THE BIFFEX REVISITED; A PAPER ON THE FUNCTIONING OF THE FUTURES MARKET FOR DRY BULK SHIPPING

Martijn THIERRY
Phd student
Faculty of Business Administration
Erasmus University
Rotterdam - The Netherlands

INTRODUCTION

The BIFFEX, the futures market for dry bulk shipping, has been active since May 1 1985. In the period 1985 - 1992, however, the volume traded - the most important indicator of success - has not reached a sufficient level (the prime objective of any futures market). Figures 1 and 2 show the volume traded in the period May 1 1985 - January 31 1990 and in the period November 18 1991 - January 16 1992. This paper has two objectives: firstly to explain why the BIFFEX has not been successful (yet) and secondly to demonstrate the current possibilities of the BIFFEX.

There are 5 paragraphs. The first two paragraphs contain general information; Paragraph 1 gives an overview of forward and futures markets in general, the position of the BIFFEX and introduces important concepts like hedging, arbitrage and speculating. Paragraph 2 deals with the factors which influence the success of futures markets. Paragraphs 3 to 5 deal specifically with the BIFFEX; Paragraph 3 gives an overview of the dry bulk shipping market. Paragraph 4 deals with hedging and speculating with the BIFFEX. Paragraph 5 contains some conclusions.

It must be noted that most of presented numerical data refers to the period May 1 1985 - January 31 1990; For this period, a large database containing all relevant information was available

Figure 1 Volume BIFFEX
1/09/1988 - 31/08/1990

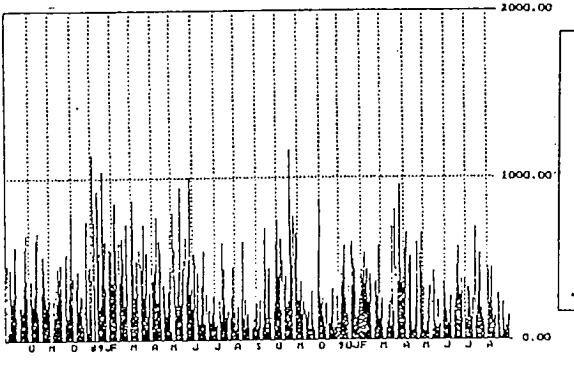
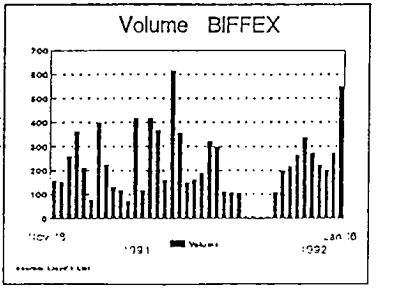


Figure 2 Volume BIFFEX
18/11/1991 - 16/01/1992



1. FORWARD AND FUTURES MARKETS

1.1 Introduction

Forward/futures markets are markets where forward/futures contracts are traded. Forward and futures contract can be used to trade 'in the future'; With both contracts, two parties agree to make delivery (one party) or take delivery (the other party) of a specific quantity of a specific good at a specific time in the future at a specific price.
In the case of a forward contract, both parties know the identity of the other party. In the case of a futures contract, each party only deals with the clearinghouse (see below).

The good which is traded is called the *underlying asset* of the contract. The date of delivery is called the *expiry date*. At the time of the closure of the contract' it is not necessary to own the goods which are traded. Naturally, the goods must be owned at the time of making delivery. With both contracts there may be a (substantial) period of time between the closure of the contract (and the determination of the 'future price') and the delivery of the goods (or services).

It is important to distinguish the different prices: the spot-price at the time of the closure of the contract, the future price (determined at the closure of the contract, and usually about equal to the expected spot-price at the expiry date) and the spot-price at the expiry date. It is clear that these prices may be very different.

The main difference between forward and futures markets is the degree of standardization and regulation; forward markets are not standardized but futures markets are highly standardized/regulated. Forward and futures markets differ on four principal aspects:

1. *the standardized contract*: each futures contract is standardized with respect to the contract size (although you trade more than one 'lot'), the quality of the underlying asset, the potential expiry dates, the place of delivery, the duration of the contract and the minimum/maximum price fluctuation per day.

