Guide to the

SFI TKL.Ship Fund Index

Design and Calculation

Scientific Support

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Contents

1. GENERAL INFORMATION

The guide on hand contains the data bases coupled with the information about the conception and calculations of the SFI TKL.Ship Fund Index ("SFI index"). The TKL.Fonds Gesellschaft für Fondsconception- und analyse mbH ("TKL.Fonds") works to exceptionally high standards in compiling and calculating the SFI index on the fundament of the rules set out in this guide.

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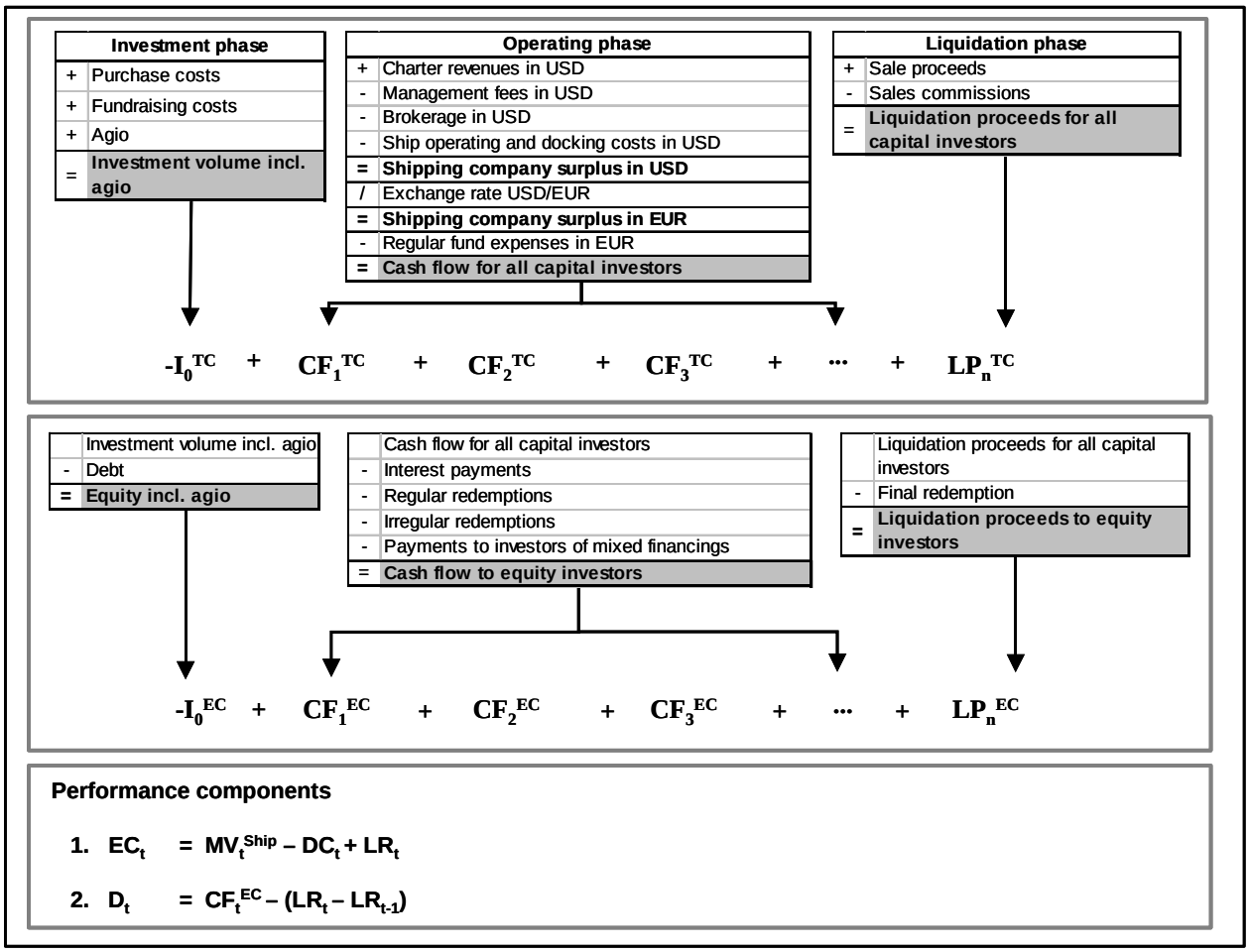
2. SFI TKL.Ship Fund Index

2.1. Introduction

The TKL.Fonds Gesellschaft für Fondsconception- und analyse mbH, Hamburg, has developed the SFI TKL.Ship Fund Index and continues to calculate the index. The SFI TKL.Ship Fund Index documents the performance of a diversified portfolio from fictitious ship funds which are organized as one-ship companies in the legal form of the GmbH & Co. KG (KG-fund) based on the assumption they acquire one ship each to the 01-01 of every year which shows a marketable ship type and a marketable ship size (see section 3.1 "Selection Criteria"). The fictitious ship funds are established (see section 2.2 "Data Basis") with a financing and expenditure structure customary to the market. The operation of the ships purchased via the fictitious investment companies is simulated using market data. The SFI TKL.Ship Fund Index is calculated as a performance index and shows the performance of the index portfolio under consideration and of all return components therein.

