FREIGHT FUTURES TRADING AND SHIPOWNERS' EXPECTATIONS

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INTRODUCTION

Freight futures trading or BIFFEX as it is more widely known to the shipping circles is a rather novel institution that has been around for just over six years at the time of writing. BIFFEX was designed as a hedging instrument that would protect market participants (shipowners and charterers) from adverse freight rate movements enabling them to plan business development in a more rational and efficient way.

As opposed to most futures markets, BIFFEX is a rather unique institution in the sense that it trades an index rather than a commodity or financial instrument. This makes BIFFEX a *cross hedge*. The index in question is the Baltic Freight Index (BFI), which is a weighted average of the freight rates of the twelve most important (in terms of cargo carried) dry bulk routes in the world.

However, observation shows that, so far, the shipowning community has not embraced BIFFEX to the required extent. A number of reasons have occasionally been put forward to explain this fact. Among them one could list ignorance, the wrong perception of BIFFEX as a speculative arrangement and questions regarding the effectiveness of BIFFEX as a hedging instrument.

It is believed here that the latter reservations concerning the instrument's effectiveness are the most serious ones deserving further investigation. Through a number of discussions of the author with shipowners involved in the dry bulk market it is becoming increasingly evident that *BIFFEX is not working the way it should* or, to put it more correctly, *BIFFEX is not as effective an instrument as it is advertised to be.*

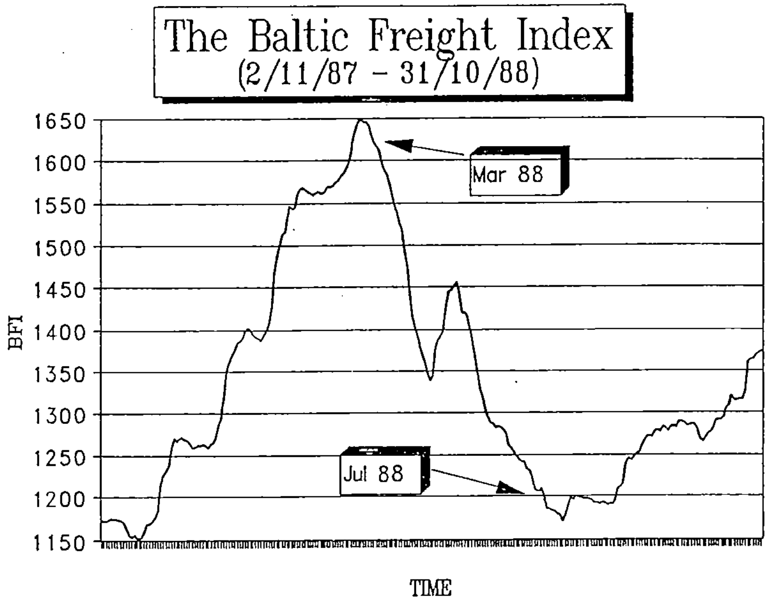
The purpose of the present paper is, therefore, to examine the validity of the above allegations and, if proven to be correct, to suggest ways and hedging strategies that would tend, if consistently used, to increase the instrument's effectiveness.

1. FREIGHT RATE DEVELOPMENTS IN THE DRY BULK MARKET

For a number of well established reasons that fall outside the scope of the present paper, the dry bulk market demonstrates a highly volatile and cyclical character that gives rise to an extremely risky business environment. Both these aspects of the market can be seen in Graph 1. It can be observed, for instance, that during the three-month period from March to July 1988, BFI fell by more than 27% before it started to recover again.

In a business environment like this, market participants are many times obliged to "take a view" on the market, in other words to speculate. Over the three-month period above many marginal shipowners and operators were finding themselves out of profitable employment while others with good company liquidity and expectations for short-term

Graph 1



freight rate recovery were buying new tonnage for future deployment.

