

Has Maritime Transport Sector Impacted on the Growth

of Nigeria's Economy?

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Abstract: Nigeria is bound by vast water resources along her coast, the access to sea water ways can therefore be explained by the volume of transportation of goods and persons to and from the country. This study investigates the effect of the Nigerian maritime sector on the growth of the Nigerian economy especially the industrial sector of the economy. This paper uses the method of ordinary least square and the seemingly unrelated regression to estimate the impact of this key sector. The data employed is secondary in nature and was sourced from CBN statistical bulletin. The result of the regression analysis shows that the maritime transport sector has a negative relationship, though not significant on the economic growth of the nation and also on industrialization of the Nigerian economy. The study concludes that for the Nigerian maritime transport to have a positive and significant impact on economic growth and industrialization in Nigeria, government should formulate policies that would encourage genuine foreign and private participations in the maritime sector of the economy.

Key words: maritime; transport; industrialization **JEL codes:** C, O

1. Introduction

Transportation can be defined as the movement of people and goods from one location to another. It is a vital aspect of the social and economic life of any country, this is because it plays a key role in the socioeconomic development of the country; moreover, it also serves as an engine of economic integration. Since the advent of mankind, mobility has always been required or involved in virtually all the productive activities that have enabled survival, reproduction, and prosperity for an individual, group or society. The evolution of the mode of transport in the world has evolved according to the growth in technology and economy of various countries.

Today, transportation industry is the largest industry in the world. This includes the manufacture and distribution of vehicles, the production and distribution of fuel, and the provision of transportation services. Therefore, the history of transportation is largely one of technological innovation; advances in technology which have allowed people to travel farther, explore more territory, and expand their influence over larger and larger areas.

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In Nigeria, the history of transportation dates back to the pre-colonial era; within this period, transportation facilities such as roads, railways, air transport facilities were really non-existent with emphasis then on the bush path using the foot or using animals such as horses, cattle, donkeys and camels as aids to transport. Eventually, the evolution of the modern Transport System in Nigeria began during the colonial period; The networks of Rail, Water and Road that was developed then was built for the exportation of cash crops and mass importation of produced consumption goods. Although they were planned in the most economic possible way, they later proved inadequate.

Maritime transport is one of the oldest forms of transport in Nigeria. It has been in existence since the time of our forefathers. It dates back as early as the history of Nigeria itself. It started out with the use of canoe and paddle boats as a means of transporting people and goods and has since then gone through several evolutionary stages. It was the main form of trans-continental transportation; it was this form of transport that was used in the famous trans-Atlantic slave trade, where slaves were exchanged for goods such as jewellery, clothing materials and the likes. Nigeria's maritime heritage has been an important economic engine for Nigeria throughout most of its history. This is due to the fact that Nigeria is endowed with different water bodies such as the Atlantic Ocean, lagoons and other various rivers.

The water transport system in its early years faced a lot of challenges making it difficult to use as a reliable means of transport, this is due to the fact that most of the creeks and cataracts are seasonal water ways that can only be navigated during the wet seasons whereas the inland waterways dry up in dry season. Other forms of water ways that were navigated got silt that made them difficult for canoes and boat to sail smoothly. Also, most of the water ways possessed rocks, hills, lowlands and rapid waterfalls that made it difficult for navigation over them. Apart from these problems, the problem of unaccountability of this sector poses a major threat- this is due to the fact that the effect of this sector on the economy is largely unaccounted for, other problems militating against the maritime transport system includes: the malfunctioning port system- where the dwell time is averagely 11 days which is a lot higher than those of developed nations, and insufficient indigenous private sector investment in shipping industries as most investors are foreigners.

In view of the foregoing, this paper seeks to find the extent of involvement of water transportation on the economic growth of Nigeria. Due to the fact that Nigeria is an economy

This paper is undertaken to examine the contribution of this industry to the Nigeria's economic growth and development and to what extent it has aided economic growth and development in terms of the increase in the price of goods due to its transport services or value added, and also to find out ways through which this sector of the economy can be improved such that trade within the country and between countries will be enhanced. Therefore, the paper has four (4) sections, following this introduction is part II which is the literature review, part III is the theoretical framework and methodology while analysis, finding and conclusion are discussed in part IV.

2. Literature Review

The realization of the fact that transportation plays a vital role in the social and economic life of any nation has led to an increase in the attention given to this industry. Sea transport or simply shipping is essential to the functioning not just of modern society generally, but of the global economy in particular (Loon, 2009). Thus a lot of extensive and intensive studies on the impact of maritime transportation have been carried out; in terms of enhancement of trade (both domestic and foreign), employment generation, revenue generation and more. Various studies have been carried out in various parts of the world to quantify the economic impacts of this key industry.

