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Ship Sales and Purchases Market: Modeling the Influences of Seaborne Trade and Charter Rates/Freight on Dead Weight Tonnage of Global new Building Orders

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Abstract:

The study analyzed the global new building order dead weight tonnage (dwt) in ship sales and purchases market and the relationship with global seaborne trade and charter rates/freight between 1999 and 2013. The major aim was to assess the dependency of new building order dwt on global seaborne trade and daily charter rates/freight with a view to ascertaining the influence of the explanatory variables on new building order dwt over the period. It also compared the new building price index and second hand price index of vessels five years older than new orders. The research data were obtained from UNCTAD Review of Maritime Transport 2014 edition and China Ship Building Research Centre as well Clarkson's price index. The econometric and statistical methods of multiple and simple regression, trend analysis, correlation analysis, and independent sample t-test were used to analyze the data obtained. It was found that global new building order DWT increases as global seaborne trade increases and as daily freight/charter rate increases, global new order DWT does not increase significantly. The practical application of this is that ship owners in order to expand capacity profitably must do when seaborne trade is increasing or in boom with less consideration to charter rates as the major factors that drive and influence the demand for the ordering of new ship tonnages (capacity) are global seaborne trade and increasing time period. A very weak correlation exists between global new building orders dwt and charter rates/freight. Increasing charter rates/freight does not induce demand/order for new ship tonnages.

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1.0 Introduction

The major source of ship acquisition for fulfillment of needs of carriage of goods by sea alternative to the ship chartering market is the ship sales and purchases market. Though the ship chartering market offers ship acquisition alternative to shippers in the sea carriage trade, the ship sales and purchases market supersedes it as the new vessel must abi initio be acquired by the ship owner from the builder on order or from the second hand market by the ship owner who may subsequently consider approaching the charter broker for chartering the ship out to shippers; in which case the ship sales and purchases market may be considered as the only existing channel of ship purchases, sales and acquisition from the ship yards to the ship owners on order in the new building market (Nwokedi etal, 2018; Hellenic shipping news, 2018). The second hand market involves transfer of ownership rights of existing vessels between ship owners. The ship sales and purchases market is therefore the global market of ship sales and purchases comprising mainly the ship yards and ship owners as practitioners; sellers and buyers of ocean going vessels and other water crafts Furset and Hordners, 2013). It is categorized into the new building market where the ship yards operate as sellers of newly built vessels on order to the ship owners who function as buyers mostly with the assistance of new building brokers. The second hand market is a market for existing ships where exchange and transfer of ownership rights for existing ships of up to five years of life or more between different ship owners are achieved. The second hand market also may involve the sale of old vessels that have spent their life span to scrap yard for demolition. The latter is more directly referred to as the demolition market (Jian, 2010; Kubi, 2011). Jie (2001) and Plomaritou (2014) note that the laws, forces and principles of demand and supply has over the years been linked as major factors influencing the directions of trade of major international commodities; however in the case of transport which is said to have a derived demand, transport cost (freight and charter rates) and the volume and /or tonnage of trade have always been identified as major determinants influencing transport/shipping demand. One expects inline to the demand and supply forces and the derived nature of transport demand that a direct relationship would exist between growth of global seaborne trade and global new building order dead weight tonnage (dwt). Also shipping charter rates/freight if directly determined by demand and supply forces will only increase with increase in global seaborne trade with decreasing and/or constant new building orders dwt. Thus shipping charter rates/freight as prices for the consumption of sea transport in the face of decreasing and/or constant global seaborne trade and new building orders are expected to decrease or remain constant. Thus the ship owner's decision to make new building orders of a particular ship tonnage/size will be influenced greatly and dependent on directions of seaborne trade and levels of charter/freight rates. Since profitability is usually the key target for major investments in ship acquisition and capacity upgrade; profit will be optimized at maximum global sea trade volumes and charter/freight rates if sea transport service production cost remains constant. It is equally expected that while increasing growth in global seaborne trade increases new building orders, increase in new ship orders (dwt) will induce increases in global new order prices and vice versa (Xu, Yip and Liu, 2007; Stopford, 2009). The aforementioned postulations are strictly speaking based on the principles and laws of demand and supply as it relates to shipping and transport; determining the actual relationships between the interacting variables tonnage of global seaborne trade, dead weight tonnage (DWT) of global new orders and charter rates/freight using available historical data from the industry will provide empirical evidence of the nature of the existing relationship as an investment decision guide for shippers, ship owners and shipyards (new building yards).