It should be mentioned at this point that due to market volatility and its subsequent effects on ships values, short-term asset play is an equally important consideration, for a shipping company, as that of ocean trading.[1]

2. THE MECHANICS OF BIFFEX

It has sometimes been argued that BIFFEX is a mechanism that tends to reduce, shift or offset freight rate risk. Strictly speaking, however, hedging neither shifts nor reduces freight rate risk; it merely establishes a second market position that has its own risk. A hedge is considered effective if the two price risks are offsetting.

Futures trading is rarely perfectly effective and hedging would very seldom eliminate freight rate risk by one hundred percent. Certain risk, called *basis risk*, will always remain and this is particularly true with cross hedges such as BIFFEX. If the basis risk is less than the freight rate risk alone, then the hedge is said to be at least partially effective.

A shipowner can create a second market position in futures by trading (selling and subsequently buying back) a freight futures contract. The unit of transaction is the *lot* priced at 10 dollars times the value of the futures index. Futures prices are published daily for the current month, two forward months and then quarterly for two years ahead.

A shipowner who anticipates a decline in the freight rate of his particular trade at the time when his tonnage will become available for rechartering, can sell futures contracts planning to buy them back upon fixing his vessel. If freight rates do go down, the shipowner will find himself in a worse position compared with the time of initiating his hedge. However, given that the traded instrument is just an average freight rate, its value should normally go down as well enabling the shipowner to buy back his "commitment" at a lower price than the one he achieved when he sold it. The profit that is, thus, made in the futures position comes to offset losses in the physical position (charter market).

The above can be illustrated with the use of an example borrowed from the BIFFEX promotional material.

THE "SHORT" (i.e. THE SHIPOWNER'S HEDGE)

DATE	PHYSICAL MARKET	FUTURES MARKET	NOTES
Mid March	Vessel employed til mid May[1] BFI: 1582 Monrovia/Rotterdam rate: $6.90 Cargo: 90,000 tonnes = lump sum $621,000[2]	July price: 1523[3] Owner sells 40 lots Total value $609,200	1. Risk for owner is that market will have declined by mid-May, but no suitable charter is available on forward market 2. Spot rate=$6.90, giving a currently expected income of $621,000 3. Futures price currently at a discount to spot. This means the best one can achieve on BIFFEX is about $6.65
Early May	BFI: 1391 Fixes vessel for Monrovia/Rotterdam at $6.35[1]x90,000 tonnes Achieves lump sum $571,500 or $49,500 less than March level	Unwinds the hedge Current July price: 1400[2] Buys 40 July at 1400 achieving a BIFFEX profit of $49,200[3]	1. As feared the spot market has fallen. 2. The futures market has fallen in parallel. 3. Net result is a freight rate of $6.89 achieved.

Comment: By using the futures market, this shipowner has protected himself against a falling market despite the discount in the July price prevailing at the time that he placed the hedge.

Present time is assumed to be somewhere in the middle of March. The shipowner of this example has his 90000 MT vessel chartered until mid of May. During this two-month period the shipowner fears that freight rates will go down and he will be receiving less charter income as compared with today's market ($6.90/ton). His fears are confirmed by the July price of 1523 which is at a discount to the current BFI of 1582. This simply means that "the market" itself also feels that rates are going to go down. Had the shipowner been able to charter the vessel now he would be receiving a gross income of 90,000x6.90=$621,000.

However, he considers the July price of 1523 to be satisfactory and he decides to sell a number of lots in order to "lock-in" this price and protect himself from a possible steeper drop in freight rates. Given that the July price is at a discount, the best that the shipowner can achieve on BIFFEX is about (15230/15820)x6.90≈$6.65.

The shipowner initiates a one-to-one hedge, in an effort to get 100% protection, and he sells 621,000/15,230 ≈ 40 lots receiving a hypothetical[2] income of 40x15,230 = $609,200 which is roughly equal to his total current freight exposure. A one-to-one (1-1) hedge is, thus, a hedge in which the amount of lots to be sold is determined in such a way so that the total amount of the sale proceeds exactly matches the shipowner's freight exposure at the time of initiating the hedge.

