Economic Analysis on the Long Term Assessment of Dry Bulk Shipping

DURU, OKAN

(Degree)
博士（海事科学）

(Date of Degree)
2012-09-25

(Date of Publication)
2012-11-21

(Resource Type)
doctoral thesis

(Report Number)
甲5667

(URL)
https://hdl.handle.net/20.500.14094/D1005667

ECONOMIC ANALYSIS ON THE LONG TERM ASSESSMENT OF DRY BULK SHIPPING

Okan Duru
B.Eng. Maritime Transportation and Management Engineering
Istanbul Technical University, Turkey, 2003
Born at Uzunkopru-Edirne, Turkey

Submitted to
***the* Department *of* Maritime Logistics**
and the committee on
***the* Graduate School *of* Maritime Sciences**
in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY
in Maritime Science and Technology

at Kobe University
July 2012

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Doctoral Committee

Prof. Dr. Shigeru Yoshida, Chair-Supervisor

Prof. Dr. Michiyasu Odani

Prof. Dr. Kenichi Shoji

Assoc. Prof. Dr. Hidenobu Matsumoto

Acknowledgments

In the last five years, I have experienced very motivated and intellectual environment at Kobe University and finally completed my PhD work. I had several chances to attend scientific meetings and opportunity to share ideas with many scholars.
Among these activities, I should gratefully acknowledge the constructive and encouraging support of my advisor, Prof. Dr. Shigeru Yoshida. I never forget his graceful heart and humbleness which presented important lessons for my life.

I am thankful to many professors of Kobe University for their insightful comments, support and lectures. Particularly the efforts of doctoral committee are gratefully acknowledged because of their valuable time and constructive comments. I had many friendships at the campus including the members of Laboratory of transport economics and management. Mr. Emrah Bulut may be an essential person in my life because of his mental support and collaborations.

Dr. Cemil Yurtören helped me for applying to Monbusho Scholarship and he is the first person encouraging me to study at Kobe University. I also received many help from Dr. Serdar Kum at the beginning of my life in Japan. I thankfully acknowledge them for their time and interests.

For ensuring the practical validity of my studies, I frequently discussed issues with a number of business professionals such as Etsutaro Nakano (Emeritus Manager of K-Line Co.), Toshiharu Takiguchi (Chief Representative of K-Line Europe), Kazumasa Oshima (General Manager of K-Line Kansai Branch), among others. Their comments and contributions improved my studies and adjusted my way to establish practically meaningful works.

Finally, my parents have always been there for me and have never doubted my dreams, and the support of my wife and my son has made my participation possible, and I am sorry for my limited time for them at the time of studies.
I gratefully acknowledge their patience and tolerance.

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Biography

Okan Duru is born in Edirne, Turkey and he has spent most of his life in Istanbul, Turkey. He received his bachelor degree from the Department of Maritime Transportation and Management Engineering at Istanbul Technical University (2003). While he was studying the Master of Engineering degree (Maritime Transportation Engineering) in Istanbul Technical University, he was working on board chemical tankers from time to time. He joined to the Istanbul Technical University as a Research Fellow in 2006. He graduated from the Department of Maritime Transportation Engineering (MEng.) in 2007. In 2007, he was awarded for the MSc/PhD scholarship at Kobe University by the Ministry of Education, Culture, Sports, Science and Technology of Japan. He moved to Kobe, Japan and completed his Master of Science degree at the Department of Maritime Logistics, Kobe University in 2009. In 2010, he published one of his major works on *Fuzzy Integrated Logical Forecasting (FILF)* in *Expert Systems with Applications*, Elsevier. He originally developed the FILF family models of fuzzy time series. At the time of preparing the present document, he was proceeding for the fulfilment of the Doctor of Philosophy in maritime economics at the Graduate School of Maritime Sciences, Kobe University.
His research interests are in *Economic theory of shipping business*, *Behavioural finance*, *Forecasting science*, *Econometric modelling*, *Fuzzy extended time series analysis* and *Decision support systems*. He has published many journal papers and conference papers. He reviewed several papers for "*International Journal of Forecasting*", "*Transportation Research Part E: Logistics and Transportation Review*", "*Technological Forecasting and Social Change*", *"Journal of the Operational Research Society-JORS"*, "*International Journal of Fuzzy Systems*", among others.
He is married to Kazue Duru (Taguchi) with two sons.

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Chapter 1

Introduction

The role of maritime transport is of utmost importance and is an essential part of the global economic system. From the raw materials to the finished goods, a series of transport services is required to ensure the flow of materials and products. In the last few decades, the inter-modality is frequently discussed and the improvement of land-based systems, including transport services, is an emergent debate in transport research. Among the modes of transport, the uniqueness of maritime transport is of indisputable importance. In terms of volume, maritime transport accounts for 90% of the entire transport supply of the world; it is also the most demanded mode of transport in the regional scope. Besides its uniqueness and the strong demand for maritime transport services, maritime transport is a highly technical and complex business. It is very difficult to regulate the shipping business because of its transnational nature. Economist Alfred Marshall (1919) stated that

> *The problems of the shipping industry are remarkably alike for their magnitude, and for the multiplicity and complexity of their detail. The carriage of goods over a certain distance in a certain time and with a certain amount of careful handling is a definite thing from a physical point of view; but, from an economic point of view, it varies with the nature of the route to be traversed; with the changing conditions of demand and supply on that route and on the return journey; and some other considerations. It is therefore not suitable for minute Governmental control, and still less for Government undertaking. But nevertheless Government has*

distinct functions in regard to it, when in a healthy condition, and still more when it has fallen into malaise of any sort.

Marshall (1919) indicates a number of facts existing in the nature of the shipping business, such as the impact of ballast voyage, utilisation and productivity, the diversity and particulars of services and cargoes in addition to the limited control of governmental institutions. His concluding remarks on the condition of ships and shipping services were discussed in the last century and many international treaties were based on these discussions. An international institution named International Maritime Organisation was established in 1948 to deal with the safety of ships and seafarers. Several regional authorities developed Memorandums of Understanding (*e.g.*, Paris MoU) that resulted in improved controls and increased frequency of comprehensive surveys. Under these agreements, the quality of safety management dramatically improved on both the company and country levels. However, the economic issues continue to be of interest to maritime economists and ship investments are still very risky as several problems exist.

The history of economic research of the shipping business goes back to the foundations of economic thought and to the particular literature of the 20th century. As an interdisciplinary field of research, quantitative analysis and forecasting of shipping markets have constituted an attractive research stream in the last 50 years. Most of the research on quantitative analysis of shipping markets has focused on the models for seaborne trade, freight rates and freight derivatives. Studies show that the forecasting of shipping markets appears to be influenced mainly by the trade flow, fleet capacity, shipbuilding schedule, demolitions and industrial production (Tinbergen, 1931; Hawdon, 1978; Shimojo, 1979; Norman, 1979; Beenstock & Vergottis, 1993). The importance of trade flow in the freight market is frequently addressed in several studies.

The earliest studies were published in the decades following World War I by Matsumoto (1929), Tinbergen (1931), Wagemann (1932) and Isserlis (1938). Matsumoto (1929) calculated a freight index for the American lumber trade for the years 1922 to 1929. He also estimated a linear function for trends. Tinbergen (1931) pointed out that fleet capacity, freight rates and shipping deliveries have the same cyclical patterns with some time-lags. He also correlated seaborne trade flow with demand for maritime transport. The model of Tinbergen (1931)

was also revised by Beenstock and Vergottis (1993). They proposed a supply-demand equilibrium model for shipping services. Wagemann (1932) computed the trend and deviations of trade flow indicators in the freight market by using the orthogonal polynomial equation method. Isserlis (1938) calculated trends by taking seven-year moving averages. In the tanker freight market, Koopmans (1939) investigated the relationship between demand and freight, concluding that there is a considerable inelasticity of demand in the tanker market. Another seminal study by Zannetos (1966) examined surplus orders in the tanker fleet by using the price expectation factor. Expectation is an important driver in the tanker market and is mostly affected by spot prices.

Hawdon (1978) proposed both a short and long term model for the tanker market. Major indicators considered in the long term-based model were freight rates, demolition and the shipbuilding market. Demand for a tanker fleet is a function of world oil transportation and trade. Norman (1979) investigated the relationship between shipping service demand and the cumulative Gross National Product (GNP) of the Organization for Economic Cooperation and Development (OECD). The study recommended he analysis of shipping markets based on economic activity. Wergeland (1981) also built a model for the dry bulk market and the positive effects of world trade. Charemza and Gronicki (1981) built a simultaneous equations model for world shipping and shipbuilding sectors.

Strandenes (1986) examined new building ship prices in terms of the interconnection between the new building market and the second-hand ship market. Cullinane (1992) suggests the forecasting of spot freight rates by Box-Jenkins type univariate ARIMA (Autoregressive Integrated Moving Average) models. Beenstock and Vergottis' (1993) study structured a supply-demand model for the voyage charter market for dry bulk and tanker shipments. The co-integration analysis of the second-hand ship markets is investigated in the studies of Hale & Vanags (1992), Glen (1997) and Veenstra (1999). The publication of Veenstra (1999) conveniently provided a wide and detailed review of quantitative studies about shipping markets. Tsolakis *et al.* (2003) applied an Error correction model to second-hand ship markets. The important factors are stated as new building ship prices and time charter freight rates. Kavussanos (1996, 1997) suggested the modelling of time-varying

volatility for dry bulk by ARCH family (Autoregressive Conditional Heteroscedasticity) models. Kavussanos and Alizadeh (2002) investigated the seasonality of tanker freight rates. Recent studies have investigated the freight derivatives market and the relationship with spot prices (Koekebakker *et al.* 2006; Batchelor *et al.*, 2007, among others).

The majority of the studies on the shipping market are confined within a few decades; a limited number of studies discuss the history of economics and economic thought as relates to the shipping business. Therefore, this dissertation contributes to the literature by the establishment of a long-term dry cargo freight index, the criticism of theories based on shipping productivity, utilization of the life cycle theory to estimate econometric models for seaborne trade and the freight market and, finally, a discussion of the impatient capital phenomenon in ship investments.

1.1 Motivation and Scope of Work

In the last few decades, there were many studies that addressed the importance of models and predictions in the dry cargo shipping markets. However, most of these studies are based on the short-term dynamics, limited data and several assumptions. Bankruptcy issues are very common in the shipping business and they indicate the contradictions between historical facts and business practices. During every recession, the media tends to highlight bankruptcies and the negative effects of a slow economy. The dynamics of the dry cargo freight market, however, does not appear to be that affected by the economic cycle as this market has not changed dramatically in the last half century. The traditional business cycle model illustrates the generally accepted rules of the market mechanism. Most investors prefer to purchase ships at the upturn of the market cycle and sell ships just at the end of a peak market. Investors base their decisions on economic forecasts, a popular subject in the media and in the literature. In an academic sense, investors are often faced with basing their decisions on purely subjective factors.

Traditional investment sentiments, supported by statistical data, are discussed in this paper. The mainstream perspective on ship investments causes many problems, such as restructuring outstanding loans, seeking bankruptcy

protection to avoid liquidation in order to continue operations, establishing flexible human resources with term contracts (enormous price swings cause oversupply-low productivity imbalances), among others.

From the evidence of business practices and existing literature, it is indicated that an assessment of dry cargo shipping over a very long term is needed in order to gain a wider knowledge and an overview of the dynamics that have occurred throughout the centuries. Although the quality and availability of data is an issue to be taken into consideration, general trends will be very useful and indicative of long-run fluctuations and useful in structuring ship investments.

This dissertation contributes to the literature by the

- Development of a long term dry cargo freight market index;
- Investigation of economic history and economic thought in the shipping industry;
- An econometric model proposal for seaborne trade and freight market;
- Investigation of the gap between theory and practice on using existing models; and
- An asset management strategy proposal for ensuring the sustainability of business.

Figure 1.1 illustrates the content of this dissertation and the relationship between chapters. The dissertation is twofold: A theoretical analysis and a practical assessment. Chapters 2 and 3 investigate the long term dry cargo freight market index and the economic history of the freight market while Chapter 4 proposes models for seaborne trade and freight rates. Although these three chapters discuss economic theory of dry bulk shipping, there is an existing gap between theory and practice in terms of "rational actor" and "information asymmetry". Therefore, a particular chapter is dedicated to discussing the role of sentiments in shipping asset management and the impatient capital phenomenon. Chapter 4 presents a number of econometric models for business practitioners. On the other hand, there are evidences of neglect of probability and related research in the shipping business. The underlying reason is thought to be based on the business perceptions of short-term or long-term orientation. Chapter 5 peculiarly deals with inconsistencies between market dynamics and business practices.

