



## ANALYSIS ABOUT THE EUROPEAN SHIPPING AND PAYMENT TRENDS 1975 – 2015

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**Abstract** *In shipping, more than in other economic sectors, changing trends are very frequent, because of the specific dynamic of markets. The freight rates and second hand prices in the dry bulk market seem to be stationary. This result is in contrast to the findings of a number of papers. However, the results confirm that classical shipping market was stationary in freight rates, which is not the case, if the freight rates followed a random walk. By transforming, all observations, from US\$, to Japanese yen, showed that freight rates and prices saw to become stationary and volatility, reduced.*

**Key words:**

shipping, market,  
price, transport,  
perspective

**JEL Codes:**

M15, M16, L91

### Introduction

There is a large literature about the stochastic property of shipping freight rates and asset value. Recently, a number of empirical studies have questioned the result of many classical papers. The classical view seems to be that freight rates and prices have mean-reversion or trend-reversion, whereas the new empirical studies, mainly conclude that freight rates and prices follow random walks.

This study focuses on the price dynamics of the international dry bulk shipping markets. The paper focuses on the international markets for sea transport of coal, iron ore, grain, bauxite, alumina and phosphates, i. e. the five large major dry bulks, and residual group often referred to as "minor bulks". Minor bulks comprise a large number of products transported in bulk, e.g. steel, forest products, cement and metals.

If price process followed a random walk, the probability distribution was independent of its path, for example, history of his evolution level. Hence, appears the probability of a given change in the price process to be identical, irrespectively of whether the price is high or low. This implies that the price does not change. For example, if the freight rate follows a random walk, there is no force that to push unusually high or low freight rates towards a normal level or a trend.

Early empirical studies of the bulk shipping markets are Tinbergen's type, from 1931 and 1934. These papers are a part of Tinbergen's major contribution, to the development of business cycle theories, but are also, signals from the perspective of the maritime economics. Early empirical studies of the bulk shipping markets are Tinbergen's type from 1931 and 1934.

The major commodities traded, in the last quarter century (1990 – 2015), are almost the same, as today, even though trade volumes and patterns have changed significantly. Tinbergen derives relations, between the freight rate development and demand indexes, tonnage capacity and fuel costs. During the period Tinbergen studies, there was a remarkable technological and organizational development, which reduced transportation costs. [11] (Tinbergen, J. 1939: pp. 46). This includes lower crew/tonnage ratios, increased fuel efficiency and declining shipbuilding costs. As Tinbergen points out, the competitive pressure in this close to perfectly competitive industry implies that decreasing costs means a downward trend in freight rates.

In the 1931, Tinbergen's paper introduces the "durable good cycle", exemplified by the shipbuilding cycle, in contrast to "non-durable good cycles".

High freight rates trigger, ordering of vessels, causes a downward pressure to freight rate when the vessels are delivered.

But, as it takes time from ordering a vessel until delivery, the fall in freight rates will not be instant and in the meantime very high freight rates may occur.

Eventually, freight rates will return to lower levels and in some cases, even a freight rate depression may follow if too much capacity is constructed. Due to the "time to built" effect it is hard to match demand and capacity at all times. Tinbergen argues that both freight rates and shipbuilding tend to move in cycles, and he suggests modeling these patterns as sine waves.

For the tanker classical markets, was busy un author, specialist in the field [7] (Hawdon, D. 1978: pp.

203-217) The suggestion that freight rates, as a part of their stochastic nature, have a downward trend when they are high and have an upward trend when they are low has been referred to as the “mean reverting” nature of freight rates. The assumption of mean reversion in freight rates has been used in theoretical examples of the valuation papers, of two authors - Bjerksund and Tvedt. [3] (Bjerksund, P., S. Ekern. 1995: pp. 118-121.) & [12] (Tvedt, J. 1998: pp. 167-175)

Tinbergen's two fundamental assumption about dry bulk shipping market prices, indicate the downward trend in price due to increased efficiency or mean reversion pattern, due to delayed capacity adjustment. On the contrary, results indicate that dry bulk shipping market prices follow random walks.

### 1 Studies and investigations referring to modern empirical literature

Others authors [1] Berg-Andreassen, J.A. 1996a: pp. 370-375) studied the dry bulk markets by investigating freight rate observations from the Baltic Freight Index (BFI). This index was compiled from freight rates on different dry bulk shipping routes, and was used for futures trading in freight rates at the Baltic International Freight Futures Exchange (BIFFEX). Daily observations, from April 1985, to December 1988, are studied for ten selected routes in the BFI.