In early May the shipowner fixes his vessel at a rate of $6.35 while the BFI stands at 1391. Both these figures suggest that, as expected in March, freight rates have indeed gone down. As a matter of fact, rates went down more than what was expected in March (1391 compared with 1523) and the shipowner, having "locked-in" the rate of $6.65, would be very content with his decision to be involved in hedging.

Chartering his vessel at $6.35 the shipowner receives a freight revenue of 90,000x6.35 = $571,500. The difference between this figure and the corresponding March one, i.e. 621,000-571,500 = $49,500, is the shipowner's theoretical loss in the physical (charter) market.

The actual drop in freight rates was accompanied by a corresponding drop in the price of the July contract which now stands at 1400 points. Upon fixing the vessel, the shipowner unwinds his hedge, buying back his 40 lots, at $14,000 each, paying a total amount of 40x14,000 =$560,000. In this way he realises an actual profit in the futures market of the order of $609,200-$560,000 = $49,200 which is roughly equal to his loss in the physical market. The *effective rate* is, thus: (571,500+49,200)/90,000=$6.89

The hedge of this example can be considered as perfectly effective as it provides 100% coverage to the anticipated freight rate risk (losses in the physical market are exactly offset by gains in the futures market).

3. THE CRITIQUE

In reality, however, things do not, in general, work as effectively as in the above example. The almost perfect result of the example is based on one very crucial assumption that is implicitly made and which reality shows to be rather unwarranted. This is the assumption that ***the decline in freight rates is, proportionately, exactly equal to the decline in the price of the futures contract.*** It can, indeed, be observed from the figures of the example that:

$$\frac{f_2}{f_1} = \frac{6.35}{6.90} = \frac{1400}{1523} = \frac{F_2}{F_1} = .92$$

where: f_1, f_2 are the two freight rates
F_1, F_2 are the March and May prices of the July contract

Such a perfect harmony in movement, suggesting a perfect correlation between the two prices, is very rarely attainable, if at all. Table 1 gives the correlation coefficients between a number of futures prices and the freight rates of the 13 routes.[3] As it can be observed, the best correlations that are achieved are around 80% (routes 1,2,4,5,7,11,12); two freight rates are rather poorly correlated with futures prices (routes 6 and 8) while three routes (3, 9 and 13) have a negative correlation with all four futures prices examined.

Table 1

	Jan 88	Apr 88	Jul 88	Oct 88
R1	.85	.76	.71	.73
R2	.87	.79	.74	.75
R3	-.43	-.50	-.44	-.54
R4	.81	.75	.69	.74
R5	.85	.82	.75	.80
R6	.17	.23	.19	.29
R7	.88	.87	.84	.85
R8	.36	.37	.36	.37
R9	- .66	-.68	-.63	-.70
R10	.71	.73	.75	.70
R11	.84	.78	.70	.76
R12	.87	.82	.75	.80
R13	-.65	-.62	-.54	-.64

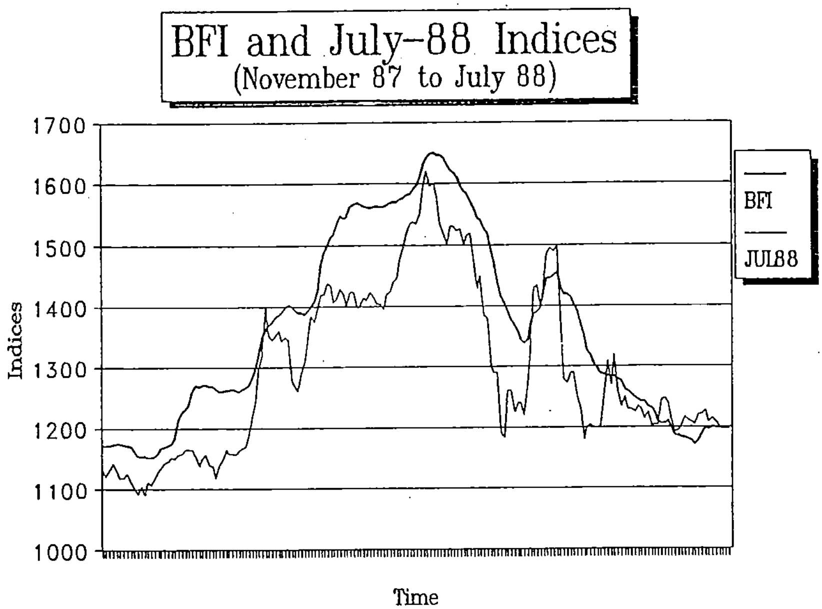
This is a good point to stress the fact that the correlation coefficient that is really relevant is the one between freight rates and futures prices and not the one between freight rates and BFI as is sometimes argued in the literature.[4] This point would not have been very important had the correlation between futures prices and BFI been high. Table 2, however, shows that this is not the case either.

