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GEMİ İNŞA AKTİVİTELERİNİN NAVLUN ORANLARINA TEPKİSİ

Sadık Özlen BAŞER* **Abdullah AÇIK****

ÖZET: *Deniz taşımacılığının diğer çoğu piyasadan farklı ekonomik özellikleri mevcuttur. Bu özellikler piyasada sürekli döngüsel hareketlerin yaşanmasına ve yanlış kararlar alan işletmelerin piyasadan silinmesine neden olmaktadır. Bu döngülere talep tarafındaki değişmelerin dışında en büyük etkiyi arz tarafının kısa dönemde inelastik olması katkıda bulunmaktadır. Bunun nedeni de gemi inşa sürecinin 1-3 yıl arasında sürebilmesi, ve bugün alınan sipariş kararının etkilerinin inşa süreci bittiğinde piyasaya yansımasıdır. Bu doğrultuda yatırım kararını etkileyen ana unsur gelir olduğu için, navlun oranlarıyla tamamlanan gemi tonajı arasında gecikmeli bir ilişki olması muhakkaktır. Bu çalışmanın amacı, teoride yerleşmiş olan bu gecikmeli ilişkiyi ampirik olarak test ederek mevcut literature katkıda bulunmaktır. Navlun gelirlerinin bir temsilcisi olarak navlun fiyatlarını baz alan Baltık Kuru Yük Endeksi (BKYE) kullanılmıştır. Çalışmada kullanılan veri 1985 ve 2017 yıllarını kapsayan yıllık gözlemlerden oluşmaktadır. Navlun gelirleriyle tamamlanan tonaj arasındaki ilişkiyi tespit etmek için korelasyon, regresyon ve çapraz korelason yöntemleri kullanılmıştır. Çalışmanın sonucunda tonajın gelirlerdeki değişime 2 yıl sonra tepki verdiği ve değişkenler arasında pozitif yönlü bir ilişki olduğu sonucuna ulaşılmıştır.*

Anahtar Kelimeler: *Navlun Oranları, Gemi İnşa, Zaman-Gecikmeli Tepki*

Jel Sınıflandırması: C01, C22, D9, R41

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THE RESPONSE OF SHIPBUILDING ACTIVITIES TO FREIGHT MARKET

ABSTRACT: *Maritime transport has different economic characteristics than most other markets. These features cause continuous cyclical movements on the market and cause some businesses to eradicate from the market due to making the wrong decisions. Apart from the changes in the demand side, the short-term inelasticity of the supply side contributes much to these cycles. The reason is that the shipbuilding process lasts for 1-3 years, and the effects of the ordering decision taken today are reflected in the market when the construction process is over. In this respect, since the main factor influencing the investment decision is income, it is certain that there is a delayed relationship between the freight rates and the completed ship tonnage. The purpose of this study is to contribute to the current literature by empirically testing this delayed relationship, which is already established in theory. The Baltic Dry Index (BDI), which is based on freight rates, is used as a representative of freight revenue. Data used in the study are annual observations covering the years 1985 and 2017. Correlation, regression and cross-correlation methods were used to determine the relationship between freight revenue and completed tonnage. As a result of the study, it was found that the completed tonnage reacted change in the income after 2 years and there was a positive relationship between the variables.*

Key Words: *: Freight Rates, Shipbuilding, Time-Lagged Response*

Jel Classification: C01, C22, D9, R41

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1.Introduction

Maritime transport has a very important role in the successful and sustainable development of world trade throughout history. Although the work of human beings seems to be difficult with the separation of continents, unlimited motorways have been formed for transportation on oceans and it has become possible to transfer resources scattered on the world more easily and economically than by any other modes. For all these reasons, the working mechanism of this vital mode of transportation is worthy of research by many researchers.

With the acceleration of technological developments, ship operation and production technologies are changing rapidly. This increases competition in the market and facilitates entry and exit into the market, especially in the bulk market. New vessels with new technology provide lower break-even points to companies. This causes them to accumulate a lot of capital in buoyant market conditions and to survive in stagnant market conditions. Contrary to this, companies with the old or obsolescence vessels have difficulty accumulating capital in the buoyant market as they have higher break-even points, and so they cannot survive stagnant market conditions (Scarci, 2007). Besides the ability of shipowners to profit from low operating costs, this new technology also facilitates international trade by offering low transportation costs to transportation service customers. But the new ship technology does not always mean that transportation prices offered to customers will be low.

