European Journal of Business and Management
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol 4, No.13, 2012

An Evaluation of Nigeria's Seaborne Trade and Demand for Sea Transport

Onwuegbuchunam Donatus*[1] Okeudo Geraldine[2]
1. Department of Maritime Management Technology, School of Management Technology, Federal University of Technology, PMB 1526, Owerri, Imo State, Nigeria
2. Department of Transport Management Technology, School of Management Technology, Federal University of Technology, PMB 1526, Owerri, Imo State, Nigeria.
*E-mail: donafutow@yahoo.com

Abstract
It is the strategic objective of maritime nations to develop and sustain an indigenous merchant marine to be able to participate in cargo lifting in the international seaborne shipping trade and thus earn shipping freight revenues. Various policies aimed at achieving this objective have been put forward by Maritime Administration of nations and indeed the Nigerian Maritime Administration. Successful implementation and appraisal of these policies arguably depend on quantitative estimation of shipping tonnage demand and other freight market indices. This paper attempts an exploratory analysis of shipping tonnage demand in the Nigeria's non-oil freight market. Based on shipment level data obtained from port terminals records, we conduct a parametric analysis to determine demand for shipping tonnage and shipping routes showing intense transport demand. Trend analysis of aggregated trade volumes is conducted to examine the viability of Nigeria's seaborne trade in the short term. Policy framework aimed at development of indigenous shipping tonnage capacity, trade facilitation and sustenance is proposed.
Key Words: Ports; Terminals; Shipping Routes; Tonnage Demand; Indigenous Carrier; Seaborne Trade.

1. Introduction

Seaborne trade involves the movement of merchandise by vessels between the ports of origin, where merchandise is received from the exporter at the port of origin to port of destination where the merchandise is claimed by the importer (Stopford, 1997). Studies have shown that seaborne trade remains the backbone of international trade with over 80 percent of world merchandise trade by volume being carried via the sea. The marine industry is an essential link in international seaborne trade, with ocean-going vessels representing the most efficient method of transporting volumes of basic commodities and finished products. In the year 2006, approximately 2.7 billion tons of dry bulk cargo for example, was transported by sea, comprising more than one-third of all international seaborne trade (Genco Shipping, 2006). This represents a significant demand for shipping tonnage for maritime nations involved in merchant shipping.

Nigeria is a maritime nation with a coastline of over 750km and eight major ports excluding oil terminals. The national ports have a cargo handling capacity of 35million tones per annum. These ports, over the past decade, have accounted for around 99 percent by volume and 95 percent by value of the country's total seaborne trade. The demand for shipping in Nigeria has always been there, but Nigeria's indigenous shipping carriers lack adequate shipping capacity to participate effectively in international trade (Damachi and Zhaosheng, 2005). As a result Nigeria is losing enormous freight revenues to foreign shipping carriers which dominate our freight transport market. Viewed from this perspective, it is an important challenge to the Nigerian Maritime Administration to provide a more robust policy framework to encourage greater participation of indigenous shipping carriers and improve trade relations with trading partner countries. The question of shipping tonnage acquisition and supply requires a thorough understanding of the following: the existing and potential market demand for shipping tonnage at aggregate or disaggregated level; intensity of the demand along relevant sea routes, among other shipping market characteristics. Consequently the present paper attempts to derive estimates of shipping tonnage demand by routes and identifies specific routes showing intense shipping tonnage demand.

The aim of research is to analyse Nigeria's dry bulk and general cargoes in order to determine the demand for transport (shipping tonnages) along Nigeria's trading regions/routes. Specifically the objectives of this research are to determine the following:

i. The tonnage of Nigeria's export and import of general and dry bulk cargoes.
ii. The tonnage of cargoes by regions or shipping routes.
iii. Nigeria's major trading regions/partners.
iv. The growth potentials of Nigeria's seaborne trade.

In order to achieve the above stated objectives, the researchers would provide answers to the following research questions;

i. What is the volume of Nigeria's seaborne trade by region?

ii. What is the percentage distribution of Nigeria's seaborne trade by routes within the study period?
iii. Which countries are Nigeria's major trading partners
iv. What is the trend of Nigeria's seaborne trade?