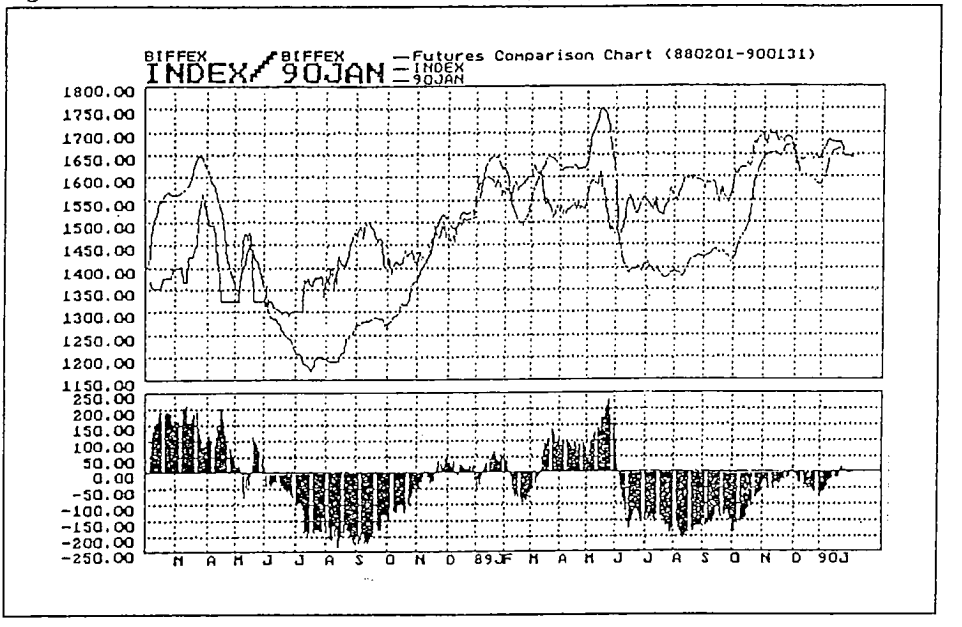
2. *the clearinghouse*: each futures market has a clearinghouse which ensures guarantees performance of all contracts to all participants by interposing itself between the trading parties; The futures-trading parties do not need to be concerned about the financial position of the other parties; They can rely on the clearinghouse.

3. *the organized exchange*: futures contracts are always traded on organized exchanges. The exchange is responsible for all operational and regulatory aspects of the market.

4. *margin and daily settlement*: each futures trader must post a margin (an amount of cash equal to a small percentage of the value of the futures contracts) with his futures broker in order to guarantee that each trader will be able to fulfill his obligations. A change in the value of the contracts will lead to a change in the required margin ('daily settlement').

By definition, the value of each futures contract at expiry is equal to the spot-price of the underlying asset. Figure 3 shows a BIFFEX futures contract: 90Jan. This corresponds to a futures contract, which expired on Jan 31 1990; began trading on Feb 1 1988 (2 years before), and whose underlying asset is the BFI (the Baltic Freight Index). More information about the BFI is presented in paragraph 4.

Figure 3 BIFFEX 90Jan futures contract & BFI, Feb 1 1988 - Jan 31 1990



The thick line shows the BFI. The other line shows the 90Jan contract. The bottom graph shows the basis: the difference between the futures contract and its underlying asset. It can be seen that the value of the 90Jan contract at the expiry date (Jan 31 1990) is equal to the spot-price of the BFI (the underlying asset). In other words: the basis is always zero at the expiry date.

The value of the 90Jan contract is 1399.5 at Feb 1 1988, and 1647 at Jan 31 1990. The contract size is $ 10; A trader who would have bought a 90Jan contract at Feb 1 1988 would have *gained* (1647 - 1350) * $ 10 = $ 2.970 at the expiry date. A trader who would have sold a 90Jan contract at Feb 1 1988, would have *lost* $ 2.970 at Jan 31 1990.

The value of the BFI is 1399.5 at Feb 1 1988, and 1644 at Jan 31 1990. The basis is -49.5 (1350 - 1399.5) at Feb 1 1988. The basis at Jan 31 1990 is 3 (1647 - 1644) due to a special calculation of *the settlement price*; price of 90Jan at expiry is equal to the average price of the contract on the last five trading days.