Freight rates consist of the interaction between supply and demand sides on the market (Beenstock and Vergottis, 1989). Supply and demand sides can be defined by 5 variables for each. The variables that constitute the demand side are the world economy, seaborne commodity trades, average haul, random shocks and transport costs while the variables constitute the supply side are world fleet, fleet productivity, shipbuilding production, scrapping and losses, and freight revenue (Stopford, 2009:136). Each of these variables is important and covers a wide range of research topics, but the scope of this study is to examine the shipbuilding market on the supply side.

The shipbuilding market can be affected by many factors, including freight rates (Kim and Park, 2007), demand for other ship types (Merikas et al., 2008) and sale and purchase market (Beenstock and Vergottis, 1989). But it is mainly affected by freight rates. When freight rates rise, some shipowners rationally (Beenstock and Vergottis, 1989), others biasedly (Greenwood and Hanson, 2014), decide to increase their carrying capacity by ordering a new ship. However, while new vessels are ordered according to current market conditions, delivery of vessels can last between 2-4 years. At the end of this period, the market is uncertain and this situation poses a risk for shipowners (Tsolakis, 2005).

In the light of such information, aim of this study is empirically testing the delayed relationship of this shipbuilding building process with the freight rates, which is commonly accepted knowledge in the theory. Towards this end, the amount of tonnage completed was selected as representative of the shipbuilding market while the Baltic Dry Index (BDI) was selected as a representative of the freight rates. It was intended to establish a lagged relationship between these variables, as the deliveries of vessels ordered according to the theory last for an average of 1 to 3 years. In other words, even if the increasing freight rates have fallen and orders have been cut off, deliveries continue to increase for a while. Even if some orders are canceled in this process, their effects to the total quantity are invisible.

Correlation and regression analysis were first used to examine the relationship between simultaneous variables. However, no significant relationship was found between the variables. Therefore, it was tried to determine the relationship between delays by applying cross correlation analysis. As a result of this analysis, a relatively high positive correlation was found between the 2 years later value of the completed tonnage and the freight rates. Then positive relationships were found in correlation and regression models using lagged values. A significant positive correlation of 0.45 was found between variables and according to the regression model, the 10% change in the freight rates caused 1.2% change in the 2 years later value of the completed tonnage. In this context, it is hoped that this study will contribute to the literature by empirically testing the response of the shipbuilding activities to the freight market.

The remainder of the study is constructed as follows. Section 2 provides the theoretical mechanism in the market. Section 3 introduces the methodology and dataset used in the study. Section 4 presents the empirical results. Finally, brief conclusion is presented.

2.Theorotical Background

Maritime companies deal with transportation activities and their main revenue sources are freight revenues. Therefore, other sub-markets, such as shipbuilding, scraping, sale and purchase markets, are shaped by the freight market. The freight market is formed by the interaction of supply and demand sides (Beenstock and Vergottis, 1989).

In maritime economics, supply can be examined in two different ways, short and long run. Because this market has its own characteristics. In the short run, supply is determined by number of voyages carried out by shipowners (Kalouptisidi, 2014) and speed of the fleet (Karakitsos and Varnavides, 2016:14). There is no other way to increase supply in the short run as the duration of the ordering and delivering lasts for 1-4 years (Stopford, 2009:157). In the long run, supply is adjusted by adding new-built ships to the fleet or by scrapping old ones (Kalouptisidi, 2014). The Cobweb theory is one of the best explaining model of the change in prices and supply in the long run.

The working principle of the Cobweb theorem is visualized in Figure 1. The graph on the left (A) shows the individual behavior of the companies and the graph on the right (B) shows the behavior of the market. While the vertical axis reflects the daily time charter rates (price), the horizontal axis reflects the number of ships. Let us first assume that the equilibrium price in the market is P_e. Afterwards, freight rates increase to P_1 level due to an event that takes place in the market mechanisms. Since the gains are high at this price level, shipowners order new vessels to offer more carrying capacity (point B). However, when new vessels are delivered, there is a supply surplus in the market and the prices suddenly fall to the level of P_2 and the process is moved to point C. From this moment on, the owners send their old ships to demolition and cause a further fall in transport capacity (Point D). This leads to a decrease in supply on the market, which again leads to a rise in freight rates and the price again occurs at the level of P_1. The process does not occur precisely at these points, but the mechanism is this as a template. On the other hand, the reflection of the individual decisions made by the companies on the market is like the other graph. New orders of companies shift the supply curve to the right causing an increase in the carrying capacity (S_1 to S_2) and a decrease in the freight rates (P_1 to P_2). By dealing with the opposite of this mechanism, when ships are sent to demolition, transport capacity is reduced and freight rates rise (Stopford, 2009:336).