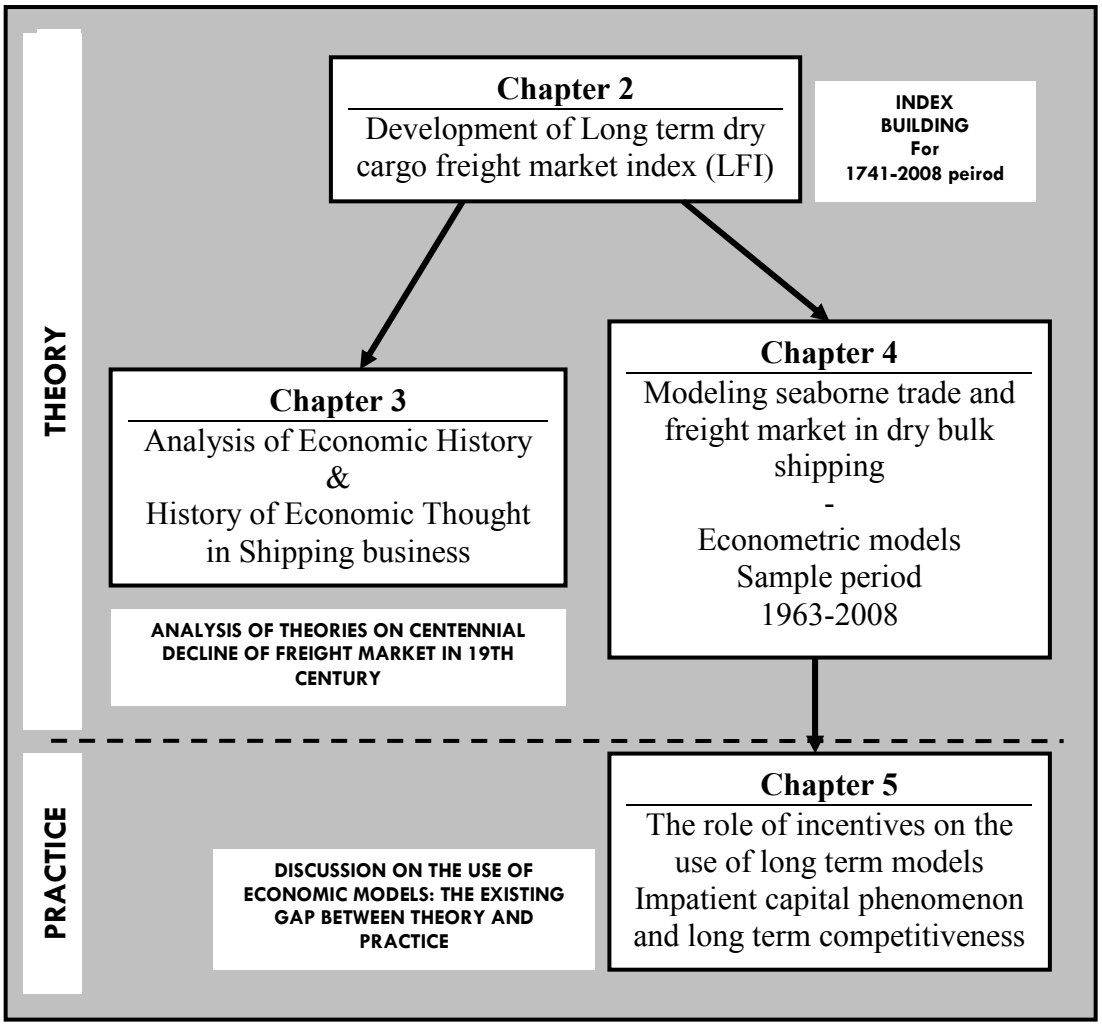

Figure 1.1 The flow chart of the dissertation.

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Chapter 2

Long term freight index

Index measures are widely used by economic and financial institutions for defining a reference as representative of a system. The main purpose of indices is to calculate cumulative effects of a number of indicators *(e.g.*, prices for a given class of goods or services) and to investigate the system *(e.g.*, the market place) by using an index. An index is used for many reasons and system modelling is the most frequent purpose. In the last decade, indexation is a pricing method for long term contracts which defines the price of a product or service based on the level of a reference index. For example, time charter contracts are very common in the shipping business and it is very difficult to compromise on a price under the highly volatile market conditions. In such cases, freight market indexation refers to a dynamic pricing regime which is composed of an initial daily freight rate per day and the reference freight index (*e.g.*, Baltic Dry Index-BDI). The daily freight rate of a subsequent month is calculated by the product of the ratio-to-change value and the last value of the freight rate.

In the literature of shipping economics, various measures of the freight index are proposed and presented (See table 2.1). Several institutions also calculate similar indices for dry cargo and tanker markets (*e.g.*, Baltic Exchange, Tramp Data Co., J.E. HYDE). The Baltic Dry Index (BDI) is one of the freight market indices which is currently fixed daily by the Baltic Exchange in London. BDI is a composite price index of spot and period shipping contracts which is publicly declared as the correct price of fixture; sometimes t can be a speculative price. Recently, the structure of the BDI was revised to include only time domain contracts.

The method of the BDI calculation is criticised by Veenstra and Dalen (2008). They stated that the structure of the BDI consists of a limited number of shipping routes that are defined by a Baltic Exchange panellist even in cases of no reported fixture. Essentially, the structure of the BDI (formerly Baltic Freight Index-BFI or Baltic International Freight Futures Exchange-BIFFEX) has been changed eight times and

today it is composed of prices of a very limited number of routes rather than as it was first presented.

Veenstra and Dalen (2008) reviewed the freight index issue and calculated various alternative indices according to route characteristics and qualitative measures of shipments such as the age of ships. The hedonic index method is also tested according to the technical particulars of contract and ship. This study collected monthly fixtures data for eight years including cargo, port and ship particulars. In the short run, substantial differences are reported when compared with Lloyd's Shipping Economics TTC index and the Maritime Research Inc. index. However, the researchers indicated that there is no particular difference in the long run evaluation (annual base series). Different methods of calculation validate similar long run fluctuations while disparity exists in short run results.

Index measures and their formulations are of interest to economists and several alternative methods are proposed. However, these methods are based on easy-to-access and high volume transactions which can be collected competently without confidentiality boundaries. For example, price quotations in stock markets can easily be obtained and price-volume statistics may ensure such kind of tailor-made index measurements. In the case of the freight market index, data collection is a challenging issue since many ship-owners prefer to maintain confidential records. The existing fixture data is usually published by intermediaries (*i.e.*, shipbrokers) and the accuracy of data generally cannot be tested or confirmed. One of the rationales to explain short-term disparities is based on the fact that the quality of fixture data is somewhat speculative. Another probable reason is based on the inequality of the sample of data that is employed. Therefore, short-term model estimations of freight markets (notably the dry cargo market) may differ in terms of the coefficients due to the data dissimilarity. On the other hand, it does not discard or invalidate the long term significance of freight indices.

The validity of the long term freight index series is of more interest in terms of the objectives of the present study. For instance, Klovland (2006, 2008) and Mohammed and Williamson (2004) presented several defects on the Isserlis freight index (Isserlis, 1938) and attempted to revise a part of it. While Klovland (2008) improved on the data missing drawbacks of the Isserlis Index, Mohammed & Williamson (2004) provided route and cargo specific deflators and extended them with current data until 1950. One of the main critiques is that the Isserlis Index is simply based on averaging of available freight rate data. However, as presented by Isserlis (1938), the data series has various gaps and, in some periods, a specific route was excessively used in the final results. The results of

Klovland (2008) and Mohammed and Williamson (2004) indicated analogous fluctuations in the long run, but level and trend differences were noted. Although these efforts improved a part of the entire Isserlis Index, they did not completely enclose the data. Therefore, the Isserlis Index is still the unique source of freight rate data for a particular term between 1913 and 1921 which consists of the WWI period and it cannot should not be ignored in the continuity of a dataset.

Recent evidence reveals that previous and current index measures can be correlated to establish a single index for long term data. This dissertation attempts to construct a composite freight index based on averaging percentage changes of an existing series for a particular year in the entire dataset and calculating the index by using an initial value for 1741.

2.1 Data description

In shipping history, a number of scholars used freight index measures to investigate several concerns. Different years in the last three centuries were used for the studies. Table 2.1 shows the details of the freight rates and the index series calculated by scholars, institutions or companies. The first two datasets are based on spot service prices per metric ton of coal and grain cargo which are carried in the Tyne-London and US-British routes respectively. The remaining dataset is the index series calculated by other institutions. There is no alternative dataset between 1741 and 1872 and average spot freight rates of existing data are used for this term. Particularly, the US-British route has one of the highest volumes of shipping during this term that North (1958) investigated. Therefore, the intended routes represent the average level of freight rates.

Deflators which are used in the present paper are also presented in Table 2.1. Deflators are used to extract price inflation from freight rate index. Brown-Hopkins price index of consumables is used for 1741-1954 term and the retail price index (RPI) of UK is utilised for 1955-2008 period. Brown-Hopkins index is a unique price index particularly for the 18th and 19th centuries. The RPI is also very unique price index for the second half of the 20th century. The series of freight rates and indices cover a part of long term data and overlap each other in some periods. For instance, the series of Harley (1988) and the American export freight rate index overlap each other in the period of 1869-1872, and the U.K. Chamber of Shipping freight index and Norwegian Shipping News (NSN) voyage freight rate indices overlap between 1948 and 1969. These overlaps of freight rate indices can be used to correlate subsequent series.

Table 2.1. Description of data which is used for establishment of LFI.

Term	Description	Code	Source
Freight rates & indices			
1741-1872	Tyne - London Coal route freight rate series.	TLCH	Harley (1988)
1741-1872	U.S. - British Grain route freight rate series.	USGH	Harley (1988)
1790-1815	British Import Freight Rate Index series.	BIFRI	North (1958)
1814-1910	American Export Freight Rate Index series.	AEFRI	North (1958)
1869-1936	Isserlis Composite Index series.	ISSCI	Isserlis (1938)
1869-1913	New UK Index series.	NUKFI	Klovland (2002)
1898-1913	Economist's Freight Index series.	ECONI	Yoshimura (1942)
1921-1939	Economist's Freight Index series.	ECONI	Yoshimura (1942)
1920-1969	UK Chamber of Shipping Index series.	UKCSV	Isserlis (1938), Hummels (1999)
1948-1997	Norwegian Shipping News Voyage Freight Index series.	NSNVI	Hummels (1999)
1948-1990	Norwegian Shipping News Time Charter Index series.	NSNTI	Hummels (1999)
1952-1989	UK Chamber of Shipping Time Charter Index series.	UKCST	Hummels (1999)
1986-2008	Baltic Freight Index / Baltic Dry Index series.	BFI/ BDI	Baltic Exchange Co., London; Hummels (1999).
1988-1996	German Ministry of Transport Time Charter Index series.	GMTTI	Hummels (1999)
1991-2007	Lloyd's Shipping Economist (LSE) Tramp Index series.	LSEFI	LSE Magazine various issues.
Deflator series			
1741-1954	Price of Composite Unit of Consumables.	PUCON	Brown & Hopkins (1956)
1954-2008	RPI: Retail Price Index of U.K.	RPIUK	Office for national statistics, U.K. (www.statistics.gov.uk).

Table 2.2 presents a correlation matrix of several overlapping series. After 1869 there is a high correlation coefficient in the series. The Isserlis Index, he American Export Freight Index, the Economist's Index and the U.K. Chamber of Shipping Index usually indicate the same fluctuations in pre-WWI and post-WWI periods (Fig. 2.1). The series of the second half of the 1900's are highly correlated (over 0.90 correlation coefficient in general). Most of the indices before 1950 consist of a large number of routes because of the lesser size of shipments. However, the recent industry indices originate from large shipments which cover most of the world dry bulk seaborne trade. As questioned by Veenstra and Dalen (2008), these indices contrast in short term fluctuations. For example, the BDI Index is an estimated price of panellist companies when there is no reported fixture, so it may be trended unnaturally.

Table 2.2. Correlation matrix for consequent freight rates/ indices.

Included observations: 1991-2007, 17 years.

Correlation	LSEFI	BDI
LSEFI	1.00	
BDI	0.99	1.00

Included observations: 1986-1997, 12 years.

Correlation	NSNVI	BDI
NSNVI	1.00	
BDI	0.98	1.00

Included observations: 1952-1989, 38 years.

Correlation	NSNVI	NSNTI	UKCST
NSNVI	1.00		
NSNTI	0.94	1.00	
UKCST	0.88	0.95	1.00

Included observations: 1948-1969, 22 years.

Correlation	NSNVI	NSNTI	UKCSV
NSNVI	1.00		
NSNTI	0.97	1.00	
UKCSV	0.96	0.99	1.00

Included observations: 1921-1936, 16 years.

Correlation	ISSCI	ECONI	UKCSV
ISSCI	1.00		
ECONI	0.98	1.00	
UKCSV	0.98	0.98	1.00

Included observations: 1869-1910, 42 years.

Correlation	ISSCI	AEFRI	NUKFI
ISSCI	1.00		
AEFRI	0.96	1.00	
NUKFI	0.95	0.97	1.00

Included observations: 1814-1872, 59 years.

Correlation	USGH	AEFRI	TLCH
USGH	1.00		
AEFRI	0.77	1.00	
TLCH	0.96	0.76	1.00

Included observations: 1790-1815, 26 years.

Correlation	TLCH	USGH	BIFRI
TLCH	1.00		
USGH	0.89	1.00	
BIFRI	0.70	0.90	1.00

For our long term index purposes, short term disparities are widely eliminated by the averaging of daily prices on the base of a particular year. A correlation analysis is carried out to compare long term disparities on BDI of the voyage base and T/C base market prices (Table 2.3). The voyage base prices (USD per ton) of Hampton Roads-ARA,

Queensland-Japan, Richards Bay-Japan and Tubarao-Rotterdam routes are selected as proper data is available from Clarkson Ltd[1]. As T/C base contracts, Capesize, Panamax, Supramax and Handysize bulker rates are compared[2]. Results indicate a very high correlation between the BDI and voyage or time domain prices.

Although freight index data is combination of spot or period market prices, the presented correlation matrices indicate that both spot and period market prices expose identical fluctuations for annual basis. Under these evidences, the existing dataset does not undervalue the generality of LFI.

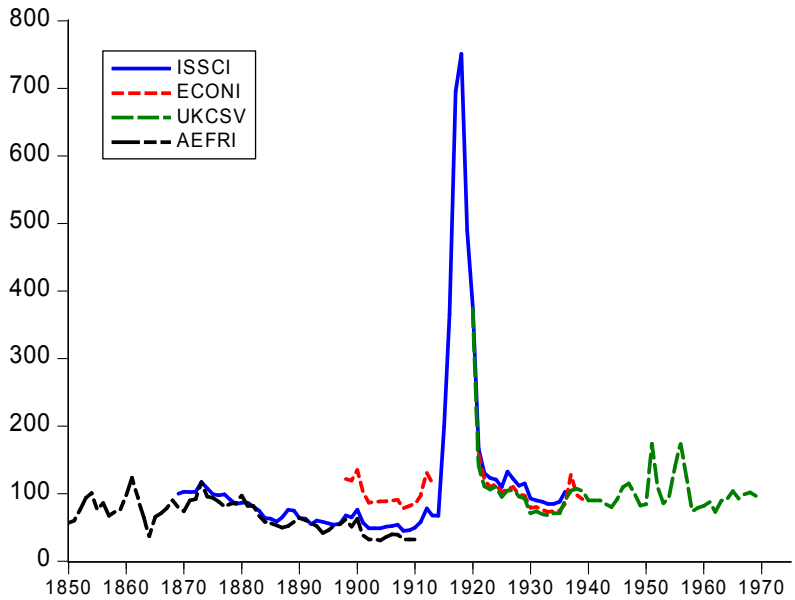

Figure 2.1. ISSCI, ECONI, UKCSV and AEFRI between 1850 and 1970.

