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Study on the development path of freight derivatives in Shanghai shipping finance

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DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

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ABSTRACT

Title of research paper: **Study on the development path of freight derivatives in Shanghai shipping finance**

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Freight derivatives are an interdisciplinary instrument of shipping and finance to avoid freight rate risks during operation. The thesis makes the study on the major freight derivatives products, namely BIFFEX, FFAs and Freight Options, in the world and analysis its functions and main market participants.

Then focus on the development of freight derivatives in China especially in Shanghai. There are currently five freight futures products underlying on five different routes among two indices published by Shanghai Shipping Exchange. FFAs have been able to be settled and cleared by RMB in Shanghai called Chinese Currency FFAs.

Later the SWOT analysis is applied for the status analysis of development of freight derivatives in Shanghai especially after the establishment of China (Shanghai) Pilot Free Trade Zone and the conclusion that the WO and ST strategies are supposed to be taken in the development has been reached.

Finally the development path of freight derivatives in Shanghai has been proposed on the basis of the previous effort and the status quo.

KEYWORDS: Freight derivatives, Shanghai shipping finance, SCFI

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List of Abbreviations

BCI: Baltic Capesize Index

BCTI: Baltic Clean Tanker Index

BDI: Baltic Dry Index

BDTI: Baltic Dirty Tanker Index

BFI: Baltic Freight Index

BHSI: Baltic Handysize Index

BIFFEX: Baltic International Freight Futures Exchange

BPI: Baltic Panamax Index

BSI: Baltic Supramax Index

CBCFI: China Coastal Bulk (Coal) Freight Index

CBFI: China (Coastal) Bulk Freight Index

CCFI: China Containerized freight index

CDFI: China Import Dry Bulk Freight Index

CFSA: Container Freight Swap Agreement

CLTX: Cleartrade Exchange

CSPFTZ: China (Shanghai) Pilot Free Trade Zone

CTFI: China Import Crude Oil Tanker Freight Index

FEU: Forty-foot Equivalent Unit

FFA: Forward Freight Agreement

FFABA: Forward Freight Agreement Brokers Association

FIS: Freight Investors Services

IMAREX: International Maritime Exchange

LCH: LCH.Clearnet

NOS: Norwegian Futures and Options Clearing House

NYMEX: New York Mercantile Exchange

OTC: over-the-counter

SASAC: State-owned Assets Supervision and Administration Commission of the State Council

SCFI: Shanghai Containerized freight index

SGX: Singapore Exchange

SHCH: Shanghai Clearing House

SSE: Shanghai Shipping Exchange

SSEFC: Shanghai Shipping Freight Exchange Co. LTD

SWOT: Strengths-Weakness-Opportunity-Threats

TEU: Twenty-foot Equivalent Unit

WCI: World Container Index

1. Introduction

1.1 Backgrounds of the study

Shipping market experienced huge fluctuations over the last decade, particularly affected by the international financial crisis in 2008, and now is recovering in a slow speed. Therefore shipping participants try lots of methods to protect themselves from floating in the changeable market circumstance. Derivatives are promoted as a modern tool of risk management with the wide use of Forward Freight Agreements (FFAs) as well as forward exchange contracts in oil shipping.

As to liner shipping market, with the gigantism of container vessels, the supply side of container shipping comes in rapid development period accompanying with increasingly frequent fluctuations of freight in the market as well as the changes of international economic situation, especially after the setback of world economy since 2008 causing the reduce of growth rate in international trade and even negative growth. In this context, Shanghai Shipping Exchange reformed and re-launched the new Shanghai Containerized freight index (SCFI) in October 2009, hoping to develop the container shipping freight index derivatives. Later in 2011, Shanghai Shipping Freight Exchange Co. LTD released two derivatives respectively underlying Shanghai Containerized freight index and China Coastal Bulk (Coal) Freight Index and set up the electronic trading platform to regulate derivative trades.[1]

Freight Investors Services (FIS) and the Shanghai Clearing House (SHCH) introduced Chinese currency (RMB) FFAs based on the Baltic indices in December 2012, which helps Chinese companies to directly participate in the FFA market and use them as a hedging and investment tool.[2]

The development of freight derivatives in Shanghai is one of the key points of the

[1] YUAN Xiang, LIU Jinming, HE Jing, (2013), Development Path of China's shipping derivatives, *Modern Management Science*, 2013(7), 70.

[2] Manolis Kavussanos, (2013), *Risk Management and Derivatives in Shipping*, Unpublished Presentation, World Maritime University, Malmo, Sweden.

construction of Shanghai international shipping as well as finance center in the world as a national strategy according to the 19th government documents in April 2009[3]. And in September 2013, China (Shanghai) Pilot Free Trade Zone began to run in formal which helps to promote further development of Shanghai shipping finance. And the development of freight derivatives under the new situation is still waiting for the test of time.

1.2 Literature review

From the earlier dry bulk BIFFEX to the current FFA, shipping companies has highly concerned on freight derivatives. Many foreign scholars do the related researches on the validity of the dry bulk freight forward market and the relationship between the freight price and FFA trading.

Kavussanos M.G. et al. (2004)[4] investigate the impact of the introduction of Forward Freight Agreement (FFA) trading on spot market price volatility in two panamax Atlantic and two panamax Pacific trading routes of the dry-bulk shipping industry. They find that the onset of FFA trading decreased spot price volatility in all investigated routes, has had an impact on the asymmetry of volatility in Pacific routes and substantially improved the quality and speed of information flow in three out of the four investigated routes. For further study, they introduce control variables. The results indicate that only in voyage routes may the reduction in volatility be a direct consequence of FFA trading. It seems that the introduction of FFA trading has not had a detrimental effect on the spot market, with an improvement in the way information is transmitted into spot prices following the onset of FFA trading.

Nicola FERRARI (2009)[5] study the topics in the area of risk management in shipping

[3] The Central People's Government of the People's Republic of China gives further information on courses (http://www.gov.cn/zwgk/2009-04/29/content_1299428.htm)

[4] Manolis G. Kavussanos, Ilias D. Visvikis, Roy A. Batchelor, (2004), Over-the-counter forward contracts and spot price volatility in shipping, *Transportation Research Part E: Logistics and Transportation Review*, Volume 40, Issue 4, July 2004, Pages 273-296.

[5] Nicola FERRARI, (2009), *Derivatives and Risk Management in the International Maritime Sector*, Fu Dan University master's thesis, Shanghai, China.

finance and operations with a particular emphasis on derivatives products and the statistical methods used in risk measurement and modeling. He analyzes the development and evolution of the freight derivatives market including FFAs and freight options as well as issues regarding trading, pricing and clearing these products and discusses the exploration of real options and the assessment of benefits in evaluating strategic and managerial flexibilities embedded in shipping investment and operations as a natural and modern extension of derivatives instruments.

Lambros Goulas and George Skiadopoulos (2012)[6] investigate for the first time whether the International Maritime Exchange (IMAREX) freight futures market is efficient over the daily and weekly horizons. They address the question in both a statistical setting as well as an economic setting and assess the economic significance of the obtained forecasts by means of trading strategies, taking into account the presence of transactions costs. They find that IMAREX is not efficient over the shorter daily horizon.

Steen Koekebakker et al. (2007)[7] set up the theoretical framework for the valuation of the Asian-style options traded in the freight derivatives market and do a Monte Carlo experiment to verify their formula with the results of very accurate prices, in particular for forward-starting freight options.

The researches of freight derivatives in China gradually increase in recent years, especially after the establishment of Shanghai Containerized freight index (SCFI) in 2009. Through several years' development and exploration, some scholars have studied the domestic freight derivatives in following aspects

YUAN Xiang et al. (2013)[8] analyze the development status of shipping financial

[6] Lambros Goulas and George Skiadopoulos, (2012), Are freight futures markets efficient? Evidence from IMAREX, *International Journal of Forecasting*, Volume 28, Issue 3, July–September 2012, Pages 644-659.
[7] Steen Koekebakker, Roar Adland, Sigbjørn Sødal, (2007), Pricing freight rate options, *Transportation Research Part E: Logistics and Transportation Review*, Volume 43, Issue 5, September 2007,Pages 535-548.
[8] YUAN Xiang, LIU Jinming, HE Jing, (2013), Development Path of China's shipping derivatives, *Modern*

derivatives in China and review its history and policy foundation to make sure the coordination between policy environment and market.

LIANG Wei (2013)[9] analyzes the applicability and price estimation of Shanghai Containerized freight index (SCFI) derivatives. He establishes the VAR model and BP neural network model to make short-time forecasting and finds the latter are better, which helps small and medium-sized shipper to make SCFI derivatives trading decisions.

LU Wei (2013)[10] analyzes the feasibility of new Shanghai containerized freight index futures by comparing with dry bulk market as well as with perspective of freight volatility, futures contracts and market participants, and draws a conclusion that the financial institutions should be allowed and encouraged to Shanghai containerized freight futures market to promote the development of the market.