To provide answers to the research questions, the following statistical hypothesis will be tested by the researchers:

- The volume of seaborne trade through major regions is not significantly different from zero.
- The volumes of Nigeria's seaborne general cargo and bulk trades (2006 – 2010) are not significantly different from zero.
- The trend of Nigeria's seaborne trade for the period under consideration is not significantly different from zero. All hypotheses are tested at $\alpha = 0.05$ level of significance.

The rest of the paper is structured as follows: in section two the researchers review literatures and develops the conceptual framework of the study. Section three discusses the methodology adopted in this study. While data is presented, analysed and discussed in section four, section five concludes the study.

2. Conceptual Framework

2.1. Background

In this chapter, the researchers focus on the demand side of dry bulk commodities. Most of the cargoes transported in dry bulk vessels are raw materials or semi-finished products used as input for industrial production. Traditionally, dry bulk cargo is divided into five "major" bulks (iron ore, Coal, grain, bauxite/aluminum and phosphate) in addition to the "minor" bulks. There are five major factors that influence the demand for transportation. The development of the world economy is an important factor. Growth in gross domestic product and industrial production correlate with peaks in demand for seaborne transportation. Klovaland (2003) found that peaks in the business cycle coincide with peaks in commodity prices and seaborne rates as seen in table 1.

Table 1: GDP Based On PPP in USD Billion As Share Of The World GDP

	1999		2004		1999-2004		SHARE OF GROWTH
COUNTRY	USD	%	USD	%	USD	%	%
JAPAN	2451	9%	3612	7%	1160	-2.50%	4%
CHINA	1497	6%	6913	13%	5416	7.30%	20%
ASIA	2743	10%	7130	13%	4387	3.00%	16%
W. EUROPE	4843	18%	8614	16%	3771	-2.20%	14%
USA	5760	22%	11175	21%	5415	-8.00%	20%
EUR.	2974	11%	3733	7%	759	-4.30%	4%
L. AMERICA	2126	8%	4034	8%	1908	-0.50%	7%
AFRICA	915	3%	1845	3%	931	0.00%	3%
OTHERS	3035	12%	6015	11%	2979	-0.20%	11%
TOTAL	26344	99%	53071	100%	26726	-7.40%	100%

Source: Mikkelson and Tronstad, (2006)

In addition to the overall effects from global growth, structural development in various areas of the world has a direct influence on the flow of commodities and hence seaborne commodity trades. This initiates seaborne trade in two ways: first, through imports of raw materials to the manufacturing areas and secondly it through generation of finished products exports to the consuming areas (Mikkelson and Tronstad, 2006).

Political events are important factors that affect demand in dry bulk shipping sector. The closure of Suez Canal during the *Yom Kippur* war I early 1970s is perhaps the event that had the greatest effect on the seaborne trades. Due to the closure of the canal vessels that normally sailed through the canal were forced to sail around Africa which in effect multiplied the average haul (Eriksen, 1982). The emergence of free trade zones together with the opening of new markets due to political changes and the resulting globalization of the economy had tremendous consequences for the evolution of transportation.

Transport cost is another factor that affects international seaborne trade. Transport cost is defined as the cost incurred in moving freight. Transport costs could also include any costs that impede trade such as policy-induced trade barriers. These freight costs consist of direct and indirect elements. Direct elements include fright charges and insurance on the freight, whereas indirect elements include all costs incurred by the transport operator. Indirect elements vary with the shipment's characteristics. Studies have shown that geographical conditions, the type of cargo, economies of scale, energy prices, trade imbalances, infrastructure, transport mode, competition and regulations are among the most important factors explaining the

variation in transport costs across countries. An important finding of these studies is that 10% reduction in transport costs increases trade volumes by more than 20%. Transport cost contributes significantly in shaping the volume, structure and patterns of sea borne trade as well as a country's comparative advantages and trade competitiveness. Therefore, during times of very high or low freight rates it is not unusual to see some changes in "normal" trading patterns, which again could influence average hauls (Stopford, 1988; Mikkelson et al, 2006).