1.2 Hedging

Forward and futures contracts can be used for hedging; A hedge is a form of 'price insurance'; A hedge is used to *lock-in* a certain price. This means that changes in the spot-price of the underlying asset after the closure of the hedge will have no effect on the *net-position* of the trader. In the case of an ideal hedge, each change in the spot-price will be balanced by a corresponding change in the futures position.

Hedging with forward contracts is very simple as each forward contract is a hedge: the price in the contract will not change after the closure of the contract.

Hedging with futures contracts is more complicated; As an example, we will look at figure 3. Let us suppose there is a trader who will lose money when 'the spot-price of dry bulk shipping' rises (for instance, a shipper). Such a trader will hedge by *buying* futures contracts: a rise of the spot-price will then be compensated (in the case of a perfect hedge) by a rise in the value of the futures contracts. As the futures value at the expiry date is equal to the spot-price at the expiry date, it can be expected that a rise in the spot-price prior to expiry will be followed by a rise in the futures price

Suppose this trader has an future obligation at the physical market at Jan 31 1990 and wishes to hedge at Feb 1 1988. He then buys a 90Jan futures contract (which expires at Jan 31 1990) at 1350. He will sell this contract at 90Jan 1990 and he will gain (1647 - 1350) * $ 10 = $ 2.970. Without hedging, his loss in the physical market in this period would have been (1644 - 1399.5) * $ 10 = $ 2.445 ; Instead his net gain is $ 525.

Generally, hedgers require:

1. *risk reduction*; the basic objective of any hedge

2. *liquidity*; hedgers want to be able to trade contracts at any time in any number without influencing the prevailing price.

3. *guaranteed performance*: there must be no *default risk*

4. *secrecy*

Hedging with futures contracts is more complicated as the value of the futures contract does not always perfectly follow the spot-price of the underlying asset. This is shown very clearly in figure 3. The basis, which measures the corresponding movements, is rather volatile. Its value is only certain at the expiry date (when it is zero by definition). It can be shown that hedging with futures contracts will be successful *if the uncertainty about the basis is significantly smaller than the uncertainty of the spot-price of the good or service which has to be hedged.* In the paragraphs 2 and 4, we will look closer at this subject.

1.3 Speculating

Speculation occurs when people trade contracts in search of direct profit. One can speculate on the absolute level of the futures prices or on the relative level of the prices of two contracts (*spread trading*). The importance of speculation for a market cannot be underestimated: speculation provides the market with the necessary liquidity.

Speculators require high price volatility, high liquidity, secrecy, possibilities for spread trading and accurate information on the spot market. More information is presented in paragraphs 2 and 4.

1.4 Arbitrage

Traders engage in arbitrage when they are able to obtain a *riskless profit* by performing a series of transactions in the physical and forward market. Although this seems impossible, it is not: when the underlying asset of a futures contract is storable at reasonable cost, then the maximum level of the basis at a time prior to expiry (the difference between the futures price and the spot-price of the underlying asset) is equal to the storage costs in the period to expiry. Thus with storable assets, arbitrage will guarantee a maximum basis at any moment prior to expiry. The level of this maximum basis naturally depends on the storage costs.

1.5 History of forward and futures contracts

Several forward markets in metals and agricultural products existed in England since the beginning of the 18th century. Soon these contracts were made negotiable and trade was further stimulated by the introduction of grading systems to establish the quality of the goods traded and thus reduced the 'quality risk'. The default risk, the risk that one of the parties would not be able to fulfill the contractual obligations, remained.

It was a small step from forward markets with negotiable contracts, moderate/high volume and standard-grades to futures markets. Futures markets emerged in 1826 in England and in 1868 in the United States. The contracts were initially based on metals and agricultural products and oil. After the 1930, it became relatively silent in the futures market. A new wave of futures activity started in 1973 with the introduction of currency contracts like the Dmark and the Yen. These contracts were followed by interest rate contracts in 1975 and stock-index contracts in 1982. These stock-index contracts were the first contracts to use 'cash-settlement' instead of physical delivery. This means that there is no delivery of goods at the expiry date but only a financial transaction to 'settle the balance'.

The BIFFEX was set up in 1985 and was the first (and only) contract which is not based upon a storable good (or a bundle of goods) but on a service: shipping. The BIFFEX uses cash-settlement. Its underlying asset is an index (BFI: Baltic Freight Index) which consists of the voyage charter prices of several dry bulk routes.