[1] Hampton Roads – Amsterdam, Rotterdam, Antverb (ARA), Coal shipped by Panamax size vessel. Queensland – Japan, Coal shipped by Capesize vessel. Richards Bay-Japan, Coal shipped by Capesize vessel. Tubarao-Rotterdam, Iron Ore shipped by Capesize vessel.

[2] Capesize: 80kDWT and over; Panamax: 55kDWT-80kDWT; Supramax: 45kDWT-55kDWT; Handysize: 10kDWT-45kDWT (limits of sizes are indefinite, but widely accepted values).

Table 2.3. Correlation matrix. BDI index versus various voyage base and time charter (T/C) rates.

Included observations: 1991-2008, 18 years.

Correlation	Capesize T/C	Handysize T/C	Handymax T/C	Hampton Roads - ARA Coal Panamax	Panamax T/C	Queensland - Japan Coal Capesize	Richards Bay - Japan Coal Capesize	Tubarao - Rotterdam Iron Ore Capesize	BDI
Capesize T/C	1.00								
Handysize T/C	0.99	1.00							
Handymax T/C	0.99	0.99	1.00						
Hampton Roads - ARA Coal Panamax	0.99	0.99	0.99	1.00					
Panamax T/C	0.99	0.99	0.99	0.99	1.00				
Queensland - Japan Coal Capesize	0.99	0.99	0.99	0.99	0.99	1.00			
Richards Bay - Japan Coal Capesize	0.99	0.98	0.99	0.99	0.99	0.99	1.00		
Tubarao - Rotterdam Iron Ore Capesize	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	
BDI	0.99	0.98	0.99	0.99	0.99	0.99	0.99	0.99	1.00

2.2 Index calculation

Indices mentioned above are turned to ratio-to-change data which denotes percentage fluctuations in itself. The beginning of the series (1741) is defined as 100 and subsequent years are calculated as year-to-year average changes of available series for the year *t*. The long term freight index, *LFI*, is calculated as follows:

$$LFI_t = \frac{\frac{\Delta^1 x_{1t}}{x_{1t-1}} + \ldots + \frac{\Delta^1 x_{nt}}{x_{nt-1}}}{n} LFI_{t-1} \qquad \text{(eq.2.1)}$$

$$LFI_1 = 100$$

where Δ is the differencing operator for index series, x_{nt}, for year *t*. The first differences of indices are divided by x_{t-1} value for calculating percentage change. The average value of ratio-to-change is applied to previous year LFI_{t-1}. LFI series is deflated by Brown-Hopkins composite price index for 1741-1954 periods and by retail price index (RPI) of U.K. for 1954-2008 periods (Deflators are presented in Table 2.1) to eliminate the trend based on price inflation. The final deflated LFI series is presented in Fig. 2.2 (LFI series is available in Appendix A).

The LFI series indicates two important super cycles which existed in the term of WWI and in the recent market conditions. Although LFI series is a deflated data, freight markets seem to be affected more than price fluctuations. A long term cycle appears for around 160 years between 1741 and the beginning of the 1900s. The peak of this cycle is around the 1810s with a sharp decline after that for a long term period of up-trended market that is evident until WWI. North (1958) received a Nobel Prize for the publication of his seminal work about the interactions of transportation cost and world economics. A critical conclusion of that study was that shipping transportation costs incur a long term decline because of the productivity gains sourced from backhaul shipments. Shipping transportation was based on one-way traffic throughout the centuries until after the Industrial Revolution in Europe and America when backhaul cargoes became available. Although seaborne trade dramatically increased, ships started to carry cargoes in both directions, resulting in a huge increase in productivity because they did not have a long ballast voyage returning to home port. Productivity gains affected shipping freights until the beginning of the 1900s between U.K. – North America, U.K.-East India, among others. Another notable effect arose from the technological improvement in ship propulsion.

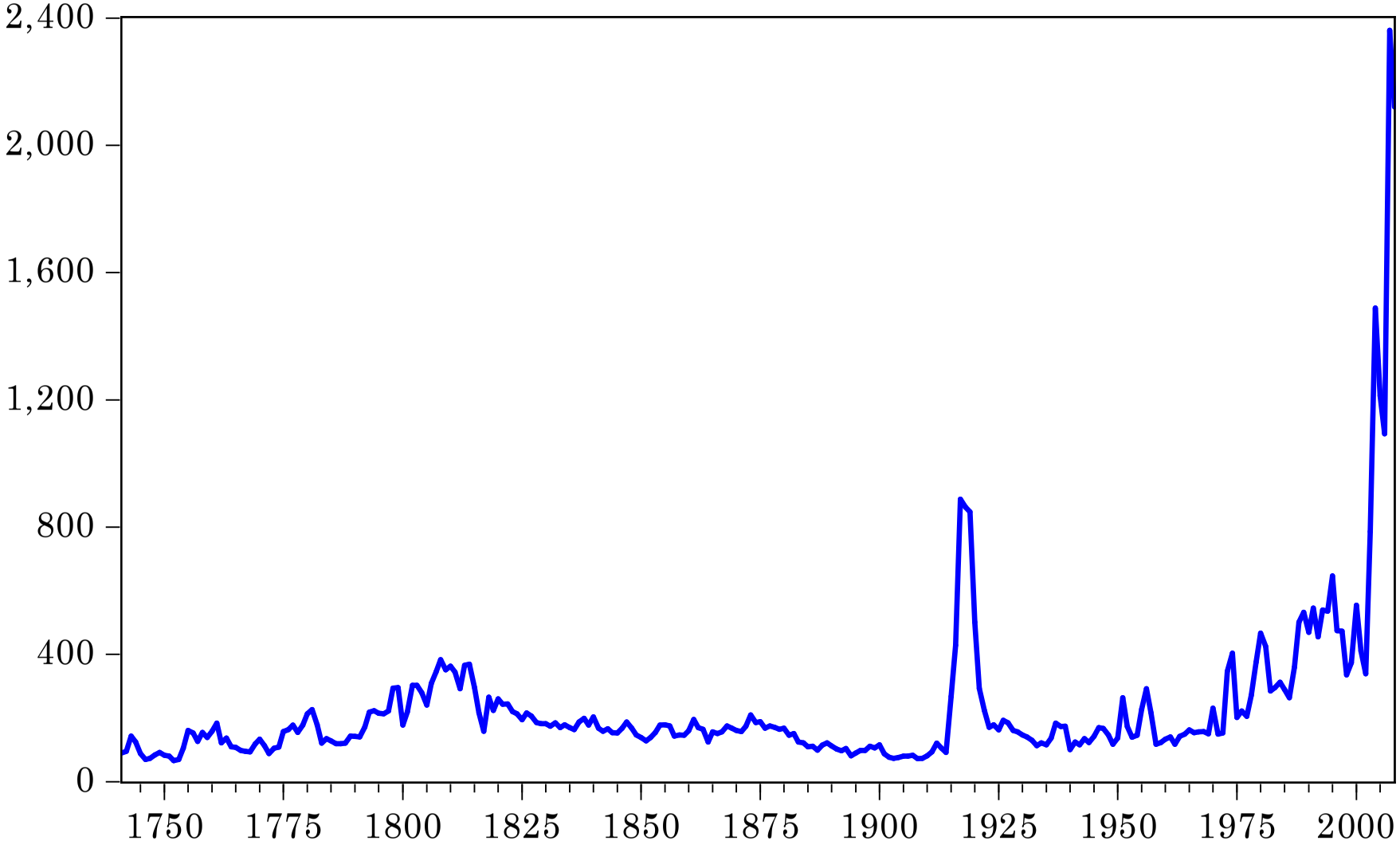

Figure 2.2. The LFI series (left scale) between 1741 and 2008.

By the 1800s, world merchant fleets started to convert to steam powered ships. Steam power resulted in a decreasing number of crew members, lower crew qualifications and higher navigating speeds. Increasing cargo carrying capacity was another critical improvement. For a detailed discussion of productivity in shipping, see Harley (1988, 1989) and Mohammed and Williamson (2004).

At the beginning of the 1900s, shipping markets were influenced by WWI and two-way traffic probably reached its capacity. Even though diesel engines were used in commercial ships, there was no considerable decline of freight rates in the long term. Although warfare affected world economics in the last century, the biggest effect arose from increasing innovations and merchandise trade. In various parts of the world, higher growth rates resulting in increased population (especially the baby boom in the second half of the 1900s) along with a higher quality of living resulted in greater consumer economics. While ship technology fostered massive developments on propulsion, crew size, and cargo capacity, world merchandise trade also increased enormously.

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Chapter 3

Economic history of dry cargo freight market

The importance of seaborne trade is indicated by several studies (Metaxas, 1971; North, 1958; Jacks, Meissner and Novy, 2009, among others). The value of seaborne trade is calculated as how much cargo is being transported over the distance between the two seaports. Productivity of shipment will depend on quantity of cargo and navigating distance. These two main items are affected by various factors including economics, politics, geographical boundaries, warfare, weather conditions etc. Increased stability on global political arena triggers trading activities and the shipping industry steps up to enhance facilities and capacities. On the other hand, seasonal factors may change direction and boost wider navigating durations and distances (i.e. hurricanes, tsunami). However, productivity changes in the long run are based on more extensive elements of world merchandise trade. Such an analysis should be performed from a broader perspective which is enriched by all economic, political, technological and historical domains.

One of the critical instruments of this analysis is proper and quality statistics on seaborne trade. In the literature of economic history, statistics for shipping volume and transportation costs are presented and investigated by various studies (Isserlis, 1938; North, 1958; Harley, 1988, among others). By the presentation of proper data, we concluded that shipping played a key role in economic development. The reasons for freight rate fluctuations are discussed in order to understand such economic interactions and results.

Foreign trade balance is generally based on import and export activities. However, there is an unaccounted item, which is the service of overseas

transportation (Isserlis, 1938). It is no doubt that shipping is a key indicator in international trade and its cost is a part of retail prices. Fluctuations on shipping freights still influence prices of finished goods as they did previously. The structure and terms of shipping freights are classified into two main divisions, which are voyage domain pricing and time domain pricing. Voyage domain pricing – named voyage charter – includes all fixed and variable costs of shipment such as operation costs, port dues, agency fees, brokerage commissions, financing costs etc. On the other hand, time domain pricing – named time charter – only consists of fixed costs such as financing costs, daily mandatory expenses (i.e. manning, victualling) and so on. If a trading price of a product is declared as CIF (cost, insurance, freight), it also reflects transport cost factor to some degree.

Various shipping companies, exchanges and governmental institutions keep freight rate records and several freight indices are published for average of the market and for a specific ship size. History of freight rate is investigated by many scholars and the theories on shipping productivity are indicated according to several hypotheses (Harley, 1988; North, 1958; Mohammed and Williamson, 2004). Particularly on long distance transportation, shipping cost is as crucial as it was in the 18th and 19th century. However, capacity of shipment was highly limited, speed of service was tied to proper seasonal winds and cargo traffic in a single way took longer than in both directions (i.e. Atlantic trades). Under the conditions of these various factors, shipping service evolved. Freight rates are broadly affected by the particulars of maritime transportation characteristics.

The present research discusses shipping productivity and compares economic thinkers based on their inferences and contributions. Furthermore, the effect of life expectancy on shipping freight rates is discussed.

3.1 Seminal works and theories

3.1.1 Preliminary works of Leon Isserlis

In 1938, Leon Isserlis published his outstanding study "Tramp shipping cargoes and freights" and provided one of the noteworthy sources of freight market fluctuations. As an important statistician, he served at the Chamber of Shipping, UK and compiled several freight rate data which mainly benefited

Angier (1920). His assessments pointed out cycles of warfare in the Franco-German War, the African War and WW I. Although Isserlis supplied freight rate index for a critical turning point of the world, these indices have been criticised by many scholars due to the lack of suitable number of fixtures and unnecessarily overweighting of some routes (Mohammed and Williamson, 2004; Veenstra and Dalen, 2008 among others). Gathering this information with previous records and inferring reasons for longer term fluctuations remained for contemporary researchers such as North (1958) and Harley (1988).

3.1.2 Institutional improvement theory of Douglass North

Douglass North (1958) attempted to extend the recent freight market knowledge by superimposing freight rate of British Import and American Export data. According to him, the decline of freight rates in the 19th century was formed by three main factors of shipping productivity: *Increasing efficiency of freight markets*, *Technological innovations* and *Development of external economies*.

The 19th century is crucial in terms of communication technology. Increasing availability and speed of telegraphy facilities ensured proper and timely communication among ship-owners, charterers and also masters of ships. Imperfect market condition (Fama, 1970) was mitigated and uniformity in the movement of rates was partly maintained by increasing availability of overseas negotiations.

Another indication is reported with respect to technological improvements. Both steam power usage and metallurgical revolution improved stability for higher carrying capacity ships and rapid service even in the lack of winds for sail propulsion. Resistance for stronger sea conditions is obtained. Hull and engine technologies led to safer navigation and prevented loss of property (i.e. due to piracy attacks).

North (1958) also mentioned an important aspect of the post-discovery term for the world, which is the presence of cargoes for returning to homeports named backhaul cargoes. After the industrial revolution, both in North American and Asian destinations, exporting products were supplied and backhaul cargoes could be carried on a highly competitive price, compared with ballast voyages of

empty cargo holds. New regions expanded population and income with new export trades and further export products were implemented.