Distance is an important part of international seaborne trade relations and the impacts of distance on transport costs have been widely documented (Venables, 2001). It has been demonstrated that exports and imports of both final and intermediate goods generate transport costs that increase with distance; see Limao and Venables (2001). Remoteness from economic activity increases transport costs and accounts for the poor export performance of many developing countries (Venables, 2005). Transport costs are amongst the most important causes of trade barriers.

The demand for dry bulk carrier capacity is determined by the underlying demand for commodities transported in dry bulk carriers, which in turn is influenced by trends in the global economy. Growth in gross domestic product and industrial production however, correlates with peaks in demand for seaborne transportation. Certain economics will act from time to time as the "primary driver" of the dry bulk carrier market. In the 1990s, Japan acted as the primary driver due to increased demand for seaborne trade and growth in Japanese industrial production.

2.2. Demand For Transport: A Mathematical Model.

Demand for transport is derived; it is dependent upon the nature of goods traffic in international seaborne trade. The extent to which increase in dry bulk trade has affected demand for dry bulk carriers is reflected in estimates of ton-mile demand. Ton-mile demand is calculated by multiplying the volume of cargo moved on each route by the distance of the voyage (Genco Shipping, 2006).

The demand for sea transport can be defined mathematically by the equation below:

$$DD_t = f(Ct_t, AH_t) \quad \ldots \quad (1)$$

$$DD_{tk} = Ct_{tk}, AH_t \quad \ldots \quad (2)$$

$$DD_k = \sum (A_{tkm}, DD_{tk}) \quad \ldots \quad (3)$$

$$A_{tkm} = DD_{tkm} / DD_{tk} \quad \ldots \quad (4)$$

Where, DD = demand for seaborne transport

CT = tons of cargo transported during the time period

AH = average haul of cargo

t = year subscripts

A = market share of ship type

k = commodity

m = ship types.

Demand measured in tons miles of transport is determined by the tonnage of cargo to be moved and the average haul over which each ton of cargo is transported as seen in equation 1. In equation 2, the volume of ship demand generated by each commodity, k and measured in ton-miles is the product of the tonnage cargo of each commodity and its average haul. At this stage, demand is expressed in terms of the total ton miles of demand by ship type, m. This is shown in equation 3, which shows that the demand for ship type m is defined as the market share of that ship type in each commodity trade, summed over all commodities. This is a simple relationship written in algebraic terms, but is much more difficult to define

in practice. In reality trade will be carried in whatever ships available which depend on what ship owners order, so analyzing trends may be the answer (Stopford, 1997).

The international dry bulk shipping industry is highly fragmented and is divided among state controlled and independent dry vessel owners. As a general principle, the smaller the cargo-carrying capacity of a dry bulk vessel, the more fragmented is the market, both with regard to charterers and vessel owners/operators. Charter hire rates paid for dry bulk carriers are primarily a function of the underlying balance between vessel supply and demand; although at times other factors may play a role. Furthermore, the pattern seen in charter hire rates is broadly mirrored across the different dry bulk categories. However, because demand for larger dry bulk vessels is affected by the volume and pattern of trade in a relatively small number of commodities, charter hires rates of larger ships tends to be more volatile than those for smaller vessels. In the voyage charter market, rates are influenced by cargo size, commodity, port dues and canal transit fees, as well as delivery and redelivery regions. In general, a larger cargo size is quoted at a lower rate per ton than a smaller cargo size. Routes with costly ports and canal generally command higher rates than routes with low port dues and no canals to transit.

The global economy powered by rising seaborne trade volume would continued to increase and African countries have steadily lost out in opportunity and economic growth, (Nigerian Annual Financial Reviews, 2007). According to the United Nations Conference on Trade and Development (UNCTAD), goods loaded at port worldwide in 2006 were estimated at 7.4 billion tons, and equivalent to an annual growth rate of 4.3% dry cargo accounted for 63.9% of total goods loaded with the inclusion of bulk, break bulk and containerized goods. By this, the world seaborne trade is no doubt one the contributory factors of the improvement in the world GDP.