2.0 Objectives

The main objective of the study is to assess the relationship between Dead Weight Tonnage (DWT) of global new building orders, global growth in tonnage of seaborne and freight/charter rates. The study specifically assess the relationship between DWT of new building orders and global seaborne trade (tons) and Charter/freight rates and compared the trend of new order price index and secondhand price index in the ship sales and purchases market. In an attempt to provide empirical evidence on the direction of growth of shipping capacity/tonnage supplied by ship owners to the global shipping trade over time, the study aims to estimate the trend of deadweight tonnage of new building orders between 1991 and 2013 while also seeking to measure the correlation between deadweight tonnage global new orders and freight/charter rates between 1999 and 2013.

3.0 Brief Review of Literature

Stopford (2009) and Koekebakker et al (2006) in their study note that though the shipbuilding industry is believed to have age long experiences in surviving the peaks and slumps of fluctuations in global economy as much as the ship owners and shippers; the survival of such major slumps always come with huge revenue losses which renders majority of the building yards and ship owners financial uncompetitive, unviable and unprofitable at the short run, and bankrupt at the long run. Fore knowledge of and mastery of the relationship between the core variables of global sea borne trade directions, charter rates/freight and level of new building orders dwt if proactively applied will protect owners and ship yards against instability and the adverse influences of slumps in global economy and seaborne trade. For example, Evidence from the ship building sector suggests that global shipbuilding industry faced considerable challenges, problems and pressures due to economic depression in shipping industry relative to slumps in global trade and economy in the recent past (Zhou, 2007). The inability of many ship yards in developing countries to foreseen the impeding slack in global trade during the economic depression period saw a continued increase in investment and expansion in the sector prior to the depression, this subsequently led to many years of losses and capacity redundancy occasioned by decline in new building order contracts in line with the directions of global trade. Increasing new building orders DWT in the face of declining global seaborne trade will lead to the problem of excess capacity which will subsequently crash freight/charter rates due to competition and render investments in ships many owners redundant. This was exactly the challenge that crashed below average the earnings and charter rates in the shipping industry before the global economic crisis as Asian ship building giants over-invested in the sector and forcefully expanded with the resultant excess capacity and slump in charter/freight rates (Paoloa, Tristan & Nishat, 2014). However, the demand for shipping services has been witnessing growth after the economic down-turn; the condition of fleet oversupply according to Zhuo (2007) continues to overrun the cargo growth rate, making future demand for sea freighters uncertain. An equilibrium state is important to protect the interest of shippers, ship yards and ship owners' in the global economics of ship building, ownership and use. The current study is aimed at filling the research gap by empirically determining the relationship between new building order dwt in the global ship sales and purchases market and global seaborne trade in one hand; and new building order dwt and charter rates/freight on the hand in order to provide the best profit inducing relationship at which capacity increment (shipping tonnage increase by ordering new capacity) is advisable as guide for ship owners and operators.

4.0 Methodology

Historical research design method was adopted data was sourced from secondary sources particularly from the UNCTAD review of maritime transport 2014 edition covering the period 1999 - 2013. The aggregate of new building order DWT including Tankers, Bulk carriers, container ships and offshore supply boats was used. The new building price index and second hand price index were sourced from Chinese ship building economy research center reports. Econometric and statistical methods comprising of multiple regression analysis, simple regression analysis, correlation analysis trend analysis and comparative statistics were used to analyze the data. While multiple regression analysis was used to model the relationship among global seaborne trade, new building order dwt and freight/charter rates, correlation analysis was used to assess the correlation between the new building order dwt and freight/charter rates; trend analysis was used to estimate the trends of global seaborne trade and new building order while the comparative tool of independent sample t-test was used to compare new building price index and second hand price index. Thus for the purposes of the multiple regression, we assume that new order dwt is dependent on freight/charter rates and of levels of global seaborne trade depict global seaborne trade as X_{trade} and X_{rate} = independent variables.

Y_{dwt} = new building order dwt,
X_{rates} = freight/charter rates.
X_{trade} = global seaborne trade
e = error term.
We write the model that: $Y = X_{dwt} + X_{rates} + e$

For the trend analysis, time is the dependent variable. So the trend of global new building order dwt representing its relationship with time (t) is:
$Y_{dwt} = a + bt + e$;
and similarly model of trends for charter rates and global seaborne trade respectively are as shown below:
$X_{trade} = a + bt + e$
$X_{rates} = a + bt + e$
Where:
Y_{dwt} = new building order dwt
X_{rates} = charter rates
t = time (1999 – 2013)
a = constant
b = coefficient.
e = error.