Wang Jun (2011)[11] discusses the necessity and the present situation of the development of shipping derivatives, noting that although Shanghai Launched the first shipping financial derivatives, but there are still many problems, and put forward the development of China's shipping derivatives strategy: actively promote the healthy growth of forward freight agreements in domestic transactions; vigorously develop the domestic shipping derivatives.

CHEN Liang et al. (2013)[12] do the prospective study on the manipulation problem in the Shanghai Containerized freight index derivatives trading market. Through the theoretical and empirical research and using the basic principles of supply and

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Management Science, 2013(7), 70-71.

[9] LIANG Wei, (2013), *Analysis of Applicability and Price Estimation of Shanghai Containerized Freight Index Derivatives*, Shanghai Jiao Tong University master's thesis, Shanghai, China.

[10] LU Wei, (2013), *Feasibility Analysis of New Shanghai Containerized Freight Index Futures*, Shanghai Jiao Tong University master's thesis, Shanghai, China.

[11] Wang Jun, (2011), Development of China's shipping financial derivatives, *Shipping Management*, 2011(10), 31-33.

[12] CHEN Liang, LIU Liang, LIU Juanjuan, (2011), Prospective Study on SCFI Index Derivatives Market Manipulation, *Commercial Times*, 2011(29), 66-68.

demand, they find the presence of abnormal results between supply and demand in the spot market container conclusions. Therefore they consider that manipulation phenomenon in the container freight index derivatives market is likely.

1.3 The framework and content of the thesis

To achieve the main goal that studying the development path of freight derivatives under the circumstance of present shipping finance in Shanghai, the thesis will use some economic principles and the qualitative analysis to contrast the status quo of the development of freight derivatives in Shanghai Shipping Exchange to that in the world. Then the SWOT model will be applied for the analysis of the status quo of development of freight derivatives in Shanghai in order to find the chances and challenges in the current market environment. Furthermore, by analyzing the development progress of freight derivatives in Shanghai in comparison with that in the world, the thesis tries to make a propose of development phase of freight derivatives in Shanghai Shipping Exchange.

2. Freight derivatives in the world

2.1 Overview of freight derivatives

A derivative is a financial contract which derives its value from the performance of underlying entity such as an asset, index, or interest rate.[13] As to freight derivatives in shipping, the main underlying entity is freight rate index published by the Baltic Exchange. Underlined entity, according to the contracts based on the freight rate index, is transacted to buy or sell at the future time period on the price agreed today.

Freight derivative is one kind of derivatives with the purpose of transferring risks or benefits and has the characteristics of dependency, complex pricing, high leverage and high risk. It can be an exchange trade as well as an over-the-counter trade (OTC) and the basic modalities of derivatives are futures, forwards, swaps and options. Forward Freight Agreements (FFAs) are widely applied in shipping, especially in dry bulk

[13] Retrieved 10 April 2014 from WIKIPEDIA: http://en.wikipedia.org/wiki/Derivative_(finance)#cite_ref-2

sector. Others like freight options, forward exchange contracts in oil shipping, container freight swap agreements have been used more and more as well.

2.2 Types of freight derivatives

2.2.1 BIFFEX

The freight derivative was introduced in shipping as Baltic Exchange published BFI in 1985. It was traded in the Baltic International Freight Futures Exchange (BIFFEX) and underlay on the BFI which was originally a weighted index of freight rates in 13 shipping routes. The underlying entity of BIFFEX was revised with the reform of the sample routes and the changes of ship size in each route. The sample routes only covered spot freight rates in 1985 until time charter freight rates were joined in the index in August 1990. The ship size in the sample routes also experienced a series of changes. At the beginning, Capesize carrier, Panamamax carrier and Handysize carrier were all covered in the index while since the November of 1993 the index only included Capesize carrier and Panamamax carrier and from the December of 1998 the sample routes only considered Panamamax carrier. Therefore the BFI were replaced by the BPI as the underlying entity, which finally quit the market at the 31 of October 1999.

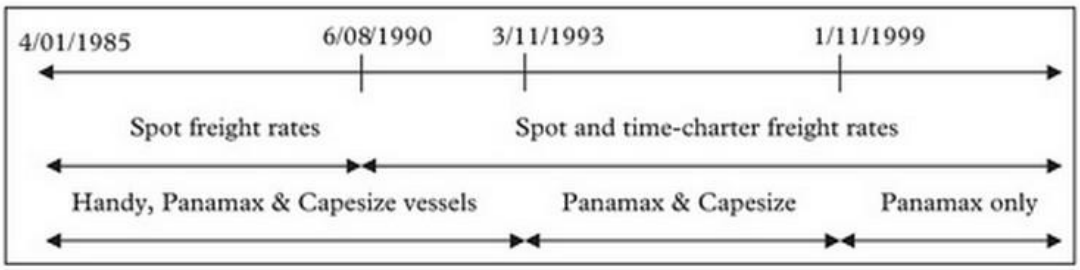

Figure 2.1 Major revisions of the BFI

Source: Kavussanos and Nomikos (2000b)

There was only quarterly contract at the beginning of BIFFEX. The monthly contract was published in July 1988 and then in October 1991 the two-monthly contract was published. After that, there were monthly, two-monthly, quarterly contracts until 18

consecutive month contract period.

As the first futures product with “invisible” service, the Baltic freight futures were once very popular in the market. However, with time going on, the deficiencies of the futures were more and more obvious and the yearly volumes of the BIFFEX contract shrunk. After changing settlement subject to the BPI in November 1999, the trading volumes decreased further. During the period from December 1999 to June 2001, the average daily trading volumes were 17 lots and the average contract values were $204,000. In June 2001, the Baltic Exchange announced to stop the Baltic freight futures trading at April 2002.

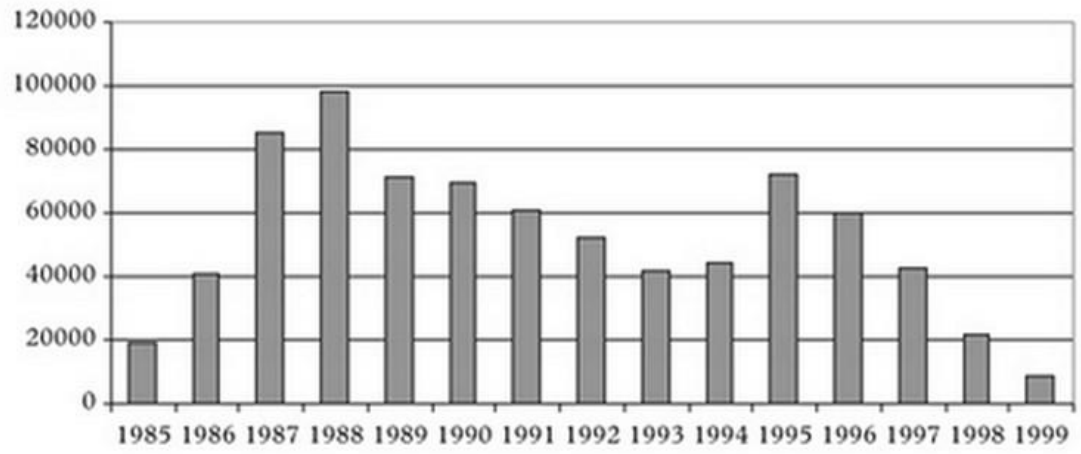

Figure 2.2 The yearly volumes of the BIFFEX contract

Although BIFFEX changed its futures contracts several times to meet the needs of the market and the relative index were adjusted with the development of shipping market, the trade in BIFFEX was not successful for many reasons. With thin trading and illiquidity of contracts, the market could not attract enough participants, which made the transactions fewer and fewer. BIFFEX contracts could only be bought on relative index (BFI, BPI), not on its constituent routes, restraining the freedom of trade to some extent which means the traders could not make a contract as their wishes for certain routes and vessels. Furthermore, the aggregation of the index over several routes and vessel sizes caused the poor hedging effectiveness of the freight futures and despite several attempts to revise the freight index, the hedging effectiveness,

which was the main factor of the derivatives to reduce the operation risks, remained low compared to other futures markets.[14] And alternative products, Forward Freight Agreements (FFAs), appeared on the market with more effective on hedging targeted freight risk.

2.2.2 FFAs

Forward Freight Agreements are principal-to-principal contracts between two parties to settle a freight or hire rate, for a specified quantity of cargo or type of vessel and also for one or a combination of the major trade routes of the dry-bulk and tanker industries at a certain date in the future, usually based on the relevant index.

FFAs were started to be used in the market in the early 1990s when some shipping business players wanted to have a more precise transaction contract on their shipping routes and vessels as well as the length of contracts to hedge their freight rate risks. FFAs were originally an over-the-counter (OTC) trading method. Most traders used the standard contracts made by the Forward Freight Agreement Brokers Association (FFABA). The bilateral contract could also be made by the two parties through the negotiation between their brokers. Considering the fact that in an OTC derivative agreement each party accepts credit risk from the other party, FFAs were able to be cleared in the exchange since IMAREX-NOS started the business. The significant difference between the two trading methods of FFAs is the risk of settlement, which is born by the parties directly in the former other than transformed to the exchange in the latter.

