainen 2007a, Fig. 1). ①A closer look reveals, however, that there are exceptions to the general rule. The two refineries on Canada's eastern coast (EC Canada) are a case in point (App. 1). The task is to find explanations for such anomalies. Answer is sought by a detailed revenue-cost analysis with emphasis on the various actors operating in the market and their diverging decision criteria. The first rudimentary steps were taken in the above study (Laulajainen 2007a, Table 5, Fig. 6).

The report begins by describing relevant crude oil trades (trade flows) with distances and some attached costs, continues by defining the actors, their revenues, costs and profits, whereafter the transportation routes are compared from actor angle.

① About one-half of VLCC cargos to NWE arrived to the Mediterranean entirely through the Sumed pipeline. They had originally been loaded in Yanbu, Red Sea or MEG. The Yanbu/MEG-Ain Sukhna-Siri Kerir chain is outside this article.

2. Route parameters

Relative distances and the surcharge for passing the Canal/Pipeline set the tenor of the discussion (Fig. 1). Previously, distances were measured from Quoin Island to major Atlantic reference ports. Now, also the loading ports are specified. Few ports are involved in a major way. In the Middle East Gulf (MEG), only Juaymah, Basra and Kharg Island actually mattered and each of them can be tied with a dominant destination. Among the 122 NWE port visits, 70 had Rotterdam and 23 the not-too-distant Le Havre as their destination, a total of 76 pct. Among the 257 Gulf Caribbean visits with known destination, 159 ended at the LOOP terminal and 60 in Galveston, about 250 nm farther west, a total of 85 pct. The coastline from Maine to Miami is too shallow for all but special built VLCCs (Concordia Maritime 1998, 28 - 9). A special feature is that Iran and Iraq channelled their exports after political maxims towards NWE and USA, respectively (Table 1).

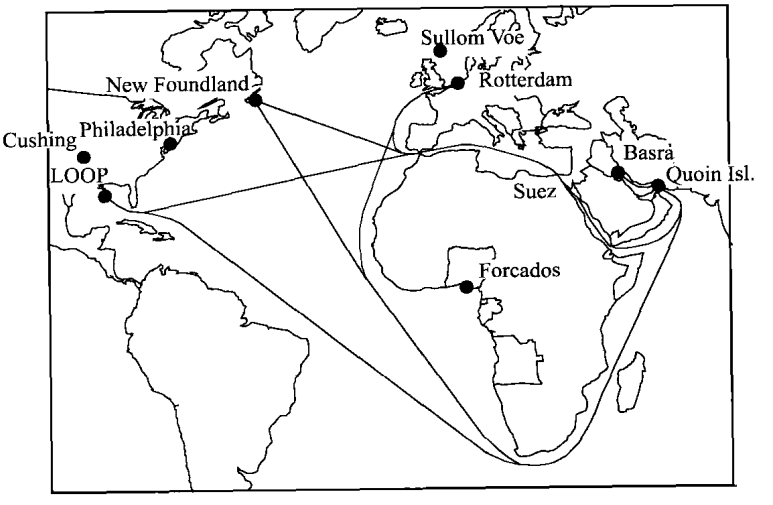

Figure 1 VLCC main routes from MEG to North Atlantic, 2004

Notes: Distances are distorted because the map projection downplays the "waistline" of the globe.

Sources: LMIU Movement Data (2004); Worldscale (2004). Laulajainen (2007b), worktables.

Table 1 **VLCC crude oil cargos MEG—North Atlantic, 2004**

	Sumed/Suez			Cape			Total
	NWE	ECNA	GulfCarib	NWE	ECNA	GulfCarib	
Iran	35			**11**			46
Iraq	4	10	14		**2**	66	96
Rest	70		18	2	**11**	245	346
Total	109	10	32	13	13	311	488

Legend: NWE = Northwest Europe (incl. Biscaya), ECNA = East coast North America, Gulf Carib = US Gulf and Caribbean, Rest = Saudi Arabia, Kuwait and UAE.

Sources: LMIU Movement Data (2004).

The base case is that vessels ballast back to their loading ports (round trip), either via Suez or Cape (Table 2, S/S and C/C). This is in line with the World-scale rating system and MEG's role as the dominant origin of VLCC cargos (App. 2). The saving by using the Suez route is almost 10, 000 nm to NWE, 8, 000 nm to EC Canada, but only 5 – 6, 000 nm to the US Gulf. These figures may surprise a layman but are logical in view of the more southern location of North America *vis-à-vis* the Continent and the growing waistline of the Globe towards the equator. Put simply, distance from the Straits of Gibraltar to Florida is twice longer than to Rotterdam. In practice, the C/C round trip is replaced by C/S because ballasting through the Canal is physically feasible. That saved cost and time, i. e. minimized lost revenue.