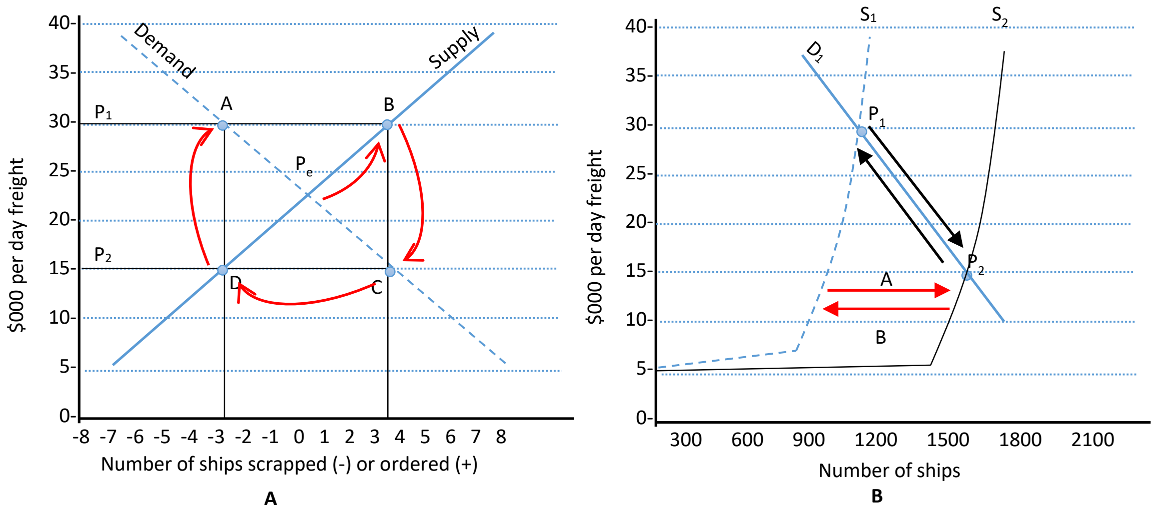


Figure 1. Cobweb Theorem in Maritime Economics
Source: Stopford, 2009:336

These behaviors on the market lead to shipping cycles with different characteristics by adding the demand side developments. These cycles consist of 4 phases; through, recovery, peak and collapse. During the through period, the excess supply reduces the freight rates, the ships with high operation costs exits from the market and the new build orders are reduced. In the recovery period, supply and demand approaches to a balance and freight rates exceed operating costs. During the peak period freight rates increase too much, capital accumulation accelerates and new build orders burst. In the collapse period, supply exceeds demand too much and freight rates are hit (Scarci, 2007). These cycles have occurred continually at different heights and lengths throughout history. For instance, between 1741 and 2007, there were 22 cycles in the bulk market. The average was 10.4 years while the standard deviation was 4.9 years (Stopford, 2009:105).

From the point of view of ship order, shipbuilding prices follow these cycles by moving together with freight rates (Beenstock and Vergottis, 1989). But the newbuilding market has a more challenging process than the freight markets. Because delivery of new orders varies between 1 and 3 years (Karakitsos and Varnavides, 2016:14) and since the orders are given according to the current market conditions, the situation of the market cannot be known when the ship is delivered (Tsolakis, 2005). Some shipowners rationally (Beenstock and Vergottis, 1989) and some shipowners biasedly (Greenwood and Hanson, 2014) decide to increase their carrying capacity by ordering new ships.

Ordering decisions can be followed in parallel with freight rates as they are received instantaneously. However, the results of today's decisions can show its effect after about 1-3 years. In this respect, this study contributed to this literature by testing these deferred results empirically. The method and data set to be used in the analysis are introduced in the next section.

3.Methodology

Correlation and regression analyzes were applied respectively in line with the objectives of study. The directions and powers of relations were determined by the correlation analysis, and the econometric relationship was modeled by regression analysis. If any, delayed correlation coefficients were determined by cross correlation analysis.

A number of correlation analysis techniques are available in econometrics. The fields of use vary according to the distributions of the data. One of the most common methods used in normal distribution data is the Pearson technique. Pearson's correlation coefficient R is a measure of the strength and direction of the linear relationship between two variables. It is defined as the covariance of the variables divided by the product of their standard deviations. The absolute value of Pearson correlation coefficients is no larger than 1. Correlations equal to 1 or -1 correspond to data points lying exactly on a straight line (Chang, 2014:78). Formula of the Pearson correlation is presented below.