This paper could only review issues in these four areas:

2.1 Conceptual Overview of Maritime Transportation

Maritime transportation, also known as waterborne transportation is one of the modes of transporting goods, persons and services. Maritime transport according to Igbokwe (2001) is the means of carrying of goods and persons by water, whether inland waterways including rivers or oceans. It constitutes economic activities that have some direct and indirect relationship with the sea, that is, maritime transportation includes water transportation, sea transportation and as well as ocean transportation. This industry has different industries within it; it is often associated with shipping lines involved in the carriage of cargo as well as including associated service providers (Workplace Performance Technology LTD, 2010). Statistics Canada also defines the Marine Transport Industry as consisting of passenger and freight transport, ferry transport, marine towing, ship chartering, marine cargo handling, harbour and port operations, marine salvage, piloting services, and marine shipping agencies (Sen, 2004). The Maritime Transport industry serves as an input into every other industry in the National economy, it will be noted that there is hardly any segment of an economy that can do without the maritime transportation sector- since it will be needed to help bring in the needed materials for economic activities in a nation. Marine transportation sector has three types of activities which are maritime transport services, maritime auxiliary services and port services (Austria, 2002). The maritime transport industry provides various services to a nation and its people; it serves as a means of transportation to people and also as a means of recreation in terms of cruise shipping and the likes. It facilitates the flow of goods and services worth billions of Dollars yearly in any one nation. Maritime transportation has been present in the world since the beginning of the world itself. Gardner, 2009 defines the water transportation industry as consisting of all activities of shipping companies, cruise ships and ferry operators, as well as revenues generated by cargo loading and unloading, port fees and pilotage authority.

2.2 Maritime Transport and Employment Generation

The maritime transport industry generates employment both directly-by those actively employed in this industry itself and indirectly by creating a need for employment in its supplier industries. In Nova Scotia, for example, the maritime transport industry generated a total of 93,500 jobs or 25% of total employment in the state (The Philippine Environmental Governance, 2006). Also in the UK, a similar study estimated that the maritime transport industry generated around 212,000 jobs in 2007 (Oxford Economics, 2007). It has been argued that in Nigeria, an estimated 10% of job opportunities are provided by both the private and public sector of the maritime transport industry (Igbokwe, 2001). The public sectors under this industry include; The Nigerian Customs Services, Immigration office, Nigerian Navy, NDLEA, Standard Organization of Nigeria, Department of State Security Service, Federal Environmental Protection Agency, NAFDAC, Nigerian Port Authority, Nigerian Maritime Administration and Safety Agency. There are also numerous private companies which are involved in maritime transport activities.

The maritime transport industry does not only create employment in the industries discussed above but also creates employment opportunity in other dependant industries like shipbuilding, ship breaking, ship repairing and maritime training. In Nigeria, the available jobs in the maritime transport industry have a multiplier effect on the development of other economic activities like freight forwarding, dock working, stevedoring operations, towage, pilotage, warehousing, and cargo handling all of which depends on the maritime transport industry for their survival. It has also induced economic activities in the informal sector such as petty trading, hawking etc. which engage Nigerians. Without the employment and job opportunities created by this industry, the unemployment situation in Nigeria would have worsened thereby leading to economic imbalance in the nation.

2.3 Challenges Facing the Maritime Transport Industry

The maritime transport industry in Nigeria even though of utmost importance to the economy has not been accorded adequate recognition, hence notable areas of concerns include

The Problems of Nigerian Ports System: The problem of static and malfunctioning port system in Nigeria has been continually identified by maritime experts, but the problem has still remained despite government's efforts to solve it (Igbokwe, 2001). Even though there has been rapid economic growth and development in the nation, the problem of port congestion which leads to disruption of economic activities still occurs. In 1975, a serious port congestion problem known as "the cement armanda", occurred which resulted in about 450 ships waiting for almost 180 days to berth. Also in 2001 a similar problem was encountered by the ports authority due to federal government's introduction of 100% physical inspection of cargoes. This situation almost grounded the Nigerian economy due to the delayed berthing of vessels carrying raw materials and equipment for manufacturers and the non-clearing of discharged cargoes, lack of space for empty containers and inflation due to scarcity of imported consumer goods. The average dwell time for cargoes is 11 days which is much longer than what is obtained in developed countries.

The problem of excessive government interference and intervention in ports activities also poses problems to the Nigerian port system. The Nigerian Ports Authority (NPA) owns all the Ports in Nigeria. By Decree No 38 of 1999 which sets up her functions and power, NPA controls all public and private tasks in the sector. It maintains and operates every available asset (fixed and movable) while stevedoring, warehousing, and industrial activities are executed by private operators under the supervision of NPA. By Section 124 of the Decree, the government exercises full control over Nigerian Ports Authority (NPA), operations: Government appoints the Chairman and the Board members, the Managing Director and Executive Directors and sets their salaries and remunerations. The Authority must seek approval from government to spend and borrow money, and make investments. The centralized system leaves little room for competition and the Ports are characterized by high tariffs, excessive manpower and gross inefficiency which make the port authority dependent on the national government for any of its decision.

The level of infrastructural facilities in Nigerian ports causes a major challenge to the maritime transport industry, it should be noted that vessels make money only when they are on the move thus time spent by vessels in discharging and handling cargo cost them revenue. The situation in Nigeria ports is such that cargo handling equipment are either old, malfunctioning, broken down or inadequate thereby slowing down cargo discharge which leads to low through-puts, longer turnaround time, inefficiency, damage to or loss of cargo. These factors make the Nigerian port user-unfriendly and unattractive to some liners, importers and shippers who therefore berth their vessels in neighbouring ports. Apart from this, there is also a lack of integrated or intermodal transportation that would have enabled discharged cargoes to be quickly removed from the ports through other means of transportation like rail and road which are well connected from the ports into the hinterland. Another problem arises when the rail-routes to and from the ports are not in good working conditions and the roads to and from most of Nigerian ports are traffic congested thereby causing unnecessary delays in evacuating discharged cargoes from the ports and its environment.

The proliferation of government agencies at Nigerian ports also poses a problem; over 30 government agencies operate concurrently at Nigerian ports (Igbokwe, 2001), these agencies cause avoidable delay in the clearing of goods and induce diversion of cargoes to neighbouring ports.