Table 2 **Distances (nm, rv) on key routes**

	Rotterdam			LOOP			Come	St. John	
	S/S	S/C	C/C	S/S	C/S	C/C	S/S	C/S	C/C
Juaymah	12690	17510	22330	**18958**	**21699**	**24440**	14696	**19590**	**23346**
Basra	12926	17746	22566	19194	21935	24676	**14932**	19826	23582
Kharg Isl.	**12768**	**17588**	**22408**	19036	21777	24518	14774	19668	23424

Legend: rv = round voyage; cargo/ballast, C = Cape, S = Suez/Sumed; **fat style**, actually used.

Notes: St. John is more distant from the MEG (Quoin Island) than Come by Chance, 754 nm via Cape and 1, 138 nm via Suez/Sumed.

Source: Worldscale (2004).

But the real world is not that straightforward. Specifically, return cargos can be picked up in West Africa by ballasting via the Cape and adding a 4 – 6, 000 nm de-

viation to the shortest possible route (Table 3). The approximate chance to get a cargo in 2004 was 0.5 (192/392) to North Atlantic, 0.15 to India and 0.45 to Asia Pacific (Table 4).① The gross revenue of the alternative closest to MEG (Karachi) was roughly $3 mill. Other alternatives promised higher revenues but implied also longer ballasting back to MEG. That, of course, had to be corrected by the original and fully paid but unfinished ballast leg from the North Atlantic.

Table 3 Cost increase for ballasting via Cape rather than Suez.

From-to	Dist nm	Time days	Fuel $'000	Rev $'000	Suez $'000	Total $'000
Rotterdam-Kharg Isl.	4820	13.9	213	900	-200	913
St. John-Juaymah	4028	11.6	177	754	-200	731
LOOP-Juaymah	2741	7.9	121	514	-200	435

Notes: Speed 14.5 knots (=348 nm/day); Fuel 90 mt/day, $170/mt; Revenue loss $65,000/day (WS-100). Possible deviation from straight Cape route to Forcados, 1,000 nm, overlooked.

Sources: Laulajainen (2008), worktables; Worldscale (2004).

Table 4 West African VLCC loadings, 2004

Legs			ECNA	NWE	India	Asia Pac	World
Cargos	from	West Africa	176	16	64	180	454
		MEG	345	17	156	1653	2610
Ballasts	to	West Africa	250	66	0	12	392
Revenue			TCE $/day/days				
From via to			LOOP	Rotter	Karachi	Kaohsiung	
LOOP via Forcados to			85280/41	n. a.	62029/50	84543/52	
Rotter via Forcados to			81040/44	n. a.	n. a.	76637/61	

Notes: Ballast legs not based on direct evidence but derived from cargo legs. For more probable figures multiply by 454/392 (=1.16). TCE data applies to good itineraries based on actual cargo legs. Jamnagar, close to Karachi, is a more likely destination.

Sources: Laulajainen (2008), worktables; Worldscale (2004).

① The total exceeds 1.0 which is due to the use of the database. LMIU Movement Data (2004) in its administered form identifies only cargo legs. Ballast legs must be inferred from them, or resort made to the unadministered data-a fair labor input. Since ballast legs in the beginning and end of the accounting period, possibly 16 pct out of the total, could not be fully identified they are omitted here.

Ideally, a new cargo is chartered when the old one is about to be discharged. When this is not possible it may still be rational to steer an unchartered vessel to a speculative cargo. Some ships necessarily fail which challenges the rule-of-thumb that practically all tankers ballasting from North Atlantic to MEG do it via the Suez Canal.