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}} \quad (1)$$

After the Pearson's correlation coefficient is obtained by (1), t statistics of coefficient should be calculated to determine whether coefficient significant or not. Calculated t value by (2) is compared with table values of t-distribution. If it is bigger than critical value, this means the coefficient is significant.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \quad (2)$$

Regression analysis is concerned with the study of the dependence of one variable on one or more other variables. The dependent variable is tried to be explained by the explanatory variables. The results that gained after analysis are used for estimating and/or predicting the mean or average value of the former in terms of the known or fixed values of the latter (Gujarati, 2004:18). Simple model of the regression equation is presented at (3). Y_i is the dependent variable of the equation, $\hat{\beta}_1$ is the predicted constant of the equation, $\hat{\beta}_2$ is the predicted coefficient of the X_i which is the independent variable in the model. At lastly $\hat{u}_i$ is the residuals that cannot be explained by existing model. (4) presents the calculation of the coefficient of independent variable and (5) presents calculations of constant coefficient. And significances of the coefficients are calculated by (6).

$$Y_i = \hat{\beta}_1 + \hat{\beta}_2 X_i + \hat{u}_i \quad (3)$$

$$\hat{\beta}_2 = \frac{n\sum X_i Y_i - \sum X_i \sum Y_i}{n\sum X_i^2 - (\sum X_i)^2} \quad (4)$$

$$\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X} \quad (5)$$

$$tstat(\hat{\beta}_1) = \hat{\beta}_1 / se(\hat{\beta}_1)$$
$$tstat(\hat{\beta}_2) = \hat{\beta}_2 / se(\hat{\beta}_2) \quad (6)$$

$$lnY_i = ln\beta_1 + \beta_2 lnX_i + u_i \quad (7)$$

Log-log regression model (7) is used for our study. One attractive feature of the log-log model, which has made it popular in applied work, is that the slope coefficient $\hat{\beta}_2$ measures the elasticity of Y with respect to X, that is, the percentage change in Y for a given (small) percentage change in X (Gujarati, 2004:176). Also using logarithmic values in data makes them continuous series. The data set was introduced in the next section.

3.1.Data

The data used in the study covers between 1985 and 2017 on an annual basis. The COMPLETED data expresses the total ship tonnage built around the world in terms of thousand gross tonnages. The BDI is used to represent freight revenues in this study as well as being an index representing the prices of transportation on the world. Descriptive statistics of these raw data and their processed versions are presented in Table 1. According to this table, since 1985 an average of 42 million gross tons of new ships have entered the market each year. The maximum amount of market entry between these years was 101.8 million gross tons in 2011, while the minimum amount of market entry was 10.9 million gross tons in 1988. Also according to the skewness value of the ΔLn COMP value, negative news has great effect on the completed tonnage. When the BDI data is examined, it is seen that since 1985 the average value has been at the level of 1909 points. The maximum value of the annual average freight rates reached 7070 points in 2007 and the minimum value dropped to 673 points in 2016. The skewness value of the ΔLn BDI, while positive, indicates that prices are more influenced by positive news.

Table 1. Descriptive Statistics of the Variables

	COMPL.	BDI	Ln COMP	Ln BDI	ΔLn COMP	ΔLn BDI
Observations	33	33	33	33	32	32
Mean	42171.58	1909.840	10.44445	7.354790	0.039959	0.007312
Median	31700.00	1354.944	10.36407	7.211516	0.071337	-0.021029
Maximum	101800.0	7070.256	11.53077	8.863652	0.223403	0.833368
Minimum	10900.00	673.1200	9.296518	6.511924	-0.311780	-0.892940
Std. Dev.	26945.20	1512.676	0.661515	0.588959	0.127296	0.391812
Skewness	0.738826	2.185785	0.036696	0.994148	-1.157363	0.094563
Kurtosis	2.367944	7.255689	1.770814	3.428800	4.282045	2.881441
Jarque-Bera	3.551555	51.17959	2.084892	5.688641	9.335457	0.066433
Probability	0.169352	0.000000	0.352591	0.058174	0.009394	0.967329

Source: SAJ, Bloomberg

A graphical representation of the raw variables is also presented in Figure 2. The BDI tested the highest levels ever before the 2008 global economic crisis. But then it fell to very low levels. The value of COMP has steadily increased to its highest level in history in 2011, then declined due to negative expectations in the market because of the poor condition of the freight markets.