Table 2.1 The comparison of OTC and cleared contract

	OTC	Cleared contract
Transaction cost	Brokers' commissions	Brokers' commissions, clearing fee
Cash deposit	None	Need to pay by ratio

[14] Kavussanos,(2013), *Risk management and derivatives in shipping*, Unpublished Presentation, WMU, Malmo, Sweden.

Credit risk (trade parties)	Have	None
Influence on the capital flow	More	Less
Use ratio	Dominant position	More and more users

Market players usually make the FFA through their brokers most of which are members of FFABA. FFA brokers collect the information of the contracts and find corresponding traders to promote the transaction after negotiation in details including routes, settlement time and place, cargo size, initiation and length of contract, settlement prices, etc. There are two contract forms applied widely in FFA market. One is aforementioned FFABA contract taking dominant market share, the other is the model contract made by International Swaps and Derivatives Association which is usually used by large shipping enterprises and some world-class banks. The details of contracts can be negotiated with each other, which is more flexible and easier to conclude a bargain.

The settlement prices of FFAs are usually the average of the relative index published by the Baltic Exchange on the contractual routes during the settlement period which is generally 7 days for single route and 30 days for time-charter route. The settlement prices should be paid on the settlement day and received in 5 days.

2.2.3 Freight options

An option contract confers the right, but not the obligation, to buy or sell a specific underlying instrument or asset at a specified price - the strike or exercise price - up until or on a specified date - the expiry date. The price to have this right is paid by the buyer of the option contract to the seller as a premium. The freight option in shipping was originally introduced in 1991 on the base of BIFFEX but did not development well and was exit with BIFFEX in April, 2002.

In 2004, with the volatility of the freight rate promoting the development of FFAs, the shipping exchange seized the opportunity to launch the freight option products. In June 2005, IMAREX traded tanker freight options underlying on TD3 and TC2 which were two index respectively reflecting the tanker dirty route from Middle East Gulf to Japan via 260,000 mt vessel and tanker clean route from Europe to US East Coast via 33,000 mt vessel published by Baltic Exchange. Freight options are also generally traded over-the-counter and FFA brokers provide the market information. The trading method of freight options are almost as the same with that of FFAs.

Options can be divided into call options and put options. The former provides the holder the right to buy the underlying asset as the contract, and the latter provides the holder the right to sell the underlying asset as the contract. Premium should be paid by the holder to get the right of option while the holder has not the obligation to exercise the option.

As a kind of Asian option, freight option treats the average price of the freight rate (the underlying freight index) during the period of the contract, from the effective day to the expiring day, as the exercise price-a main factor of options. It can be divided into three kinds, namely ATM-at the money, OTM-out of the money and ITM-in the money. ATM means the exercise price is equal to the price of the underlying asset. OTM options are not worth executing otherwise the costs of call would be larger. ITM options have the execution value to reduce the call costs.

2.3 Functions of freight derivatives

The derivatives were introduced in shipping with the original wish to hedge the risks due to the volatility of freight rates while the first attempt, BIFFEX, was proved to be failure primarily because of its poor hedging effectiveness and then some foregoers improved the trading methods of derivative products and vivified the contracts. There came the FFAs, which generally attracted the majority of market participants and found new functions through analysis.

2.3.1 Hedging

A hedge is an investment position intended to offset potential losses/gains that may be incurred by a companion investment.[15] This kind of trading function is hedging, primarily aiming to reducing price risks on the offset position of the traders in the future market compared to theirs in the spot market. In shipping market, hedging is applied for keeping current profits of the company rather than crediting more profits. The reason why hedging is able to be used for reducing price risks in economical principle is that theoretically the impacts and constraints on the price of certain kind of commodity in the spot market and future market are equal, meaning that the tendency of the two prices have convergence. The price of commodity in the spot market decreases and that in the future market would decrease as well. Furthermore, as close to the expiring date of the contracts, the difference between the spot market prices and the future market prices, named price basis, is tend to be zero, otherwise there is arbitrage opportunity. Therefore the investors operate the main business in the sport market and hedge on their offset position in the future market. If they loss in the spot market due to the price decrease, they will gain in the future market through hedging to make up their loss and keep value.

Hedging is the first cause for the beginning of the future market. In order to avoid the risks due to the fluctuation of prices of raw materials and made-up products in the production process, the producers spontaneously traded for future contracts, which generally born the future markets. As to hedging freight revenue, shipping services is treated as the possession of ships owned by ship owners and operators who transfer the freight risks to the speculators willing to take the risks through derivative contracts in the future market.

2.3.2 Price discovery

Price discovery is widely found in future market, especially in FFA market, which

[15] Retrieved 27 April 2014 from WIKIPEDIA: http://en.wikipedia.org/wiki/Hedge_(finance)

means that the transaction price in the market caused by the open bidding between a large number of buyers and sells has a strong authority and advancement. It can dynamically reflect people's anticipation of change and revenue of stock index, interest rate, exchange rate, freight rate in FFA and so on. It also reflects the comprehensive forecast of market participants to the relation between supply and demand and the price situation. With the fast development of modern communications especially telecommunications and the internet, the information of formation of each knock down price is able to be spread around the world to form the price in the world market.

The price discovery function of FFA is based on the high-efficiency FFA market, which FFA is able to reflect a relative accurate forecast to the future price in shipping market. Although freight derivatives are without the need for physical performance and no restrictions to physical operation, it can lead physical market and give market insight through the analysis of people's opinion of relative future market.

As the financial crisis exploring in 2008, many futures exchanges have reinforced their trading management, of which trading screen is widely applied to promote the transparence of trades. The general information of every new trade agreed in the exchange should be notified to the members as well as floor brokers and make pubic. The regulations promote the information feedback to the trades and floor brokers in futures market and help them make new decisions according to the new market situation, which further affects the trend of futures and finally embodies in the price.

2.3.3 Speculation

The investors aiming at speculation take less account of trades in spot market. Predicting the price change trend according to the present information, they buy in when predicting the price would increase and sell out when predicting the price would go down and thus extract profits. Although freight derivatives were created to reduce risks due to the volatility of freight rate in shipping, it is unable to remove all of the

risks in the production and management fundamentally. In fact, hedgers transfer their price risks through FFA trade, on the basis of which another party burden the risks, in other words, speculators play the role in the market and from their point of view freight derivatives are used to make profits, which is existence other than recommendation.

2.4 Main derivatives markets and participants

The main derivatives markets are FFA market including dry-bulk FFA market and tanker FFA market. In the dry-bulk sector, FFAs are available at present to complement the Capesize (BCI), Panamax (BPI), Supramax (BSI) and Handysize (BHSI) routes. To hedge long-term freight risk, a time-charter FFA is usually applied based on the difference between the contract price and the daily average of the time-charter route from Panamax, Capesize or Supramax indices. Some 85% of the dry FFA market is traded on the Baltic Exchange's Capesize, Panamax, Supramax and Handysize Time Charter average indices, with 15% traded on the individual routes. It is customary to divide the period into monthly settlements to establish cash-flow. As to the tanker FFA market, settlement occurs at the end of each month, where the fixed forward price, expressed in World scale or Time-Charter Equivalent-TCE, is compared against the spot price average of all the business days of the delivery month of the contract for the routes of the BDTI or BCTI or Platts, mostly for TC1,TC4 and TC5. The FFA market has experienced a period of development during the past two decades.

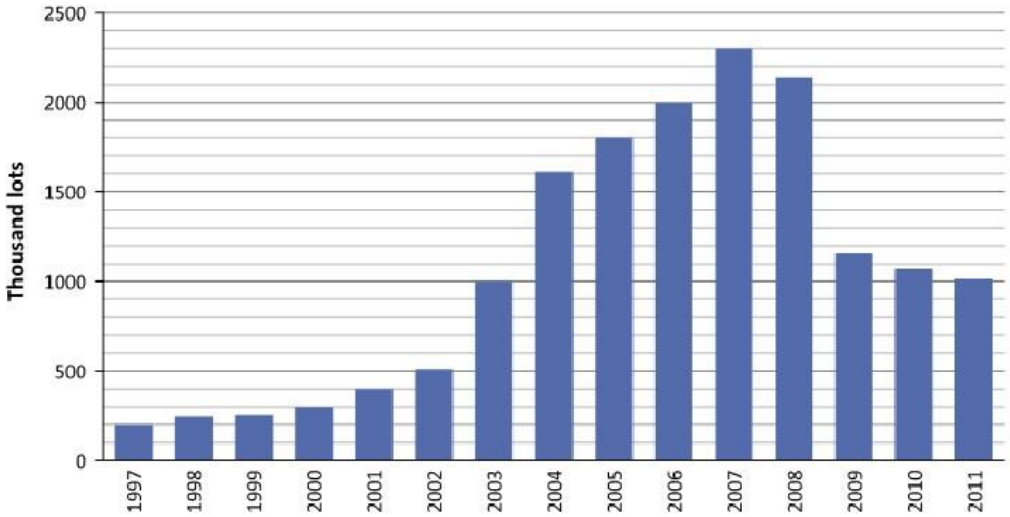

Figure 2.3 Dry FFA volumes 1997-2010[16]

In 1991, the concept of Forward Freight Agreements (FFAs) was first put forward by Clarkson, primarily as a response to the needs of market players who were aware of the deficiencies of the BIFFEX contracts as a hedging instrument. These players were looking forwarding to a new risk management tool to hedging their risks due to the volatility of shipping freight rates, which facilitated the first recorded trade of dry-bulk FFA between two European shipping companies, Burwain and Bocimar in 1992. In 1994, Cargill and BP signed the first FFA on tankers. In the year of 2000, there were about 1600 lots trading in the FFA market and the amount of transaction were about 3 billion USD, after that the amount of transaction in the FFA market have grown at a stable rate. FFA market experienced a rapid and huge development since 2005, with the participation of more and more shipping companies and large banks and funds such as Citi Bank, Morgan Stanley, Merrill Lynch, Okanos, GMT, etc. for which the amount of transaction were increased at an exponential rate. However, after 2008 financial crisis, the FFA volumes returned to that of the year of 2004. Nowadays, FFA players are more cautious to make a deal and prefer to clear the contracts in the clearing house.