For stock performance indices the price changes and the dividends paid build the return components. Transferred to a closed-end ship fund the return components result from the sum of the changes of the market value of the equity capital of the one-ship company (EC_t) and the distributions paid to the investor (D_t). These can be derived from the cash flow calculation of a closed-end ship fund represented in illustration 1.



Illus. 1: Cash flow calculation of a closed-end ship fund

According to illustration 1 the purchase costs of the ship as well as the incorporation and its fundraising costs add up to the requirements of a one-ship company in the investment phase. The total investment volume is financed with debt and equity capital. The market value of the equity capital of the one-ship company as a result is derived from the total investment volume ($-I_0^{TC}$) deducting the debt in t_0 in the investment phase ($-I_0^{EC}$). The amount of the cash flows during the operating phase (CF_t^{TC}) are determined by the charter rate as well as the cost object and company related expenditures. Since the equity investors are residual receivers they are entitled to all cash flows exceeding the debt service (CF_t^{EC}). These then can be completely distributed to the equity investors (D_t) or they may remain partly or fully as liquidity reserves in the one-ship company (LR_t).[1]

A cash flow model forms the basis of the SFI TKL.Ship Fund Index, which, according to illustration 1, determines on a monthly basis the performance-relevant components and thus the time series of market values of the fictitious one-ship companies contained in the index portfolio.

The basis date of the SFI TKL.Ship Fund Index is the 01-01-1997 with the basis 100.

[1] In illustration 1 a currency congruent financing between revenues and debt service was assumed. Hereafter, there is merely a currency risk on a EUR/USD basis for the equity investor. With regards to an outside financing third party currencies are frequently used in order to reduce the interest expense. Consequently, equity investors would face further currency and interests risks.

2.2. Data Basis

2.2.1 Required data

The time series of market values of the fictitious one-ship companies contained in the index portfolio cannot be observed on the market. Therefore, they must be generated using a cash flow model. The following data sets are required monthly for every one-ship company:

- Ship prices and charter rates
- Ship operating and docking costs
- Brokerage and management fees
- Fund expenses
- Exchange rates
- Interest rates

2.2.2 Ship Prices and Charter Rates

2.2.2.1 Market Rates and Charter Rates from External Sources

As a basis for the determination of the ship prices, monthly market rates are prepared and published by ship-brokers. The ship-brokers publish standardised prices for new builds as well as market rates for 5, 10, 15 and 20 year old ships and charter rates for various ship types and ship sizes.

For calculations within the scope of the cash flow model 6-12-month charter rates for container ships as well as 1-year charter rates for tanker and bulkers are drawn upon. When mentioning charter rates in the following it is always referred to these particular charter rates.

Primarily, publications of the following ship-brokers are consulted:

- Clarkson Research Services Ltd. (www.clarksons.net)
- RS Platou Shipbrokers (www.platou.com)
- Barry Rogliano Salles (www.brs-paris.com)

Current data from the external sources may be adjusted or amended in certain cases, though. The following adjustments must be carried out:

- Surcharge for construction time interest and building supervision on prices for new builds
- Market rates for ships which show an "intermediate" age
- Completion of missing data

2.2.2.2 Construction Time Interest

The ship-brokers publish market rates without construction time interest. For example the accounted new building prices refer to conditions of proportional payment 20/20/20/20/20, i.e. rates in the amount of 20% each of the purchase price are due at the following point in time:[2]

- 20% of the price at order,
- 20% of the price at steel cut after approx. 3/4 (76.3%) of the construction time,
- 20% of the price at laying the keel after approx. 4/5 (81.5%) of the construction time,
- 20% of the price at launching after approx. 92% of the construction time,
- 20% of the price at delivery.

The rates being charged before delivery must be financed. In the context of this bridging finance the so-called construction time interest is charged. The prices for new builds must be adjusted by the amount of the construction time interest. Using historical data the construction time interest was charged for every ship type and every ship size at the end of every month in the time period from 01-01-1997 - 12-31-2007. After that it was added to the valid purchase price. A study[3] ordered by TKL.Fonds from the Institute of Shipping Economics and Logistics (ISL) provides historical data of the construction times during this time period. The data held by the ISL are a basis for the ISL survey of Lloyd's Register[4] /Fairplay. For this the current fleet database as well as the order books of the past 11 years were consulted. For every ship of the current fleet the date of embarkation as completion was filed. For each of these ships the date of admission of the corresponding construction order to the database from the order book was identified by Lloyds. A slight bias arises with regards to the construction orders, which are only then included by LR/Fairplay if they were confirmed by two independent sides. Particularly at smaller shipyards this may require a few weeks. The determined values are not related to the actual construction time, which – even for big ships – often only take a few months at the Korean shipyards. They rather reflect the workload of the shipyards as well as the delay between investment decision and active capacity.