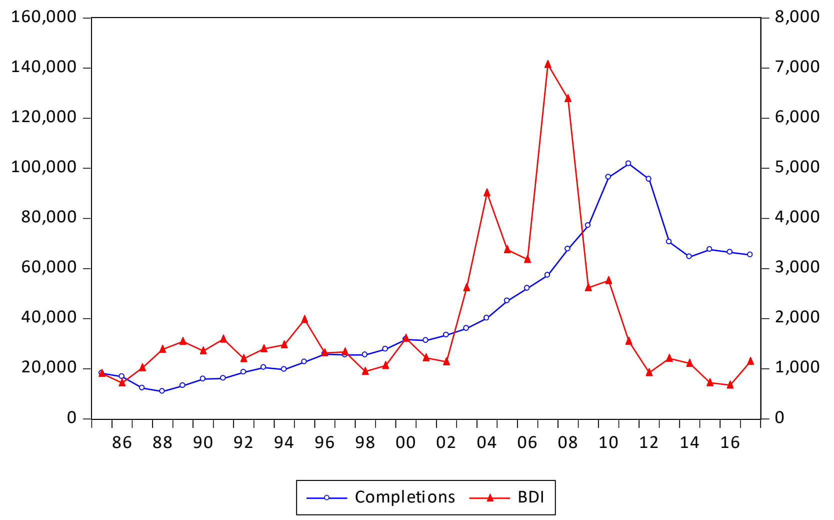


Figure 2. Graphical Display of Baltic Dry Index and Tonnage Completed

3.2.Research Model

The model of the research is presented in Figure 3. The vertical axis represents the freight rates, ordered tonnage and completed tonnage, while the horizontal axis represents time. There is a positive relationship between freight rates and new orders, as noted Kim and Park (2017), and it is assumed in the model that as freight rates increase, new orders also increase in the same direction. When the tonnage ordered at time T-k is delivered at time T, the amount ordered increases in T as freight rates follow a rising trend. Tonnage ordered in time T are delivered on time T+k, but more orders are placed in time T+k as freight rates are still trending up. This continues for as long as the cycle is rising. But when the freight rates go into a falling trend, for example at time T+3k, the tonnage ordered will be low despite the high tonnage being delivered at same time. As seen in the Figure 3, "k" time delayed relationship is expected between the freight rates and the completed tonnage. In this direction, the aim of this study is to find out this value of "k" and verify positive relationship by testing variables.

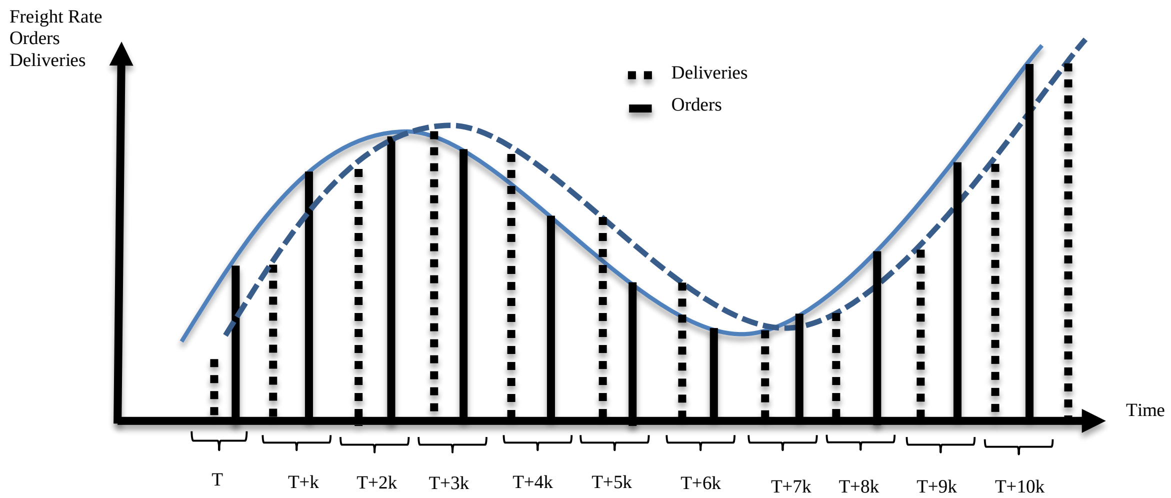


Figure 3. Research Model of the Study

In the next step of the study, findings were presented by going to the stage where econometric relations modeled in methodology were tested.