North (1958) extended our knowledge about the long term decline of freight rates in the 19th century and collected freight rate data till the beginning of the 20th century. Later, these data were judged by Harley (1988) because of the technical particulars of cotton loads. The following section will address this argument.

3.1.3 Technological improvement theory of C. Knick Harley

C. Knick Harley (1988) pointed out that the main source of increasing productivity is metallurgical development, which was broadly improved by industrial revolution. His argument concluded that technological improvements provided stronger hull designs (i.e. metal ships), increased capacity of ships and service speeds (i.e. steamship technology). Therefore sea transport ensured productivity gains due to technical performance.

Harley (1988) indicated that North's freight rate data for cotton trades has an important shortcoming since the packaging technique of cotton bags has changed. Compressing cotton into bags provides additional transport volume and the cost of carriage is lesser per ton of cargoes. In this way, capacity decreases from 20-25 pounds to 8-12 pounds per cubic foot. It is almost twice that of previous measures. North's evidence for the sharp decline at the beginning of the 19th century arose mainly from such technical metamorphosis. In spite of a long term moderate decline in the rates, it was not expected to deepen – as indicated for the first half of the 1800s.

Harley (1988) summarises reasons for freight rate decline into six items:

- Innovation of steamships against the sailing ships.
- Opening of Suez Canal and superiority of steamers on Asia-Europe transport. Larger sailing ships are usually not suitable for Red Sea navigation because of lack of proper winds.
- Metallurgical technology provided safer ship design, decreasing number of crew, lessening loss of ships, and increasing capacity of cargo space.

- Increasing productivity on steel industry reinforced the shipbuilding industry for cheaper production and stronger and larger designs.
- Packaging technology ensured increasing use of transport volume.
- Presence of tugs supported manoeuvrings of larger steamers in the port.

Furthermore, there is an unavoidable factor of *warfar*e. The 18th century witnessed substantial warfare including the War of the Austrian Succession (1740-1748), the Seven Years War (1756-1763), the War of American Independence (1776-1783), and the Wars of the French Revolution and Napoleon (1793-1815). Compared with the 19th century, the 18th century had a stronger effect of warfare on international trade. Therefore, it was not safe for navigation, and increments for war risks incurred increasing rates of shipping transport.

3.1.4 Recent contributions

Kaukiainen (2001) reported research about the transmission of information and influences of electric telegraph. After the 1820s, information transfer speed and coverage were broadly developed and communication has been available for intercontinental transmissions as well. Increasing distribution of information ensured efficient use of commercial news, meteorological records and port facilities. Thus, circulation of freight rates and nominated cargoes were easily performed in several locations including both sides of Atlantic and Indian trades. "*Communication technology*" is noted, once more, as one of the critical reasons for freight rate decline.

O'Rourke and Williamson (2002) examined the "*Globalisation*" issue including a long history of international trade. About the freight market, they pointed out the globalisation effect and the increase in international trade. By the establishment of free trade and commercial collaboration between various trading routes, efficiency of markets was increased competitiveness in shipping service.

Jacks (2005) investigated international commodity market integration in the Atlantic economy under the global developments in the 19th century. He reported issues concerning price fluctuations and trade costs. An important indication was presented about the freight market. Freight rates slackened in

the 19th century because of the increasing bilateral trades among the Europe-America and Europe-Asia routes as well as technological developments. During several centuries, trade flows were characterised by the single direction transport and ballast voyages (empty cargo holds) were steered for backing to product sources. The industrial revolution influenced many countries including developing continents such as Americas and Asia. Manufacturing facilities were developed and products were available for exporting. Merchant ships were loaded on both directions and free spaces were utilised well. "*Bilateral utilisation*" provided reduction of cost for shipping.

3.2 Overview of contributions

One of the most cited issues in economic history is the decline of freight rates in the 19th century and its influences on global trade. Although wholesale prices increased in the same period, shipping costs distinctly exposed a long term decline. Many economic philosophers developed theories about the decline of freight rates and they mainly indicated the rise of shipping productivity for several reasons. In order to build a wide perspective, this study outlines and extends these theories.

First of all, the political, economic and structural differences between the 1700s and the 1800s should be defined. Analysis is based on investigation of 'efficiency of freight markets' and 'technological capability of shipping service facilities'. Although concentration is on two main issues, one more item should be expressed, which is the opening of Suez Canal.

As indicated in Table 3.1, the 20th century ensured several technological improvements and the freedom of trade was extended in world wide circumstances. Even these contributions were quite more than in the previous century. However, a possible decline of freight rates was not recorded in the long term. These indications lead us to review the great recession phenomenon with other evidences. The following section points to this issue and introduces life cycle theory and its inferences.

Table 3.1. Comparison of leading factors between centuries.

Factor	1800s	1900s
Trading independence	Free trade policy of England (1849).	Trading is broadly free in worldwide.
Marine technology	Steam power and metal hull	Diesel engines and higher propulsion power, very large carriers, electronic navigation, automatic cargo handling, satellite communication, higher speed, self-manoeuvring by thrusters, among others.
Communication technology	Telegraph	Telephone (although it is invented on the last quarter of 1800s, practically and widely used after 1900s), satellite systems, internet, electronic mails, P2P internet phones, among others.
Trading routes	Multilateral trading.	Multilateral trading. World wide, unlimited trading.
Transport geography	Suez Canal opening.	Various sea canals were constructed including Panama Canal.

3.2.1 Efficiency of Freight Markets

Concerning the condition of free trade, Navigation Acts (1660 and 1696) of the British Empire have critical importance. Navigation Acts regulate shipping from and to British states. According to the Acts;

- Only British ships could transport imported and exported goods from the colonies.
- People who were allowed to trade with the colonies were only British citizens.

- Commodities such as sugar, tobacco, and cotton wool which were produced in the colonies could be exported only to British ports.

These regulations restricted flexibility of the fleet and discriminated other countries' fleets. Therefore, the available shipping fleet term is different than today. Although probably there is suitable number of tonnages, supply of shipping service is partly regulated. The case of Navigation Acts continues till the end of the 1700s. In the second half of the 18th century, the British had fallen in several wars and the Navigation Acts were loosened. In spite of the official declaration of free trade in 1849, shipping service gained its freedom by the revolutions.

From the 18th century to the 19th century, one of the critical discriminations of sea trade was collapsed. The effect of Navigation Acts presumably can not be avoided. Notably, the Napoleonic Wars dissolved the discrimination and both Atlantic and Levant trades gained competitiveness. The downturn of the Ottoman Empire also contributed to that by the liberation of Levant trading routes.

Another important improvement arose from the *'Bilateral trading pattern'*. Particularly in the Atlantic case, shipping service was mainly employed on single-way trades from Europe to Americas before the 19th century. However, the Industrial Revolution brought several opportunities for Americas to improve manufacturing activities, while external economies contributed to transportation industry. The technological improvements of the Industrial Revolution (which will be discussed in the next section) ensured the production of some backhaul cargoes from Americas to Europe and from Indies to Europe. Ships were chosen to be loaded for backhaul routes at a competitive price. Freight rates would be balanced on both directions day by day. Marginal discounts existed on long distance shipments.

3.2.2 Technological Capability of Shipping Service Facilities

By the Industrial Revolution, shipping industry had gained productivity through three main tracks: the first was the development of steam power on

merchant ships, the second was the development of steam power on manufacturing industries, and the third was metallurgical innovations.

Steam power provided an exclusive superiority, and ships were available to navigate more safely and rapidly with increasing cargo capacity. It was very valuable for both Atlantic and Indian routes. By the steam powered industries on both sides of Atlantic, ships were loaded for both directions. Manufacturing and export products have been raised in Americas and empty spaces of ships could be loaded with reasonable low costs. Metallurgical improvement of hulls provided larger, stronger and higher capacity merchant fleet. These ships were also less costly in the manning. Compared with a highly specialised sail ship operation, metal steam ships are easy to operate and crew size declined.

Communication technology is another critical improvement which develops efficiency of freight markets by exchanging commercial information. By the 1800s, port and shipping news were distributed more quickly and intercontinental telegraph communication increased competitiveness of negotiations. Meanwhile, both ports and fleet were better utilised.

One of the most fascinating geographical technologies should be the opening of the Suez Canal. In 1869, the Suez Canal had begun service for merchant shipping and the canal provided shorter voyages to Indies. However, in the time of opening and later during the closure issues of the 20th century, effects of Suez canal was not larger than a regular freight rate cycle.

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Chapter 4

Implementation of life cycle theory for dry cargo freight markets

The volume of consumption is the key driver of the trading and transport business. Based on the volume of consumption, the price of goods and services is defined accordingly. Since the maritime transport is the unique mode of transport for the most of the products and regions, the cost of shipping is reflected in the prices of finished goods. Therefore, shipping freights and wholesale prices have a strong relationship in the global economy (Metaxas, 1971).

The effect of population is somewhat complicated since many countries with high population can not contribute to the development of the wealth of nation. The definition of consuming population refers to people with surplus income and satisfaction at fundamental quality of life. Consuming potential of population depend on wealth and quality of life among the whole members of community. Life expectancy is one of the most proper indicators of life quality and wealth.

Life expectancy is used for many econometric models and it defines several economic dynamics. Fogel (1994)(Nobel laureate in economics-1993) pointed out effects of decreasing mortality and increasing life expectancy on economic growth and these are frequently used for long term modeling and analysis of economic growth (Barro, 1996; Sachs and Warner, 1997; Bloom and Sachs, 1998; Bloom, Canning and Sevilla, 2004, among others). Bloom, Canning and Sevilla (2004) presented a model of economic growth and it is reported that life expectancy is a statistically significant driver of increase in production output among 104 countries. The opinion of dynamics between life expectancy and economics was a pioneering step in economic history and later the novel research field, *cliometrics*.

Bloom and Canning (1999) express four main reasons for defining life expectancy as an economic indicator:

"*Productivity. Healthier populations tend to have higher labor productivity, because their workers are physically more energetic and mentally more robust. They suffer fewer lost workdays due to illness or the need to care for other family members who have fallen ill.*

Education. Healthier people who live longer have stronger incentives to invest in developing their skills, because they expect to reap the benefits of such investments over longer periods. Increased schooling promotes greater productivity and, in turn, higher income. Good health also promotes school attendance and enhances cognitive function.

Investment in physical capital. Improvements in longevity create a greater need for people to save for their retirement. Insofar as increased savings lead to increased investment, workers will have access to more capital and their incomes will rise. In addition, a healthy and educated workforce acts as a strong magnet for foreign direct investment.

Demographic dividend. The transition from high to low rates of both mortality and fertility has been dramatic and rapid in many developing countries in recent decades. Mortality declines concentrated among infants and children typically initiate the transition and trigger subsequent declines in fertility. An initial surge in the numbers of young dependents gradually gives way to an increase in the proportion of the population that is of working age. As this happens, income per capita can rise dramatically, provided the broader policy environment permits the new workers to be absorbed into productive employment."

Fogel (1986) collected the life expectancy data for the U.S. population, which is also calculated by several institutions (e.g. United Nations) for many countries. However, it is very difficult to collect data for the period before the 1900s. The data presented by Fogel (1986) is the sole source of the life expectancy data for that period. Although the life expectancy data is available for the U.S. population, it has generality for the rest of world in terms of the trading volume of U.S. and its impacts on export-import activities of others. The export-import volume of the U.S. is one of the leading factors in global economics since the 1700s. In the recent statistics, U.S. is the most importing country in the world and it is the second biggest exporter just behind China. The U.S. is also on the top of exporting volume of China. Under these indications, the U.S. is the top customer for shipping services and the particulars of the U.S. consumer population is a leading indicator for entire shipping markets as

well as the world economy. According to the statistics of United Nations Population Division, the correlation between life expectancy data of U.S. and the average of the world is 0.95 which indicates the representative power of U.S. data for the rest of the world (Dataset is presented for the average of five-year intervals between 1950 and 2005).

The life expectancy data of Fogel (1986) and the U.N. are associated to establish the long term single dataset (at the age of 10 for the U.S. population) and it is compared with the LFI series. Figure 4.1 illustrates both series and a co-trended behaviour is indicated. Although series are very long term dataset, the turning points have similarities with a time lag. The length of time lag is around 20-30 years for the 18th - 19th centuries and the reason of such time lag is thought to be based on the maturity of life expectancy for consuming power. The existing life expectancy data is available for the age of 10 years. Therefore, the most consuming ages such as the 20s or 30s have 10-20 years time lag with the intended data.