The construction time interest is charged at the end of every month for every ship type and every ship size under the following conditions in the time period from 01-01-1997 - 12-31-2007:

- The rates to be paid are distributed independently regardless of the construction time period as represented in the pattern above.
- The interest rate for the bridging finance amounts to the USD-3-Months-LIBOR valid at the end of each month plus a market standard risk premium in the amount of 1.375 percentage points. It is effective during the complete construction time.
- The interest days amount to 360 p.a.

[2] Cf. *Welk*, in: Winter/Hennig/Gerhard (Hrsg.), Grundlagen der Schiffsfinanzierung, 2007, p. 286.
[3] *Institut für Seeverkehrswirtschaft und Logistik (ISL)*, Entwicklung der Bauzeiten für Schiffe unterschiedlicher Typen und Größen, Bremen 2008.
[4] Lloyd's Register - Fair play is one of the leading information providers in the sector of the maritime business world. The company belongs to the Lloyd Register Group, a ship classification society and risk management organization founded already in the 17th century. Cf. www.lrfairplay.com and www.lr.org.

On this assertion, there is a monthly market based and exactly determined purchase price incl. construction time interest for the period 01-01-1997 - 31-12-2007. For the running calculation of the index one requires the amount of the building prices as well as the construction time interest at the end of every month, though. This also pertains to future times. An exact calculation as determined for the period of 01-01-1997 - 31-12-2007 would therefore be very intricate, since the current length of the construction times has not been published. Therefore for the period as of 01-01-2008 the price for new builds incl. construction time interest is determined with the help of a flat-rate surcharge. The flat-rate surcharge is determined for every ship type and ship size as a mean average value of the surcharges of the period 01-01-1997 to 31-12-2007.[5] The following table 1 represents the flat-rate surcharges for the different ship types and ship sizes as of 01-01-2008:

Ship type	**Ship size**	**Surcharge in % of the new building price**
Container ship	725 TEU	2.90%
	1,000 TEU	2.91%
	1,700 TEU	3.24%
	2,000 TEU	3.12%
	2,750 TEU	3.74%
	3,500 TEU	3.94%
	4,400 – 5,100 TEU	3.92%
Tanker	37,000 tdw	3.78%
	47,000 tdw	3.62%
	74,000 tdw	3.70%
	110,000 tdw	3.71%
	150,000 tdw	4.12%
	310,000 tdw	4.29%
Bulker	30,000 tdw	3.23%
	52,000 tdw	3.45%
	75,000 tdw	3.48%
	150,000 tdw	3.83%
	170,000 tdw	3.83%

Tab. 1: Flat-rate surcharges for construction time interest

[5] The surcharge for construction time interest in % can be calculated by dividing at the end of each month the determined construction time interest by the current building price at the end of the corresponding month.

2.2.2.3 Building Supervision

During the construction time, expenditures arise for the building supervision. Profitable discussions with shipping companies and designated ship experts have shown that the costs for the construction supervision remained relatively stable in the past and likely will in the future.

The following table 2 displays the amounts based on building supervision for the different ship types and ship sizes:

Ship type	**Ship size**	**Construction supervision costs**
Container ship	725 TEU	USD 300,000
	1,000 TEU	USD 325,000
	1,700 TEU	USD 350,000
	2,000 TEU	USD 350,000
	2,750 TEU	USD 350,000
	3,500 TEU	USD 350,000
	4,400 – 5,100 TEU	USD 350,000
Tanker	37,000 tdw	USD 300,000
	47,000 tdw	USD 300,000
	74,000 tdw	USD 325,000
	110,000 tdw	USD 350,000
	150,000 tdw	USD 350,000
	310,000 tdw	USD 350,000
Bulker	30,000 tdw	USD 300,000
	52,000 tdw	USD 325,000
	75,000 tdw	USD 350,000
	150,000 tdw	USD 350,000
	170,000 tdw	USD 350,000

Tab. 2: Flat-rate funds for building supervision

2.2.2.4 Market Rates for Ships Which Show an "intermediate" Age

The ship-brokers publish current market rates for new, 5, 10, 15, and as the case may be, 20 year old ships. The performance index shall, however, be calculated monthly. For every fictitious one ship corporation a current market rate of the ship is always needed at the end of the month. Therefore for example the market value of a 2 year and 4 months old ship must be estimated approximately. In this regard it is assumed that the market rate decreases linearly between the designated age categories.