4.Findings and Discussion

Our analysis begins by using a unit root test. Because the variables that will be used to construct our econometric models must be stationary in order to avoid spurious regression problems. Augmented Dickey-Fuller (ADF) test, which is a commonly accepted method for detecting unit roots, is selected and used. The null hypothesis of the test is that the original series has a unit root which means series is non-stationary. The ADF test results are presented at Table 2. According to test results both of the variables are stationary at their first difference. So ln BDI and ln COMP variables are integrated of order one, I(1).

Table 2: ADF Unit Test Results

		Intercept	Trend and Intercept
Level	Ln BDI	-2.001103	-1.860684
	Ln COMP	-1.095069	-3.420334*
First Differences	ΔLn BDI	-2.552923	-5.132231***
	ΔLn COMP	-3.360058**	-3.297697*
Critical Values	1%	-3.653730	-4.273277
	5%	-2.957110	-3.557759
	10%	-2.617434	-3.212361

Significance levels = * 10%, ** 5%, *** 1%

The graphical display of the stationary data was presented on Figure 4. This kind of graph helps to understand the relationship between variables. However, when the lines were examined, no harmonic relationship was observed between the variables. So, correlation analysis was introduced to determine whether there is a directional relationship.

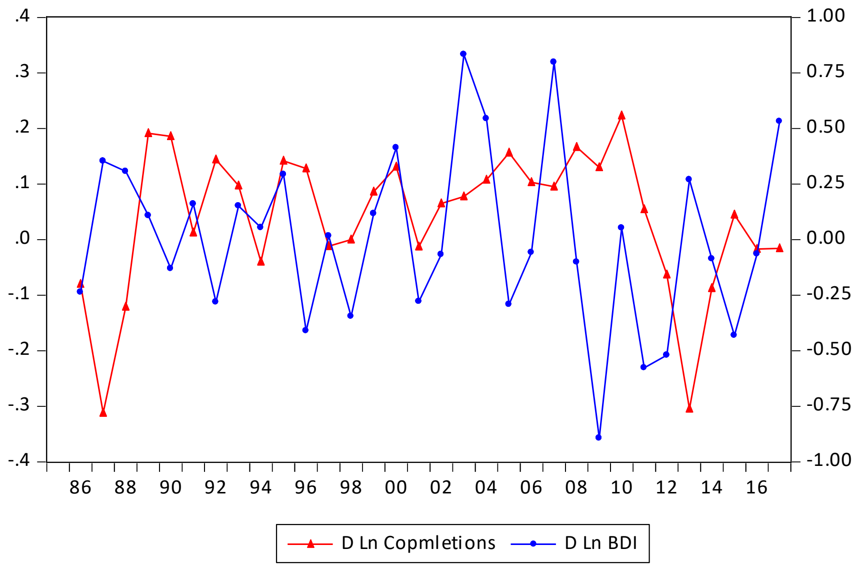


Figure 4. Graphical Display of Differenced Logarithmic Values

When choosing a method in correlation analysis, it was stated that the distribution characteristics of variables were important. When Table 1 is examined, it is seen that the BDI variable shows the normal distribution characteristics, whereas the COMP variable does not. Therefore, correlation between variables is investigated by both Pearson and Spearman methods. According to the results presented in Table 3, the correlation between the two variables seems to be insignificant in both methods. Then the relationship is examined by going through regression analysis.

Table 3. Correlation Analysis of the Variables

	∆Ln BDI	
	Pearson	**Sperman**
	-0.121750	-0.089809
∆Ln COMP	(-0.671851)	(-0.493902)
	0.5068	0.6250

When the regression model is examined, it is determined that the model as a whole is insignificant according to the F statistic. Moreover, while the constant is significant at 90%, the independent variable is insignificant. Therefore, this model is a statistically insignificant model. The reason for this is thought to be that the ship construction period lasts for 1 to 3 years, as mentioned in theory. So the next step is to apply the Cross Correlation analysis showing the lagged relationship between the variables.

Table 4: Regression Model Equation Results

Dependent Variable: ∆Ln COMP				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.040249	0.022709	1.772373	0.0865*
∆Ln BDI	-0.039556	0.058876	-0.671851	0.5068
R-squared	0.014823	**F-statistic**		0.451384
Adjusted R-squared	-0.018016	**Prob (F-statistic)**		0.506820

Significance levels = * 10%, ** 5%, *** 1%

When cross correlation analysis is applied, 9 lags are chosen. However, since the theoretical construction time is usually between 1 and 3 years, longer delays are theoretically insignificant. When the results in Table 5 are examined, it is seen that the highest coefficient was at +i=2 level. This result indicates that there is a correlation between the current value of BDI variable and 2 years later value of COMP variable. Based on this analysis, re-correlation analysis between BDI and two-year later values of COMP variable is performed.