Using the augmented Dickey-Fuller test, which has become the standard tool for testing for random walks, Berg-Andreassen concludes that the freight rates follow random walks. This implies that the process was non-stationary, but the first difference is stationary, i.e. it is integrated of order one.

Berg-Andreassen also, studied quarterly observations from 1990 to 2000, “of freight rates and of second hand prices for dry bulk vessels. The result was equal to those of the daily observations of freight rates, i.e. all series seem to follow random walks.

Some authors [2] (Berg-Andreassen J.A. 1996b: pp. 381-395), after ten years of quarterly observations from three BFI routes, they did were tests for order of integration. For each of routes, both spot freight rates and time charter freight rates are available.

Berg-Andreassen concludes that all freight rates are integrated of order one, which indicates that the variables follow random walks. Kavussanos and Nomikos Two specialists [10] (Kavussanos, M.C., N.K. Nomikos. 1999: pp. 353-376), also argue that the BFI follows a random walk. The focus of their paper is to investigate the unbiasedness hypothesis of the BIFFEX futures prices hypothesis.

For each of routes, both spot freight rates and time charter freight rates were available. Berg-Andreassen concludes that all freight rates are integrated of order one, which indicates that the variables follow random

walks. Kavussanos and Nomikos also argue that the BFI followed a random walk.

Were studied the monthly freight rates [14] (Veenstra, A.W., P.H. Franses. 1997: pp. 447-458.) the monthly freight rates for three capsize and three panama routes. Observations cover the period, September 1983, to August 1993. using an Dickey-Fuller test, without a time trend on the natural logarithm of the observations, they conclude that all series are non-stationary at a 1% level. At a 5% level the hypothesis of non-stationarity, can be rejected for two of the panamax routes. Despite this, Veenstra and Franses assume for the rest of study bulk markets, that the log of the freight rates are integrated of order one.

Their main conclusion is that the freight rates follow random walks but are co-integrated [13] (Veenstra, A.W. 1996: pp. 79-81).

Kavussanos Was studied, also, about the volatility in dry freight rates, about spot and time charter freight rates. [9] (Kavussanos, M.G. 1996: pp. 67-92.0. He uses monthly data, from 1973, until 1992, where the time charter market is represented by an aggregated freight index and the spot market is represented by an aggregated index as well as data series, representing each of the three vessel types; capsize, panamax and handysize.

The log of all of these data series is reported to be integrated of order one and are co-integrated.

Others authors [5] (Glen, D.R., P. Rogers. 1997: pp. 245-260) have studied freight rates index for the Capesize market and find that for all routes the freight rates in level form are non-stationary, but for the first difference the unit-root hypothesis can be rejected.

Studies in field [6] (Hale, C., A. Vanags (1992: 31-39). have focused on the stochastic nature of relation between the second hand values of handysize, panamax and capsize vessels. They have studied monthly observations, from October 1970, to July 1988, for each of the vessel types and conclude that all variables are integrated of order one and, hence, seem to follow random walks. Was extended [4] Glen, D.R. 1997: pp. 245-260) the data set used by Hale and Vanags, to cover monthly observations for the period 1979 to 1995. Basically, he confirms the result of Hale and Vanags that the log of the second hand values are integrated of order one. He also concludes that the asset prices are co-integrated.

Has studied, also [9] (Kavussanos, M.G. 1997: pp. 433-443) has studied the volatility in dry bulk second hand values. Are studied, Monthly observations, from 1976, to 1995. Using a methodology for seasonal data, Kavussanos reports indicate that the log of all second hand prices are integrated of order one. In the paper, time charter freight rates are, also, studied and are found to be stationary, a fact which contradicts the

results of Kavussanos, from 1996, but no test of this is presented.

With only, very few exceptions, the evidences seem very strong, from the modern literature, because that freight rates and second hand values in the dry bulk shipping markets followed random walks.

This means that high prices not necessarily are followed by lower prices and vice versa. The next section of this paper re-established the result from the empirical shipping literature as regards the lack of stationarity in dry bulk freight rates and second hand values.

For completeness new building prices are also included in this study. Thereafter, an alternative perspective is suggested: the study is carried out on the same set, but the denomination of the observations is changed from, US\$, to Japanese yen.