Pearson Correlation Analysis was used to measure the extent of correlation between global new order dwt and freight/charter rates. It gives information about the magnitude of the association, or correlation, as well as the direction of the relationship. The test model is as shown below: Also the Independent Samples *t*- test which compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different was used to compare the new building price index and the second hand price index from 2012 to

5.0 Results and Discussion

5.1 Modeling Relationship among new building order dwt, global seaborne and freight/charter rates.

Descriptive Statistics

	Mean	Std. Deviation	N
Ydwt	98.4000	56.73094	15
Xseabornetrade	7706.6000	1337.35233	15
Xrates	20166.6667	7092.92068	15

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.655[a]	.430	.334	46.28220

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-100.201	72.333		-1.385	.191
	Xseabornetrade	.031	.010	.731	2.981	.011
	Xrates	-.002	.002	-.250	-1.019	.328

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	8.0601	149.8222	98.4000	37.18016	15
Residual	-64.96111	71.49487	.00000	42.84899	15
Std. Predicted Value	-2.430	1.383	.000	1.000	15
Std. Residual	-1.404	1.545	.000	.926	15

a. Dependent Variable: Ydwt

Source: Authors calculation

The result reveals that the mean dwt of new building orders over the 15 years period covered in the study is 98.4million per annum with standard deviation of 56.7million dwt and a mean global seaborne trade of 7706.6million tons with standard deviation of 1337.3million tons and a mean daily charter rate/freight of 20166.67USD per annum with a standard deviation of 7092.9USD. The model showing the dependency of new building orders (DWT) on global seaborne trade and daily charter rate/freight is: $Y_{dwt} = -100.201 + 0.031X_{seatrade} - 0.002\ X_{rates.}$ The implication is that increasing tonnage of seaborne trade directed increases the ordering of new dwt's while increasing charter rates does not directly increase new building order dwt. The R-square of the model is 0.43 indicating a non-significant relationship among the three variables. A t-score of 2.823, t-table of 1.761 and p-value of 0.014; that there a significant relationship between dwt of global new orders and global seaborne trade loaded between 1999 and 2013. Also a t-score of -1.019, t-table of 1.761 and p-value of 0.014 indicates that there is no significant influence of daily charter rates/freight on global new building orders dwt in the ship sales and purchases market. The model equation of the relationship between global tons of seaborne trade loaded over the period and global new building orders dwt is :

$Y_{dwt} = -100.201 + 0.031X_{seabornetrade} + e.$

The positive coefficient of $X_{seabornetrade}$ confirms that global new building order DWT increases as global seaborne trade increases. Also the relationship between global new building order dwt and daily charter rates/freight is :

$Y_{dwt} = -100.201 - 0.002\ X_{rates.} + e.$

The negative coefficient of Xrates (daily charter rates) indicates that as global new order dwt increases, freight rates decreases and vice versa. The management implications to global

shipping industry operators is that the factor that drives demand for new building orders and dwts is the level of seaborne trade and not freight rates.

5.2 Trend of new building order (DWT) from 1999 to 2013

Descriptive Statistics

	Mean	Std. Deviation	N
DWTNeworders	98.4000	56.73094	15
Years	8.0000	4.47214	15

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.855[a]	.731	.710	30.52993

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.629	16.589		.701	.496
	Years	10.846	1.825	.855	5.945	.000

Source: Authors Calculation

The result of the trend analysis shows that the quantitative model of relationship between new order dwt and time over the 15 years period is :

$Y_{dwt} = 11.629 + 10.846t + e.$

This implies that there is an increasing trend in global new building order DWT over the 15 years period covered in the study. The positive coefficient of the explanatory variables indicates that increasing years (time period) of trade increases demand for new building dwt. The explanatory power of the model is 0.73implies that the model is significant as time significantly influences the global new building order dwt to increase over the period covered in the study. To maintain the current trend of global new building order dwt, the minimum and maximum DWT that was ordered per annum is 22.48million dwt and 174.32million DWT respectively.

5.3 Trend of Global Seaborne Trade (Tons) Loaded from 1999 to 2013

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.837[a]	.701	.677	759.51071

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5704.314	412.686		13.822	.000
	Years	250.286	45.389	.837	5.514	.000

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	5954.6001	9458.5996	7706.6000	1119.31174	15
Residual	-1946.59998	1126.25720	.00000	731.88283	15
Std. Predicted Value	-1.565	1.565	.000	1.000	15
Std. Residual	-2.563	1.483	.000	.964	15

Source: Authors calculation

The result of the trend analysis equally indicates an increasing trend in global seaborne trade over the period covered in the study. The quantitative expression showing the trend of global

seaborne trade over the period is : Y = 5954.600 + 250.28X + e. The R square is 0.70 indicating that about 70% variations in global tons of seaborne trade is influenced by changes in time. This similar to the earlier result which indicates an equally increasing trend in new building order dwt over the period; an indication that increasing time period in years influences both global new building order dwt and seaborne trade to increase.