This can be demonstrated by example: According to Clarkson a new ship costs USD 38,000,000 incl. construction time interest and building supervision, a 5 year old ship costs USD 32,000,000. It is assumed that in the "intermediate" age range the price of a newly built ship decreases linearly up to the market rate of a 5 year old ship. A 4, 3, 2 and 1 year old ship then would cost:

4-year-old-market rate = - (38,000,000 - 32,000,000) 38,000,000* (4/5) = USD 33,200,000

3-year-old-market rate = - (38,000,000 - 32,000,000) 38,000,000* (3/5) = USD 34,400,000

2-year-old-market rate = - (38,000,000 - 32,000,000) 38,000,000* (2/5) = USD 35,600,000

1-year-old-market rate = - (38,000,000 - 32,000,000) 38,000,000* (1/5) = USD 36,800,000

Via this procedure the market rates are calculated for all "intermediate" age ranges.
The market rates are determined accordingly on a monthly basis, and the market rates for a full year are linearized. A 2 year and 4 months old ship then would cost:

2-y-4-m-old-market rate = - (35,600,000 - 34,400,000) 35,600,000* (4/12) = USD 35,200,000

It is linearized monthly between the market rates for 2 year (35,600,000) and 3 year (34,400,000) old ships.

In market phases with high surplus in demand for certain ship types it can occur that 5 year old ships (immediately available) are more expensive than new builds would be, as they are delivered considerably later and thus only available much later. In this case the procedure of a linearization is not applicable for ships which are up to 5 years old. If one were to use them, one would, for example, get a lower market rate for 1 year old ships than for 5 year old ships (the same applies to the years 2-4). Each defies logic as 1 year old ships are available just as immediately as 5 year old ones.

In the case of such high costs of immediacy it is assumed that all ships which are up to 5 years old show the same market rate as 5 year old ships.

Up to 5-y-old-market rate = MAX (5-y-old-market rate; market rate according to linearization)

2.2.2.5 Completion of Missing Data

For the calculation of the index the data for the complete recording time period must be comprehensively available for ship prices and charter rates including all ship types and ship sizes (for most of them since 01-01-1997). If data from external sources should be missing they will be estimated. In individual cases procedures are as follows:

- **Data for Second hand ships is not available for the complete time period:** It arises that data for second hand ships is not available for the complete time period in which they are needed. In a first step the average ratio is calculated between the prices for new builds and the second hand prices for the time period for which there are second hand prices available. In a second step the missing second hand prices are derived using this ratio of the prices for new builds.

- **Data for second hand ships is not available at all:** It arises that data is not available for second hand ships for a ship size at all, but there are prices for new builds. In a first step the average ratio is calculated between the prices for new builds and the second hand prices of the neighboring ship size for which there are second hand prices available. In a second step the missing second hand prices are derived using this ratio of the prices for new builds. Similarly, the procedure will be much the same if there are no prices for new builds available for a ship size, but second hand prices are available.

- **Charter rates are not available for the complete time period:** It arises that charter rates are not available for the complete time period in which they are needed. In a first step the average ratio is calculated between the charter rates and the neighboring ship size for charter rates for the time period in which charter rates are available. In a second step the missing charter rates of the featured ship size are derived by applying the ratio of the charter rates of the neighboring ship size.

This procedure can be demonstrated through example:

New building prices for 150,000 tdw bulkers are not available, but they are needed for the complete time period since 01/1997. However, second hand prices for 5 year old 150,000 tdw bulkers, as well as new building prices and prices for 5 year old 170,000 tdw bulkers are available for the whole period of time. The new building prices for 150,000 tdw bulker (NBP150,000) are determined by multiplying the second hand prices for a 5 year old 150,000 tdw bulker (NBP150,000) with the ratio of the prices for new builds (NBP170,000) and the prices for a 5 year old 170,000 tdw (SHP170,000).

NBP150,000 = SHP150,000 x (NBP170,000 / SHP170,000)

The estimated data, the period of time for which the data had to be estimated, as well as the basis of the estimation are outlined in the table 3:

Estimated data	Period	Basis of the estimation
Charter rates for 4,400 – 5,100 TEU container ships	01/1997 - 04/2002	Ratio of charter rates for 4,400 - 5,100 TEU and 3,500 TEU container ships in the period 05/2002 - 12/2007 and charter rates for 3,500 TEU container ships
Prices for new builds for 4,400 – 5,100 TEU container ships	01/1997 - 11/2000	Ratio of the prices for new builds for 4,400 - 5,100 TEU and 3,500 TEU container ships in the period 12/2000 - 12/2007 and prices for new builds for 3,500 TEU container ships
Prices for 5, 10 and 15 year old 4,400 – 5,100 TEU container ships	since 01/1997	Ratio of the prices for new builds and second hand prices for 3,500 TEU container ships as well as prices for new builds for 4,400 - 5,100 TEU container ships since 01/1997
Prices for 20 year old container ships of all sizes	since 01/1997	Ratio of the prices for 10 and 15 year old container ships as well as the prices for 15 year old container ships of the corresponding size since 01/1997
Charter rates for 37,000 tdw tankers	01/1997 - 11/2001	Ratio of charter rates for 37,000 tdw and 40,000 tdw tankers in the period 12/2001 - 06/2005 and charter rates for 40,000 tdw tankers
Charter rates for 47,000 tdw tankers	01/1997 - 12/2000	Ratio of charter rates for 47,000 tdw and 40,000 tdw tankers in the period 01/2001 - 06/2005 and charter rates for 40,000 tdw tankers
Charter rates for 110,000 tdw tankers	01/1997 - 02/2000	Ratio of charter rates for 110,000 tdw and 95,000 tdw tankers in the period 03/2000 - 12/2007 and charter rates for 95,000 tdw tankers
Charter rates for 150,000 tdw tankers	01/1997 - 02/2000	Ratio of charter rates for 150,000 tdw and 140,000 tdw tankers in the period 03/2000 - 12/2007 and charter rates for 140,000 tdw tankers
Charter rates for 310,000 tdw tankers	01/1997 - 02/2000	Ratio of charter rates for 310,000 tdw and 285,000 tdw tankers in the period 03/2000 - 12/2007 and charter rates for 285,000 tdw tankers
Prices for new builds for 37,000 tdw tankers	since 01/1997	Ratio of the prices for new builds and prices for 5 year old 47,000 tdw tankers as well as prices for 5 year old 37,000 tdw tankers since 01/1997
Prices for 5 year old 47,000 tdw tankers	01/1997 - 10/2001	Ratio of the prices for new builds and prices for 5 year old 47,000 tdw tankers in the period 11/2001 - 12/2007 as well as prices for new builds for 47,000 tdw tankers
Prices for 15 year old 37,000, 150,000 and 310,000 tdw tankers	since 01/1997	Ratio of the prices for 5 and 10 year old tankers as well as the prices for 10 year old tankers of the corresponding size since 01/1997
Prices for 15 year old 110,000 tdw tankers	since 01/1997	Mean value of the prices for 10 and 20 year old 110,000 tdw tankers since 01/1997
Prices for 20 year old 37,000, 150,000 and 310,000 tdw tankers	since 01/1997	Ratio of the prices for 10 and 15 year old tankers as well as the prices for 15 year old tankers of the corresponding size since 01/1997

Charter rates for 75,000 tdw bulker	01/1997 - 02/2001	Ratio of charter rates for 75,000 tdw and 65,000 tdw Bulker in the period 03/2001 - 12/2007 and charter rates for 65,000 tdw Bulker
Charter rates for 170,000 tdw bulker	01/1997 - 11/2001	Ratio of charter rates for 170,000 tdw and 150,000 tdw Bulker in the period 12/2001 - 12/2007 and charter rates for 150,000 tdw Bulker
Prices for new builds for 150,000 tdw bulker	since 01/1997	Ratio of the prices for new builds and prices for 5 year old 170,000 tdw Bulker as well as prices for 5 year old 150,000 tdw Bulker since 01/1997
Prices tdw bulker for 10 and 15 year old 170,000	since 01/1997	Ratio of the prices for 5 and 10 or 15 year old 150,000 tdw Bulker as well as prices for 5 year old 170,000 tdw Bulker since 01/1997
Prices tdw bulker for 20 year old 75,000 and 170,000	since 01/1997	Ratio of the prices for 10 and 15 year old Bulker as well as the prices for 15 year old Bulker of the corresponding size since 01/1997

Tab. 3: Estimated data for ship prices and charter rates

If the gaps, however, should be closed by the ship-brokers at a later point in time using real market data then the index is calculated again using this market data.

2.2.3 Ship Operating Costs

The ship operating costs in USD per day include the allocated docking costs, and are charged for employees, lubricants etc. as well as for maintenance and repair work. The ship operating costs incl. docking costs for the different ship types and ship sizes are determined on the basis of studies of the following market participants:

- Moore Stephens Chartered Accountants (bulker and tanker)
- Drewry (bulker and tanker)
- HSH Nordbank/ECONUM/Ernst & Young/Fondsbörse Deutschland (container ships)

For ship sizes of which no ship operating costs are published in the mentioned studies the ship operating costs of the considered ship size are estimated on the basis of the neighboring ship size and the ratio of the charter rates of both ship sizes.

For container ships real data is available for ship operating costs for the years 2000 - 2007. The ship operating costs in the years 1997 - 1998 are estimated by discounting the ship operating costs of the year 2000 by 3% p.a.. The ship operating costs of the years 2008 - 2009 are estimated by increasing the ship operating costs of the year 2007 by 5% p.a.. **As soon as current real ship operating costs are published in the studies the index is recalculated by applying this market data.**

Since the ship operating costs (on a day by day basis) are available, the number of working days per annum is still to be determined. A total of 360 working days p.a. is assumed for those years when docking does not take place. Dockings last ca. 10 days and take place every 3-5 years – depending on ship size. The docking days are allocated. The ship's working day average is estimated over its lifetime. One presumes 357 working days.