## 2 Eloquent digits

The dry bulk data employed in this paper are any observations from the SeaWin database, which is based on observations from Clarkson Research Studies Ltd of London, Fearnleys of Oslo or Gothenburg Chartering

Three new building price series are available; the new building price of a 30,000 dwt handysize bulk carrier, a 60,000, to 70,000 dwt panamax bulk carrier and a 120,000 to 140,000 dwt capsizes bulk carrier.

The quarterly new building prices, in million US\$, are available, from 1st quarter 1970, to 3rd quarter 1999, i.e. 119 observations. The three second-hand value series, available are: the price of a five old 30,000 dwt handysize bulk carrier, a five year old standard panamax bulk carrier and a five year old standard capsizes bulk carrier.

The freight rates are represented so by time charter (TC) equivalent spot rates and spot rates in US\$ per ton. The time charter equivalent spot rates are denoted in US\$ per day, for a 30,000 dwt handysize bulk carrier, a 60,000 dwt panamax bulk carrier and a 120,000 to 150,000 dwt capsizes bulk carrier.

The time charter equivalent spot rates are available, from 1988, to 1999, on a weekly basis, a total of 591 observations. The spot rates in US\$ per ton include the cover of voyage related costs and three routes are studied; coal 120,000 tons from Hampton Roads/Roberts Bay (HR/RB) to Japan, coal 65,000 tons from US gulf? ARA and grain 55,000 tons from US Gulf to Rotterdam.

Observations of the spot rate, in US\$ per ton, are available, from 1984, to 1999, a total of 748 observations. In addition, the Baltic freight Index (BFI) has studied. The index has been compiled on a daily basis, from 1985. Are studied, data, from 4th January 1995 to 5th October 1999, i.e. 3722 observations.

The price series of new building and second hand values, that are reported monthly and quarterly by shipbrokers, are based on a very low number of observations. The number of new building contacts and second hand sales fluctuate substantially, and during some months transactions are carried out at all, or the contacts are related to non-standard tonnage.

Hence, data are in many cases not based on actually observations but on the brokers' best estimate of current market. It is more appropriate to use monthly or weekly data for the spot freight rates due to the high number of freight transactions in the market. When it comes to the daily observations of the BFI index, sub-index values are occasionally substituted by the ship brokers' best estimate of the current market in the cases that no transactions has been carried out.

## 3 The habitual trend on carriage of goods

To test for random walk, the augmented Dickey-Fuller test is used. This method is applied in most of the empirical papers presented above. Both the augmented Dickey-Fuller regressions with and without a trend are studied.

Generally, it is not possible to reject the random-walk hypothesis. The only exception in our study is the spot rate in US\$ per tones for the coal, 65,000 tones from US Gulf/ARA, rout and grain, 55,000 tones from US Gulf to Rotterdam, rout for which the null hypothesis of non-stationarity can be rejected at 5% and a 10% level, respectively, in case of no trend. This is in accordance with the findings of Veenstra and Franses, that spot rates for the panamax vessels seem to be stationary. Hence, our study confirms the general result that shipping freight rates and values seem to follow random walks but study also confirms that the panamax spot rates may be an exception.

## 4 Carriage of goods and them values

Demand for the large dry bulk vessels are mainly generated by transport to Asia and Europe. Iron ore, coal and grain dominate the dry bulk trades. The main exporters of iron ore are South America and Australia (together about 70%) and the main importers are Japan, other Far East and Europe (total about 90%). North America contributes to only a very marginal share of world iron ore trade, about 7% of export and less than 4% of imports. Coal export is dominated by Australia, North America and South Africa (total about 70%) and the main importers are Japan, other far East and Europe (total about 90%). Grain export is dominated by North America (above 60%) and imports re dominated by Asia (above 50%).

North America is unique since the region combines a huge natural resource base with a high degree of industrialization. Hence, the region is almost self

sufficient as regards commodities transported in dry bulk vessels and is therefore close to independent of dry bulk shipping services for imports. However, dry bulk vessels are used for exporting coal, grain and some other commodities like forest products, from North America. Japan, on the other hand, is totally dependent on the dry bulk fleet for importing almost any commodity used by the domestic industry.

In the early 1970's European yards were still major players in the market for bulk carrier construction, but for most of the period studied here Japan has dominated the international market. Due to a continuous improvement in efficiency, Japan has been able to keep its large market shares despite rising wages. Today, also South Korea and China are major suppliers of bulk tonnage in addition to Japan. Europe has a very minor role in this market and the USA has not constructed large bulk vessels for free international trade for decades.