Inadequate Manpower Development: The maritime transport industry has suffered a generational vacuum

in the area of manpower training since the liquidation of the Nigerian National Shipping Line in 1995 (Alozie-Erondu, 2009). This has created the opportunity for foreigners to operate on Nigerian water. Also the Maritime Academy of Nigeria, which is the only institute in the country for the training of seafarers, does not have curriculum that is designed to issue internationally recognized certificate. Similarly, due to dearth in manpower development, graduate from the Maritime Academy of Nigeria end up on the streets doing other jobs. This problem of inadequate manpower development goes a long way in reducing the competitiveness of the Nigerian maritime transport industry because foreigners will have to be employed in the industry and thus huge amount of profit is being repatriated to their home countries.

Weaknesses of the on-going Reform in the Maritime Sector: The Nigerian maritime transport industry has undergone series of policy reforms, but it is not the fact that policy are enacted but if they are really implemented and also to make sure that it does not have negative impacts on the industry (Iroegbu, 2010). A major policy reform which is on-going in this sector is the cabotage act. Cabotage law is a law empowering navigation and trading within a country's coasts or from port to port within a nation to be reserved exclusively for the country's national flag ships and its nationals. Cabotage therefore simply means empowering the indigenous competencies and skills in the maritime industry (Iroegbu, 2010). The Cabotage Act enacted in 2003 provides that only vessels, wholly owned and manned by Nigerian citizens, built and registered in Nigeria, shall engage in the domestic or coastal carriage of cargo and passengers within Nigerian territorial waters or any point within the waters of the Exclusive Economic Zone of Nigeria. This act is very useful because it creates employment opportunities for Nigerians. Under the Cabotage act, before a vessel carries cargo in Nigeria it must be owned and manned by Nigerians or built and registered in Nigeria and if a vessel does not belong to any of the above class, it becomes illegal for that vessel to operate on the Nigerian waters except the foreign vessel obtains a waiver and license from the Minister of transport. The conditions prescribed for obtaining a waiver or license by the foreign companies are so simplistic that it is likely that most foreign ships will be granted licenses and waivers to engage in Cabotage in Nigeria. This is simply due to the fact that there is presently not enough Nigerian fleet to cater for the needs of her populace. With the introduction of the waiver, the bulk of responsibilities of the indigenous vessel holders have been shifted to the foreigners who are given the right to operate within the country. This practice however makes the cabotage act ineffective and automatically defeats the whole system of protecting Nigerians which is the main agenda of the act. Nigerian vessels that would have been employed in carrying these cargoes have to suffer at the expense of these foreign vessels resulting in foreign dominance of the maritime industry. Thus a lot of reforms made by the Nigerian government most times have a setback which renders the reform ineffective.

2.4 The Economic Impact of the Maritime Transport Industry

The economic impact of any industry in an economy is routinely measured in terms of its contribution or value added to GDP of that economy or nation (Sen, 2004). It should be noted that the concept of value added to GDP is not total sales or an equivalent by this industry, since total value of sales of an industry includes the value of all the inputs that have been purchased from other industries; the sum of final sales across all industries can therefore end up "counting" some output a multitude of times (for example, the crude oil that is refined into fuel, and the fuel that is purchased by a ship operator) and is not used as a measure of economic activity for a country as a whole. Instead the GDP which is considered here is the "value added" to products by the maritime transport industry. In most studies relating to the impact of maritime transport, it has been noted that the economic impact (Oxford Economics, 2009; Sen, 2004; Mandale, 1998; Apex Companies, 2010; Pinfold, 2009; Marinova consulting LTD,

2009). The direct effects of the Marine Transport Industry are obvious. The concept of direct impacts can be best illustrated through the case of imported goods coming to Nigeria on a Nigerian owned vessel. Usually, a vessel is guided into a port by a pilot boat, arranged by the ship's agent. In some instances the vessel may require tugs in addition to the pilot boat. The vessel is then tied up by stevedores. Once secure, the vessel is boarded by the ship's boarding agent and customs inspectors. The crew may disembark and spend money on either personal or ship's provisions. Documentation is handled by the ship's agent, customs broker or freight forwarder. The vessel has to be cleared in and out by the Nigerian Customs Agency. Cargo can then be loaded in and/or out. The effect of the activity of this one vessel will impact the Nigerian economy not only by providing income and employment to its own crew but also to the crew of the pilot boat, stevedores, and ship agents. The direct impact (Sen, 2004), while according to Oxford economics, it is employment and contribution to GDP. The direct impact can therefore be seen as the impact arising from the expenditures made by firms in the subject industries on the goods and services needed to produce industry outputs (Marinova Consulting LTD, 2009). The direct GDP impact of this industry on the Nigerian economy was approximately 3% in 2010 (Olayiwola, 2010).

The indirect impact is said to be the inter-industry purchases triggered by the direct demand, they are backward linkages to the economy (Marinova Consulting LTD, 2009). It is the impact on economic sector that the maritime transport industry, can have on other sectors through their demand of those sector's goods and services as input to its own production (Sen, 2004). For example, pilot boats buy fuel from suppliers and repair services from ship yards, while the stevedoring companies buy or lease vehicles. The vendors of these goods and services in turn purchase more basic goods and services, and so on. The indirect impact is mainly measured by using the input- output analysis.