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The Suez Canal and Sumed Pipeline dues playd a role in the decision. What is unclear is their actual impact. The canal is owned and managed by the Egyptian government whereas the Pipeline belongs to a joint venture consisting of Egypt and the Middle East oil producers, except Iran (Sumed Pipeline 2005). Full dues for a a 275,000 mt cargo in 2004 were $ 2.68/mt S/S and $ 1.36/mt C/S (Worldscale 2004). Figures from the early 1970s suggest that partcargos using the Pipeline cannot have paid more than 40 pct above that (Hansen and Tourk 1974, 109). Posted dues are mostly for reference, however, because generous discounts are granted to attract traffic and maximize the canal net income (Abu-el-Hassan 1974, Englund 2008). The discounts are related to the level of freight rates, ship's cargo, loading and discharging ports, possibly also the importance of ship owner as a customer. Any average percentage will consequently be inaccurate (App. 3). Anyway, when average logistics costs with 50 pct Canal dues fall within a range of $ 18 - 28/mt, discounting alone can only finetune the route choice (Table 8, LOG).

For the discounting to succeed technically, the ship and its destination need to be identified and the deal made before the ship turns to its final route (Fig. 1). Vessels carrying company cargos are easier to deal with than those chartered by traders because they are mostly heading to company refineries. For example, Exxon's Atlantic refineries are in Fawley, Antwerp, Rotterdam, Slagen, Baton Rouge and Dartmouth, NS. Trader cargos, by definition, have more alternatives and the one selected may change while steaming. A laden vessel is contacted before it leaves the MEG and the latest point for vessels ballasting from Gulf Caribbean is the Florida Straits or Tobago. From NWE it is Cape St. Vincent, Spain. Vessels departing from EC Canada are best contacted when the coast is still visible. The discount is set so that the calculated travel cost via Suez becomes in ballast slightly lower than via Cape (de Spon 2008). The angle is formally ship owner's because the change in cargo value is ignored.

3. Actor angle

The classical solution of a routing problem is to specify the parameters by route, apply them, and arrange the items to reflect the financial outcome for ship owner and cargo owner (App. 3 and 4). Their interests are different, even oppo-

site, and the hypothesis is that route choice will reflect their preferences and relative negotiating strengths. To put it simply, when tonnage is in short supply and rates high the ship owner has the upper hand and the other way round. That may result into differing route preferences, ship owner's and cargo owner's. Such a situation may have existed in the Northern Atlantic in 2004 and possibly later on, when both freight rates and oil prices fluctuated heavily and occasionally reached unprecendented levels (Fig. 2). The principles are naturally transferable to any market.

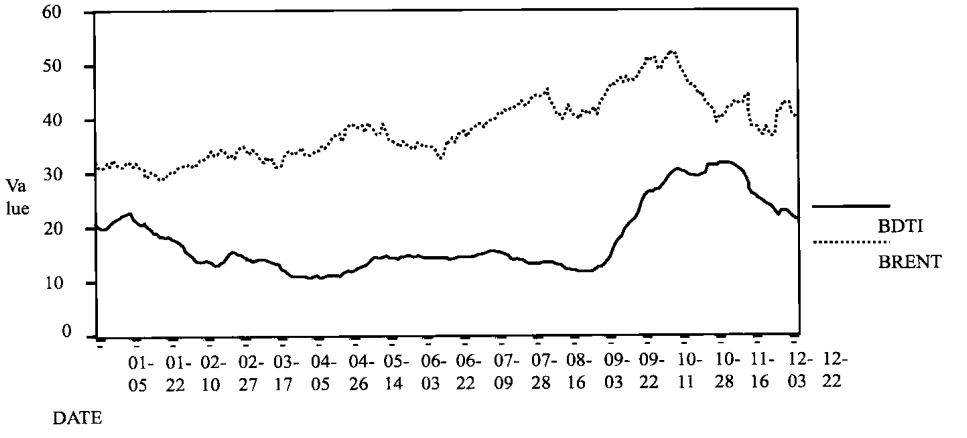

Figure 2 Baltic Dirty Tanker Index and Brent Blend crude oil price, 2004

Note: BDTI scores divided by 100.
Sources: BDTI (2004); EIA (2008).

Ship gets paid for every day as long as the charter lasts. If a new charter is immediately available after the old one expires, all what matters is whether rates are rising or declining. If they are rising a short charter is preferable and the other way round. Ready availability of new charters is connected with rising rates. Cargo belongs to a public body administering safety stocks, a refinery purchasing feedstock, or a trader operating for profit. Public body and refinery should be relatively indifferent to the inventory location as long as costs are reasonable, safety and availability guaranteed. Storage on land is cheaper and safety better than on board, although the variation is large. Safety is probably better in USA and NWE than MEG, and the Cape route avoids better the pirate infested waters around the Somali coast. Consequently refinery is an acceptable reference point also for a public body. Trader differs from refinery by taking speculative positions, the opportunities will turn up more frequently and success is facilitated by regular price cycles

(Fig. 3). Traders usually hedge their positions, a practice which takes a slice of profits and is ignored here.