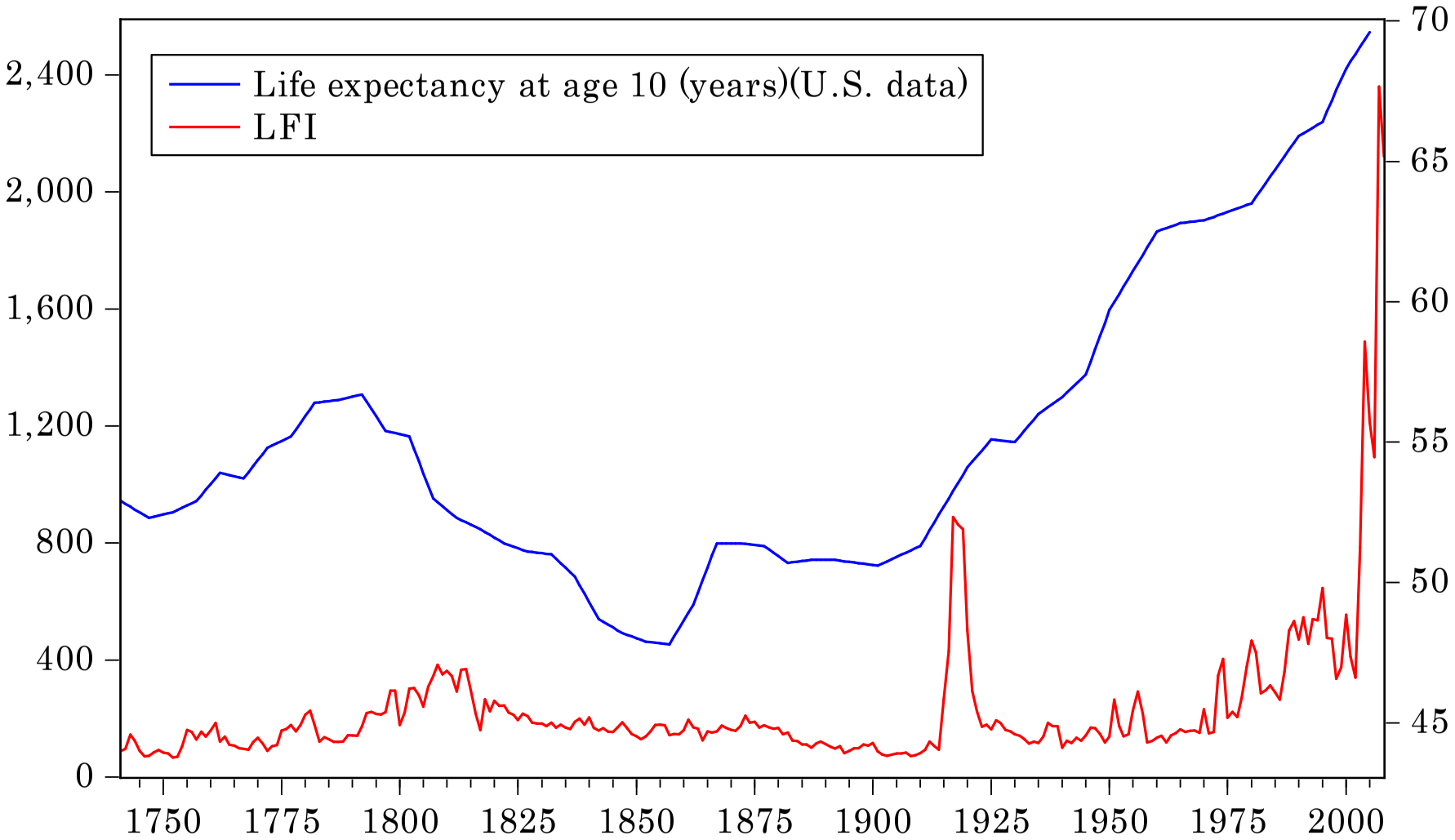

Figure 4.1. LFI (left scale) and Life expectancy (right scale in years)(at age 10, U.S.) between 1741 and 2008.

In Figure 4.2, WWI effects are treated by interpolation between pre-war and post-war levels and correlation coefficient is calculated between LFI and 23 years lagged life expectancy series. Correlation is found around 0.76. Life expectancy provides some leading signals for long term movements of world economy and also for long term changes in shipping freight rates of dry cargo. Acemoglu and Johnson (2006) investigated life expectancy as an indicator of GDP development and pointed out that increasing life expectancy triggers increasing population and rapid economic growth.

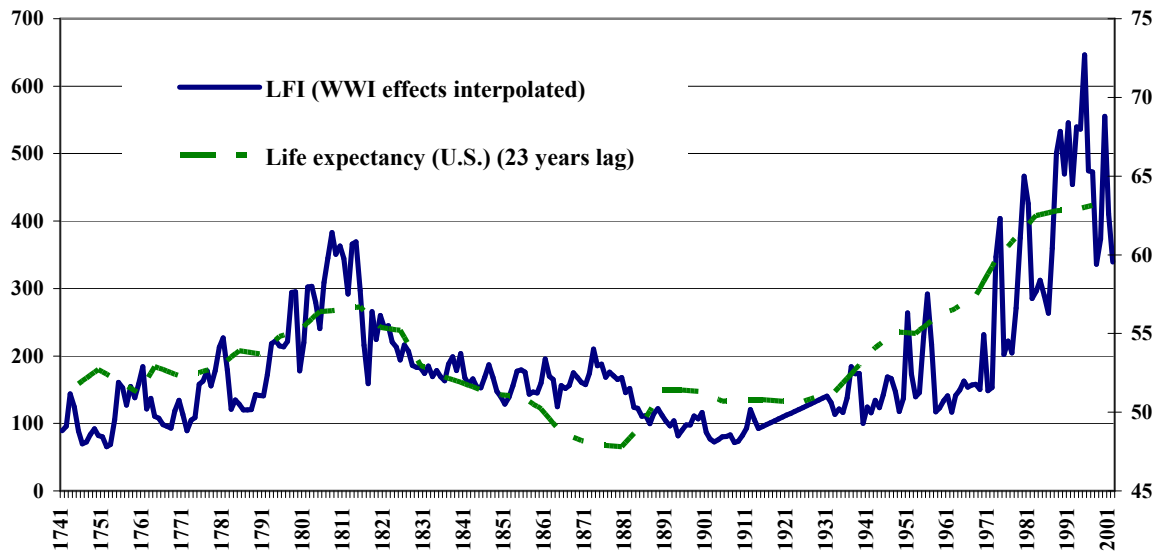

Figure 4.2. LFI and 23 years lagged life expectancy series after the treatment of WWI effects in LFI by interpolation.

Modelling supply side of freight markets is investigated in the early studies (Koopmans, 1939; Tinbergen, 1959, among others), but demand models were first estimated by Norwegian scholars, Norman (1979) and Wergeland (1981). Gross Domestic Product (GDP) and Industrial Production were used for global economic indicators. Later, Beenstock and Vergottis (1989) used GDP and wholesale price index for similar purposes without stationarity control.

4.1 Modelling dry cargo seaborne trade & freight market

Econometric modelling of the shipping industry is investigated by several studies and relationship between freight markets, fleet capacity and seaborne trade volume is frequently reported. Beenstock and Vergottis (1989, 1993) presented models for dry cargo and tanker segment shipping markets. The modelling period of these studies included 25 years at most (between 1960 and 1985) and the measure of goodness of fit, R squared value, was not over 0.7 in many of the models. Twenty-five years at least are illustrated as a typical long term modelling studies. However, modelling such a long term requires wider perspectives including life cycles of world population, which is the demand power of merchandise trade.

In this paper, a possible combination of long term dynamics of population and seaborne trade itself is attempted to establish a wider econometric model of dry cargo shipping. Because of the data limitation, the sample size is 46 years between 1963 and 2008. The seaborne trade model of Beenstock and Vergottis (1989) is modified and life expectancy data at the age of 10 in the U.S. is incorporated. The LFI is used to expose freight market effects.

Therefore, theoretical model is proposed as

$$ST = f(\overset{+}{LFI}, \overset{+}{BF}, \overset{+}{E^{10}}, \text{Pure judgmental factors}) \qquad \text{(eq. 4.1)}$$

where ST is dry cargo seaborne trade in ton-miles; LFI is the long term composite freight index which is proposed in this paper; BF is the dry cargo (mainly dry bulk) fleet in dwt (deadweight tonnage) and E^{10} is the life expectancy at the age of 10 in the U.S. population.

Beenstock and Vergottis (1989) proposed to append several additional variables like voyage costs, average haul and average speed. Although these variables were also theoretically significant in terms of the role of shipping business costs, sources of these variables were not clearly presented and data collection is practically difficult or accuracy of sources is highly questionable. Beenstock and Vergottis (1989) did not declare sources of these data series. On the other hand, the use of such kind of data has several drawbacks based on the functionality of data and its quality. First of all, the cost of shipping business is somewhat complicated and it is very difficult to normalise cost related data. The cost of shipping business is usually classified in three sections: “capital expense” which is the cost of financing ships, “operational expense”

which also stands for "fixed cost" of ship operation (e.g. manning, stores, wages) and "voyage expenses" which is originated from a specific shipment (e.g. port related costs, commissions, cargo related expenses). The operational expense is the most stable one among the entire costs of ship management. However, both capital and voyage expenses are unstable based on the capital structure and business reputation of ship-owners, debt-to-hull ratio, intended voyage, the particulars of cargo, ports of call, whether the ship is in the slow-steaming condition, among others. Therefore, even a simple average of whole industry is not a representative of the business practice. A similar problem exists for the average speed indicator. Under the shortcomings of these variables, this dissertation does not deal with this kind of indicators and Eq. 4.1 does not contain these data as explanatory variables.

Duru and Yoshida (2008a, b) indicated that shipping markets are highly sensitive for several judgmental factors including warfare, political declarations, crowd psychology etc. Tsolakis (2005) adopted "political events" as a judgmental factor of bulk shipping. However, there is an existing gap in the literature addressing the measurement of such effects. The present work assumes that pure judgmental fluctuations are neutral in the long run. Since the modelling sample is post-WW I and II, there are no super cycle fluctuations due to warfare issues.

For freight market model, effects of fleet capacity should be negative. Theoretical model is:

$$LFI = f(\overset{+}{ST}, \overset{-}{BF}, \overset{-/+}{E^{10}}, \text{Pure judgmental factors}) \qquad \text{(eq. 4.2)}$$

Interpretation of life expectancy is somewhat complicated. Fig. 4.2 indicates a long wave co-movement among the freight rates and life expectancy. However, in shorter terms (10-15 years), relationship is reversing. Increasing life expectancy is an indicator of forthcoming recession in freight markets. Increasing life expectancy will be followed by a slowdown in production output. In Eq. 4, it is found that the most significant time lag is 11 years which covers such local fluctuations. Although it is not reported, same model gives positive coefficients for life expectancy in longer time lags such as 18 years and more. After the treatment of spurious regression evidences, we will see that longer time lags reverse this dynamic.

The theoretical relationships are illustrated in Figure 4.3 with the expected sign of the variables for the freight rate (LFI) and seaborne trade (ST) models. The freight rate, seaborne trade and fleet size (BF) are simultaneous variables without a time lag. The relationship between LFI and ST is expected to be a co-trended spillover since the data is in the annual frequency. In case of monthly data, a time-lag between these

data can be expected while it is very difficult to estimate a time-lag in the annual averages. The fleet size is positively related with the seaborne trade. In the long run, fleet size is oriented to supply the seaborne transport demand. However, the fleet size negatively contributes to LFI since it is the supply side indicator. Life expectancy is a leading indicator for both LFI and ST, and the causal relationship is indicated by a time-lag and the related signs (directions) of the data.

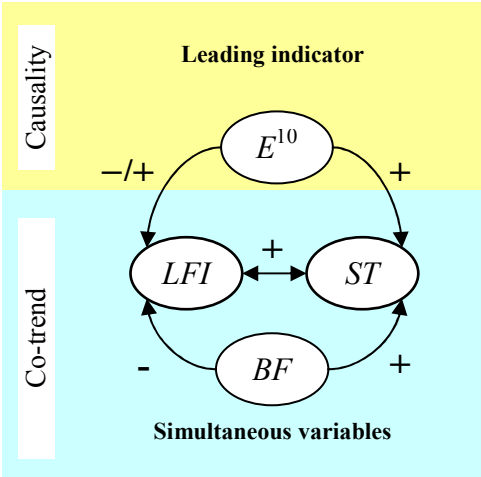

Figure 4.3. The relationship diagram for proposed models.

The signs of life expectancy data (E^{10}) are based on the model and the time-lag at the highest significance level (See fig. 4.4). In the intended range of sample (1963-2008), life expectancy has a growing trend in the long run while the LFI data has business cycles in around 10-year span. Due to the cycles of LFI, life expectancy may expose different signs in different time lags for LFI model. On the other hand, life expectancy positively leads the ST in both short and long-run estimations.

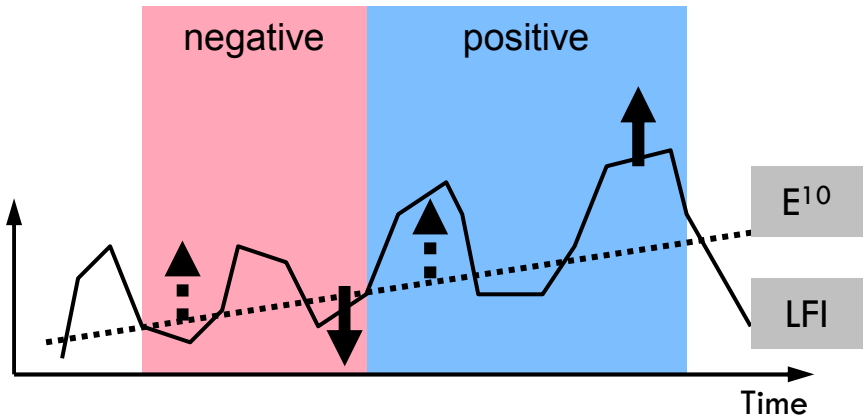

Figure 4.4. The sign reversal of life expectancy based on lag order selection.

The econometric model is estimated by Ordinary Least Squares method and residual white noise tests are performed by investigating auto correlations, heteroscedasticity and Durbin-Watson (DW) statistics. Since the normality of residuals is confirmed by Jarque-Bera (1980) statistics (J-B: 2.40, p: 0.30) and no autoregressive variable is included, the DW indication is consistent. Breusch-Pagan-Godfrey test is for investigating the white noise assumption of residuals (Breusch and Pagan, 1979; Godfrey, 1978).

Eq.4.3 and eq. 4.4 present model estimation results of dry cargo seaborne trade and dry cargo freight rate (LFI) including tests for residuals. All parameters are estimated with high significance and R-squared value indicates that 99% of variances are explained by the proposed model. Residual tests confirm white noise assumption with DW statistics, auto correlations and heteroscedasticity results. Test values for DW statistics are presented together which states that an interpretation of auto correlations is not suitable.