[16] LU Wei, (2013), *Feasibility Analysis of New Shanghai Containerized Freight Index Futures*, Shanghai Jiao Tong University master's thesis, Shanghai, China.

Dry-bulker FFA market covers the routes underlying on the 24 main dry-bulker shipping routes of Baltic freight index and the tanker FFA market involves 6 clean tanker routes and 15 dirty tanker routes. Nowadays FFAs can be cleared at IMAREX, LCH, SGX and NYMEX.

The market participants pay attention on the freight derivatives from their own perspective. Some focus on the hedging function of the freight derivatives that aims at ensuring the revenue or costs in advance through transferring their risks. For example the cargo owners are worried about the freight rate increasing in the next few months while the ship owner think that the freight rate will decrease, the two parties are likely to make a deal on forward delivery to meet their own needs due to the different point of view on the future market. With the increasing of market liquidity, there are more speculative opportunities to make profits in freight derivative market, which attracts the attention of financial institutions and funds. At the same time some giants in shipping also seize a chance to seek private gain by taking the advantage of using their familiar with the market. There must be some winners and losers while each market participants takes what they needs.

i. Shipping companies

As the ups and downs of freight rate in the dry-bulker and tanker markets, many shipping companies make use of freight derivatives locking the revenue in advance to get stable cash flow and avoid risks. The shipping companies with more relying on chartering vessels can get a lot of management flexibility from freight derivative contracts while those preferring to have their own vessels can get stability of earnings and keep the control of assets. There are more foresight information in the forward market than that in the spot market thanks to the price discovery function of freight derivatives, which helps the shipping companies to make their production plan and capacity allocation more reasonable.

ii. Financial institutions

The financial institutions take part in the freight derivatives markets for the reasons that the freight derivatives are not only an investment instrument to avoid risks but also an effective way to do portfolio management, which can be proved by the fact that Goldmaachs and Mogget Stanley participated actively in the energy- related tanker freight derivatives market. What's more, financial institutions pay attention on the tendency of shipping market directly relating to the sale ability and repayment ability of shipping companies, especially in ship financing sector which usually involves a large amount of capital. They can hedge their risk positions in the derivatives markets to reverse their risk aversion. Meanwhile financial institutions provide financing services of derivative trading for their clients. Some banks like Barclays Bank, Deutsche Bank and Dresdner Bank also provide trading and settlement services relating to the shipping market.

iii. Traders

As extremely similar to perfect competition market, shipping market is full of risks and the freight rate fluctuates drastically. It is no possible for a single trader to control the freight rate in the market but only accept passively, which brings the traders high risks and huge indeterminacy of transporting costs. In order to confirm the costs, traders also hedge themselves through freight derivatives.

iv. Cargo owners/oil majors

Cargo owners in dry-bulk shipping and oil majors in tanker shipping are the demand sides in the market. They participate in the derivative market to lock the transporting costs in future and make an optimal allocation of capacity, especially for the oil majors who generally transport their products by their own shipping sectors. As to cargo owners, it used to be high correlation coefficient between the freight rate and the value or volume of cargo while the appearance of container changed the situation to some extent. However, with the explosion of the financial crisis in 2008, people began to be aware of the volatility in the container shipping as well. The derivatives underlying on Shanghai Containerized Freight Index have been put forward in the

recent years, which will be discussed in detail in the next charter.

3. Freight derivatives in Shanghai

3.1 Shanghai Containerized Freight Index (SCFI) Derivatives

3.1.1 Background

The liner market is generally considered as a monopolistic competition market, in which the freight rate was used to be controlled by the liner conferences while the last liner conference in Europe was dissolved in 2008. In the year of 2008, coincidently, the global financial crisis firstly outbreak in the United States causing a downturn in the derivative market involving the shipping market as well as related freight derivatives. The low ebb of shipping market including the liner market have not fully recovered back until the supply and demand of the market come to a relatively balance period and well allocation of capacity without overcapacity since 2008. Thus the volatility of freight rates in liner market is increasing which promotes the consideration of improving the risk management in the container shipping.

Since 2008, Shanghai Shipping Exchange (SSE) has cooperated with Clarkson to develop a new index reflecting the freight rate from Shanghai to several different parts of world in container shipping. The result came in 2009 when Shanghai Shipping Exchange renovated and publicized Shanghai (Export) Containerized Freight Index (SCFI), which was officially issued on October 16th 2009, including both freight rates (indices) of 15 individual shipping routes and a composite index.

3.1.2 Introduction of SCFI

The SCFI reflects the spot rates of Shanghai export container transport market, including the ocean freight and the associated seaborne surcharges of individual shipping routes on the spot market, where the unit and weighting of the destinations are presented as follows.

Table 3.1 The unit and weighting of the destinations of SCFI

Description	Unit	Weighting
Europe (Base port)	USD/TEU	20.0%
Mediterranean Sea (Base port)	USD/TEU	10.0%
USWC (Base port)	USD/FEU	20.0%
USEC (Base port)	USD/FEU	7.5%
Persian Gulf and Red Sea (Dubai)	USD/TEU	7.5%
Australia/New Zealand (Melbourne)	USD/TEU	5.0%
East/West Africa (Lagos)	USD/TEU	2.5%
South Africa (Duban)	USD/TEU	2.5%
South America (Santos)	USD/TEU	2.5%
West Japan (Base port)	USD/TEU	5.0%
East Japan (Base port)	USD/TEU	5.0%
Southeast Asia (Singapore)	USD/TEU	5.0%
Korea (Pusan)	USD/TEU	2.5%
Taiwan (Kaohsiung)	USD/TEU	2.5%
Hong Kong (Hong Kong)	USD/TEU	2.5%

Source: Shanghai Shipping Exchange

Ports of destination: the base ports are defined in each individual trade route.

Table 3.2 The definition of base ports

Europe	Hamburg/Rotterdam/Antwerp/Felixstowe/Le Havre
Mediterranean Sea	Barcelona/Valencia/Genoa/Naples
USWC	Los Angeles/Long Beach/Oakland
USEC	New York/Savannah/Norfolk/ Charleston
West Japan	Osaka/Kobe
East Japan	Tokyo/Yokohama

Source: Shanghai Shipping Exchange

Considering the special charging method of container shipping based on the number and kind of different container, the publisher of SCFI defines the price type as the mainstream trading price between major container lines and shipper or freight forwarders on the spot market reported by the panelists, which is not affected by the specially of ship's type, ship's age, carrier or transport volume. In addition, surcharges are taken into account to some extent in order to make the index more closely to the situation of the market.

The seaborne surcharges include:

- Bunker Adjustment Factor (BAF)/ Fuel Adjustment Factor(FAF)
- Emergency Bunker Surcharge（EBS）/ Emergency Bunker Additional (EBA)
- Currency Adjustment Factor(CAF)/ Yen Appreciation Surcharge (YAS)
- Peak Season Surcharge(PSS)
- War Risk Surcharge(WRS)
- Port Congestion Surcharge (PCS)
- Suez Canal transit Fee/Surcharge (SCS)/ Suez Canal Fee (SCF)/ Panama Transit Fee (PTF)/ Panama Canal Charge (PCC).

Unit: USD/TEU (USD/FEU is for US West coast and East coast services)
Trade and transport term: export CIF, CY-CY
Container type/cargo description: General dry cargo container (General cargo is for US west coast and east coast services)

The basis composite index is 1,000 points and the base period is specified on October 16th 2009.

The freight information for SCFI compilation is reported by CCFI panelists, including liner companies and shipper/freight forwarders. All member panelists are world-renowned enterprises with outstanding performances and sound reputation in

shipping circle. At present, 15 liner companies and 17 shippers/freight forwarders provide the freight information.