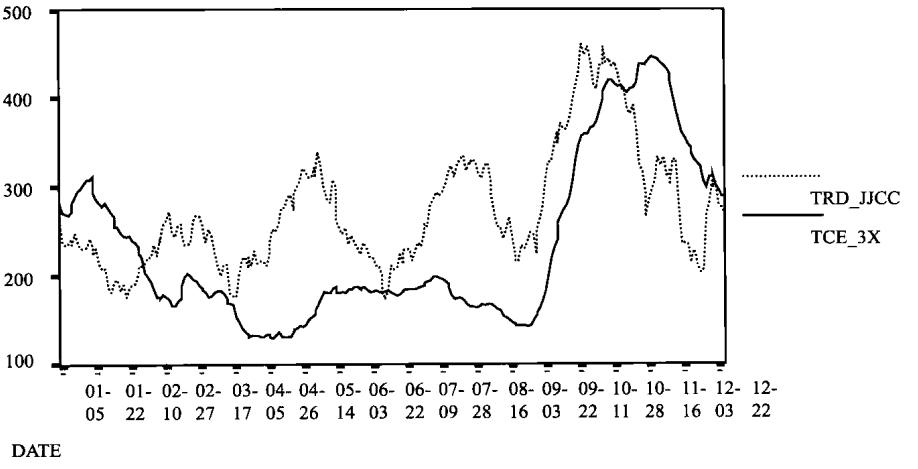

Figure 3 Trader (TRD) has more opportunities than Shipowner (TCE)

Note: TRD in $/mt; TCE ($'000/day) multiplied by 3.

Ship owner maximizes the net revenue of operations whereas cargo owner minimizes the cargo's logistics cost, alternatively maximizes its value increase. The available "chips" are the same, their selection and subsequent arrangement differ (App. 5). The dollar amounts are flanked by percentages to clarify their weights in the end result. The value of cargo at the loading port (f. o. b.) and the discharging port (c. i. f.) differ by the transportation and insurancem cost. There may also be a price difference for the crude around and after the load date. Transportation cost consists of the flatrate multiplied by the Worldscale quotation and cargo weight, and includes also basic port charges. This is ship owner's Gross Revenue from which bunker cost and port charges are subtracted to arrive at Operational Revenue. This, divided by the calculatory duration of the (assumed) round voyage, gives Time Charter Equivalent (TCE) per day, which is equivalent to the daily rate of a time-chartered ship, a conventional measure for comparing charters and routes. From it the owner pays personel costs, vessel's maintenance and capital costs. At flatrate (WS 100) conditions these items add to TCE. That, however, applies only to the standard ship with a 75,000 mt cargo, paying and non-paying. At larger ship sizes scale economies play in and the breakeven rate becomes much lower. At WS - 50 a VLCC will give TCE = $ 25,000 which is close to the calculatory breakeven hire el-

ement of $ 24,000 (Laulajainen and Johanson 2006, Table 6). To the Gross Revenue will be added Canal dues, a proxy also for Sumed dues and some port charges, not included in the WS flatrate. Ship owner pays them but collects the monies later on from cargo owner.

Cargo owner pays the above amount, Gross Revenue, and the attached canal dues to ship owner. The cargo is insured at a premium far below 1 pct when the political situation is relaxed but 5 pct and over when tensions escalate to an armed conflict. The former figure is used in this report. These items are out of pocket. Upon them come calculatory items, interest on cargo and change of its value during the transfer. Interest on raw material inventory, whether landed or *en route* is part of accounting routine and so is the change of its value, the mark-to-market principle. But whether the change needs to be accounted for during the transfer is more debatable. If the cargo is part of normal process inventory it need not, but if it is going to be sold at the end of the voyage the value change is relevant. The alternatives are labeled Producer and Trader cost, respectively. The rate of interest is set at 10 pct, a low figure but sufficient in a time with low inflation and central bank rates. Interest is calculated on the f. o. b. price of the cargo for the cargo days (sea days/2 + port days).