Sea borne trade will continue to be the backbone of international trade with over 80% of world merchandise trade by volume being carried by sea. With an annual average growth rate of 4.3%, World seaborne trade is expected to increase by 4.4% in 2020 and double by 2031, potentially reaching 11.5 billion tons and 16.04 billion tons, respectively (Review of Maritime Transport, UNCTAD, 2005). Manufactured goods account for over 70% of the world merchandise trade by value. Trade in manufacturing goods includes consumption goods as well as intermediate goods and semi-finished products. Over the years, the conjunction of several factors has contributed to the dynamism of the international trade and maritime transport services. These include:

- Increased trade liberalization.
- Advances in information and communication technology (ICTS).
- Transport technology (larger ships size, tracking and tracing technologies).
- Sophisticated logistics services (e.g. third and forth party logistics).

In a related issue, Clarkson's Research Studies, recently posits that tons-mile for dry bulk cargoes may be expected to continue to grow with China's iron ore needs being increasingly met by new suppliers such as Latin America. In addition to the supply side factor of demand for dry bulk transport (e.g. fleet, transport infrastructure and cargo availability), the performance of seaborne trade is dictated by demand size consideration such as;

- Level of development (e.g. matured, emerging or growing economies).

- The structure of the economy (e.g. service economy, industrial or agricultural based economies)
- The political and regulatory frame work (e.g. trade liberalization) as well as unforeseen event e.g. weather strikes and political unrest.

An important poser in this regard is that, with all of these demand pull factors, what is the size of Nigeria's fleet that can take advantage of the opportunities. The urgent task before Nigeria according to experts is to develop its national fleet, human and economic resources. By so doing, the country will cease to be treasurers of resources and opportunities and rather become utilizers. In 1996, for instance the total seaborne dry trade in Nigeria was 2,810,359 tons and this figure represents 6.25% of the entire seaborne trade (Abstracts of Port Statistics, 1996). However, within ten years it has experienced a dynamic increase of about 12, 536, 236 tons or 28.89% of the entire seaborne trade during that period. The positive trend is expected to continue in future and thus represents shipping opportunities to charterers and ship owners.

3. Research Methodology

This research study is concerned with the estimation of shipping tonnage demand in Nigeria's freight market. The main data for this research consist of shipment level data obtained from the various terminals of Nigeria's ports Authority (NPA). The NPA publishes data on import and export tonnages discharged or loaded in all the Nigerian ports terminals on annual basis. Specifically, the publication contains the following: commodity types (classified according to SITC format), type of packaging and origin/destination of commodities discharged or loaded at the various port terminals across Nigeria. Tonnage values of non oil commodities were aggregated from various issues of the publication. For more meaningful data analysis, the aggregations were done over type of packaging and countries of origin/destination further classified into origin or destination regions. The complete data set assembled and used for the analysis is a panel data containing tonnage of non-oil commodities handled at various port terminal from years 2006 – 2010.

To determine the extent of trade (shipping tonnages) that is generated between Nigeria and other trading regions (made of up some countries); an analysis of means (ANOVA) was first employed to test if variations in means (of tonnages) exist. Thus, using the shipping tonnages as an index of shipping demand, it was possible to estimate the following: demand for shipping tonnage in the Nigeria's non-oil commodity freight market, the routes or regions showing intense transport demand. The trend of the total trade generated (imports and exports) over time was examined to assess the future potentials of Nigeria's trade with her partners. We discuss below, the statistical models applied in data analysis. The descriptive statistics of the sample data and results of inferential statistics carried out are also presented.

3.1. Analysis Of Variance (or Means) Model.

ANOVA is often a statistical method for determining the existence of difference among several population means. Application of ANOVA aims to detect difference among several population means. The hypothesis test of analysis of variance (means) is and as follows:

$$H_0 : \mu_1 = \mu_2 = \mu_3 = \ldots = \mu_r$$

H_a : not all μ_i (i=1, 2,…,r) are equal …. (5)

Where:

$\mu_i = i^{th}$ mean 'r' population and 'r' implies 'r' populations, or treatments under study.

The populations in this case are shipping tonnages generated between Nigeria and various countries. To test for the null hypothesis that 'r' populations are not equal, Fisher test is conducted by calculating the 'F' statistic according to the equation below:

$$F = \frac{MSB}{MSW} = \frac{SSB/(r-1)}{SSW/(n-r)} \quad \ldots \quad (6)$$

Where MSB: Mean square Between, MSW: Mean Square Within, while SSB: Sum of Squares Between and SSW: Sum of Squares Within. 'n' represents the number of observations in the population under study.