2.2.4 Brokerage and Management Fees

At the chartering a brokerage is charged; it normally amounts from 1.25% up to 5% of the gross charter revenues. Here a brokerage of 3% is assumed.

Furthermore a management fee is deducted of the gross charter revenues, to which the ship owner is entitled. It normally amounts from 3% up to 5% of the gross charter revenues. Here a management fee of 5% is assumed.

2.2.5 Regular Fund Expenses

Apart from the ship costs corporation-related costs have to be taken into account as well. The running fund expenses are charged for the management and the operation of the investment vehicle. As standard, they initially amount to approx. 0.5% of the fund volume p.a. for closed-end funds. For the annual increase of the running company expenses it is usual to assume an increase of 2% -3% p.a.. An increase of 3% p.a. is assumed here.

2.2.6 Assumptions in the Investment Phase

The ship is acquired and the purchase price paid in the investment phase of the one-ship company. In addition fund expenses arise with regards to incorporation and the capital fundraising. The fund expenses in the investment phase depend on the investment vehicle. As set out in the TKL database working on analyses of 341 closed-end ship funds (incl. agio), for closed-end ship funds the fund expenses amount to an average of approx. 27.75% of the equity capital.

The total amount of investment has to be financed by debt and equity capital. The typical financing structure reads as follows: The purchase price is financed to a level of 65% by loan.[6] The loan has to be regularly amortised within 15 years. Loan redemptions are usually to be paid quarterly. Here monthly loan redemptions are presumed (12 redemptions p.a.), since the value of the equity capital is determined monthly. For ship mortgage loans a risk premium of 1.375 percentage points[7] supplementary to the 3-month-LIBOR is usual. 30% of the loan is taken up in JPY, the rest in USD.

[6] The amount of the ship mortgage loan depends on the type and the age of the ship as well as on additional securities, and lies between 50% and 80% of the market value of the ship, cf. *Stopford*, Maritime Economics, 3. Ed. 2009, p. 287. The majority of the banks hypothecates on standard ships up to 70% of the market value of the ship, cf. *Hennig*, in: Winter/Hennig/Gerhard (Edt.), Grundlagen der Schiffsfinanzierung, 2007, p. 397.

[7] The margins within the ship financing vary between 0,2% up to 2% p.a. regarding the LIBOR. Cf. *Stopford*, Maritime Economics, 3. Ed. 2009, p. 288.

2.2.7 Assumptions in the Business Phase

Each month the cash flow is determined for all capital providers on the basis of the one-ship company. Outside investors are served first. The cash flow to creditors results from the structure of the loans listed above and the current exchange and interest rates. Since the equity investors are residual cash flow recipients they are entitled to cash flow exceeding the regular debt service. About the use of such cash flow the following assumptions are advanced:

- One part is deposited towards the **liquidity reserve** until a minimal liquidity reserve is obtained. In the index calculation a minimal liquidity reserve of 0.5% of the fund volume is assumed.
- After obtaining a minimal liquidity reserve dividends are paid to the equity investors until the **target minimum payout** is reached. An annual target minimum **payout** of 6% of the initial equity capital is assumed here.
- If a surplus in addition to the minimum payout should be available, it can be used for **special redemptions**. It is assumed that at first all special redemptions are paid towards a perhaps available JPY loan. After that all surpluses are paid towards the USD loan in terms of special redemptions.

The liquidity reserve of the company are deposited as interest-bearing and charged with an interest rate of 2% p.a.. If the liquidity reserve is used up in a period the company takes out an advance from a current account which is charged with an interest rate of 7.5% p.a. and will be amortised as quickly as possible.

3. Index Concept

3.1. Selection Criteria

The selection of the ship types and ship sizes contained in the index portfolio orients itself with respect to ship prices, charter rates and ship operating costs at the availability of the market data required for the cash flow model. As a result the required data and relevant history are available for the following ship types and ship sizes:

Ship type	Ship size	In the index basket since
Container ship	725 TEU	01/01/1997
	1,000 TEU	01/01/1997
	1,700 TEU	01/01/1997
	2,000 TEU	01/01/1997
	2,750 TEU	01/01/1997
	3,500 TEU	01/01/1997
	4,400 – 5,100 TEU	01/01/1997
Tanker ship	37,000 tdw	01/01/1997
	47,000 tdw	01/01/1997
	74,000 tdw	01/01/2001
	110,000 tdw	01/01/1997
	150,000 tdw	01/01/1997
	310,000 tdw	01/01/1997
Bulker	30,000 tdw	01/01/1997
	52,000 tdw	01/01/2002
	75,000 tdw	01/01/1997
	150,000 tdw	01/01/1997
	170,000 tdw	01/01/1997