Trader can speculate about the cargo as long as its transport and handling lasts. It follows that cargo days form the basis of trader's speculation period (Table 5). The entries are created in principle by subtracting the Trader cost at loading from its homologue at discharging. The price difference is calculated each day and labeled optimistically "Trader profit". Its average approximates closely the rising price trend, or the depreciating dollar. The data is prepared for the period December 2003 – March 2005 using Worldscale 2004 figures but only the period 5 Jan – 24 Dec 2004 is used for analysis, 250 observations. From this time series a suitable number of speculative periods (local maxima) are selected, as explained below. The sample is taken from each route alternative.

Table 5 **Speculation periods**

Route			Days
Juaymah	St. John	C/C	26
		C/S	22
Basra	Come by C	S/S	19

continue

Route			Days
Juaymah	LOOP	C/C	28
		C/S	26
		S/S	23
Kharg Isl.	Rotterdam	C/C	26
		S/C	22
		S/S	17

Note: Includes also weekends.

Value change, interest and insurance need an underlying price series to become operative. There are not too many alternatives to choose among (Table 6). Brent Blend at Sullom Voe in the Shetland Islands and Western Texas Intermediate (WTI) at Cushing, OK are the usual reference prices and correlate well. ① Since Sullom Voe is not too far from the NWE consumption hub its quotation is close to a c. i. f. price. Cushing, instead, is an inland location without good transportation to the coast (Blas 2009). Marsh Blend at LOOP is locationally superior and costwise comparable with Sullom Voe. Its weakness is a relatively thin market. Since both are similar to quality Brent appears an acceptable choice. To arrive at a MEG f. o. b. price it is necessary to deduct from the Brent c. i. f. price the logistics cost, the netback principle. The problem is that the North Sea crude is lighter and less sulphurous than the MEG crude it is more expensive. The premium depends on the desired product mix which is different in Europe and North America and subject to seasonal variation. Therefore, Arabian Light or Dubai might be an alternative although not fully representative for all MEG. For example, Kuwait and Iran crudes are lighter and more sulphurous. In any case, the logistics cost depends on the selected route. This being the case and for the sake of simplicity, Brent Blend is taken as the overall basis from which transport costs are deducted to arrive to the f. o. b. MEG price.

① R-sqr (adj) = 0.971 and WTI lies $ 2.76 above Brent. Only days when both quotations are available have been used. This is not a general rule and in mid - 2007 and January 2009, for example, the spread was opposite.

Table 6 **Relevant crude oils**

Oil	Brent Blend	WTI	Mars Blend	Arabian light	Dubai
Priced at	Sullom Voe	Cushing, OK	LOOP	Juaymah	Fateh
Our perspective	c. i. f.	f. o. b.	c. i. f.	f. o. b.	f. o. b
Price availability	good	good	poor	poor	fair
Relative location	seaside	inland	seaside	seaside	seaside
Market hub	Rotterdam		Philadelphia		
nm rv	1, 206		3, 206		
flatrate $/mt	3. 71		4. 11		
API°	38	40	30	34	31
Sulphur, pct	0. 37	0. 24	1. 98	1. 78	2. 04

Notes: High API° indicates light crude. Light, low-sulphur crude commands a price premium. Venezuelan and Mexican crudes contain 2. 5 – 3. 3 pct sulphur. Flatrate Sullom Voe to Come by Chance $ 6. 23, distance 4, 216 nm rv. Cushing is halfway between Oklahoma City and Tulsa.

Sources: BP Statistical Review (2007) 6, 22; Energy Intelligence Group (2006); Worldscale (2004).

4. Route and actor comparisons

The analytical core is the question whether it is decidedly more economical to select the Suez route rather than the Cape route from the MEG to various corners of North Atlantic, say, EC Canada, US Gulf and NWE; and whether the three major actors, ship owner, refinery ("producer") and trader have divergent views on the question. If the netback principle is taken to the letter and Brent Blend is assumed fully representative all over North Atlantic then the problem is no longer refinery's but crude oil producer's: some sales give a higher netback than others. A simple way to gain an overview is to display relevant curves in the same figure and make visual comparisons, to be complemented by indicator averages. Three actor angles, destination areas and route combinations make 27 combinations, sufficiently many to recommend preliminary pruning. The route choices are tied to identical overall factor prices: Brent oil price, a single rate function with Baltic Dirty Tanker Index as argument, identical Canal/Pipeline dues, and fixed interest & insurance rates. It follows that key variables move within well defined limits and rule out dramatic differences between destinations and routes. The choice can be further narrowed by selecting few representative variables. The screening begins by correlating all variables with each other by route (Table 7).

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