2. SUCCESS OF FUTURES MARKETS

2.1 General

In this paragraph we will try to explain when a futures contract in a new asset (like the BIFFEX) will be successful. In general, it can be concluded (Gray (1966), Working (1977) that a futures contract will be successful if it is able to attract:

1. hedging investment out of the forward market

2. speculative investment from traders active on the spot/forward market of the asset

3. speculative investment from traders 'outside the market'

Regarding the speculative investments, it can be shown that these investments will come 'out of the woodwork' when a futures contract has proven to be attractive to hedgers and thus has obtained some liquidity. *The direct consequence is that the hedging need is the first requirement to be met.* In general, a futures contract will succeed if it is able to offer a large portion of the physical market sufficient risk reduction while offering substantial liquidity.

In the next section, we will look at the relative attractiveness of forward and futures contracts for hedgers and speculators.

2.2 Forward and futures contracts

Each forward contract is tailor-made: adapted to the wishes of the two parties involved. This results in perfect risk-reduction, poor liquidity, poor secrecy and the possibility that the other party will default.As has been stated, hedging with futures contracts will be successful if the uncertainty about the basis is significantly smaller than the uncertainty about the spot-price of the underlying asset. It must be noted that the uncertainty about the basis will be larger (unfavorable for the futures contracts) if:

1. the underlying asset is not equal to the good which has to be hedged.
2. the hedge is reversed prior to expiry.
3. the contract size of the contract matches with the quantity which has to be hedged.
4. the futures contract is illiquid.
5. there are no possibilities for arbitrage.

There are three other influencing factors. The first is the substitutability between the forward and futures contracts; the chance of success for a futures contract is higher if the contracts are substitutes. Otherwise, the forward contract will still attract substantial volume. The second factor is the efficiency of the forward market: An efficient forward market could be a fierce competitor of the futures market.

The third factor is the size and heterogeneity of the spot market; It will be difficult for a futures contract to offer sufficient risk reduction for each variety in a heterogeneous market. Clearly, large spot markets will stimulate futures contracts.

Speculation with forward contracts is rather difficult; due to their tailor made character, they are usually not very negotiable. Futures contracts are perfectly suited for speculation providing the price volatility is high, initial liquidity is obtained through hedging, information on the spot market is available and the market is not very complex.

It can now be concluded that a futures contract will have a higher probability of success if:

1. the forward and futures contract are substitutes.
2. the price volatility of the underlying asset is high.
3. the size of the spot market of the underlying asset is large.
4. the heterogeneity of the market is small.
5. arbitrage is possible.
6. the market of the underlying asset seems simple to outside traders.

The next paragraph will examine these factors in the case of the BIFFEX.

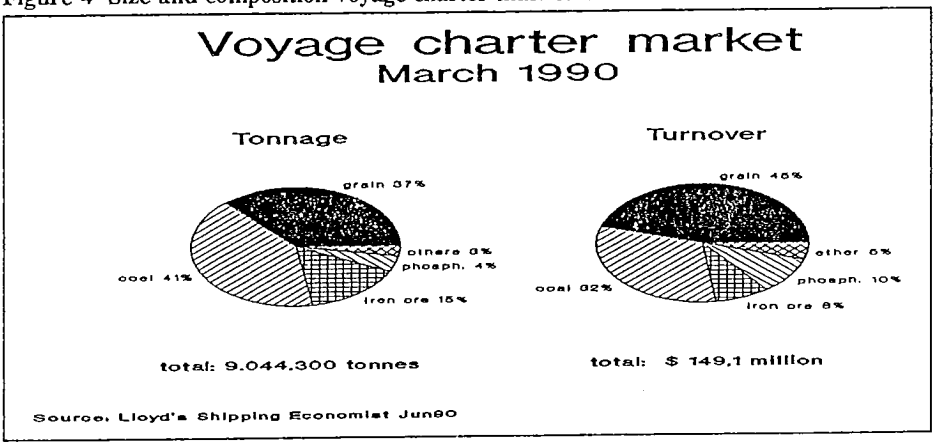
3. THE DRY BULK SHIPPING MARKET

The BIFFEX has been set up as a futures market for dry bulk shipping. In this paragraph we will examine the size and composition of the relevant market for the BIFFEX.