As to the calculation of the index, the freight rate of individual shipping route is the arithmetic mean of all freight rates of each route and the composition index is the weighted average of all routes.

$$P_i = \sum_{j=1}^{n} P_{ij} / n$$

Where: i = route, j = sample company, n = number of sample companies on the route

Figure 3.1 Freight calculations of individual shipping routes

Source: Shanghai Shipping Exchange

$$I = \sum_{i=1}^{m} (P_i * W_i / P_{i0}) * 1000$$

Where: i = route, m = number of the route, Wi = weighting of route i

Figure 3.2 Calculation of composition index

Source: Shanghai Shipping Exchange

The SCFI is publicized by SSE at 15:00 (Beijing Time) on each date of publication. The date of publication is generally each Friday and will be adjusted in legal holidays. The specific dates will be made known to public by SSE. If necessary and reasonable, SSE may postpone or cancel the publication.

3.1.3 The derivatives underlying on SCFI

Freight derivatives in shipping birthed and developed with the increasing emphasis on controlling risks in shipping market and learning from the financial derivatives, having the function of hedging aiming at avoiding risks as well as speculation function aiming at make profits. The first derivative underlying on the freight index in shipping is the BIFFEX launched by the Baltic Exchange in 1985, but with the emergence of FFAs as a replacement as well as the low effectiveness of hedging, the

BIFFEX has been exited from the market gradually. FFAs become the fastest-growing freight derivatives in shipping. The marked ups and downs of the freight rate in the dry-bulker market makes the drastic fluctuations of BDI, the underlying entity of FFAs, promoting the demand of market participants using FFAs to avoid risks.

Compared to the gradually mature FFA market, the freight derivatives in container sector is still at the initial stage. The Container Freight Swap Agreement (CFSA) is a kind of paper contract on mid-long term freight rate similar to the FFA, where the information like specific routes, prices has specific provision. The SCFI is used in settlement to calculate the difference between the underlying index and the regulated freight rate in the contract. As a convenient risk management instrument of freight risk, CFSA is traded over the counter cleared by LCH or SGX to avoid the counterparty risk. The first bilateral CFSA was executed in January 2010, and six months later the first CFSA was cleared.

In 2011, Shanghai Shipping Freight Exchange CO., LTD. (SSEFC) was established as the first third-party trading platform worldwide. Later the container products underlying on SCFI were published covering two routes, namely from Shanghai to Europe and from Shanghai to U.S. West Coast. They are traded in the exchange to get high efficiency and with the aid of electronic trading platform. The products were developed rapidly as soon as they were published with a lot of trading activity, e.g. more than 500,000 lots of unilateral volumes and about 30,000 lots of average daily unilateral trading volumes, 36,000 lots of average daily holdings, which guarantees the trading mobility in the platform and meanwhile forms an effective mechanism of hedging the freight rate risk. As of the March of 2013, the transaction amount of products underlying on the SCFI has been 200 billion RMB (about 32.1 billion US dollar)[17].

Table 3.3 Container Products

[17] YANG fan, (2014), *the comparative study on the product design of shipping financial derivatives*, Times Finance, NO.1, 2014.

Routes	**Shanghai to U.S. West Coast**	**Shanghai to Europe**
Code	UW	EU
Underlying index	Shanghai Containerized Freight Index, Shanghai to U.S. West Coast route	Shanghai Containerized Freight Index, Shanghai to Europe route
Lot size	1 Lot=1 FEU (40 feet equivalent container)	1 Lot=1 TEU (20 feet equivalent container)
Trading unit	Lot	Lot
Pricing currency	USD, US$	USD, US$
Minimum price fluctuation	USD 1 per FEU	USD 1 per TEU
Maximum limit per order	500 FEU	1000 TEU
Maximum open position per account(client)	5000 FEU	10,000 TEU
Trading hours	08:55-11:30,13:30-15:00, Beijing local time, GMT+8	
Margin	20% of the contract value	
Currency rate	The latest Central Parity of RMB/US$ published by China Foreign Exchange Trading Center prior to the first trading day of the contract	
Daily settlement price	Volume-weighted average price in a day	
Contract months	6 consecutive months starting with current month	
Daily price fluctuation limit	±5% of previous settlement price (except for the first and delivery day)	
Delivery price	See Formula for Delivery Price	
Last trading day	Last publication day (Friday) of the underlying index in the contract month	
Delivery day	Same as last trading day	
Delivery	Cash	
Transaction fee	0.05% of the contract value	

Fee of close day trading	NA
Delivery fee	0.1% of the contract value
Transferability	Transferable among traders

Source: Shanghai Shipping Freight Exchange CO., LTD.

The main difference between CFSA and container products underlying on SCFI is the trading method. The former is mainly OTC trading while the latter is usually exchange trading.

Table 3.4 Character of OTC trading and exchange trading

Characteristic index	OTC trading	Exchange trading
Trading method	Through negotiation	Through electronic trading platform
Clearing mode	Traders, choose to clear in the clearing house	Only in the clearing house
Delivery manner	Through negotiation and delivery at maturity date	Standard contracts, expire automatically
Fee	Broker's commission	Delivery fee, transaction fee
Deposit	None	Have
Goal	Hedging	Speculation arbitrage

3.2 China Coastal Bulk (Coal) Freight Index (CBCFI) Derivatives

3.2.1 Introduction of CBCFI

CBCFI was developed on the basis of existing system of China (Coastal) Bulk Freight Index (CBFI) by Shanghai Shipping Exchange (SSE), for the purpose of timely reflecting frequent and drastic fluctuation of freight rates of China's coastal coal transport market. The freight information for CBCFI compilation is reported by 38 CBFI panelists, most of which are domestic shipping companies operating in bulk sector. SSE publicizes the composite index and spot rates of different routes and types of vessels of coastal coal service market at 15:00 (Beijing local time, GMT+8) every

working day.

CBCFI takes September 1st 2011 as the base period and the base index is 1000 points. It includes 10 routes along the coast of China mainly from the northern to the southern with certain type of vessel in each route.

Table 3.5 Routes and types of vessel of CBCFI

Routes	**Types of vessels**
Qinhuangdao—Guangzhou	50,000-60,000DWT
Qinhuangdao—Fuzhou	30,000-40,000DWT
Qinhuangdao—Ningbo	15,000-20,000DWT
Qinhuangdao—Shanghai	40,000-50,000DWT
Qinhuangdao—Zhangjiagang	20,000-30,000DWT
Tianjin—Shanghai	20,000-30,000DWT
Tianjin—Zhenjiang	10,000-15,000DWT
Huanghua—Shanghai	30,000-40,000DWT
Jintang/Caofeidian—Ningbo	40,000-50,000DWT
Qinhuangdao – Nanjing	30,000-40,000 DWT

Source；Shanghai Shipping Exchange

3.2.2 The derivatives underlying on CBCFI

In December 2011, there were two derivative products respectively underlying on two routes of CBCFI, namely from Qinghuangdao to Shanghai and from Qinghuangdao to Guangzhou introduced formally. The products are monthly contracts traded by the memberships of SSEFC on the electronic platform.

Table 3.6 Coal products

Routes	**Qinhuangdao to Shanghai**	**Qinhuangdao to Guangzhou**
Code	QH	QG
Underlying index	China Coastal Bulk (Coal) Freight Index: Qinhuangdao to Shanghai route (40,000-50,000 DWT)	China Coastal Bulk (Coal) Freight Index: Qinhuangdao to Guangzhou route (50,000-60,000 DWT)
Pricing currency	*CNY,* ￥	

Trading Unit	Lot
Lot size	100 metric tons
Minimum price fluctuation	2 CNY per 100 metric tons
Maximum limit per order	1,000 Lot
Margin	20% of the contract value
Maximum open position per account(client)	10,000 Lots
Trading hours	08:55-11:30,13:30-15:00, Beijing local time, GMT+8
Daily settlement price	Volume-weighted average price in a day
Delivery price	See Formula for Delivery Price
Daily price fluctuation limit	±5% of previous daily settlement price (except for the first and delivery day)
Contract months	3 consecutive months starting with current month + following 3 end-quarter months
Last trading day	Last publication day (Friday) of the underlying index in the contract month
Delivery day	Same as last trading day
Delivery	Cash
Transaction fee	2 CNY per lot
Fee of close day trading	NA
Delivery fee	5 CNY per lot
Transferability	Transferable among traders

Source: Shanghai Shipping Freight Exchange CO., LTD.

In October 2013, another derivative product underlying on CBCFI began to be traded on the electronic platform of SSEFC. It focuses on the coal transport from the northern coast to the southern coast in China (code: NS), in other words, it pays more attention on the domestic market. However, it is the world first capacity delivery type of derivative in shipping, creating the delivery settlement other than cash settlement to meet the need of the real capacity in the market.

In fact, the NS products are more similar to a real transport contract rather than a

paper contract like FFAs. Each lot capacity of the derivative is on behalf of 100 metric tons of coal prices. The limit price of daily price is ±4% of the previous day's settlement price and the initial margin ration is 10% of the contract value increasing to 30% when comes to the delivery month. The minimum number of delivery is 450 lots (45,000 tons) just to meet mainstream type of vessel (40,000-50,000 tons) in the current market of China's coastal coal transportation.