Tab. 4: Ship types and sizes in the index basket

3.2. Index Calculation

3.2.1. Determination of the Equity Value of a One-ship company

The period-related return of a capital investment results generally from the relative change in value of the investment object plus the regular profits within an accounting period. For listed investments such as stocks these components (the change of the stock price and the dividends paid) are observable on the market any time. A stock performance index depicts the growth of stocks contained in the index portfolio that gives consideration to these components. In order to design a performance index for closed-end ship funds the performance components of the fictitious one-ship companies contained in the index portfolio has to be determined. These are constituted by the market value of the equity capital of the considered fictitious one-ship company and the payouts within the accounting period to the equity investors. Illustration 2 depicts how the performance components of a one-ship company can be determined.

Investment phase

Point in time	Investment	Financing
t = 0	$MV_0^{Ship} + AE_0$	$EC_0 + DC_0$

Operating phase

Point in time	Assets	Financing
t = 1	$MV_1^{Ship} + CF_{0,1}^{EC} =$ $MV_1^{Ship} + LR_1 + P_1$	$EC_1 + P_1 + DC_1$
Performance components:	$EC_1 = MV_1^{Ship} - DC_1 + LR_1$ $P_1 = CF_{0,1}^{EC} - LR_1$	
Point in time	Assets	Financing
t = 2	$MV_2^{Ship} + LR_1 + CF_{1,2}^{EC} =$ $MV_2^{Ship} + LR_2 + P_2$	$EC_2 + P_2 + DC_2$
Performance components :	$EC_2 = MV_2^{Ship} - DC_2 + LR_2$ $P_2 = CF_{1,2}^{EC} - (LR_2 - LR_1)$	

Illus. 2: Determination of the performance components of a one-ship company

In the investment phase of the one-ship company (t = 0) the ship is acquired and the purchase price (MV_0^{Ship}) is paid. Furthermore additional expenses (AE_0) arise in terms of incorporation and the capital fundraising. The total capital expenditure is financed with debt (DC_0) and equity capital (EC_0). After the ship has operated for 1 period (t = 1), the assets of the one-ship company amount to the current market value of the ship (MV_1^{Ship}) and the cash flow gained during the period for the equity investors ($CF_{0,1}^{EC}$). This gained surplus can partly be paid out to the investors (P_1) and partly remain as a liquidity reserve in the one-ship company (LR_1). Furthermore the assets are financed with debt (DC_1) and equity capital. One part of the equity capital can be paid out to the equity investors (P_1) . The remaining equity capital (EC_1) stays in the one-ship company and finances the assets.

For a performance index the value of the equity capital and the payouts are of interest to the equity investors. At the end of the first operating period the value of the equity capital[8] amounts to the market value of the ship after deducting the debt plus the liquidity reserve of the one-ship company:

$$EC_1 = MV_1^{Ship} - DC_1 + LR_1 \qquad (1)$$

[8] In connection with this, two value concepts can similarly be aligned to stock indexes: The performance value and the market price of the equity capital. The performance value of the equity capital contains all the interim accrued cash flows for the equity investor and assumes a reinvestment of the cash flows for the equity investors regarding the respective one-ship company. These are interest-bearing in the period-related return of the respective one-ship company. The market price of the equity capital does not take into account the cash flows for the equity investors. If in the following the value of the equity capital of the one-ship company is mentioned it is always done with regards to the market price.

At the end of the second operating period the value of the equity capital is calculated similarly. The value of the equity capital at the end of a period can now be calculated as follows:

$$EC_t = MV_t^{Ship} - DC_t + LR_t \qquad (2)$$

with: EC_t = Value of the equity capital of the one-ship company at the time of t
MV_t^{Ship} = Market value of the ship at the time of t
DC_t = Status of the debt at the time of t
LR_t = Liquidity reserve of the one-ship company at the time of t

In the end of the last period n, the liquidation phase, the following ratio can be observed:

$$EC_n = LP_n^{Ship} - DC_n + LR_n \qquad (3)$$

with: LP_n^{Ship} = Liquidation proceeds or scrap value of the ship at the time of n
DC_n = Status of the debt at the time of n
LR_n = Liquidity of the one-ship company at the time of n

The value of the equity capital at the time of t cannot be observed on the market and has to be determined with the help of the cash flow calculation. If it is assumed that the ship is acquired at an observable rate on the market and that the amount of the debt as well as the initial additional expenses are known, the equity capital (EC_0) invested in the investment phase can be calculated. The value of the equity capital in the subsequent periods can then be calculated according to the formula (2).

If the value of the equity capital should become negative at a fictitious one-ship company, then the company is bankrupt and will be deleted from the index portfolio.