The induced effect refers to the demand created in the broader economy through consumer spending of incomes earned by those employed in direct and indirect activities of the maritime transport industry (Marinova Consulting LTD, 2009). For instance, a decline in wages in the maritime transport industry, or in one of its suppliers, will result in less spending by employees and therefore a drop in demand for consumer goods from other industries. The induced impact might take a while, say one year, before it works its way through the economy.

The economic impact of an industry, even though often measured by the level of economic activity of that industry, in the form of value added to GDP and employment generation, is not only restricted to these economic activities but also include the impact of these industry on other aspects of the economy such as; its effect in facilitation of trade and commerce, revenue generation and availability of finance, promotion of tourism, enhancement of industrial growth and development, international relations and peaceful co-existence, socio-political harmony, defence and security- territorial protection and also for transportation of persons across places in Nigeria(Igbokwe, 2001).

The level of adequacy of the maritime transport industry in an economy will determine if the economy can partake in international trade or not. The performance of the maritime transport sector is closely linked to the derived demand of the merchandise sector in an economy (Irish maritime development office, 2007). Maritime transport, otherwise known as shipping has been an important human activity throughout history, particularly where prosperity depended primarily on international and interregional trade (Corbett and Winebrake, 2008). For a nation like Nigeria which relies heavily on external trade to sustain its domestic economy through importation of raw materials, equipment and machineries used by manufacturers and for exportation of its crude oil, agricultural and manufactured products, the importance of a cheap mode of transport which maritime transport offers does not only make the total cost of these cargoes lower but also makes it possible for large quantity of goods to be carried over long distance and landed in Nigeria, thus reducing the cost of imported goods. A very large percentage of world's trade is carried by water, thus, the demand for maritime transport has been on the increase due to the effect of globalization and liberalization of trade, which has made the demand for goods between countries increase, thus increasing the need for maritime transport.

The maritime transport industry, apart from generating revenue and profit for companies under it, also generates revenue to a nation through the form of corporate tax, VAT, and many other ways (Oxford Economics, 2007). The role of maritime transport industries in revenue generation for the Nigerian government cannot be underestimated. The revenue which is realized from these industries are used in providing better welfare for the citizenry by investing more in maritime infrastructures and also investing in other sectors of the economy. The revenues come from fees for the registration of ships and their mortgages, custom duties, ports charges and tariff realized by the Nigerian Port Authority for the use of its facilities for vessels or ships which berth at Nigerian ports, corporate taxes paid by shipping companies, fees for licensing, clearing and forwarding agents or freight forwarders and the registration of shipping companies. The National Maritime Authority collects 2% statutory charge on gross earnings of shipping companies on imports and exports (section 17, National Shipping Policy Act). The National Maritime Authority also fines erring tankers that pollute the Nigerian marine environment, and every vessel lifting Nigerian crude oil pays a mandatory fee. Billions of Naira is being generated yearly as revenue by Customs through import and export duties. A large portion of the revenue collected by the Nigerian Port Authority and the National Maritime Authority is in foreign currency, thereby enhancing the nation's foreign reserve (Igbokwe, 2001). Apart from these sources the income tax paid by employees of this key industry increases the fund which is available to the Nigerian government to help develop the nation, and also to invest more in key sectors of the economy.

World tourism has always been enhanced by the maritime transport industry. In 2005, an estimated 10.5% of total world tourism expenditure was directly related to maritime transport (The Philippine Environmental Governance, 2006). The tourism sector of the maritime transport industry also helps in generating revenue to a nation.

Due to the geo-physical features of Nigeria, the availability of water bodies, waterborne transport has been enhanced and facilitated. The maritime transport, apart from engaging in the affreightment of goods, also relieves other forms of transport of avoidable pressure and congestion when it comes to human transportation (Igbokwe, 2001, 2002). For example, Ferry services from Apapa to Mile 12 and CMS in Lagos state reduces traffic jams on road transportation and the slowing down of economic activities in the environs. It also provides a relatively cheap and reliable form of transport for individuals, thus reducing their personal expenditure on transportation. Thus maritime transport helps reduce stress which people go through daily by providing an alternative form of transport to them.

The impact of transportation on the economic emancipation of a country cannot be over emphasized. In Nigeria, transport accounts for approximately 3% of the Gross Domestic Product (GDP) (Olayiwola, 2010). A vibrant, responsive, effective and efficient transport system will enhance Nigeria's economic, developmental and strategic roles in the global economy. For this reason, transportation ought to be accorded high priority in the Nigerian economy.

3. Theoretical Framework and Methodology

3.1 Sectoral Modeling of the Impact of Maritime Sector

The study of the impact of the maritime sector on economic growth is more or less like any other sectoral impact analysis. However one major difference that comes with the consideration of the maritime sector is the fact that the maritime sector may have linkages with other sectors of the economy asides contributing directly to economic growth. While authors like Lin et al. (1999), Henrichsmeyer and Witzke (2000), Rolfe et al. (2011) develop input-output method in analysis sectoral impact, the amount and nature of data involved usually turn out to be the constraints that stand in the way of research in that manner. Hence we consider in a narrative manner, buttressed with a mathematical summary, the impact of the maritime sector on economic growth in Nigeria.