3.2. The Linear Trend Model.

The linear model is represented by the equation as shown:

$$Y_t = \beta_0 + \beta_1 t + e_t \quad \ldots \quad (7)$$

Where

Y_t = Value of the dependent variable Y (Volume of trade along regions) during time period *t*.

$t = i^{th}$ unit of time (years 2006 -2010).

e_t = Random movement unexplained by the trend variable during time period *t*.

The trend analysis of cargo volumes was conducted to assess the potentials of Nigeria's seaborne trade atleast in the short term. In order words we try to find out the direction of trade (upward or downward) will be sustained in the short term.

4. Presentation And Analysis Of Data

In table 2 below five region shipment regions were identified where import and export commodities are generated. The 'unspecified' region represents commodities whose origin or destination could not be accounted for, but nonetheless adds to the size of Nigeria's trade with other nations. Thus, for the period under study; the USA, countries in Asia and Europe traded more with Nigeria. Their import and export volumes (combined) averaged over six (6) million metric tonnes. African countries and an unspecified number of other countries accounted for an average little above one million (1) metric tonnes of trade.

Table 2: Distribution Of Nigeria's Trade ('000) By Trade Regions And Analysis of Variance Results

REGIONS/ROUTES	TONNES (MEAN)	STD DEV	MIN	MAX
AFRICA	2,222.57	908.498	1,008.86	3,974.12
ASIA	6,899.47	3,765.91	1,285.41	13,170.01
AUSTRALIA	66.1969	89.116	4.518	283.973
EUROPE	6,532.28	2,809.16	4,388.08	14,007.36
USA	8,598.75	4,817.22	2,616.13	16,850.56
UNSPECIFIED	2,493.35	3,220.21	92.86	8,621.60
ALL REGIONS	**4,468.77**	**4,246.38**	**4.518**	**16,850.56**
ANALYSIS OF VARIANCE				
SUM OF SQUARES:	*Between*	5.555		
	Within	5.083		
F. Statistic:		***11.800***		
Prob > F (5,114):		***0.000***		

The F statistic computed from analysis of variation of means as shown in table 2 has a value of 11.80 and a P – value of 0.000. The significant P - value (at $\alpha = 0.05$) indicates differences exist in trade generated between Nigeria and her trading partners. It is also found that there is a growing trend in Nigeria's seaborne trade at least in the short term. Table 3 below indicates a positive trend (t) with a coefficient of 85,484.6 tonnes. The't' statistics has a significant P – value (0.006) at $\alpha = 0.05$. This result indicates a positive future outlook for Nigeria's freight market.

Table 3: Trend Analysis of Nigeria's Seaborne Trade.

Parameter	Estimate	Std. Err.	t	P>|t|
β_{trend}	85484.6	29888.54	2.86	0.006
β_0	1861488	1048303	1.78	0.081
Model Fitting information				
F(1, 58)	8.18			
Prob > F	0.0059			
Adj R-Sqd	0.1085			

4.1 Discussion Of Findings

Before concluding this research, we wish to recognize the limitations of this study and advise that the results from the findings should be interpreted with caution. It was part of the objectives of this work to evaluate quantitatively the demand for shipping tonnage in the Nigeria's non-oil freight market. In evaluating this, we aggregated trade volumes of imports and exports originating and destined to Nigeria from countries trading with her. The demand estimated did not consider average distance of haul owing to distance data constraints. We hereby caution that the estimated demand figure is only an index. Besides, our estimates did not include air-sea transshipments or trades across national borders which records are sketchy.