Table 5. Cross Correlations in Different Lags and Leads

	∆Ln BDI	∆Ln BDI		∆Ln BDI	∆Ln BDI
	∆Ln COMP (-i)	**∆Ln COMP (+i)**		**∆Ln COMP (-i)**	**∆Ln COMP (+i)**
i	**lag**	**lead**	**i**	**lag**	**lead**
0	-0.1218	-0.1218	5	-0.0882	0.2338
1	-0.2113	0.2292	6	-0.2870	-0.0716
2	-0.0435	0.3662	7	-0.0171	0.0605
3	-0.0609	0.1786	8	0.0939	0.1059
4	-0.1104	0.2312	9	-0.0775	-0.1993

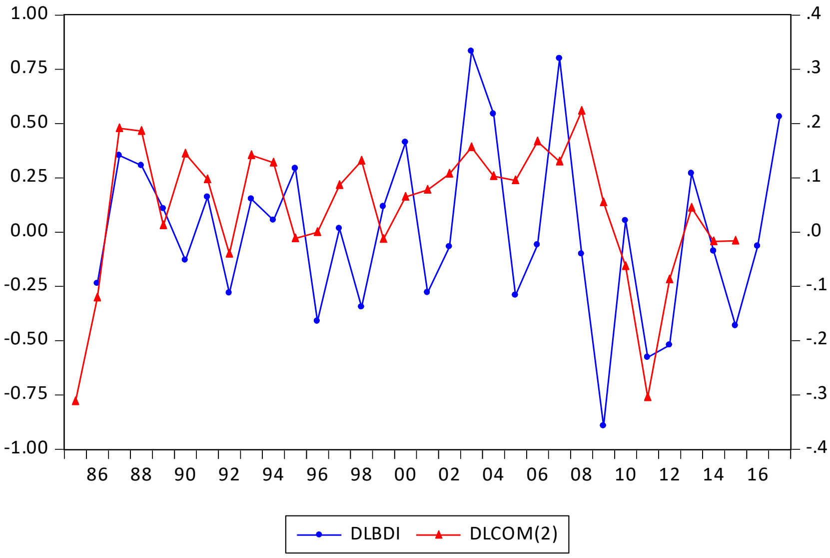
A significant relationship is found in the results of correlation analysis with delayed value as seen in Table 6. Significant correlation coefficients are obtained at a value of 0.44 for the result of Pearson analysis and 0.40 for the result of Spearman analysis. At this point, it can be said that the completed tonnage can react to changes in the freight rates after 2 years.

Table 6. Correlation Analysis of the Variables

	ΔLn BDI	
	Pearson	**Sperman**
ΔLn COMP	0.453848 (2.695089) 0.0118	0.440267 (2.594676) 0.0149

Also when the graph based on the delayed value is examined on Figure 5, it is seen that the data get more harmonious. They act together in the positive direction as the correlation analysis points out. Regression analysis is applied in the next step to determine the degree and econometric significance of this relationship.

Figure 5. Graphical Display of Logarithmic Differenced and Delayed Values



The results of the regression equation are presented in Table 7. When the table is examined, it is seen that the established model is significant as a whole according to the F test. Although the explanatory power of the model is low, the constant variable and independent variable in the model are statistically significant. Changes in the BDI value explains nearly 20% of the changes in the completed tonnage value. When the coefficient of the independent BDI variable is examined, a 1% change in BDI causes a change of 0.13% in completed tonnage. In order to be able to interpret the results reliably, some assumptions of the residuals of the model must also be provided. These assumptions can be listed as the absence of autocorrelation and serial correlation between residuals, the absence of heteroscedasticity in residuals, and the normal distribution characteristics of residuals.

Table 7. Regression Model Equation Results

Dependent Variable: ∆Ln COMP(2)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.056678	0.018369	3.085616	0.0045***
∆Ln BDI	0.128191	0.047564	2.695089	0.0118**
R-squared	0.205978	**F-statistic**		7.263507
Adjusted R-squared	0.177620	**Prob (F-statistic)**		0.011765**

Significance levels = * 10%, ** 5%, *** 1%

First, autocorrelation and partial correlation tests were applied by selecting 12 lags. When the test results in Table 8 are examined, it can be seen that the null hypothesis cannot be rejected at all lags. This result shows that there is no autocorrelation problem among the residuals of the series. Hence it means that there is no information that cannot be separated from the residuals.