Assuming that we have just two sectors of the economy, the maritime sector and all other sectors and that the maritime sector produces output Q_1 with the inputs: capital from domestic sources, capital from international sources and domestic labour k_1 , k_2 and l_1 respectively. With these definitions, maritime sector is faced with the production of output given its constraints and hence to obtain the maximum output permissible given the cost relations we have the following problem:

$$MAX(Q_1): Q_1 = Af(k_1, k_2, l_1) \text{ where } f(\tau k_1, \tau k_2, \tau l_1) = \tau f(k_1, k_2, l_1)$$
(1)

subject to the constraint:

$$C_1 = p_{k_1}k_1 + p_{k_2}k_2 + p_{l_1}l_1 \tag{2}$$

On obtaining the optimal value of output corresponding to the cost constraint we have:

 Q_1

1

$$Q_{1} = Q_{1}(A, p_{k_{1}}, p_{k_{2}}, p_{l_{1}}, C_{1})$$

$$(3)$$

Where
$$\frac{\delta Q_1}{\delta p_{k_1}} < 0$$
; $\frac{\delta Q_1}{\delta p_{k_2}} < 0$; $\frac{\delta Q_1}{\delta p_{l_1}} < 0$; $\frac{\delta Q_1}{\delta C_1} < 0$; $\frac{\delta Q_1}{\delta A} > 0$.
And from this equation we obtain the cost function which is an inverse function of function represented in

the equation (4):

$$C_{1} = C_{1}(A, p_{k_{1}}, p_{k_{2}}, p_{l_{1}}, Q_{1})$$

$$Where \ \frac{\delta C_{1}}{\delta p_{k_{1}}} > 0; \ \frac{\delta C_{1}}{\delta p_{l_{1}}} > 0; \ \frac{\delta C_{1}}{\delta Q_{1}} > 0; \ \frac{\delta C_{1}}{\delta A} < 0.$$
(4)

On assuming that the objective of the maritime sector is to maximize profits at the market price 'p' then the unconstrained optimization problem becomes:

$$MAX(\pi_1): \pi_1 = p. Q_1 - C_1(A, p_{k_1}, p_{k_2}, p_{l_1}, Q_1)$$
(5)

And on obtaining the critical value(s) of Q_1 we have:

$$= Q_1 (A, p_{k_1}, p_{k_2}, p_{l_1}, p)$$
(6)

$$Where \ \frac{\delta Q_1}{\delta p_{k_1}} < 0; \ \frac{\delta Q_1}{\delta p_{k_2}} < 0; \ \frac{\delta Q_1}{\delta p_{l_1}} < 0; \frac{\delta Q_1}{\delta p} > 0; \frac{\delta Q_1}{\delta A} > 0$$

However for the case of other sectors, we assume that the presence of linkages from the maritime sector to other sectors of the economy which makes a portion of the output of the maritime sector output come into the production function Q2 and cost relation C2 of the other sectors as an input. Hence for the other sectors of the economy combined the profit maximization problem is:

$$MAX(Q_2): Q_2 = Af(q_1, k_3, l_2)$$
(7)

subject to the constraint

$$C_2 = p_{q_1}q_1 + p_{k_3}k_3 + p_{l_2}l_2 \tag{8}$$

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And on solving the above for its critical values and obtaining the maximum output obtainable given the constraint function we have:

$$Q_2 = Q_2 \left(A, p_{q_1}, p_{k_3}, p_{l_2}, C_2 \right) \tag{9}$$

and on obtaining the cost function which the inverse of the equation (9) we have:

$$C_2 = C_2(A, p_{q_1}, p_{k_3}, p_{l_2}, Q_2)$$
(10)

Where $\frac{\delta C_2}{\delta p_{q_1}} > 0$; $\frac{\delta C_2}{\delta p_{k_3}} > 0$; $\frac{\delta C_2}{\delta p_{l_2}} > 0$; $\frac{\delta C_2}{\delta Q_2} > 0$; $\frac{\delta C_2}{\delta A} < 0$.

However at the market price 'P' for other sectors of the economy and with the above cost function we obtain the unconstrained profit maximization problem below:

$$MAX(\pi_2): \pi_2 = P.Q_2 - C_2(p_{q_1}, p_{k_3}, p_{l_2}, Q_2)$$
(11)

The critical value(s) of Q1 that maximizes the profit function is:

$$Q_2 = Q_2(p_{q_1}, p_{k_3}, p_{l_2}, P)$$
(12)

Where
$$\frac{\delta Q_2}{\delta p_{q_1}} < 0$$
; $\frac{\delta Q_2}{\delta p_{k_3}} < 0$; $\frac{\delta Q_2}{\delta p_{l_2}} < 0$; $\frac{\delta Q_2}{\delta P} < 0$; $\frac{\delta Q_1}{\delta A} > 0$.

The total output in the economy is hence given as:

$$Q = Q_1 + Q_2$$

$$Q = Q(p_{k_1}, p_{k_2}, p_{l_1}, p, p_{q_1}, p_{k_3}, p_{l_2}, P)$$
(13)

Where
$$\frac{\delta Q}{\delta p_{q_1}} < 0; \frac{\delta Q}{\delta p_{k_3}} < 0; \frac{\delta Q}{\delta p_{l_2}} < 0; \frac{\delta Q}{\delta p_{k_1}} < 0; \frac{\delta Q}{\delta p_{k_2}} < 0; \frac{\delta Q}{\delta p_{l_1}} < 0; \frac{\delta Q}{\delta p} > 0; \frac{\delta Q}{\delta p} > 0; \frac{\delta Q}{\delta A} > 0$$

On combining the equations (12) and (13) we obtain the models which provide the basis for the estimation of the impact of the maritime sector on economic growth.

$$Q_2 = Q_2(p_{q_1}, p_{k_3}, p_{l_2}, P)$$
(12)

$$Q = Q(p_{k_1}, p_{k_2}, p_{l_1}, p, p_{q_1}, p_{k_3}, p_{l_2}, P)$$
(13)

From the model equations (12) and (13) we find that the impact of the maritime sector on growth is felt via the price of intermediate sales to the other sectors of the economy as a result of the linkages from the maritime sector to the other sectors of the economy. Hence if maritime services are produced significantly given the level of demand there is the tendency for a decline in the price of maritime services and hence the output of other sectors which have significant linkages with the maritime sector would expand and grow the economy as a whole.