Table 2

	Jan88	Apr88	Jul88	Oct88
BFI	.87	.79	.73	.75

It is true that futures prices and BFI tend to move in the same direction, as can be seen from Graph 2, but this movement is not always uniform. When the futures price exceeds BFI the market is said to be in *contango* while when the futures price is below BFI the market is said to be in *backwardation*. The difference between the two prices is sometimes known as the *basis*. As the futures contract approaches maturity, the two prices tend to converge and so the basis should also converge to zero. This convergence, however, is not necessarily smooth.

Graph 2



To come back to the figures of the hypothetical example above, it should also be noted that even if there was a perfect correlation between freight rates and futures prices, this fact alone is not enough to guarantee an equal proportionate change in the two prices, as is assumed in the example. Consider, for instance, the case where the two prices are related in a deterministic way, through a linear relationship of the type:

$$f_t = 5 + 0.01 \cdot F_t$$

In this case, once F_t is known, f_t is determined automatically and vice versa. The correlation coefficient of the two variables is 1 and they are said to be perfectly correlated. Assume that in a certain day F takes the value of 1400. To this, corresponds a freight rate of:

$$f = 5 + 0.01 \cdot 1400 = 19$$

If subsequently F drops to 1000, which represents a 9% decline, the corresponding freight rate will be $f = 5 + 0.01 \cdot 1000 = 15$ which means that it has dropped by only 6.25%.

Perfect correlation does not of course exist in reality and short term hedging results may be very surprising even in cases where there is a high (but not perfect) correlation among the two prices. A correlation coefficient of, say, 80% calculated on data over a long period of time, indicates a strong association between the two variables but should not be taken to mean that their movement is uniform at all times. The case may be, for example, that, during a certain period, futures prices are going up while actual freight rates are going down. In that case the shipowner would be much better off by not getting involved in BIFFEX at all, as he would be losing money in both markets (physical and futures).

For the same reasons, the argument that, through hedging, the shipowner "locks-in" *now* a certain future freight rate that he considers adequate, is also inaccurate and not generally true. In the above example it was said that, by selling the July contract, the shipowner locks-in a rate of \$6.65. This would be true only if, in May, the price of the contract had indeed gone down from 1582 to 1523, as anticipated in March (as a matter of fact the price went further down to 1391) and this decline was accompanied by a similar proportionate fall in freight rates. In every other case the locked-in freight rate could be higher but also considerably lower than \$6.65. In short, the freight rate in question is unknown at the time of initiating the hedge and the term "locked-in" is for obvious reasons rather misleading.

Consider, for instance, the case where the futures price went indeed down but only to the level of 1450 (instead of 1400) and freight rates dropped to \$6.35 as suggested in the example. In that case, the profit in the futures market would only be 40·(15230-14500)=\$29200 which only partially (60%) offsets the \$49500 loss in the physical market.