Both from a demand for shipping services and from a ship building perspective Japan is major player in dry bulk market, and in an over-all perspective, Japan together the rest of Asia, is most probable more important for the dry bulk market than the USA. Most transactions in international shipping are, however, carried out in US\$. On the other hand, if the fundamentals in dry bulk shipping, both regards demand for shipping services and the construction of new capacity, are mainly influenced by Asia in general and Japan in particular, then an Japanese yen, perspective may be more appropriate when studying the long run relations in the dry bulk markets than usually US\$ perspective.

Below the unit root analyses are repeated but all observations of new building prices, second hand values and freight rates are converted from US\$ to a Japanese yen denomination, using each periods' end Yen/US\$ exchange rate.

By changing the denomination of the data from US\$ to Japanese yen the dry bulk freight rates seem to be stationary. Time charter equivalent spot rates for panamax and handysize dry bulk carrier seem to be stationary around a trend, i.e. trend-reverting. The trend seem to be slightly downward, as we should expect from gradual improved efficiency in a close to perfectly competitive market. The freight rates, measured in yen per ton, for 65,000 tons of coal and 55,000 tons of grain, i.e. panamax lots, seem to be stationary, maybe a slight downward trend. For time charter equivalent capsized spot rates we cannot rule out the random walk hypothesis, even from the yen perspective. The freight rate in this market seems to be more volatile than the freight rates in the market for the smaller dry bulk vessels. The number of capsized vessels is much lower than the number of panamax and handysize vessels

and long-term contracts are more frequent. Hence, the capsized spot market may be more exposed to short-term market imbalances than the markets for smaller vessels. This may explain the lack of structure in capsized freight rates. However, at a 10% level the yen per ton freight rate of 120,000 tons of coal, i.e. a capsized lot, seems to be stationary.

The BFI in this data set, is a combination of capsized, panamax and handysize freight rates and of US\$ per ton freight rates and short time charter freight rates. At a 5% level of significance the random walk hypothesis can be rejected for the BFI. Hence, the stationarity result for the BFI is not as strong as for the panamax and handysize freight rates but stronger than for the capsized.

For the newbuilding and second hand values we cannot reject the random walk hypothesis when values are measured in Japanese yen. The only exceptions are the capsized and panamax values at a 10% level of significance. The second hand market does not directly influence the total transport capacity or the utilization of the existing capacity, as the new building and freight market fundamentals, which to such a large extent are governed by the development in the Asian economies. The main asset players in the bulk markets are independent owners in Europe, especially Greek shipowners. Traditionally, they have a US \$, or local currency, perspective on their investments. Nevertheless, in the long run second hand values should follow a pattern consistent with the trend in new building values and freight rates. A five-year-old vessel, like in the available data, may for another 15 to 25 years, and therefore, the value of the vessel is in most cases heavily influenced by new building prices. From the unit root tests, it seems as if the new building prices follow a random walk whereas the freight rates are stationary. Hence, it seems reasonable that there are only weak indications of stationarity in second hand values.

### Conclusions

By changing the perspective, from US \$, to Japanese yen, freight rates in the dry bulk shipping industry seem to be stationary. These results apply to all "deep sea" dry bulk vessels sizes, i.e. handysize and panamax vessels. Hence, the empirical result confirms what traditional models of the shipping markets suggest. That is, high freight rates trigger increased supply via new building and increased utilization of existing tonnage and low freight rates trigger reduced supply via lay-up and scrapping of vessels. Therefore, freight rates are mean reverting.

The dry bulk shipping markets are, mainly, influenced by Asia, both as regards demand for shipping services but and ship construction. Non-Asian

ship owner, generally, see international shipping, as a US\$ industry. This study indicates that this perception may be somewhat misleading, since yen denominated prices probably better reflect the fundamental changes in the industry and, hence, give more valuable feedback to the market agents. Investing in a shipping asset probably means to go long in a yen related asset, which implies a substantial exchange rate risk, from the perspective of an investor who wishes to maximize his US\$ fortune.

In recent years China's position in the dry market has increased significantly. Hence, future studies along these lines may include a basket of Asian currencies, not only Japanese yen. For prices in other markets the choice of the most appropriate currency, or basket of currencies, may not be straightforward. Nevertheless, the currency that for historical reasons is used for international transactions may very well be inappropriate when searching for long run economic fundamentals.

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