There are three different *types of contracts* which are relevant in the dry bulk shipping market. These types are voyage chartering, time chartering and bareboat chartering. The essential differences are the duration of the contract: short-term for voyage, medium-term for time and long-term for bareboat chartering, and the element which are included in the contracts; voyage charters are 'all-inn, time charters are exclusive running costs like fuel and harbor costs, and bareboat charters are exclusive all running and operating costs (like the crew). The main consequence is that the level and movement of the prices of these contracts can hardly be compared.

Figure 4 shows the size and composition of the relevant market for the BIFFEX; the voyage charter market.The dominance of grain is clear. Other information from the same source (Lloyd's Shipping Economist, June 1990) indicates that the US Gulf coast is the most important region of origin with 50.3% of the turnover in March 1990. Most remarkable is the relative small size of the voyage charter market: 'only' $ 149.1 million in March (always an active month); This represents an annual turnover of about $ 1.6 billion. It must be noted that the voyage and time charter markets are efficient markets. Some commentators dare to qualify these markets as the only real 'efficient' markets available.

Figure 4 Size and composition voyage charter market March 1990



4. TRADING BIFFEX

This paragraph deals with the composition of the BIFFEX and the possibilities of trading with BIFFEX. The underlying asset of the BIFFEX, the BFI, consists today of 15 routes; 11 voyage charter and 4 time charter routes is shown in Figure 5.

Figure 5 Routes, January 16 1992

	route	weighting	price
1	USG - North Continent	10 %	14.150
1a	Transatlantic round	10 %	11933.333 *
2	USG - Japan	10 %	25.533
2a	USG - Japan	10 %	14866.667 *
3	US North Pacific - Japan	7.5 %	14.833
3a	Transpacific round	7.5 %	11916.667 *
4	USG - Venezuala	5 %	15.808
5	Continent - S.America - Far East	5 %	12350.000 *
6	H.Roads/Richards Bay - Japan	7.5 %	14.458
7	H.Roads - North Continent	5 %	5.342
8	Queensland - Rotterdam	5 %	12.058
9	Vancouver/San Diego - Rotterdam	5 %	13.050
10	Tubarao - Rotterdam	5 %	6.233
11	Casablanca - West coast India	2.5 %	36.235
12	Aqaba - West coast India	5 %	18.925

* : Time charters

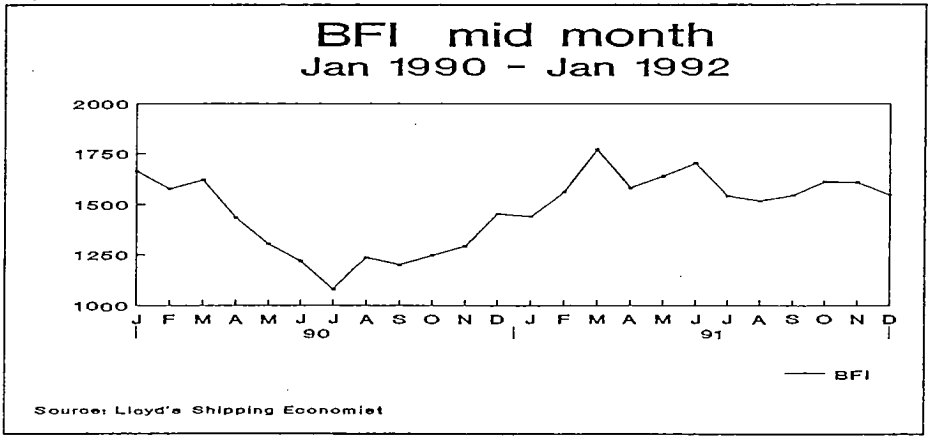
Figure 6 Route characteristics and correlation with BFI

rte	avg	std	max	min	a	b @	R 2
rte 1	9.9	3.2	16.4	4.3	-0.48	9.21	0.96
rte 2	18.0	6.2	29.6	7.4	-2.53	18.11	0.99
rte 3	11.1	3.3	17.5	5.3	0.27	9.61	0.97
rte 4	13.8	4.2	19.9	6.3	0.78	11.53	0.88
rte 6	11.8	4.2	18.8	6.0	-1.55	11.76	0.93
rte 7	6.1	1.7	9.4	3.0	0.52	4.95	0.97
rte 8	10.1	2.0	13.6	6.0	4.04	5.40	0.84
rte 9	11.4	2.3	15.5	6.4	4.38	6.18	0.83
rte 10	5.1	1.5	8.6	2.6	0.14	4.38	0.96
rte 11*	36.5	1.0	38.5	34.0	39.59	-2.01	0.05
rte 12*	15.9	5.3	24.2	7.8	0.27	13.81	0.78
BFI	1131.5	340.6	1751.0	553.5			