【Model of Dry cargo seaborne trade – Log-linear model】
OLS, 1963-2007.

$$\ln ST = -17.83 + 0.14\ln LFI + 0.48\ln BF + 4.69\ln E^{10}_{-11} \qquad \text{(eq. 4.3)}$$
$$(-9.180) \quad (9.422) \quad (32.892) \quad (9.291)$$

R^2: 0.997 S.E.: 0.03 DW: 1.40 (d_L: 1.38, d_U: 1.66, p: 0.05)
Breusch-Pagan-Godfrey test: F-statistics 0.46 (p: 0.71) / Obs*R-squared 1.47 (p: 0.69)
Jarque-Bera: 2.40 (0.30)
Wald test for c(4)=0, t value (p): 9.29 (0.000)

【Model of Dry cargo freight rate (LFI) – Log-linear model】
OLS, 1963-2007.

$$\ln LFI = 66.35 + 4.74 \ln ST - 2.24 \ln BF - 17.64 \ln E^{10}_{-11} \qquad \text{(eq. 4.4)}$$
$$(4.030) \quad (9.422) \quad (-8.179) \quad (-4.104)$$

R^2: 0.908 S.E.: 0.20 DW: 1.39 (d_L: 1.38, d_U: 1.66, p: 0.05)
Breusch-Pagan-Godfrey test: F-statistics 2.42 (p: 0.08) / Obs*R-squared 6.77 (p: 0.08)
Jarque-Bera: 0.21 (0.90)
Wald test for c(4)=0, t value (p): -4.10 (0.000)

Freight rate elasticity of seaborne trade is 0.14 which is almost same as the estimation by Beenstock and Vergottis (1989). Elasticity of life expectancy on seaborne trade points out that a 1-year increase on life expectancy in 11-year time lag raises seaborne trade about 7% in current values[1]. On account of absolute average of

[1] The average life expectancy for the intended data is 65 years. Elasticity of life expectancy on seaborne trade=%ΔST/ %ΔE which is 4.69=%ΔST/ (1/65), then %ΔST=4.69x(1/65)=0.07.

yearly variations of seaborne trade is about 6% in period of 1960-2007 and 1 year increase in life expectancy takes about 5 years in the last century, about 1.5% rise (7% / 5 years = 1.5%) on seaborne trade is probably triggered by demographic changes.

In Eq. 4.4, fleet size and life expectancy have negative coefficients as discussed before. One percent increase of life expectancy (in 11 year's time lags; around 0.7 years) supports 18% decrease on freight levels.

Wald coefficient restriction test is performed to clarify the significance of life expectancy and the results indicated the statistical causality.

4.2 Treatment of spurious regression drawbacks

Although many scholars used non-stationary variables as both dependent and independent ones or there is no reported test of stationarity (Norman, 1979; Beenstock and Vergottis, 1989, among other previous works before 1990s), the modern econometrics consists of a standard test of stationarity in variables. Tsolakis (2005) also indicated that several ex ante studies were based on a mix of non-stationary and stationary datasets, which explicitly violates assumptions of the classical linear regression model (CLRM). Under these conditions, spurious regressions are possible (Granger and Newbold, 1974 and 1977). Therefore, amendments are performed to confirm stationarity of intended data series. Unlike traditional differencing method, the present paper applies percentage changes as a transformation method. The selection of the percentage changing transformation method lies on the convenience for sustaining long term cycles. The differencing method may cause the loss of cyclic information since the size of cycles may change in different time spans. The percentage change method particularly maintains the size of fluctuations based on the level of current data. Another contribution of transformation is the elimination of multicollinearity drawback. In the initial model, some variables have high correlation which causes the multicollinearity problem. After the data transformation, cross-correlation coefficients are reduced under 0.85 level which is conventionally expected as a boundary of multicollinearity bias.

Augmented Dickey-Fuller (ADF) test is performed to confirm stationarity of series (Dickey and Fuller, 1979). All data series are stationary at the 95% level of confidence after percentage change transformation (See table 4.1). ADF tests are performed with intercept and trend configurations except *BF* percentage change series (no intercept, no trend).

Table 4.1. Augmented Dickey-Fuller (ADF) unit root tests (Dickey and Fuller, 1979).

	Results				MacKinnon (1996) Critical Values (p: 0.05)	
	Level		%-change		Level	%-change
ST	2.28	(c, t)[a]	-5.70	(c, t)	-3.51	-3.51
LFI	-0.36	(c, t)	-7.35	(c, t)	-3.50	-3.50
BF	-1.91	(c, t)	-2.72	(none)[b]	-3.52	-1.94
E^{10}	-1.39	(c, t)	-3.53	(c, t)	-3.51	-3.51

Note:
Maximum lags:15.
[a] (c, t) means ADF test based on intercept and trend.
[b] (none) means ADF test based on no intercept and no trend.

By using amended data series, econometric models of seaborne trade and freight market are established as in Eq. 4.5 and eq. 4.6.

Treatment of spurious regressions induced lower coefficient of determination (R-squared statistics), but residual statistics are well recorded as normally distributed (5% confidence level), white noise (as mean and variation) and no significant autocorrelation. The ratio-to-change model results differ from the log-linear model. One percent increase of $E^{10\ \%\Delta}{}_{t-14}$ term provides 9.38% additional growth of seaborne trade in eq. 4.5. Effects of fleet size and current freight rates are weak as recorded in the previous studies. In eq. 4.6, 1% increase of life expectancy with 18 years time lag ($E^{10\ \%\Delta}{}_{t-18}$) develops 49% raise of freight rate.

Wald coefficient test results also significantly indicate the validity of life expectancy.

【Model of Dry cargo seaborne trade – Ratio-to-change model】
OLS, 1964-2007.

$$ST^{\%\Delta}_{t} = 0.09\ LFI^{\%\Delta}_{\ t} + 0.30\ BF^{\%\Delta}_{\ t} + 9.382\ E^{10\ \%\Delta}_{\ t-14} \qquad \text{(eq.4.5)}$$
$$(5.568) \qquad (2.640) \qquad (2.557)$$

R^2: 0.566 S.E.: 0.04 D.W.: 2.03 (d_L: 1.38, d_U: 1.66, p: 0.05)
Breusch-Pagan-Godfrey test: F-statistics 1.31 (p: 0.28) / Obs*R-squared 3.93 (p: 0.27)
Jarque-Bera: 5.65 (0.06)
Wald test for c(3)=0, t value (p): 2.55 (0.014)

【Model of Dry cargo freight rate (LFI) – Ratio-to-change model】
OLS, 1966-2007.

$$LFI^{\%\Delta}_{\ t} = 4.22\ ST^{\%\Delta}_{t} - 3.57\ BF^{\%\Delta}_{\ t} + 49.23\ E^{10\ \%\Delta}_{\ t-18}$$
$$(5.833) \qquad (-4.123) \qquad (2.217)$$

$$-0.41\ LFI^{\%\Delta}_{\ t-2} \qquad \text{(eq.4.6)}$$
$$(-2.708)$$

R^2: 0.616 S.E.: 0.26 D.W.: 2.13 (d_L: 1.38, d_U: 1.66, p: 0.05)
Breusch-Pagan-Godfrey test: F-statistics 1.58 (p: 0.21) / Obs*R-squared 4.67 (p: 0.20)
Jarque-Bera: 2.90 (0.23)
Wald test for c(3)=0, t value (p): 2.21 (0.032)

4.3 Conclusion

This chapter reviews the previous econometric models on dry cargo freight rate and seaborne trade. Price elasticity of seaborne trade estimated in this chapter is very close to the estimation of Beenstock and Vergottis (1989) (inelastic). Life expectancy is found a significant indicator for both seaborne trade and dry cargo freight rates.

Time lags among freight rates, seaborne trade and life expectancy are defined in several years. However, the log-linear model is not significant, just a reference and the way of elasticity calculation, because of the spurious regression prospects. After the data transformation, it is about 9-14 years for seaborne trade and it is about 18-21 years for freight rates.

Based on the empirical results, the effects of life expectancy on LFI series are found negative in the short run (less than 15 years; Juglar-type cycles), and positive for longer periods (15-25 years; Kuznet-type cycles) by log-linear model and ratio-to-change model respectively.

Nomenclature

ST : Seaborne trade in ton-miles (dry cargo).
Fearnleys reviews,
Maritime transportation statistics handbook, Japan Shipowners Association.
(海運統計要覧, 日本船主協会)

$ST^{\%\Delta}$: Seaborne trade in ton-miles (dry cargo) (percentage change).

LFI : Long term composite freight index.

$LFI^{\%\Delta}$: Long term composite freight index (percentage change).

BF : Bulk carrier fleet (dwt).
Fearnleys reviews,
Maritime transportation statistics handbook, Japan Shipowners Association.
(海運統計要覧, 日本船主協会)

$BF^{\%\Delta}$: Bulk carrier fleet (dwt) (percentage change).

$E^{10}{}_{t\text{-}11}$: Life expectation at age 10 (11 years lagged) (U.S. population).
Fogel (1986),
U.N. Population Statistics.

$E^{10\,\%\Delta}{}_{t\text{-}11}$: Life expectation at age 10 (11 years lagged) (percentage change).

OLS : Ordinary Least Squares

D.W. : Durbin-Watson statistics (1950, 1951)

AC_L : Auto correlation of residuals in *L* lags.

Q-stat : Ljung-Box (1978) Q statistics

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Chapter 5

The impatient capital phenomenon in dry cargo investments

In previous chapters, the models of dry bulk shipping are estimated and discussed based on the existing literature. There are several studies in the literature illustrated the dynamics of shipping markets and the role of business cycles is well indicated (e.g. references in previous chapters). However, the gap between theory and practice leads to unexpected asset bubbles and boom-bust cycles in the market. Although the theory of dry bulk shipping is investigated in the previous chapters of this dissertation, an additional chapter is thought to be useful for filling a part of the existing gap between knowledge (theory) and action-knowledge (practicing knowledge). The neo-classical economic theory is developed based on the homo economicus investor assumption. However, the recent economic theory is a relaxation of traditional assumptions such as rational actors (i.e. homo economicus) which is emerged by disparities between the economic theory and the business practice. Under these indications, this chapter investigates the behavioural aspects of shipping asset management by two major perspectives, impatient capital phenomenon and the long term competitiveness.

The impatient capital is a term used for the investors or corporations which have the short-term sentiments for profit making and business growth. The impatient capital is generally synchronized with short-termism and volatile business operations (Crotty, 2003; Laverty, 1996; White, 2006, among others). Leana and Barry (2000) indicated the impatient capital phenomenon and expressed that:

> *"Financial capital in the United States and elsewhere has become increasingly impatient, with investors demanding more immediate returns from investments that are held for shorter periods of time. Managers face pressures to meet short-term financial targets and to*

nimbly adapt to the changing demands of investors. The impatience of capital is manifested in several ways, including the increase in day trading among investors and the shorter tenure of corporate CEOs. The effect of such impatience is the failure of firms to make long-term investments that create economic value by levering resources that require time to build"

On the other hand, a patient capital is used for long-term incentives and its major attribute is the stability of business activities and labour force. The recent state of shipping business has a variety of examples of both the impatient and patient capital. Particularly, most of the enterprises of European and Greek origin are referred to the attractive investors with higher levels of income volatility and asset play (hyperactivity in the sale & purchase market). However, the growth of the Japanese and Norwegian maritime companies is mainly benefited from the long term-customer oriented business technique. Although the short-term turnover is less, long-term competitiveness improves the business sustainability, price volatility drawbacks, employment risk, and capital costs.

The impatient capital is focused on the short-term gains and particularly on the large-scale income. Short-termism is usually followed by asset play and higher debt-to-hull ratio. Therefore, shipping investors are urged with sale-and-purchase game rather than quality service provision. The asset-play investor has particular advantage on labour management. Since the asset is volatile and the capital liquidity is high, the manpower contracts are based on easy-to-lay off-employ strategy. The vast number of US companies is characterised with labour mobility. Labour mobility is particular for asset players and also for stock market listed companies since they are in charge of public satisfaction to some degree. On the other hand, labour mobility reveals a possible reduction in service quality and increases cost of operations per unit. The learning curve effect illustrates how experience and unit cost are correlated (e.g. Adler and Clark, 1991). Long-term competitiveness improves organisational learning and reduces unit cost of service.

For compromising the merits of both perspectives, an intermediary management policy needs to be established. Also the organisational culture and

profit-making incentives should be oriented according to the proposed management technique.

This chapter discusses how to improve an intermediary strategy to gain from the benefits of both long-term competitiveness and short-termism. A shipping company is expected to develop its business network and build a good reputation by long term orientation while consider the short-term opportunities in the market to reduce risks of not investing.

5.1 The impatient capital vs. patient capital: The origin of market anomalies

Crotty (2003) investigates the impatient capital phenomenon under the neoliberal paradox. He indicates that

> *"Financial market pressures led to shorter planning horizons, a declining allegiance of stakeholders to long-term corporate goals, and a large increase in the percentage of cash flow paid to financial market agents"*

Particularly, publicly traded firms are leaded to be short-oriented in terms of company strategies and investment opportunities. Crotty (2003) also draws attention to the conversion of investors in stock markets. The most part of the shares in financial markets are now held by the institutional investors (such as pension funds, insurance companies etc.) rather than the situation in 1960s and these investors do not mind what the long term goals of a company. A few decades ago, households were active in stock markets and they were figured by long term investments. Today's institutional investors manage their large amount of funds which has an extreme power on price movements and tend to investigate short-term gains.

Laverty (1996) discusses that issue and presents it as the major cause of short-termism in American business society. He also argues that American companies lose their competitive advantage particularly to Japanese and German companies. Laverty (1996) indicates the critical role of intertemporal choice and the undervaluation of future outcomes is given as a business symptom. The origin of intertemporal choice is defined by the theory of

"The course of action that is best in the short term is not the same course of action that is best over the long run"

Actually the major problem exists in the valuation of the future cash flows in financial tradition. Net Present Value (NPV) method is frequently used for calculating the cumulative present value of series of future cash flows. Figure 5.1 illustrates two intentions, project *A* and project *B*, on the long horizon.