3.2 Research Method and Model Specification

Quite a number of structural models exist as can be found in Gujarati (2005) and Brooks (2008) but for the purpose of this study we adopt the application of the ordinary least squares estimation of the equations in the model and the seemingly unrelated regressions model as discussed in Brooks (2008). The equations in the model that we seek to estimate are such that the regressand are expressed in terms of exogenous variables and hence we could assert that the model equations are in their reduced form and this makes the application of the ordinary least squares method of estimation on the individual equations one possible method of determining the parameters of the model while keeping with the best unbiased linear estimators condition as spelt out in econometric texts like Rubinfeld and Pindyck (1991). However there is the tendency for the application bias where the parameter estimated would not be in line with the expected best unbiased linear estimator properties and this occurs when there's contemporaneous correlation between the stochastic disturbance terms of the individual equations in the model equations in the expected best unbiased linear estimator properties and this occurs when there's contemporaneous correlation between the stochastic disturbance terms of the individual equations in the model equations and this calls for the Zellner (1962) seemingly unrelated regressions technique which uses a

weighted average technique in adjusting the variance-covariance matrix of the vector of stochastic disturbance terms to correct for the problem of contemporaneous correlation between the disturbance terms. The use of these methods, in estimating the econometric model for this study, will necessitate the tests for exogeniety of the regressors of the model equations being employed to ascertain that the use of the ordinary least squares method and the seemingly unrelated regression method are justified (indicating that the model being estimated does not violate the assumption that the regressors are truly not related to the stochastic disturbance terms (Gujarati, 2005) and to carry out this test we employ the Hausmann test for simultaneity as described in Brooks, (2006). In addition to the Hausmann test for simultaneity we shall also be considering other diagnostic tests to ensure that the parameters estimated from the model are efficient and unbiased and these diagnostic tests include: Jacque-Bera test for normality, the White test for heteroscedasticity, Breusch-Godfrey test for serial correlation, examination of the variance-covariance matrix of the vector of error terms and the Ramsey RESET which tests for model specification bias.

The econometric model we seek to estimate to capture the impact of the maritime sector on the industrial sector and the entire economy is given as:

$$LGDP = \rho_0 + \rho_1 TREND + \rho_2 LMGDPs + \rho_3 LFDI + \rho_4 LCA + \rho_5 MDEFd + \rho_6 ADEPr + \rho_7 TRGDPr + \rho_8 NEER + \rho_9 CPI + \rho_{10} GOVGDP + \mu_1$$
(14)
$$LINGDP = \rho_0 + \rho_1' TREND + \rho_2' LMGDPs + \rho_3' LFDI + \rho_4' LCA + \rho_5' MDEFd + \rho_6' ADEPr + \rho_7' TRGDPr + \rho_8' NEER + \rho_9' CPI + \rho_{10}' GOVGDP + \mu_1$$
(15)

Definition of variables	Determination of proxy
natural log. transformation of the gross domestic product	Proxy for economic growth
natural log. transformation of the ratio of industrial	Proxy for industrial output growth
output to the gross domestic product	
captures the growth in the gross domestic product	Proxy for technical progress
accounted for by technical progress.	
is the natural log transformation of the foreign direct	Proxy for capital account section of the balance
investment	of payment
is the natural log transformation of the gross capital	Proxy for capital stock
formation	
implicit deflator of the maritime sector	Proxy for the price of maritime services
Average deposit rate	Proxy for financial services
Ratio of total trade to the gross domestic product	Proxy for the current account section of the
	balance of payment
Nominal effective exchange rate	Proxy for macroeconomic stability
Consumer price index	Proxy for the general price level
Ratio of government spending to the gross domestic	Proxy for the impact of fiscal policies
product	· – – –
	Definition of variables natural log. transformation of the gross domestic product natural log. transformation of the ratio of industrial output to the gross domestic product captures the growth in the gross domestic product accounted for by technical progress. is the natural log transformation of the foreign direct investment is the natural log transformation of the gross capital formation implicit deflator of the maritime sector Average deposit rate Ratio of total trade to the gross domestic product Nominal effective exchange rate Consumer price index Ratio of government spending to the gross domestic product

Definitions of variables

The major limitation facing the method of research adopted in this study is the shortage of data. While some of the time series data available span 1960–2010 some other time series variables span 1980–2010 and since there is little or nothing that can be done to remedy the situation—like providing data for the years between 1960 and 1980—we decide to carry out our analysis based on the time frame 1980–2010 and this may engender the problem of near singularity of the data matrix involved in estimating the regression equations in the model. Also this problem bars us from using more data involving methods like the three stage least squares which may also help in correcting the problem of contemporaneous correlation which is expected to be the case in the model specified earlier.