Table 8. Autocorrelation and Partial Correlation Test Results

Lags	AC	PAC	Q-Stat	Prob	Lags	AC	PAC	Q-Stat	Prob
1	0.164	0.164	0.8878	0.346	**7**	0.011	-0.052	5.7782	0.566
2	-0.213	-0.247	2.4498	0.294	**8**	0.013	0.026	5.7860	0.671
3	0.092	0.193	2.7531	0.431	**9**	-0.164	-0.180	7.0192	0.635
4	0.049	-0.076	2.8432	0.584	**10**	-0.009	0.041	7.0234	0.723
5	-0.233	-0.183	4.9269	0.425	**11**	0.126	-0.002	7.8235	0.729
6	-0.145	-0.075	5.7727	0.449	**12**	-0.002	-0.016	7.8237	0.799

The results of the other tests to be used are presented in Table 9 collectively. First, Breusch-Godfrey LM test is applied for serial correlation detection. When the probability value of the test is examined, the null hypothesis, that indicates no serial correlation among residuals, cannot be rejected. The other test is the Jarque-Bera test, which tests whether residuals show normal distribution characteristics. The null hypothesis of this test is that the residuals show normal distribution properties. According to the results in the table, the null hypothesis cannot be rejected. The last test applied to residuals is the heteroscedasticity tests. The null hypothesis of these tests is that there is no heteroscedasticity problem in the residuals. When the White test is applied, the null hypothesis cannot be rejected at a critical point, so the ARCH test is also applied additionally. According to the result of this test, the null hypothesis cannot be rejected at a more stable point.

Table 9. Robustness Tests for Residuals of the Model

Breusch-Godfrey	F-statistic	1.244674	Prob. F(2,26)	0.3046
Serial Correlation LM	Obs*R-squared	2.621346	Prob. Chi-Square(2)	0.2696
Normality	Skewness	-0.637125	Jarque-Bera	2.5356
	Kurtosis	3.636259	Probability	0.2814
White	F-statistic	2.264496	Prob. F(2,27)	0.1233
Heteroscedasticity	Obs*R-squared	4.309360	Prob. Chi-Square(2)	0.1159
	Scaled explained SS	4.948167	Prob. Chi-Square(2)	0.0842
ARCH	F-statistic	0.095610	Prob. F(2,25)	0.9091
Heteroscedasticity	Obs*R-squared	0.212540	Prob. Chi-Square(2)	0.8992

After all these robustness tests it was determined that the residuals did not contain any problems. Therefore, the model can be used statistically and econometrically to interpret the relationship between variables.

Conclusion

The maritime market has its own characteristics. This market includes many sub-markets such as newbuilding, sale and purchase, and demolition but all these markets are directly affected by the developments in the freight market. For instance, owners with high returns want to increase their transport capacity as motive to gain more returns. They do this by ordering a new ship or by purchasing it from ships in the current market, and consequently ship prices will increase in these two markets. Or if freight rates drop to the point where they cannot meet the operational costs, shipowners send their ships to the demolition market. It is seen how important freight rates are, and they consist of supply and demand balance in the market.

Unlike most markets, the maritime market is having difficulty responding to sudden increases in demand. The way to increase supply in the short term is to increase the speed. Because the shipbuilding process can last between 1 and 3 years depending on the density of shipyards. Also demand for other ship types also contributes to this density, in other words demand from different markets affects the density in shipyards. This is called time-to-build effect and causes cycles in the market. Moreover, the result of a decision for investing new ships today is reflected in the market after 1-3 years.

In this framework, this study aimed to establish a lagged relationship between freight rates and delivered tonnage, assuming that shipowners are making rational decisions. In theory this delay has been handled, but in practice there has been no study empirically testing its reflection on the market. Afterwards lagged movement was determined by cross correlation analysis, variables were modeled by correlation and regression analysis. As a result of the analyzes, a positive correlation was found between the two-year delayed value of the completed tonnage and freight rates.

The most important limitation of study is the failure to separate the completed tonnage and freight rate data on the basis of different markets. Because these data are too costly to reach. For this reason, future studies may investigate this delayed relationship between freight rates and completed tonnage on the basis of different markets.

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