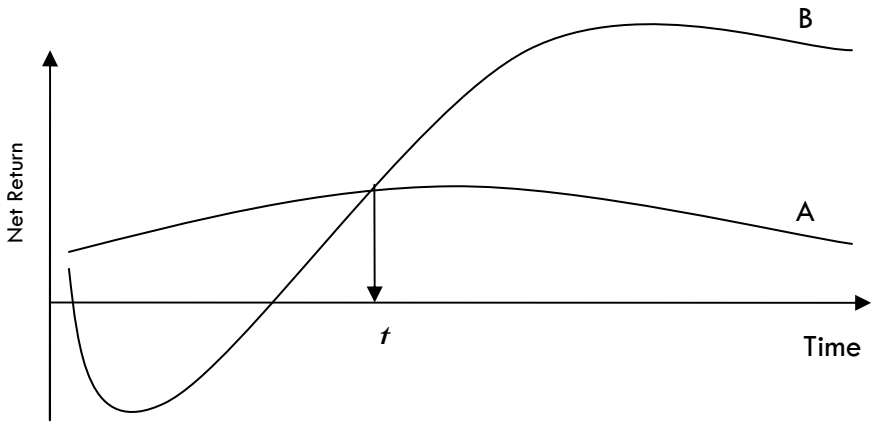


Figure 5.1. The long term difference between projects *A* and *B* (Laverty, 1996).

Under the principles of classical NPV approach, the discounted cash flow of projects is calculated by using the value of cash flow, its timing and the discounting rate. From these components, the most critical contribution arises from the rate of discounting process. Since the higher discounting rate undervalues the far future and overestimates the near future, a single point change on the rate may contribute to radical shifts between projects and future prospects. Laverty (1996) also debates the negative impacts on innovative motivation of firms. Short-termism is a reason to ignore many innovative business opportunities.

One of the major causes of short-termism is based on the moral hazard and the individual intentions. A vast number of studies indicated that managers prefer to make investments that assure relatively faster payback, in order to more rapidly develop their business reputations and such enhancement has lasting effects. Therefore, a manager who has private information about a project will have an incentive to speed up the project's returns at the expense of long-run gains (Holmstrom, 1999; Holmstrom and Costa, 1986; Hermalin, 1993; Narayanan, 1985; Hirshleifer, 1993, among others). Porter (1992) stated that

managers have a short-term horizon, and that they are not able to plan for the long-term due to the pressures inherent in our economic system.

Information asymmetry is another reason of short-termism. Since the long-term is relatively uncertain and the short-term is clearer, investors tend to overemphasize the current developments rather than future prospects (Laverty, 1996). Short-termism is also found negatively related to the innovation in high levels of debt, but it is also positively correlated in stable environments (Li and Simerly, 2002). In the recent competitive markets, firms are expected to ensure innovative structure and improvements. However, innovation is depending on the long term success and the existence of patient investors because of its long-lasting process.

Table 5.1 briefly presents particular characteristics of the impatient and patient capital. In case of patient capital, long term competitiveness is crucial and therefore customer satisfaction is carefully handled. Unlike the excessive income for short-term, long term contracts with moderate prices are preferable. Since the business is based on long term agreements, labour force and assets are stabilized and broadly in static form. The long term competitiveness is usually formed by risk averse and secured income rather than risk taking incentives.

Table 5.1. The capital incentives and their particulars.

The impatient capital	The patient capital
Short-term gains	Long-term gains
Investor pressure	Stability on labour force and assets
Mobility on labour force and assets	Customer oriented services
Aggressive marketing	Specialization
Price volatility	Stable prices
Risk taker	Risk aversion
Dynamic management	Social responsibility
Higher cost of capital	Lower cost of capital
Entrepreneurship	Inertia

The impatient capital requires a dynamic management and asset play is significantly performed. One of the major indicators of the business is the investor pressure to gain short paybacks. Therefore, the impatient capital is a risk taker and aggressive marketer. Such business shifts and rapid changes in activities damage its business reputation and customer confidence.

Some additional specifications follow the distinction between capital incentives. Short-termism is also a type of retroactive business rather than proactive perspective. Unexpected fluctuations in market may fundamentally impair the instable financial structure of the firm. By using large amount of debt finance, companies increase its short-term income. However, this is a hindsight effect which is usually followed by extreme loss of company value in the period of downturn.

The dynamics of the impatient capital and long-term competitiveness broadly exist in the shipping business and the next section discusses its nature.

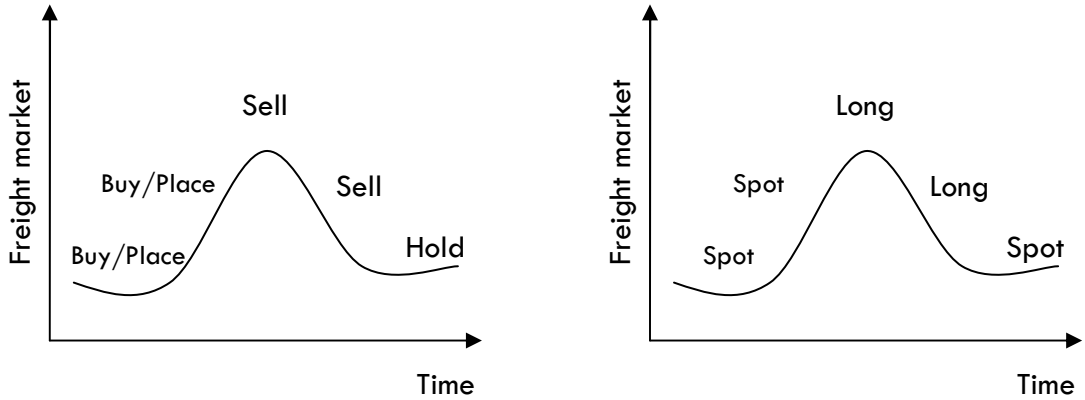
5.2 Short-termism in Shipping Business

There are various shipping business strategies among the different maritime cultures and regional trends. Investment behaviour of a shipping company is not only depending on the pure company policies, but it is also strongly related with the character of the society. For instance, Greek maritime industry is usually identified by its volatile and risk taking incentives. Since the business is based on risk taking, Greek companies are also very active on freight derivatives market. On the other hand, Japanese shipping industry has its unique style which is mainly supported by the network economy (Keiretsu) and the strong relationships with the domestic charterers (probably a member of network). Because of the close coordination among different components of the business (finance, production, electronics, transportation, heavy industry etc.), shipping investments are broadly insulated from the impacts of extreme competition and strong dependency on overseas customers. Collective solidarity is very high and network companies are sharing their needs by outsourcing among the fellows of the network. Another particular contribution of Japanese business system is the subcontracting strategy. Among its several merits, subcontracting also contributes to ensure long-term thinking and planning.

Turkish shipping industry is currently in a conversion period. Unlike the traditional family companies, the industrial investors enter to the shipping markets and their strong connections with the remaining industries have a secondary contribution to the business by improving networks and benefiting from the reduction of transaction costs. While the former industry is mainly figured by family-based firms, the recent entrepreneurs such as YA-SA Holdings, Densa Maritime Corp., Geden Lines and Ciner Maritime Corp. are composed of group of companies from a variety of industries such as energy, mining, agriculture, food, among others.

Although many companies are improving their business and increasing their value, equity financing is additionally employed to extend business and to ensure multiplicative impact on rising company value. In the last decade, maritime industry indicated the boom of public issues. Many shipping companies are traded in stock markets, while private equity issues are also very active. Company shares are sold to individual and institutional investors which raise the principal-agent problem as in many other industries.

Short-termism is particularly found in the publicly traded companies, but it also naturally exists in several business cultures. For analysing the short-termism and impatient capital impact, the optimum investing strategy should be defined as a priori for further assessment. According to Lorange (2009), market entry and asset play are optimum in case of buying ships in recession and in the improving market, while selling them on peak and downward market conditions. In case of trading policy, ships should be traded on spot market in recession and on long term contracts in peak market, while the opposite policy is optimum for charterers (Fig. 5.2).



(a) (b)

Figure 5.2. The asset management policy (a) and trading policy (b) (Lorange, 2009).

The optimum trading policy has several difficulties in business practice, since charterers tend to perform conversely. However, asset management policy is relatively applicable if the investor ensures proper capital contribution for the assets. A rational and patient investor is somewhat expected to follow the figure of freight markets (asset market as well).

On the other hand, asset play policy is focusing on paybacks rather than service providing task. While a company optimizes its asset management task, providing shipping service is ignored or assumed to be a secondary purpose of the business. Quality and sustainability of shipping service are essential in Japanese maritime society. Unlike a conventional investor, Japanese shipping companies mainly focus on their transport service and the improvement of customer relationship is raison d'être.

Asset play optimization is a type of patient capital behaviour at some degree, but it also loses its long-term competitiveness. Since the investor anyhow enters the freight market in a period of market improvement, customer relationships have particular importance for ensuring competitive and lucrative contracts.

For the assessment of practical shipping business, the shipbuilding contracting and orderbook data of dry bulk fleet are collected from Clarkson Shipping Intelligence and compared with the new building prices (NB Price) of a Panamax bulk carrier asset (72k DWT). Figure 5.3 shows the relationship between the NB Price series and the contracting activities of the year. The correlation coefficient between series is 0.80, which is very high value indicating

co-trended behaviour. While the new building prices peak, new building contracts follow the market. A similar indication exists in the correlation between the NB Price and orderbook statistics (Fig. 5.4). The correlation coefficient is around 0.79. The co-trended behaviour is particularly stronger after the mid 1990s. These evidences significantly indicate that ship investors do not mind broadly the cyclic behaviour of the shipping business and orders are put even in the highest level of the asset prices. Therefore, the theoretical optimum policy for asset management is usually found to be ignored in the business practice. Lorange (2009) concluded an identical foundation and argued that the investor anomaly is based on the *irrational exuberance* in the sense of Shiller (2000).

Probably, another interpretation can be raised from the fact that market liquidity also follows the asset prices and freight rates. Since the shipping business is highly capital intensive, shipping investments are depending on the capital accumulation. Although a proper size of capital accumulation is succeeded in the peak market, the investors are not patient enough to monitor the suitable time for market entry. The recent statistics indicate that the ship investors are leaded by herd behaviour and they follow the competitors.

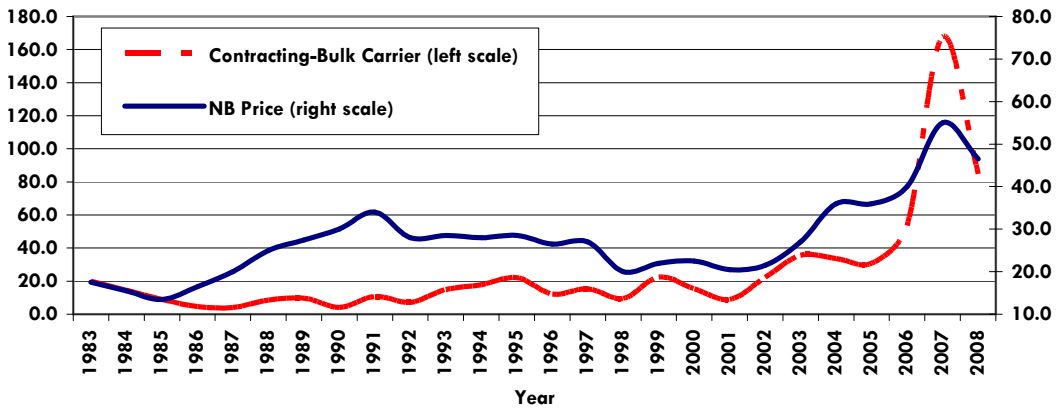


Figure 5.3. New building asset prices (mill. USD) and bulk carrier contracting statistics (mill. DWT) (annual data between 1983 and 2008).

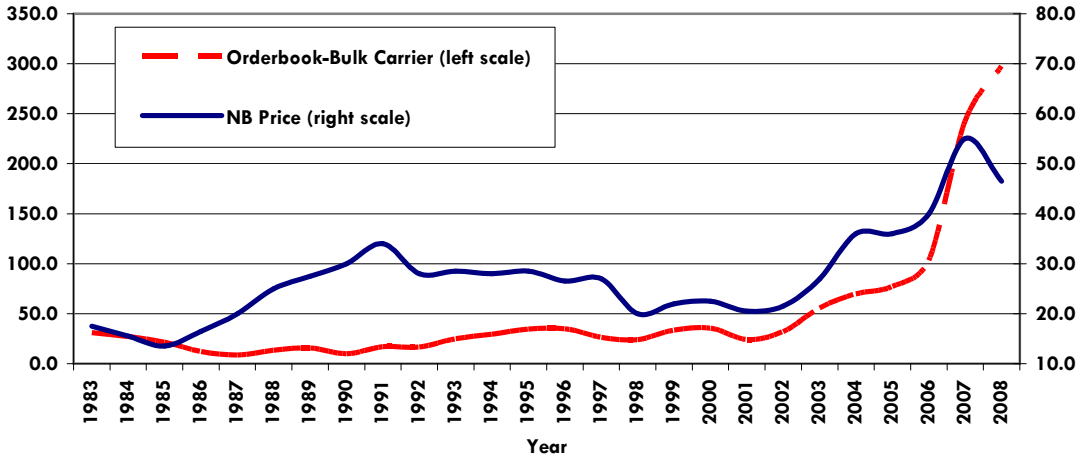


Figure 5.4. New building asset prices (mill. USD) and bulk carrier orderbook statistics (mill. DWT) (annual data between 1983 and 2008).

The irrational exuberance is an investor bias which particularly exists in the high level of liquidity and peak market conditions. It is effective along with the impatient capital symptoms and causes market anomalies such as oversupply, extreme loss of asset value, debt crisis etc. The shipping assets are usually based on debt finance and minimum market value is generally used as the major covenant for the credit issue. By the beginning of a short decline of the market, a series of assets are arrested by creditors for recovering the outstanding principal in the second hand market which stimulates the multiplier effect on declining asset prices by increasing the number of sellers in the sale and purchase activity.

By the assessment of both asset play and shipping service providing policies, an intermediary management policy may improve the long term business success and reduce the risks based on the investment timing.