5.4 Measuring Correlation Between DWT of Global New Orders and Charter Rates/Freight from 1999 to 2013.

Correlations

		DWTNeworders	freightchaterrates
DWTNeworders	Pearson Correlation	1	.084
	Sig. (2-tailed)		.765
	N	15	15
freightchaterrates	Pearson Correlation	.084	1
	Sig. (2-tailed)	.765	
	N	15	15

Nonparametric Correlations

Correlations

			DWTNeworders	freightchaterrates
Spearman's rho	DWTNeworders	Correlation Coefficient	1.000	.236
		Sig. (2-tailed)	.	.397
		N	15	15
	freightchaterrates	Correlation Coefficient	.236	1.000
		Sig. (2-tailed)	.397	.
		N	15	15

Source: Authors Calculation.

The result of the correlation analysis indicates a Pearson's correlation coefficient between global new order dwt delivered over the period and the daily freight/charter rates within the period covered in the study is 0.084. This indicates the existence of only about 8.4% weak but positive correlation between the two variables. The spearman's correlation coefficient between the two variables is 0.24. This equally indicates a poor/weak but positive correlation between the global new order dwt and daily charter rates over the period covered in the study. The weak correlation suggests a poor relationship between new order dwt and charter rates.

5.5: Comparing the New Build price Index and Second Hand Price Index of ship from 2012 to 2018.

Independent Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
newbuildpriceindex	128.1429	7	6.12178	2.31382
secodhandpriceindex	99.1429	7	13.69219	5.17516

Independent Samples Correlations

	N	Correlation	Sig.
newbuildpriceindex & secodhandpriceindex	7	.877	.010

Independent Samples Test

	Differences			
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference
				Lower
newbuildpriceindex - secodhandpriceindex	29.00000	8.83176	3.33809	20.83198

Independent Samples Test

	Differences	t	df	Sig. (2-tailed)
	95% Confidence Interval of the Difference			
	Upper			
newbuildpriceindex - secodhandpriceindex	37.16802	8.688	6	.000

Source: Authors calculation.

The results shows that mean new building price index per annum over the 7 years period covered is 128.142 points with a standard deviation of 6.122 while the mean second hand price index per annum over the years covered in the study is 99.142 points with a standard deviation of 13.692. The correlation coefficient between the new building price index and the second hand price index is 0.88. This indicates the existence of a perfect positive correlation between the new building price index and second hand price index implying that the second hand price index increases as the new building price index increases too. The result indicates a difference of means of 29.00 points between the new building price index and the second hand price index with a standard deviation of. This difference is in favour of the new building price index.

6.0 Conclusion

The major factors that drive and influence the demand for the order of new ship tonnages are global seaborne trade and increasing time period. A very weak correlation exists between global new building orders dwt and charter rates/freight. Increasing charter rates/freight does not induce demand/order for new ship tonnages. There is no strong correlation between dwt of global new orders delivered over the period and daily charter rates/freight over the period covered in the study. In conclusion, we state based on the findings of the study that there is a significant increase in the trend of DWT of global new building orders delivered between 1999 and 2013. A significant difference was found to exist between the new order price index and second hand price in index of vessels up to five years over the period covered in the study. The practical application of this is that ship owners in order to expand capacity profitably must do when seaborne trade is increasing or in boom with less consideration to charter rates as the major factors that drive and influence the demand for the ordering of new ship tonnages (capacity) are global seaborne trade and increasing time period.

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Appendix1: Global seaborne trade , new building order dwt and charter rates/freight per day from 1999 to 2013.

S/n	year	Global seaborne trade (Millions of Tons Loaded)	New-building orders (Millions of DWT)	Freight/charter rates ($/day)
1	1999	4008	40	8000
2	2000	5984	50	17500
3	2001	7275	48	14000
4	2002	7553	52	8500
5	2003	8082	53	18500
6	2004	7829	50	30000
7	2005	7109	70	27000
8	2006	7700	80	24000
9	2007	8034	95	32000
10	2008	8229	100	26000
11	2009	7858	148	17000
12	2010	8409	200	16000
13	2011	8784	205	19000
14	2012	9197	165	22000
15	2013	9548	120	23000

Sources: (1) UNCTAD review of maritime transport 2014 edition. (2) China Ship building economy research center.

Appendix11: Table showing the new-building price index and second-hand price index

s/n	Year	Secondhand price index	New-building price index
1	2012	110	130
2	2013	98	128
3	2014	120	140
4	2015	101	128
5	2016	80	125
6	2017	85	120
7	2018	100	126
8			

Source: OECD report 2018; Clarkson's price index.

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