Again, no attempt was made to provide separate estimates of demand for import and export shipping tonnages. Doing this would have been ideal since it would give an idea of what share of shipping tonnage capacity that can 'rightfully' be supplied by indigenous carriers as stipulated in UN code of Conduct for Liner Conferences. However, while these are noted as limitations, we wish to point out that Shipping Conferences (in which the United Nation's Code for Liner Conferences-UNCTAD applies) have in recent times been replaced by new market formations like mergers and acquisitions etc. However, this work is exploratory in nature and may provide valuable insights for a more elaborate work on the subject. We finally admit that the short span of data (five years) may not give adequate picture of the extent of trade volumes but the finding are rather instructive. Thus, future studies should take care of the limitations and in addition provide disaggregated estimate of shipping tonnage demand based on specific commodity types.

Against the backdrop of the foregoing, we submit the research findings as follows: that the average demand for shipping tonnage in the Nigeria's non-oil freight market peaks over four (4) million metric tonnes during the study period. Of the regions considered; the USA, Asia, and European countries showed intense transport demand with the following tonnages: 8.6, 6.8 and 6.5 million tonnes respectively. While Africa, Australia and 'Unspecified' number of countries averaged to 2.2, 0.066 and 2.5 million tonnes respectively. Therefore the major shipping routes are Nig-USA, Nig- Asia and Nig-Europe in that order. It is also noteworthy that the estimated demand is sustainable atleast in the short term given the positive trend observed from the analysis.

5. Conclusion/Recommendation

Shipping capital acquisition policies have for a long time been made to address gap in cargo lifting capacity of indigenous shipping lines visa-viz their foreign counterparts. However, it appears these policies are not based on quantitative assessment of shipping and freight market indices. The outcome of this paper is relevant to the government for planning purposes. It may also serve as policy guide to private firms for focused shipping tonnage investment strategy. The paper recommends thus: that the Nigerian Maritime Administration should encourage more robust development indigenous shipping tonnage capacity since the prospects of Nigeria's freight market is positive. That trade relations between major trading regions (identified) be improved for sustainable seaborne trade. There is also need to improve trade among African countries in order to take advantage of trade with nearest neighbor. The reduced distance and hence transport cost savings from inter regional trade transactions would accrue indirectly to the economy. The positive trends in seaborne trade observed should be sustained through effective implementation of 'Trade Facilitation policy'. This would likely enhance inward/outward hinterland shipments made especially by cargo shippers and hence increase trade volumes.

References

Damachi, B. B. and Zhaosheng, Y. (2005). *The Nigerian Shipping and Indigenous Companies* 32 (1). Routledge: Taylor & Francis Group.

Eriksen, I.E (1982), The Demand for Bulk Ship Services. Menbra Hill Inc, 2nd ed. New York.

Genco Shipping and Trading Limited (2006), http://www.gencoshipping.com/

Klovland, J.T (2003), Business Cycles, Commodity Prices and Shipping Freight Rates: Some Evidence from Pre – World War Period.

Limao, N and Venables, A. J. (2001). Infracstructure, Geographical Distance; Transport Costs and Trade. *World Bank Economic Review*, 451-479.

Mikkelson, Reinhard O.; Tronstad, Petter (2006), *'Can Leading Indicators Be Used To Predict The Demand For Sea Borne Dry Bulk Activity In The Far East'*. An Unpublished M.Sc Thesis, Norwegian School of Economics And Business Administration, Bergen. Retrieved from *http://brage.bibsys.no/nhh/bitstream/URN:NBN:no_bibsys_brage_22800/1/Tronstad%20and%20Mikkelson%202006.pdf*
Nigerian Ports Authority (1996), Annual Abstacts of Port Statistics; An annual publication of Nigeria Ports Authority. Marina Lagos.

Review of Maritime Transport (2005). United Nations Conference on Trade and Development (UNCTAD), New York & Geneva.

Stopford, Martin (1988), Maritime Economics. 1st ed. Routledge ,Taylor & Francis Group, New York.

Stopford, Martin (1997), Maritime Economics. 2nd ed. Routledge ,Taylor & Francis Group, New York.

Venables, A. J. (2001). Geographical and International Inequalities: The Impact of New Technologies. *http://econ.lse.ac.uk/staff/ajv/abcde3.pdf. Retrieved 3/01/11.*

Venables, A. J. (2005). Geographical Economics: Notes on Africa. *Journal of Development Perspectives* , 63-84.

Winston, C. (1983). The Demand for Freight Transportation: Models and Application. *Transportation Research* , 27-419.