As was said in the beginning, the point of a freight futures hedge is to offset the freight rate risk associated with a position in the charter market. However, the above example demonstrated that potential losses in physicals would rarely be 100% offset by gains in futures and vice versa. There will always be a difference (no matter how small or large) between the two amounts whose variance is sometimes known as the *basis risk*. A 1-1 hedge would, thus, be perfectly effective only by accident. Even with perfect correlation between freight rates and futures prices, a 1-1 hedge should not normally be expected to yield optimum freight risk coverage.

Consider the case where the freight rate of a particular route is almost perfectly correlated with both the April and July contract prices. The tonnage to be hedged is becoming available for rechartering some time towards the middle of June and, thus, the shipowner can choose to sell anyone of the two contracts.[5]

This near perfect correlation warrants that variations in the two futures prices are almost entirely explained by variations in freight rates. This conclusion, however useful, does not provide any information about the magnitude of the relevant variations.

Assume for example that a 10% change in freight rates is accompanied by a 5% change in the price of the April contract and a 20% change in the price of the July one. If the shipowner chooses to hedge against the April contract he would consequently underhedge by 50% whereas he would overhedge by 100% by using the July contract. In other words, if freight rates go down by \$1, resulting in a \$1 loss per ton of cargo carrying capacity, a 1-1 short hedge in the April contract only offsets 50% of the shipowner's loss. On the contrary, the July contract would fully compensate the shipowner's losses in the physical market but at the cost of assuming a substantial freight futures risk.

Being as it is, the question naturally arises of how the optimum hedge should be calculated in a way that would tend to minimise the difference between losses in physicals and gains in futures or vice versa. Although large gains in futures, exceeding losses in physicals, are desirable, they should really be dismissed as they increase the shipowner's uncertainty and, by being speculative in nature, they counteract the hedger's main objective which is the minimisation of risk.

4. CALCULATION OF THE OPTIMUM HEDGE

Upon initiating a hedge, the shipowner knows:

1. The prevailing freight rate in his route and, thus, his total freight exposure.
2. The price of a suitable freight futures contract, preferably one whose expiry is as close to the time of the actual physical transaction (fixing of vessel) as possible.

However, the shipowner does not know:

1. The settlement price of his futures contracts which, at the time of initiating the hedge, is a random variable.
2. The actual freight rate that will prevail when he fixes the vessel (and unwinds his hedge) which is also a random variable.

Assume that, at time t, the shipowner initiates the hedge, to be unwound at time T, simultaneously with the fixing of the vessel. He decides to sell X number of lots, at a price of $\$10 \cdot F_t$, which is known at time t. His net position (the final result of his transactions in the physical and futures markets) at time T, as perceived at time t, will also be a random variable given by:

$$\pi = Tf_T + 10 \cdot X \cdot F_t - 10 \cdot X \cdot F_T$$

where:

T=The vessel's cargo carrying capacity
f_T=the unknown freight rate at time T
X=the number of lots to sell
F_t=the value of the freight futures index at time t (known)
F_T=the unknown settlement value of the futures index at time T

(the price of one lot is equal to $10 per full index point)

Assuming that the shipowner receives disutility from higher risk (variance of net position), rational optimising behaviour suggests that he should choose the number of lots to sell, X, in such a way as to minimise the variance of his future net position.

The shipowner's expected net position and its variance are given by:

$$E(\pi) = T \cdot E(f_T) + 10 \cdot X \cdot F_t - 10 \cdot X \cdot E(F_T)$$

$$Var(\pi) = T^2 \sigma_f^2 + 100 X^2 \sigma_F^2 - 2 \cdot 10 \cdot T \cdot X \cdot \sigma_{fF}$$

where:

$$\sigma_f^2 = Var(f_T)\ ,\ \sigma_F^2 = Var(F_T)\ ,\ \sigma_{fF} = Cov(f_T\ ,F_T)$$

Differentiating Var(π) with respect to X and setting the result equal to zero we get:

$$\frac{\partial Var(\pi)}{\partial X} = 2 \cdot 100 X \sigma_F^2 - 2 \cdot 10 T \sigma_{fF} = 0$$