4. Analysis Interpretation of Findings and Conclusion

4.1 Presentation and Description of Main Variables

Here we consider the characteristics of the main variables being studied which are the share of maritime output in the gross domestic product (GDP), the gross domestic product and the industrial output. The graphs of the gross domestic product and the industrial output are given below and from the graph it is clear that both the gross domestic product and the industrial output are likely to be explained by common factors in the economy as both graphs have trend lines with slopes that are approximately equal (when we correct to one decimal place). Also it is clear from the graph that the gross domestic product and the industrial output are both not stationary but may be stationary about a trend and as suggested by Gujarati (2005) trend stationary processes can be made stationary by introducing a trend component in the equation modeling trend stationary processes.



Figure 1 Graphical Depiction of the Main Variables Involved in the Model Constructed by the author.

On the other hand the share of the water transport sector in the gross domestic product (GDP)–which is used to capture the maritime sector in Nigeria—shows an initial rise which peaks in 1983 and afterwards there was a steady decline even until 2010.

Hence beyond 1983 the trend in the maritime sector has been one of a decline compared to the gross domestic product. Summary results of the three variables are presented in the table below:

	•			
	LIND	LGDP	LMGDPS	
Mean	13.06086	14.02540	0.001379	
Median	13.70708	14.64223	0.000254	
Maximum	16.19823	17.18988	0.006214	
Minimum	9.671102	10.77100	4.65E-05	
Std. Dev.	2.300200	2.224030	0.001927	

Table 1 Summary Results of the Main Variables Involved in the Econometric Model

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Skewness	-0.209635	-0.127060	1.379340
Kurtosis	1.628180	1.589009	3.483381
Jarque-Bera	2.572097	2.569342	9.804963
Probability	0.276361	0.276742	0.007428
Sum	391.8257	420.7620	0.041356
Sum Sq. Dev.	153.4367	143.4430	0.000108
Observations	30	30	30

Note: LIND: is the natural logarithm of the industrial output; LGDP: is the natural logarithm of the gross domestic product and; LMGDPS: is the share of the water transport in the gross domestic product.

From the summary results above, we find that the standard deviation of the natural log of the industrial output and the gross domestic output are approximately equal to the nearest integer and so are their skewness and kurtosis properties. However the natural log of the water transport share of the GDP is more leptokurtic and positively skewed than the natural logs of the industrial output and the gross domestic product and hence departs from a normal distribution unlike the other two variables.

4.2 Model Estimation and Diagnostic Tests

We begin estimating with the ordinary least squares estimation method and hence assuming that the two equations to not have their stochastic components highly correlated to warrant the use of the seemingly unrelated regression approach to correct for contemporaneous correlation of the residuals μ_1 and μ_2 . In addition we seek a parsimonious model that would be devoid of redundant variables while enabling us to check for the sensitivity of the results to model changes.

The ordinary least square estimation of the model equations (17) and (18) is given below:

	OLS outp	out (Full r	nodel)		OLS outp	out (Adjus	ted model)		OLS out	tput (Furt	her adjuste	d model)
Variable	LGDP	Prob	LIND	Prob	LGDP	Prob	LIND	Prob	LGDP	Prob	LIND	Prob
С	5.683	0.000	3.054	0.113	6.052	0.000	4.856	0.000	6.193	0.000	4.963	0.000
TREND	0.142	0.001	0.152	0.013	0.114	0.000	0.128	0.000	0.130	0.000	0.140	0.000
LMGDPS	-83.156	0.252	-58.53	0.593	-63.295	0.226	-72.517	0.358	3.271	0.907	-21.667	0.598
LCA	0.196	0.026	0.320	0.017	0.125	0.004	0.171	0.008	0.136	0.002	0.179	0.005
LFDI	0.346	0.010	0.371	0.064	0.344	0.000	0.272	0.037	0.287	0.001	0.229	0.046
MDEFD	-0.001	0.813	-0.003	0.522	0.002	0.266	0.001	0.746	0.003	0.153	0.001	0.612
ADEPR	-0.016	0.318	-0.016	0.527	-	-	-	-	-	-	-	-
TRGDPR	0.887	0.004	1.728	0.000	1.006	0.000	1.999	0.000	0.977	0.000	1.976	0.000
NEER	0.002	0.088	0.002	0.262	0.002	0.136	0.001	0.448	-	-	-	-
CPI	-0.003	0.322	-0.005	0.253	-	-	-	-	-	-	-	-
GOVGDP	-0.058	0.967	-1.560	0.463	-	-	-	-	-	-	-	
	SUR outp	out (Full r	nodel)		SUR out	tput (Adju	sted mode	l)	SUR ou	tput (Furt	her adjuste	d model)
Variable	LGDP	Prob	LIND	Prob	LGDP	Prob	LIND	Prob	LGDP	Prob	LIND	Prob
С	5.683	0.000	3.054	0.048	6.052	0.000	4.856	0.000	6.193	0.000	4.963	0.000
TREND	0.142	0.000	0.152	0.002	0.114	0.000	0.128	0.000	0.130	0.000	0.140	0.000
LMGDPS	-83.156	0.152	-58.530	0.503	-63.295	0.159	-72.517	0.284	3.271	0.894	-21.667	0.547
LCA	0.196	0.006	0.320	0.003	0.125	0.001	0.171	0.002	0.136	0.000	0.179	0.001
LFDI	0.346	0.002	0.371	0.021	0.344	0.000	0.272	0.016	0.287	0.000	0.229	0.024

Table 2 Ordinary Least Square and Seemingly Unrelated Regression Estimation Results