The freight pricing of the NS contracts is on the basis of the route from Qinhuangdao to Shanghai and implements the premiums and discounts on the routes from Qinhuangdao respectively to Ningbo, Zhangjiagang, Nanjing, Fuzhou and Guangzhou. There are twelve contracts from January to December in the year of 2014 in first listing.

3.3 Chinese currency (RMB) FFAs

Chinese currency (RMB) FFAs was formally published at the 16th of April 2013 after 4-month trial operation. It was jointly introduced by the Baltic Exchange, the Shanghai Clearing House (SHCH) and Shanghai Pudong Development Bank to meet the need of Chinese companies, with the increasing proportion of China's shipping and trading volume in the world, directly participating in the FFA market to improve their risk management on the volatility of freight rate in shipping market.

RMB FFAs is underlined on the series of Baltic Exchange Dry Index. The traders reach the transaction through the RMB FFA brokers by RMB in both invoicing and settlement and SHCH provides the central counterparty clearing. Nowadays, there are three kinds of RMB FFAs, namely Capesize time charter average (CTC), Panamax time charter average (PTC) and Supramax time charter average (STC).

Table 3.7 RMB FFAs

Name of Agreement	Average rents of each ship charter (all day)
Product code	1. CTC

	2. PTC 3. STC
Agreement scale	1 day
Price	X yuan / day
Number of Agreements	Y months
Term of the agreement	1. Monthly agreement when the remaining months of the quarter 2. From the next quarter for four consecutive quarters of quarterly agreements 3. The next two consecutive years of annual agreement
Lowest price volatility	0.01 yuan / day
Receiving time of transaction data (China time)	Both China and the United Kingdom working :14:00-20: 00; Last Trading Day :14:00-18: 00
Last Trading Day	Monthly agreement: the last working day of the month; Quarterly agreement: the last working day of the previous quarter; Year agreement: the last working day of the previous year.
capital settlement date	9:30 am to 10:30 am at the last trading day of each month in the duration of agreement of the next working day in China
Final settlement price	The arithmetic mean of the daily spot price of the month in Baltic Exchange multiplied by the central parity of RMB against the U.S. dollar at the date, accurate to two decimal places

Source：Chinese website of the Baltic Exchange

4. SWOT Analysis of freight derivatives of Shanghai Shipping Exchange

From the discussion in the last chapter, there are six freight derivatives products appearing to the public in Shanghai which can be divided into two kinds, futures and forward agreements. RMB FFAs is a localization branch of FFAs based on Baltic freight indices while the other five products are all launched by SSEFC, a local company of shipping freight third party centralized trading platform controlled by Shanghai Shipping Exchange and supervised by Municipal Government of Shanghai and Ministry of Transport of the People's Republic of China. With a view to the fact that Shanghai Shipping Exchange publishes the indices of freight rate as the

underlying entity of freight derivatives products, it is obvious that Shanghai Shipping Exchange is the main force and the only one leading the development of freight derivatives in Shanghai. Therefore the SWOT analysis will be studied on the subject of freight derivatives of Shanghai Shipping Exchange.

4.1 Theory of SWOT

SWOT is a strategic management analysis method as the acronym of strength, weakness, opportunity and threats. It involves the identification of the internal and external factors, in which strength and weakness belong to the internal factors and, opportunity and threats belong to the external factors, whether they are favorable to achieve the objective or not.

SWOT is a qualitative analysis method through listing strength, weakness, opportunity and threats and then making a combination of them to form SO, ST, WO, WT strategies. Finally the strategies will be identified and chosen to confirm the present specific strategy and tactics. The degree to which the internal environment matches with the external environment is expressed by the concept of strategic fit.

- Strengths: characteristics of the business or project that give it an advantage over others.
- Weaknesses: characteristics that place the business or project at a disadvantage relative to others
- Opportunities: elements that the project could exploit to its advantage
- Threats: elements in the environment that could cause trouble for the business or project[18]

4.2 SWOT model of developing freight derivatives in SSE

4.2.1 Strengths analysis of developing freight derivatives in SSE

[18] Retrieved 26 May 2014 from WIKIPEDIA: http://en.wikipedia.org/wiki/SWOT_analysis#SWOT_-_landscape_analysis

I. Adequate shipping elements for developing freight derivatives in SSE

During the past ten years, Shanghai experienced a rapid development in shipping, especially in the port infrastructure reflecting on the increasing port throughput as a basic service. A well-equipped port can attract more vessels calling and thus facilitates the demand of further services in shipping including shipping broking, shipping consulting, shipping insurance, derivatives products, etc. Thousands of shipping-related companies including some world famous ship-broking companies like Clarksons have been registered in Shanghai and all of the top 20 container lines have set up branches and offices as well as some international organizations like BIMCO has established representative offices in Shanghai, which offers demand basis to the development of freight derivatives in Shanghai. On this basis, Shanghai Shipping Exchange re-published the new SCFI in 2009 and relevant freight futures were launched on electronic trading platform of SSEFC in 2011, starting the precedent of freight derivatives of container in the world.

Table 4.1 The development of ports in Shanghai

Year	10,000 tonnage berths (unit)	Port freight throughput (10,000tons)	International containers (10,000TEU)	Of which	
				Input	Output
2002	115	26384	861.2	414.1	447.1
2003	125	31621	1128.3	544.4	583.8
2004	123	37897	1455.4	699.6	755.8
2005	124	44317	1808.4	887.2	921.3
2006	131	53748	2171.9	1064.4	1107.5
2007	133	56144	2615.2	1276.3	1338.9
2008	137	58170	2800.6	1397.8	1402.8
2009	153	59205	2500.2	1222.9	1277.3
2010	157	65339	2906.9	1436.1	1470.8
2011	160	72758	3173.9	1555.1	1618.9
2012	162	73559	3252.9	1605.1	1647.9

Sources: Shanghai Statistical Yearbook 2013

II. Open innovation and friendly policies for developing freight derivatives in SSE

Shanghai Shipping Exchange plays a leading role on the development of freight derivatives in the construction of Shanghai international shipping centre. SSE put its emphasis on the freight index in the container sector as an innovation and extends to other shipping sectors like dry-bulk and tanker. It has been six freight indices formally published by SSE after several years' efforts, namely CCFI, SCFI, CBFI, CBCFI, CDFI and CTFI, and another container freight rate index between the Taiwan Strait is in trial run. All of these indices take the Chinese market as the core. The derivatives underlying on SCFI and CBCFI have been launched by SSEFC in recent years arousing much market response.

Further development of freight derivatives are promoted with increasing experience of SSE as well as great support of friendly policies for the construction of Shanghai international shipping centre. In 2013, the Ministry of Transport and the Shanghai Municipal People's Government jointly issued "on the implementation <China (Shanghai) Pilot Free Trade Zone overall program> to accelerate the construction of Shanghai international shipping center opinions" (referred to as "the opinions"). "The opinions" indicates to accelerate the construction of Shanghai international shipping center in five areas, namely expanding the level of openness, innovation and shipping policies, expanding center functions, improving service levels, strengthening the infrastructure. In the requirements of expanding center functions, "the opinions" clearly pointed out the need to speed up the development of the shipping freight derivatives business as well as improve the regulatory system to prevent the risk of shipping finance, strengthening the long-term freight regulation. Support Shanghai to carry out China's imports of dry bulk cargo preparation and dissemination of crude oil and other bulk cargo freight index.

4.2.2 Weakness analysis of developing freight derivatives in SSE

I. Limited conscious of domestic shipping companies participating in freight derivatives market

The main reason for participating in the freight derivatives market is to hedging the risks while it is not widely aware of among the domestic shipping companies. As an alarming case, the COSCO made a loss as much as 4 billion yuan in the FFA market as well as operated losses in the physical market at the end of 2008 when the shipping market dramatically went down, which reflects the lack of valid method of domestic shipping companies participating in the freight derivative market. After this case, the SASAC reinforced the supervision of the large derivatives transactions of state-owned companies including two large-scale domestic shipping companies COSCO and China Shipping.

II. Small-scale of domestic freight derivatives market and limited products of freight derivatives

It was estimated that there are nearly 150 billion US dollars freight derivatives market size in shipping while the portion of that in Shanghai didn't reach 1% in 2009. After three years' development, there were more than 2000 traders in the electronic platform of SSEFC reaching a trading volume of 100 million yuan in 2012. The daily average number of transactions of derivatives underlying on SCFI came to 200 lots. However, the trading scale is still not large enough.

What's more, Compared to a wide range of freight derivative products abroad, there are only five derivative products launched by SSEFC although the researches of new products keep going. Besides SCFI and CBCFI, Shanghai Shipping Exchange published, another two freight index, China Import Dry Bulk Freight Index and China Import Crude Oil Tanker Freight Index, in November 2012, making first-phase preparations to innovate new derivative products. However, how well the freight index published by Shanghai Shipping Exchange reflects the corresponding shipping market is still waiting for test.