Substituting $\sigma_{fF}=\rho_{fF} \cdot \sigma_f \cdot \sigma_F$ (where ρ_{fF} is the correlation coefficient between the two variables) and solving for X, we get the optimum number of lots to be equal to:

$$X^* = \frac{T}{10} \rho_{fF} \frac{\sigma_f}{\sigma_F}$$

It can be shown that the expression $\rho_{fF} \cdot \sigma_f / \sigma_F$ is equal to the regression coefficient, b, from regressing the route freight rate, f, on the freight futures index, F. Thus, the formula for the optimum number of lots becomes:

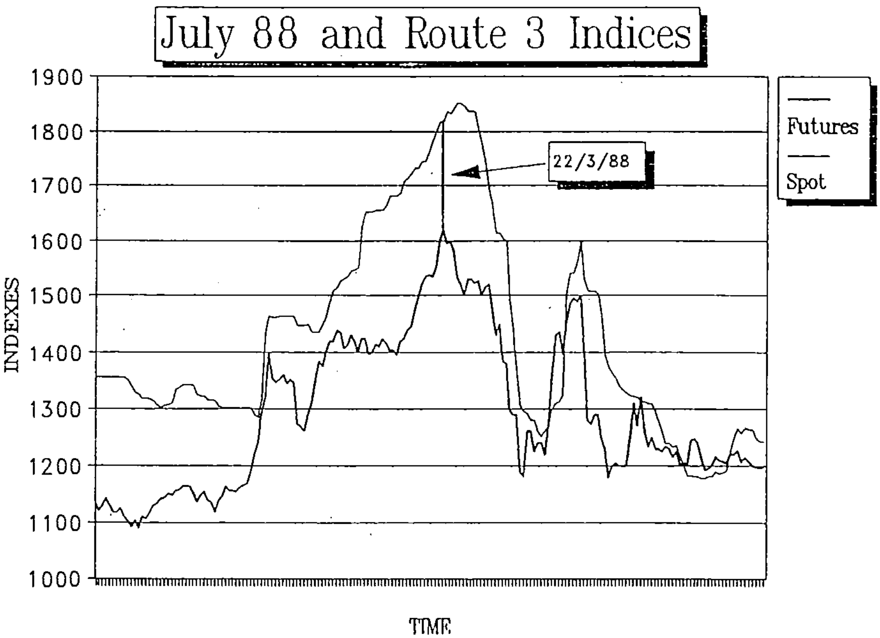
$$X^{*} = \frac{T}{10}b$$

5. A HEDGE OPTIMISING EXAMPLE[6]

5.1. The 1-1 hedge

The vessel in this example is a 52,000 MT bulk carrier trading in Route 3, US North Pacific/S Japan. The shipowner initiates his hedge towards the end of March, after having observed that freight rates have started to decline (Graph 3).

Graph 3



The shipowner sells the July 88 contract as this is the one closest to the estimated time of fixing the vessel. At that time, the July index stands at 1500 and the actual freight rate for his route is \$17.04.

The shipowner's freight exposure is: 52,000 x 17.04 = \$886,080

He sells: 886,080/15,000 = 59 lots

Receiving a (hypothetical) total of: 59 x 15,000 = \$885,000

(*Note:* Over the period to July, freight rates and futures prices have declined remarkably. The value of the July index now stands at 1198 and the actual freight rate in route 3 has dropped to \$11.46.)