5.3 Compromised Asset Management Policy (CAMP) and the gap between theory and practice

Discussions above pointed out two major tasks for shipping asset management. First, the shipping investment timing is critical and market entry/exit decision must be performed by investigating the cycle of the freight markets. Second, the investor shifts between regimes of trading policy whether

to charter on short term or long term contract. Trading policy has three important particulars.

- The period of chartering contract defines how assets are flexible for possible sell out.
- Switching between long and short term contract regimes defines how the business is risky and secured.
- Proceeding to long term contract with major charterers may develop business network and reduce risks based on the market entry barriers. Although many investors prefer short term contracts in the period of improving market, an investor with incentives to develop business network may agree on relatively low prices for long term contract.

A compromised asset management policy is expected to follow possible tradeoffs between period and spot freight market (short & long term T/Cs as well) while utilizing the asset play. In case of the asset play, one of the major factors of the decision is the expected age of owned fleet. Many shipping firms prefer to renew their fleet for ensuring a pre-determined average age of the fleet. Since the average length of a full shipping cycle is around seven years in the last half century, the age-based asset decisions should be covered from the long perspective (more than a single cycle)(Stopford, 2009). Such a long horizon makes the business highly complicated and it is difficult to present these dynamics in mathematical form.

Figure 5.5 presents a sample of asset management in the cyclic behaviour. The market entry-exit decisions are based on the principles of a short-memory investor and the trading among the period and spot contracts is figured by the long term competitive strategy for ensuring business sustainability. The market exit decision is postponed over a cycle to cover a series of service contracts and to benefit from the operating income in the transition period. Under the average cycle terms, the asset holding period is around 10-15 years. In case of an age-based renewal policy, the average age of owned fleet can be around 5-7 years for new building assets and around 10-12 years for second hand assets (5-year old purchases are assumed).

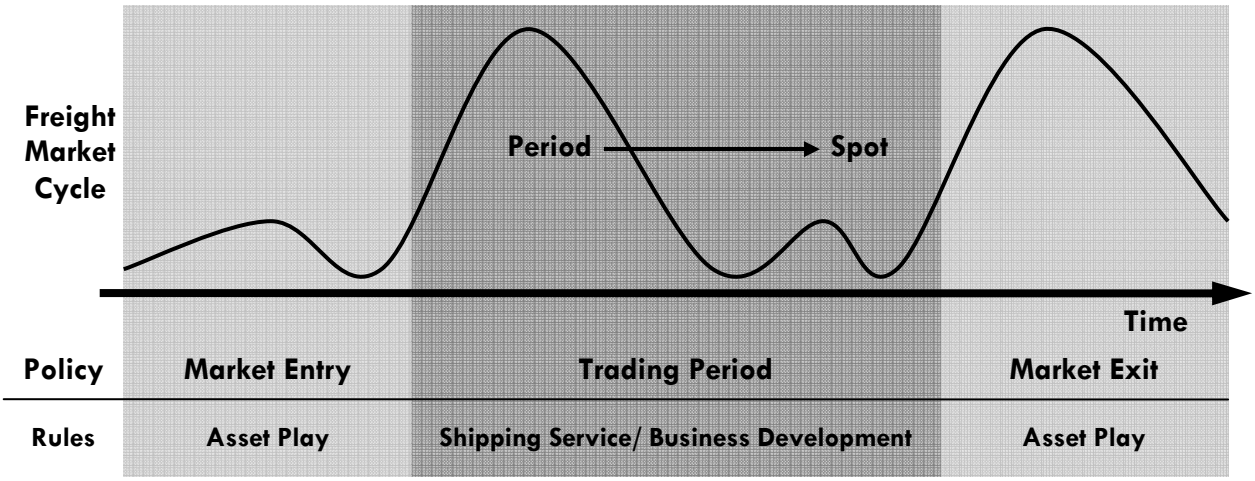


Figure 5.5. A sample of asset management through the market cycle.

Although many shipping firms theoretically declare that their business strategy is based on similar principles, the statistics on contracting and the asset prices indicate that shipping firms are still impatient on purchasing behaviour and they are probably oriented by herd behaviour and irrational exuberance. Since the majority of new orders are placed at peak time, the downturns become deeper and more destructive.

The theory of market liquidity and financing simplicity may support this occasion, but the most part of the bulk shipping business is covered by the former companies which manage large scale of capital. Without a credit issue, asset purchases can be postponed for relatively optimum time in the period of downturn and marginal income of asset play can be raised. However, the shipping investors are somehow impatient to secure capital in peak market and transfer it to low asset market. The paradox between theoretically rational investment and the current investor sentiments is one of the key indicators of the highly volatile boom-bust cycles. Pink (2009) presented a seminal work on the origin of the motivation and he concluded that the nature of the boom-bust cycles is derived from the illogical abundance and financial hyperactivity which is a type of externally motivated short-sightedness. While the investor is irrational on the assessment of the market cycle, he is motivated with short-termism and impatience which themselves generate the risky boom-bust cycles.

Under the issues mentioned above, the assumptions of the shipping business models such as rational expectations and market efficiency have

critical bias from the practical business. Shipping investors behave irrationally and even when they have information about the market cycles, they do not perform as the information presents (Although they are expected to perform and ensure market efficiency). Therefore, the models of shipping markets play a critical role in long term policy making, but they are limited and biased because of the complicated human behaviour. The impatient capital perspective assumes the market conditions follow the estimated measures of the perfect economic dynamics. However, the historical results indicate different foundations which explicitly denote the drawbacks of the short-termism.

5.4 Conclusion

The irrational investor behaviour and the impatient capital anomalies are discussed in the existing literature of theoretical and empirical finance. Although the widely accepted financial theories illustrate the economic behaviour in perfect particulars, biases and heuristics are still the major drivers of the financial markets as in the shipping markets (Duru and Yoshida, 2009). The style of investors has two major divisions, the asset players and shipping service providers. In contrast to a trade-off between these policies, a compromised asset management policy may optimize several aspects of the business and improve sustainability of the firm.

However, the close relationship between new orders and the freight market is familiar in the shipping economics which conflicts with the well-known dynamics of the shipping business. The crowd behaviour appears to be a strong driver of the investor choices. In terms of the gap existing between theory and practice, the shipping investors have irrational attributes and the shipping capital is somewhat impatient to transfer capital between peaks and troughs for improving asset management in the optimal market cycle.

Under the foundations of this chapter, a shipping investor is expected to ensure a number of business principles as follows:

- A shipping company should be based on customer orientation rather than pure profit maker. Shipping investments survive within long-term contracts and customer satisfaction. Otherwise, the business will be highly fragile and unexpected loss of income is a critical and threatening

factor. From this point of view, Chief Customer Officer (CCO) and Chief Financial Officer (CFO) should closely collaborate to improve the business sustainability and the design of long term policy. One of the practical difficulties of long term company orientation is the risk of not investing. Therefore, the multi-layer business planning and customer relationships should be considered and the risk concept should be investigated from a wider perspective possibly by a distinct follow-up agent such as a Chief Risk Officer (CRO).

- The optimization of charter-in/out decision is becoming more of an issue. The shipping company should define pre-conditions of switching between long and short term contracts (according to its particular service coverage) and the market follow-up/ forecasting tasks are crucial for such purposes.
- Innovation is an endless process which contributes to the sustainability of the business and customer satisfaction. The position of Chief Innovation Officer (CINO) is becoming more necessary, particularly for the large size enterprises, to secure the lifespan of the business.

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Chapter 6

Conclusion and Future Research

Economics of shipping is very critical since the most of international and regional trades are based on the seaborne transport. According to an article published in Time Magazine, shipping freight rates (i.e. cost of shipping) are the least known leading indicators for global economic climate (June 5th, 2009). In the history of economic research and economic thought, the role of maritime transport is extremely impressive and change-making.

In 1993, two scholars received the Nobel Prize for economics: Douglass C. North and Robert Fogel. Although these two scholars are from different branches of economic history research, both of them critically contributes to the literature which is the major motivation of this study.

This research proposed to establish a long term dry cargo freight market index based on the literature induced by Douglass C. North and to investigate the impact of life expectancy over the ocean freight rates by utilising the evidences of Robert Fogel. In the posterior part, this study also discussed the history of economic thought in the shipping business and stated a number of criticisms for the existing theories for the centennial decline of ocean freight rates. Finally, the impatient capital phenomenon and short-termism were investigated for the shipping business in terms of the business culture in Western economies and Japan.

6.1 Method and Major Outcome

The long term dry cargo freight index (LFI) was established by collecting a vast number of data for ocean freight rates and consumer price index (as a

deflator of freight rates). A wide range of published documents were reviewed and finally the LFI was associated from several datasets by using the rate of change for each year.

The life expectancy data is collected from the indications of Robert Fogel and the statistics of the UN.

The role of life expectancy was tested by utilising the classical linear regression model framework and the existing theories of shipping economics were revised by embedding the life expectancy impact.

Life expectancy was found significant for modelling the seaborne trade volume and the LFI series. The time lag between LFI and life expectancy data was found between 10-20 years. The coefficient of life expectancy was significant for several years. Increasing length of time lag contributed to the predictive horizon and it particularly ensures a spectacular mechanism to derive long range predictions for both microeconomic and macroeconomic drivers in addition to policy development.

One of the major outcomes of this research is to find that the source of the centennial decline can be based on the structural change in population particulars such as the quality of life. A decline of life expectancy indicates the loss of wealth which causes the devolution of life quality and possible deduction of expenditures.

On the other hand, another major outcome is derived from a historical fact named British Navigation Act (BNA). In the middle of 17th century, British Empire established a special provision to improve shipping cartel of British flagged and operated fleet. Under these conditions, the shipping markets were extremely imperfect and shipping prices were led by British ship-owners.

In the final part, this research indicated the shipping investors tend to endorse asset contracts even when the market prices are gradually peaking, which means the shipping investors are extremely impatient and do not precisely investigate the market climate. However, the Japanese shipping companies differ from the mainstream investors of Western economies and most of the asset contracts are based on the long term agreements with charterers.

The rise of Ottoman Empire also eliminated the free trade of Levant routes. The beginning of the 1800s is critical period for the collapse of BNA (officially 1849) and the decline of Ottoman power. According to the evidences of this

research, the role of BNA and the impact of two huge empires can not be ignored for the market prices.

This research also proposed a compromised asset management policy to benefit from the sustainability of long term competitiveness while ensuring the business flexibility to deal with the opportunity risk due to the loss of potential business projects.

6.2 Originality and Impacts of Study

The originality of this research is twofold: The novel contribution to economic literature and the shipping business specific results. This dissertation is the first attempt to establish a long term freight index (268 years) and originally proposed the theory of life cycle oriented freight market in the long run. Since the freight rates contribute to the prices of finished goods and shipping assets, the introduction of LFI enables a series of future research and the revisions of the existing theories.

This study questions the validity of theories based on technological change and also proposes an additional theory of market efficiency change based on British Navigation Act. These indications are first mentioned by Duru & Yoshida (2010) in the economic history literature.

This research also contributes to the Behavioural Economics of shipping business and originally discusses the role of sentiments in the investment timing The market anomalies and the impacts of irrational exuberance are indicated at the peak market conditions of shipping business. By investigating the shipping asset contracts and the asset prices, the instability and herd behaviour are stated as the reason of boom-bust cycles.

Therefore, the further research on freight markets should consider behavioural aspects and a stream of studies are expected to clarify the nature of market psychology and related investment incentives.

6.3 Limitations of Study

Although this dissertation is eliminated from several drawbacks, a number of limitations should be indicated to illustrate the robustness and generality of

results for further assessments. As it is usually mentioned in academic works, the quality of data is somewhat uncertain since the data is not directly collected by the researcher. We assume that the source of data is reliable and possible disparities will not extremely change results and intended theoretical interpretations. Particularly the collection of freight rate data (also index series) is performed by screening lots of periodicals, academic papers and databases. Freight rate data is usually based on the available and publicly declared fixtures of shipping deals. The mainstream literature and the research institutes assume that the existing fixtures do not represent the whole picture and the price movements also do not deviate exceptionally, which may cause spurious outcomes. Under this generality assumption, the intended data is utilised for model estimations and theoretical interpretations, while considering its limitations and possible weak form of bias.

The long term dry cargo freight index (LFI) is calculated for 1741-2009 term by using the several series of freight rate or quasi freight indices. The theoretical significance of life cycle theory over the dry cargo market is estimated by using the entire dataset of LFI and life expectancy. However, the models of seaborne trade and dry cargo freight rate are estimated for 1963-2009 term because of the limited data for bulk carrier fleet and seaborne trade volume. Therefore, the estimated model is not suitable for the case of long-lasting decline of the market (around a century) since it is estimated under the long-lasting rise of the market.

The theoretical causality between series is tested by using the Granger cause framework or the significance of coefficients. However, the limitation of statistical causality is well discussed in the literature and a researcher should account the possible incorrectly rejection of zero coefficient hypothesis (Type I error). From the economic perspective, the practical meaning of the mentioned bias is that the estimated model is useful for interpreting theories or comparisons while it does not guarantee the predictive accuracy.

Arguments mentioned above explicitly lead to elicit the intrinsic value of this study and its practical sensitivity. Under these limitations, the present study is supposed to be valid for the intended theoretical and empirical literature, and the most part of this study is presented in scholarly published journals for peer review and criticism.

6.4 Future Prospects

The scope of future research prospects is expected to investigate a number of change-making issues for path-finding in the transport infrastructures and to elicit the role of shipping for global economy. The potential topics for future research include:

a. The analysis of technology substitution model in terms of wind to steam and steam to diesel power transitions and their resulting impacts on shipping costs. By using the existing fleet statistics, the role of technology change on shipping costs can be investigated by utilising the LFI data.

b. The future of shipping industry (also transport industry) based on the population dynamics. This paper is a snapshot of the current situation and an additional research may clarify the future of the industry.

c. The role of transport geography and trading focus on the cost of shipping and interactions with the global shift of political and economic centre.

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