@: b * 0.001
Example: rte 1 = - 0.48 + 9.21 * 0.001 * BFI R2 = 0.96

Some of the characteristics of the routes which were in the database (the time charters have been introduced later) are presented in figure 6. It is clear that the route prices and the BFI are very volatile and that the correlation between the BFI and some of the route prices is very high except for route 11, Casablanca - W.C. India, which has a very poor correlation with the BFI. The movements of the BFI are shown in Figure 7.

Figure 7 BFI mid month, January 1990 - January 1992



We will now look at an actual example of hedging with BIFFEX. It mst be noted that traders (shippers, shipowners) who use BIFFEX for hedging, will have a 'physical commitment' in a specific route.

We will see that the actual outcome of the hedge will be determined by the correlation between the movements of the spot-price of the specific route and the movements of the futures price of the selected futures contract, although this contract is based on the BFI and not on the specific route.

Let us suppose that there is a shipowner on February 1 1988, who knows that his ship of 10.000 tonnes (currently time chartered) will become available for voyage chartering on route 8 on Jan 31 1990. How can he hedge and how successful will this hedge be ?

A shipowner will hedge by buying a certain number of 90Jan futures contracts at February 1 1988 (providing there is sufficient volume) and selling them at January 31 1990. However, he has to answer the following questions: What is his *lock-in price* ? *How many contracts* must he buy ? What is the value of his *net position* (spot position and futures position) in this period ?

The prices on February 1 1988 are: route 8 = 12.017, BFI = 1399.5 and 90Jan = 1350. As the net position is determined by the price movements of the 90Jan contract (which is based upon the BFI) and route 8, the shipowner has to make two decisions:

1. How will route 8 and the BFI be correlated at January 31 1990 ?
2. How will the basis (the difference between 90Jan and BFI) be at January 31 1990 ?

Regarding the first question, there are (at least) three methods: *the constant shares method* (the share of route 8 in the BFI) is assumed to be stable, *the linear equation method* (the relation between route 8 and the BFI is determined by a linear equation, see figure 6) and *the direct proportion method* (route 8 and the BFI will change with the same percentage). In this case, the shipowner will use the last method as most BIFFEX users do so (Gray(1987)). Regarding the second question, the basis will be almost zero (see paragraph 1.1) January 31 1991 as this is the expiry date. If his ship would become available earlier, then he would have to make an estimation of the basis at that time. The direct proportion method gives the lock-in price and the required number of contracts:

$$\text{lock-in price} = \text{price route 8} * \frac{\text{price 90Jan - expected basis}}{\text{BFI}} = 12.017 * \frac{1350 - 0}{1399.5} = 11.592$$

$$\text{number of contracts} = \frac{\text{price route 8} * \text{number of tonnes}}{\text{BFI} * 10} = \frac{12.017 * 10000}{1399.5 * 10} = 8.58 \ (9 \text{ contracts})$$

Figure 3 shows the actual behavior of 90Jan and the BFI. The actual movement of route 8 and the net price are shown in figure 8. It can be seen that there is a significant difference between the lock-in price and the net price.

This difference (shown in figure 9, thick line) can be divided into 3 risks:

1. *prediction risk*: the risk that the prediction (using the direct proportion method) is not accurate. This risk is shown in figure 9.
2. *basis risk*: the risk that the basis is unequal to zero; This risk is shown in Figure 10.
3. *contract size risk*: the risk due to difference in the optimal number of contracts and the available contract size; This risk is shown in figure 11.