3.2.2. Determination of the Index Formula and Weighting

The SFI TKL.Ship Fund Index is calculated as a performance index. The index contains all return components and assumes implicitly the reinvestment into the fictitious one-ship company of the payouts to the equity investors.

The SFI TKL.Ship Fund Index is an equally weighted index. An equally weighted index shows the value performance of a portfolio in which identical amounts of money are invested in every fictitious one-ship company in the basis period. An equally weighted index would therefore be suitable to show a portfolio of the closed-end ship funds of a retail investor since it can be assumed that the retail investor does not make his/her investment dependent on the size and the type of the ship to be acquired.

The performance of the fictitious one-ship companies, which have acquired ships of the ship types and sizes represented in the section 3.1 "selection criteria" is equally weighted in the index. SFI TKL.Ship Fund Index is calculated as follows:

$$PI_t = CN_T \times \frac{1}{N} \sum_{i=1}^{N} \frac{(EC_{i,t} + P_{i,t}) \times C_{i,t}}{EC_{i,0}} \times Basis \qquad (4)$$

with:
- PI_t = Performance index at the time of t
- CN_T = Index-specific chaining factor valid as of the point in time T
- EC_i = Value of the equity capital of the i^{th} one-ship company
- P_i = Payouts of the i^{th} one-ship company
- C_i = Payout correction factor of the i^{th} one-ship company
- N = Number of one-ship companies contained in the index portfolio
- 0 = Basis point in time, as of 01-01-1997 also the last chaining time
- t = Reporting date
- T = Time of the last chaining
- Basis = 100

3.2.3. Computational Frequency

The SFI TKL.Ship Fund Index is calculated monthly and determined to the last working day of a month. The publication of the index status is carried out monthly.

3.2.4. Computational Accuracy

The index status is published two-digit. The chaining factors are rounded six-digit in the calculation.

3.2.5. Adjustments

3.2.5.1 Payouts

Since the SFI TKL.Ship Fund Index is a performance index the payouts to the limited partners must be taken into account. It is presumed that the payouts are reinvested into the fictitious one-ship company which pays out.

The reinvestment of the payout is contained in a payout correction factor. It is calculated with the following formula:

$$C_{i,t} = \frac{EC_{i,t-1} + P_{i,t-1}}{EC_{i,t-1}} \times C_{i,t-1} \qquad (5)$$

with: $C_{i,t}$ = Payout correction factor of the i^{th} one-ship company at the time of t

$EC_{i,t-1}$ = Value of the equity capital of the i^{th} one-ship company at the time of t-1

$P_{i,t-1}$ = Payout of the i^{th} one-ship company at the time of t-1

t = Reporting date

3.2.5.2 Corporate Action

Regarding ship funds in the form of a one-ship company the acquisition of a ship is financed with a fixed capital sum. As soon as the required capital is raised the fund becomes closed-end so that no future subscriptions can be carried out. Given this fixed capital sum no capital changes are taken into account in the context of the index structure.

3.2.6. New Listings and Deletions

As opposed to listed corporations which ex ante possess an infinite economic life, ships do have a finite service life of as about 25 years. Therefore an index depicting the performance of a portfolio of all ships included to 01-01-1997 could not be continued after 25 years.

Therefore a continuous investment strategy is assumed in the context of the index portfolio. This is carried out in a way that up to the 01-01 of every year new fictitious one-ship companies could be incorporated and then purchase new build ships at a valid current market rate. The infinite term of the performance index is therefore ensured. The continuous investment strategy is also congruent with the assumption that the gained cash flows are reinvested in fictitious one-ship companies for the equity investors (reinvestment premise).

A change of the index portfolio is therefore performed to 01-01 of every year since there are new ships added and if necessary old ships eliminated after a term of 25 years.

If the value of the equity capital should become negative at a fictitious one-ship company, then the company is bankrupt and will be deleted from the index portfolio.

3.2.7. Chaining

The index chaining assumes that a hypothetical investor sells the index portfolio in his previous composition and immediately invests the sales proceeds in the new index basket. The index-specific chaining factor CN_T indicates how often the investor can buy the new index basket for the sales proceeds of the old index portfolio. It calculates as:

$$CN_T = \frac{PI_T^{old}}{PI_T^{new}} \tag{6}$$

with: CN_T = Index-specific chaining factor at the time of T
PI^{old} = Index status before chaining time, calculated after the index portfolio composition before chaining time
PI^{new} = Index status before the chaining time, calculated after the index portfolio composition after chaining time
T = Time of chaining

An arithmetic equally weighted index according to the formula (4) shows the chart-development of a portfolio in which identical amounts of money are invested in every one-ship company basis period. The weights of an arithmetic index, however, adjust themselves as soon as the one-ship companies take on a different value development. Therefore an arithmetic equally weighted index must be chained at certain intervals to establish the identical weighting again.

The chaining procedures are carried out monthly. All index quotations have to be multiplied by the index-specific chaining factor K_T from this time on.