III. Lack of inter-disciplinary talents understanding both shipping and finance

Freight derivatives are more complicated than the usual derivatives as they are not only related to shipping industry but also involving the financial sector, belonging to the interdisciplinary. The lack of talents will reduce the launch rate of new products as well as affect the rationalization of the design of contract rules. Although there are relatively more expertise in this area in Europe and America, due to the lack of relevant preferential policies and measures, the introduction of talents in this area is very slow.

4.2.3 Opportunity analysis of developing freight derivatives in SSE

I. The transfer of world shipping centre

According to the "2013 global port development report", there are 17 Asian ports ranking in the top20 largest port by port throughput and the other three are the port of Rotterdam in Europe, South Louisiana in America and Hedland in Australia. It is obvious that Asia plays a more and more important role in the global shipping. Although the centre of shipping-related businesses, such as vessel registration, shipping financing, shipping insurance, maritime arbitration, etc., is in Europe, the emphasis of shipping business is transferring to Asia generally. Asia needs a shipping centre providing a one-stop service in shipping involving financial services relating to freight derivatives to ship owners and shipping companies as well as traders and financial institutions. With the advantage of the largest container throughput port and the second largest cargo throughput port in the world as well as the manufacturing base of port machinery, Shanghai put its emphasis on developing the soft environment of shipping and the development of freight derivatives plays an important role.

II. The establishment of China (Shanghai) Pilot Free Trade Zone

China (Shanghai) Pilot Free Trade Zone was formally established at September 29, 2013 as a trial of further deepening the reform and opening up. It refers to many aspects including trading services, shipping services, financial services, professional services, etc. and the most important point is the open policies in the CSPFTZ.

Overseas enterprises are permitted to engage in commodity futures trading and financial transaction platform will be built adapting to international practice. International shipping financial derivatives exchange is planned to be set up in CSPFTZ to attract both domestic and foreign shipping companies and traders participating in the freight derivatives market and offer shipping companies a new system to avoid risks due to the dramatic volatility of freight rates.

What's more, as a special area, the supervision system in CSPFTZ is unique. The "Negative Lists" replaces the prior approval and some special regulations are put out step by step. It is convenient for foreign companies to take part in the derivative markets in Shanghai, which will set an example for the domestic shipping companies to learn more about freight derivatives.

III. Increasing strong financial sector in Shanghai

Aiming to be the financial centre of China, Shanghai has experienced a huge development in financial industry during the past few years. Several exchanges have been set up in Shanghai, including Shanghai Stock Exchange, Shanghai Futures Exchange, Shanghai Shipping Exchange, as well as some related research institutions like Commodity Development Research Centre of China (CDRC) have founded in Shanghai. Many financial institutions gather in Shanghai getting cluster effectiveness in Lujiazui Area and Qiantan is another developing emphasis for finance in the next few years. According to "2013 Shanghai Municipal Economic and Social Development Statistics Bulletin", the annual financial added value reaches 282.329 billion yuan in 2013 with an increase of 13.7% over the previous year. By the end of the year, the city's various financial institutions reached 1240, among which are 564 units of monetary and financial service, 252 units of capital market services, 347 units of insurance. Foreign financial institutions operating in Shanghai reached 215 units and 198 units of representative offices of foreign financial institutions. The total transactions in financial markets throughout the year (excluding the foreign exchange market) reached 588.87 trillion yuan increased by 20.9%.

IV. The economic agglomeration and radiation effect of Shanghai in the region

Standing at the estuary of the Yangtze River, Shanghai connects the inland with the outbound market. In addition, Shanghai is almost at the middle point of China's coast. Therefore Shanghai is a natural combination of waterways in China which is convenient for cargo transport. With the industrial restructuring and the regional integration of the Yangtze River delta, Shanghai has a more and more obvious economic agglomeration and radiation effect. The import and export trade volume through customs of Shanghai in 2013 reached 81.21 billion US dollars and the total value of foreign trade imports and exports were only 33.14 billion US dollars.[19] The balance of these two statistic data is the imports and exports of other provinces and cities through Shanghai port, which further embodies the concentration and radiation effects of Shanghai.

4.2.4 Threats analysis of developing freight derivatives in SSE

I. The competition of freight derivatives in other shipping exchanges

Since the first freight derivative BIFFEX was introduced by Baltic Exchanges in 1985, the freight derivatives have experienced a huge development in the world. "Hybrid" FFAs are widely used after the 2008 financial crisis, which was firstly introduced by LCH.Clearnet in September 2005, to avoid the counterparty risks by clearing the contracts in the exchange. Nowadays the main trading platforms clearing freight derivatives are LCH.Clearnet, Cleartrade Exchange (CLTX), Norwegian Futures and Options Clearing House (NOS) and Singapore Exchange (SGX) AsiaClear. Most of them focus on the FFA markets including FFA options and FFA swaps and provide clearing services for the participants. As to container freight derivatives, LCH.Clearnet provides the products of TEU CFSAs, FEU CFSAs and WCI Containers as well as SGX offers similar services.

[19] Shanghai Statistics Bureaue, (2014), *Shanghai Municipal Economic and Social Development Statistics Bulletin of 2013*. Retrieved 28 May 2014 from the World Wide Web: http://www.stats-sh.gov.cn/sjfb/201402/267416.html

II. The construction of shipping finance in other domestic cities

There are many other domestic cities announcing to build international or regional financial centre for the purpose of promoting the development of economy such as Beijing, Tianjin, Nanjing, Dalian, Shenzhen, etc. Some of them are big ports and also plan to construct international or regional shipping centre. It is inevitable to form a fierce competition especially facing the limited resources during the development, for example Dalian has set up commodity exchange. How to transfer the domestic threat to benign competition benefiting for both parties should be taken into account.

4.3 Forming the Confrontation Matrix

By making the SWOT analysis and forming relevant confrontation matrix, the WO strategies should be dominated in current development of freight derivatives in Shanghai Shipping Exchange and ST strategies also need to be effectively applied for further development. On one side, it is a good opportunity for SSE to develop freight derivatives at present when the global shipping is at downturn and many parties are making full of preparation for the next eruption of the market. On the other side, with the target of becoming the international shipping centre and financial centre, Shanghai gathers a lot of corresponding resources involving a potential large market, supported policies and good district and freight derivatives as a actual operation relating to both shipping and finance have a great development space in good conditions.

Table 4.2 Summary of SWOT analysis

Strengths	Weakness
I. Adequate shipping elements for developing freight derivatives in SSE II. Open innovation and friendly policies for developing freight derivatives in SSE	I. Limited conscious of domestic shipping companies participating in freight derivatives market II. Small-scale of domestic freight derivatives market and limited products of freight derivatives III. Lack of inter-disciplinary talents

	understanding both shipping and finance
Opportunity I. The transfer of world shipping centre II. The establishment of China (Shanghai) Pilot Free Trade Zone III. Increasing strong financial sector in Shanghai IV. The economic agglomeration and radiation effect of Shanghai in the region	Threats I. The competition of freight derivatives in other shipping exchanges II. The construction of shipping finance in other domestic cities

Table 4.3 Confrontation Matrix

	Strength (S)	Weakness (W)
Opportunity (O)	SO strategy I. Allocate resources efficiently in both shipping and financial sector II. Improve the shipping industry chain from low-end services to high-end services III. Enhance the researching ability to increase the products of freight derivatives	WO strategy I. Strengthen education of freight derivatives in domestic market II. Use attractive talent polices to gather experts III. Diversify the products of freight derivatives in SSE
Threats (T)	ST strategy I. Learn from the successful experience of foreign freight derivatives II. Cooperate with other exchanges to promote products of each other	WT strategy I. Attract more shipping companies, financial institutions, traders and other parties to settle in Shanghai and participate in freight derivatives market II. Focus on domestic market

5. Development strategies and path of freight derivatives of Shanghai Shipping

Exchange

5.1 Development strategies of freight derivatives of Shanghai Shipping Exchange

Established as the unique National Shipping Exchange, Shanghai Shipping Exchange takes major initiatives in the construction of Shanghai international shipping center with the functions of protecting shipping market fair competition, regulating shipping transactions and communicating shipping information, of which freight rate index have been paid more attention and great efforts on the development of freight derivatives, especial derivatives underlying on the SCFI, have been made in recent years.

As the imbalance of the development of freight derivatives between the domestic and the abroad, Shanghai Shipping Exchange has pushed forward the derivatives underlying on the SCFI in the cooperation with foreign exchange while the domestic freight derivatives market was slow to open. According to the "three-step" development plan of the freight derivatives of Shanghai Shipping Exchange, it is first to realize the transaction of CFSA underlying on the SCFI abroad. Then achieve futures contracts of freight rate of containers in domestic and finally launch futures underlying on international container freight rate index in good time. On this basis, the framework of freight rate index of Shanghai Shipping Exchange has been built fundamentally till now and relevant freight derivatives are in research and will be launched in near future.