Figure 8 route 8, lock-in and net rice

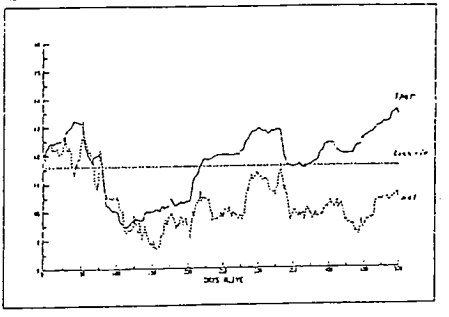


Figure 9 total difference & pred. risk

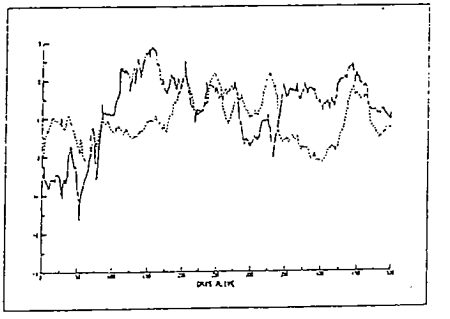


Figure 10 total difference & basis risk

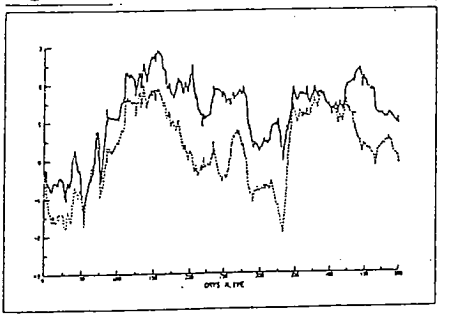
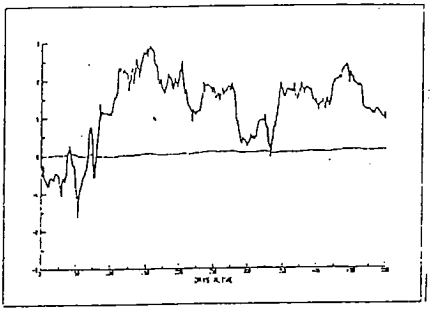


Figure 11 tot.dif. & contract size risk



The following table gives an overview of these differences and risks:

	AVG.	STD.	MIN	MAX	on Jan 31 1990
spot-price	11.76	1.11	9.44	13.59	12.79
lock-in price	11.59	0.00	11.59	11.59	11.59
net price	10.34	0.93	8.67	13.24	10.12
dif_tot	1.25	0.93	- 1.64	2.92	1.47
dif_pre	0.91	0.58	- 0.23	2.27	1.32
dif_bas	0.27	0.99	- 1.95	2.01	0.03
dif_con	0.07	0.05	- 0.03	0.15	0.12

5. CONCLUSIONS

It can be seen that this hedge **has not been very successful**: the difference at the expiry between the net-price and the lock-in price is substantial. This results is an unexpected loss for the shipowner of $ 1,47 * 10.000 = $ 14.700. The difference at January 31 1990 is caused by the difficulty of forecasting the relation between route 8 and the BFI (the prediction risk). It can also be seen that the uncertainty of the basis, prior to expiry, is significant; the standard deviation of the basis is 0.99 compared to a standard deviation of the spot-price of 1.11. This implies that it will be very difficult to successfully hedge commitments in the spot market which 'expire' prior to the expiry date of a contract. Thus, the total difference between the lock-in price and the actual position is equal to:

prior to expiry: **total difference = prediction risk + basis risk**
at expiry: **total difference = prediction risk**

The example has shown that these risks may be quite substantial. It must be noted that other routes will have other prediction risks depending on their correlation with the BFI; Route 2, for instance, will have a lower prediction risk. All routes, however, face the same basis risk.

It is not very remarkable that massive speculation on the BIFFEX has not taken place due to the poor hedging risk reduction of the BIFFEX.

We can conclude that the BIFFEX has not been successful (yet) because:

1. The voyage and time charter market is efficient.
2. The size of the voyage charter market (the underlying asset of the BIFFEX) is relatively small.
3. The heterogeneity of the market is relatively large; This is reflected by the size of the prediction risk.
4. Arbitrage is not possible, and seasonal influences are quite important; This is reflected by the size of the basis risk.
5. Speculative investment is low because hedging has not (yet) provided sufficient initial volume and because the relevant markets for the BIFFEX are quite complex.

BIBLIOGRAPHY

Gray,J.W.. Futures and options for shipping, London: Lloyd's of London Press, 1987

Gray,R.W.. Why does futures trading succeed or fail ? An analysis of selected commodities. Futures Trading seminar, Vol 3, Madison, Wisconsin, 1966

Working,H.. Economic functions of futures markets. Selected writings of Holbrook Working, Chicago, 1977