At the end of July the shipowner fixes the vessel at \$11.46 and receives:

52,000 x 11.46 = \$595,920

Loss in the physical market: 886,080-595,920 = \$290,160

He buys back 59 lots at a cost of: 59 x 11,980 = \$706,820

Profit/lot: 10(1500-1198) = \$3,020

Total profit in futures: 59 x 3,020 = \$178,180

Partly offsetting loss in physicals by: 178,180/290,160 = <u>61.4%</u>

5.2. THE OPTIMUM HEDGE

The regression results from regressing route 3 freight rates on the July index are:

$$R^2=80\%,\ b=0.013803,\ a=-5.14931$$

The optimum number of lots to sell is, thus:

$$X^* = T\cdot b/10 = 5200 \times 0.013803 = 72 \text{ lots}$$

Through his optimum hedge strategy, the shipowner should have sold 13 more lots (72 instead of 59) realising an additional futures profit of 13 x 3,020 = \$39,260 which raises his coverage to (178,180+39,260)/290,160 = <u>75%</u>

6. CONCLUSIONS AND RECOMMENDATIONS

As a hedging instrument, BIFFEX is not as effective as it was advertised to be and sometimes this conclusion creates a feeling of frustration among shipowners that tends to keep them away from adopting a very useful risk minimisation device. BIFFEX's relative ineffectiveness is due to two reasons.

First, BIFFEX is a cross hedge. This means that the price in the physical market (i.e. the applicable freight rate) is not the same with the price of the futures contract which is a weighted average of *a number* of freight rates. Further, the freight rate in question may or may not be included in the construction of the index. As a result, the basis and its variance does not, in general, tend to zero as the futures contract tends to maturity.

The BIFFEX Secretariat, aware of this deficiency, are presently considering the feasibility of substituting a route index for BFI. This, if it happens, will undoubtedly help participants in the proposed route to hedge more effectively but it is doubtful whether such an arrangement will help traders in other routes (markets).

The second reason for BIFFEX's relative ineffectiveness has to do with the inadequacy of the 1-1 hedge. As it was , hopefully, demonstrated above, the shipowner can increase the effectiveness of his hedging strategy by calculating the *optimum hedge* along the lines suggested in this paper.

A word of caution is, however, due. The adoption of an optimum hedge strategy does not necessarily mean that the shipowner will *always* increase hedging effectiveness vis a vis 1-1 hedges. Statistical analysis is based on the *law of averages* which may, at times, reserve unpleasant surprises to the uninitiated. The optimum hedge strategy should, then, be taken to mean that, on average, in the long run and after consistent use, this strategy will end up the shipowner far better off than the 1-1 strategy.

The calculation and regular update of the correlation coefficients of Table 1 is, thus, a step that, if adopted by the Secretariat, could facilitate shipowners, charterers and brokers considerably. The necessity of regular updates becomes apparent from the fact that the correlation coefficient is a measure of linear association among variables and as such is not suitable for use with cyclical data. Different (updated) correlation coefficients should, therefore, be calculated for the upswings and downturns of the freight market.

Correlation and regression coefficients have been, so far, rather unjustifiably dismissed as sources of potential confusion to hedgers. Their "dubious" usefulness has been limited only to the verification of the existence of a relationship between freight rates and BFI; something that, as has been argued can be done simply through visual inspection.[7]

This attitude does not really help to extend BIFFEX's longevity. Correlation and regression coefficients are easily calculated and can be rather profitably employed by hedgers without them having to know the "mechanics" involved, in the same way as weekend drivers do not have to know a lot about car engines in order to derive pleasure from driving. Further, correlation coefficients are necessary for the calculation of the optimum hedge; an idea that, if adopted and promoted properly, can give new life and attractiveness to BIFFEX.

Notes

1. see H.E. Haralambides, A New Approach to the Measurement of Risk in Shipping Finance, *Lloyd's Shipping Economist*, April 1992.
2. given that BIFFEX is a paper transaction, the shipowner does not actually receive the proceeds of the sale but only the difference between the sell and buy-back prices upon unwinding the hedge.
3. presently the routes have been reduced to 12.
4. see for example Gray, J. (1990), *Freight Futures*, 2nd ed., Lloyd's of London Press, p.48.
5. The shipowner could also choose to sell a mix of the two contracts by initiating a *composite hedge*. Although, in general, composite hedges may be more effective, they are not considered in the present paper.
6. This example was worked out with actual BIFFEX data provided courtesy of BIFFEX Secretariat.
7. Gray, op. cit., p.51.