As the result of SWOT analysis, the short-term and long-term strategies of developing freight derivatives of Shanghai Shipping Exchange should be both taken into account. The WO strategies should be applied for the short-term development and the ST strategies should be applied for the long-term development. In short-term, SSE should highlight its opportunities for developing the freight derivatives, especially as the establishment of CSPFTZ and the changing in the global shipping structure. At the same time, with the existing freight index and relevant derivatives, SSE should facility the transactions of freight derivatives in the domestic market by best efforts.

In long-term, the integrity and comprehensiveness of the freight rate index should be improved and the derivative products should be diversified with own characteristics to have differences with others in the world. Meanwhile SSE should cooperate with more exchanges both in China and at abroad to expand its global influence.

5.2 Development path of freight derivatives of Shanghai Shipping Exchange

5.2.1 Complete the framework of freight derivatives of SSE till the end of 2015

It is necessary to build a basic framework for the development of freight derivatives in Shanghai as it is almost completely new in the domestic. After several years' investigations and researches, Shanghai Shipping Exchange chose the container as the innovation point and made an initial development plan. The new SCFI published in 2009 plays a pioneer role on the development of freight derivatives in Shanghai. In January 2010, the first CFSA underlying on the SCFI in the world was executed and cleared in the six months later in SGX. In June 2011, SSEFC launched the container products which are traded through the electronic platform. As to the dry-bulk and tanker freight derivatives, in 2011 SSECF launched the domestic freight derivatives underlying on the CBCFI relating to the coastal coal transport in China. And in 2012, Shanghai Shipping Exchange published China Import Dry Bulk Freight Index (CDFI) and China Import Crude Oil Tanker Freight Index (CTFI) in succession to make early-stage preparations for the launch of derivatives in corresponding sector.

Table 5.1 The development history of freight derivatives in Shanghai shipping finance

Time	Market development
2009.10	SSE republished new SCFI
2010.1	The first CFSA underlying on SCFI was executed
2011.3	SSEFC was established and began to set up electronic trading platform
2011.6	Container products underlying on SCFI were launched by SSEFC
2011.12	Coal products underlying on CBCFI were launched by SSEFC
2012.11	SSE published CDFI and CTFI in trial
2013.1	Chinese Currency (RMB) FFAs started trading

All of the freight indices (SCFI, CBCFI, CDFI and CTFI) have a strong factor of China that the one of the calling ports is in China as China occupies a large proportion of global trades derived shipping. The freight derivatives are a good instrument to verify the accuracy and correlation of the indices. The framework of freight indices involving dry-bulk, tanker and container sectors has elementarily constructed and the container freight derivatives based on SCFI has a good start while it still has a long way to get the trading volume of FFAs, with the same as other relevant freight derivatives going to be released in the future. For example the international dry-bulk capacity transaction contract of SSEFC is now seeking for public opinions at second time. Developing at this rate, by the end of 2015, the freight derivatives underlying on each separate route of SCFI, CBCFI, CDFI and CTFI will be introduced to the public, at least among the domestic companies.

5.2.2 Cultivate a mature domestic freight derivatives market till the end of 2018

The freight derivatives are relatively fresh in China compared to that in Europe and America where the markets have generally come into maturity after decades' development while the domestic freight derivatives market is small in size, relatively speaking.

The cultivation of domestic freight derivatives market can be started from the individuals among market participants. Derivatives brokers are a part of them of which qualification certification system should be applied for. In 2013, SSEFC has held twice trainings of freight derivatives brokers successfully. It is also necessary for employees of shipping companies, traders as well as financial institutions to know more about freight derivatives. Colleges and universities are able to establish relevant courses of on-the-job education. For example, Shanghai Advanced Institute of International Shipping is now in the construction aiming to cultivate high-end service

personnel in the industry of modern shipping.[20]

Apart from the individuals, domestic large-scale shipping companies are the main part of freight derivatives market. However, as the failure of COSCO in the FFA market in 2008, the SASAC strengthens the supervision of state-owned companies' participating in the freight derivatives market, from which the shadow of government intervention in the market can been seen. As a policy-driven of development of freight derivatives in Shanghai other than a natural formation of market, domestic freight derivatives market was not large in the beginning. The number of market participants will be increase step by step with the coordination between institutional environment and market situation. To avoid speculative actives of some companies in the freight derivatives market, the contracts are designed to be settlement in real ship capacity by SSEFC, which reminds the participants to pay more attention of hedging to avoid the risks due to the volatility of freight rate. It will help to cultivate a healthy and mutual-benefit freight derivatives market.

The education of freight derivatives of the shipping-related practitioners should start as quickly as possible since it usually takes at least one year to complete the education while it will spend more time to practice in the reality. As more employees in the shipping-related companies begin to realize the functions of the freight derivatives, the domestic freight derivatives market may come into maturity generally. This period will last for several years with the construction of framework of freight derivatives of SSE and it is estimated to come true by the end of 2018.

5.2.3 Update the products on and on to expand international influence

As shipping is an international industry, it changes rapidly and unpredictably. Just like "Butterfly Effect", a small accident somewhere in the world may cause a huge reaction in the other part. It is hard to make a constant composition of index to reflect

[20] The Shanghai Advanced Institute of International Shipping web site gives further information on course (http://saiis.shmtu.edu.cn)

the changeable market. Therefore the index should be updated to reflect an accurate and actual spot market, which directly affects the freight derivatives market. It is not only controlled by the competitive market but also needed an effective supervise system. One statement of the collapse of BDI in 2008 is that the financial institutions made lots of speculative transactions forming a huge bubble which was broken amid the financial crisis.

On the other hand, derivative products are not only traded on the exchange but also traded over the count. The main difference is the burden of counterparty risks, of which the OTC contracts can be cleared in the clearing house and it is widely applied nowadays. Electronic platform is another innovation in the recent years. SSEFC put out the electronic trading platform of freight derivatives in 2011 as well as the Baltic Exchange Derivatives run the Baltex, a central screen based trading solution for the dry-bulk FFA market in almost the same time. They both hope to bring greater transparency, confidence and liquidity to the freight derivatives market. Despite of the counterparty risks, the core competition power in the market is the products of freight derivatives, in other words, a more well and rational design of contracts, as well as the diversification of freight derivatives products meeting the different needs of the participants. From this point of view, RMB FFAs and local freight derivatives products in Shanghai can be well complementary to each other.

6. Summary and conclusion

6.1 Author's recommendation and conclusion

Freight derivatives are an interdisciplinary instrument of shipping and finance to avoid freight rate risks during operation. The thesis makes the study on the major freight derivatives products, namely BIFFEX, FFAs and Freight Options, in the world and analysis its functions and main market participants. And then focus on the development of freight derivatives in China especially in Shanghai. There are currently five freight futures products underlying on five different routes among two indices published by Shanghai Shipping Exchange. FFAs have been able to be settled

and cleared by RMB in Shanghai called Chinese Currency FFAs. Later the SWOT analysis is applied for the status analysis of development of freight derivatives in Shanghai especially after the establishment of China (Shanghai) Pilot Free Trade Zone and the conclusion that the WO and ST strategies are supposed to be taken in the development has been reached. Finally the development phase of freight derivatives in Shanghai has been proposed on the basis of the previous effort and the status quo. The conclusions of the thesis are as follows.

I. The freight derivatives are one kind of financial derivatives specific in shipping. The failure of BIFFEX and collapse of BDI causing a credit threat in FFAs market tell us that the freight derivatives market should keep transparency and liquidity for all market participants to enhance their confidence of the market.

II. Through SWOT analysis, it is a good opportunity to develop the freight derivatives in Shanghai as the large potential domestic market and friendly policies especially in China (Shanghai) Pilot Free Zone where allowing both domestic and overseas capital to invest freight derivatives through reform experimentation of Chinese exchange rate regime. However the weakness of immature freight derivatives market should be improved by correct guide of market and more education of freight derivatives to domestic market as well as gathering more experts.

III. The freight derivatives are fresh in China and its development in Shanghai is still in fledging period. The basic framework of freight index covering several sectors in shipping with emphasis on Chinese market has been set up. The electronic trading platform of SSEFC is an innovation and good for forming a fair and transparent market while relevant freight derivatives are of limited number and waiting for further investigations.

6.2 Deficiencies and prospects

With the limitation of author's ability and lack of practice experience, the thesis has several deficiencies in following aspects.

I. There is mostly qualitative analysis and lack of further quantitative analysis in the thesis which may lack convincing and easily to makes the understanding

incomprehensive.

II. As the rapid development of China (Shanghai) Pilot Free Trade Zone, the new policies are announced frequently which may cause the changeable environment for developing freight derivatives in Shanghai.

III. The discussion of two new indices, CDFI and CTFI, formally published by SSE in 2013 is limited because of the lack of more details.

For further study on the development of freight derivatives in Shanghai, it can be discussed in further aspects.

I. Use quantitative analysis to discuss the probability of developing other kinds of freight derivatives underlying on SCFI.

II. Do further study on the investment strategy of freight derivatives on the basis of study on the prices in the futures market.

III. Investigate the relationship between the spot and futures freight rate of SCFI and compared to that of BDI.

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