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MDEFD	-0.001	0.766	-0.003	0.421	0.002	0.195	0.001	0.705	0.003	0.103	0.001	0.563
ADEPR	-0.016	0.211	-0.016	0.428	-	-	-	-		-	-	-
TRGDPR	0.887	0.000	1.728	0.000	1.006	0.000	1.999	0.000	0.977	0.000	1.976	0.000
NEER	0.002	0.034	0.002	0.160	0.002	0.083	0.001	0.376	-	-	-	
CPI	-0.003	0.215	-0.005	0.153	-	-	-	-	-	-	-	-
GOVGDP	-0.058	0.958	-1.560	0.358	-	-	-	-	-	-	-	-
DIAGNOS	ΓICS											
R-Squared	0.998		0.995		0.997		0.994		0.997		0.994	
D.W test	2.269		2.508		2.403		2.547		2.127		2.412	
J.B test	0.731		0.956		0.953		0.760		0.874		0.784	
Augmented Dickey Ful test	ller 0.000		0.000		0.000		0.000		0.000		0.000	

Constructed by the author using regression output available in the appendix.

The OLS estimation output above shows the share of maritime output in the gross domestic product and the implicit price deflator of the maritime sector having statistically insignificant impact on both economic growth and industrialization as evident from the regression coefficients C(3); C(6); C(14) and C(17) and contrary to our expectations the share of maritime output in the gross domestic product has a negative impact on both growth and industrialization. This confirms the graphical characteristics of the share of the maritime output in the gross domestic product vis-à-vis the gross domestic product and the industrial output. This negative relationship may be the result of years of neglect which the maritime sector has witnessed from 1983 when the decline in the contribution of the sector to the gross domestic product began to decline. This result would also imply that the maritime sector may have very weak linkages with the other sectors of the economy and more interesting is the somewhat insensitivity of the regression coefficients C(3); C(6); C(14) and C(17) of the maritime variables in the two equations to the changes made in the model. With the removal of redundant variables: average weighted deposit rate (ADEPR), nominal effective exchange rate (NEER), ratio of total trade to the gross domestic product (TRGDP) and the ratio of government spending to the gross domestic product (GOVGDP) in succession we find that the regression coefficients C(3); C(6); C(14) and C(17) of the share of maritime output in the gross domestic product (LMGDPS) and the implicit deflator of the water transport sector (MDEFD) in both equations are all statistically insignificant but with the adjustment of the model for redundant variable we find that the negative impact of the maritime sector variables recorded in the first two versions of the model equations were reversed in the last version of the model equations. The diagnostic tests applied on the two model equations in all three versions of the model shows the presence of high overall statistical significance as seen from the R-squared value which is above 90% for both model equations and model versions and with the adjustments made to the model as well as the constancy in the statistical significance of the maritime sector variables and the high level of individual statistical significance of the regression coefficients, we observe a very low level of multicollinearity despite the very low availability of data. The problem of autocorrelation is detected with the modified d-statistic presented in Guajarati (2005) and since all the d-statistic values are greater than two we shall test for the presence of negative autocorrelation using the statistic $4 - d_l$ and on obtaining the values of d_l from the Durbin-Watson tables for 30 values of observation and 10, 8 and 7 regressors excluding the intercept term for the three versions of the model we find that the computed d-statistic values do not exceed the critical values of $4 - d_1$ and hence the threat of negative autocorrelation is absent. The Jacque Bera test for normality probability values are presented

and they are all not significant in rejecting the null hypothesis that the residuals of the regression equations are normal and finally the augmented Dickey Fuller test probability values are presented to ensure that the high R-squared values are not indicative of a spurious regression and from the results we find that the probability values reject at the 5% level the null hypothesis that the residuals have a unit root and hence each equation estimated above are in a long run relationship and not spurious. However due to the observation that the natural logarithmic transformations of the gross domestic product and the industrial output have similar graphical characteristics we investigate the possibility of a contemporaneous correlation between the residuals of the model equations across versions and from our estimation of the residual correlation matrix we find that the problem of heteroscedasticity in each of the model equations across versions and these is evident in the table below:

Residual correlation matrix			
Variables	Trend	LGDP residuals	LIND residuals
Trend	1.00	$2.76*10^{-12}$	1.71*10 ⁻¹⁴ (1.0000)
LGDP residuals	2.76*10 ⁻¹² (1.0000)	1.00	0.877767 (0.0000)
LIND residuals	1.71*10 ⁻¹⁴ (1.0000)	0.877767 (0.0000)	1.00

Constructed by the author.

The presence of high positive contemporaneous correlation would necessitate the use of the seemingly unrelated regression approach to correct the standard errors and hence p-values to ensure that we do not underestimate or overestimate the regression significance of the individual regression variables. From the table 1 above, we find the seemingly unrelated regression output and from the results we find that the share of the maritime sector in the gross domestic product has a negative impact on growth in the first two model version but in the last it became positive but nevertheless statistically insignificant. The implicit deflator representing the maritime sector had a positive impact on growth and industrialization as expected from theory but once again we find these regression coefficients to be statistically insignificant. Thus the coefficient significance did not change despite the removal of redundant variables and the use of a different method of estimation. This informs us of the lack of substance in the maritime sector which has failed to impact on growth or industrialization in the Nigerian economy.

4.3 Economic Implications of Empirical Findings

The economic implications of our findings above are quite explicit enough and do not require any complex reasoning. In all three versions of the model estimated, we find the maritime sector doing poorly in explaining growth and industrialization in the Nigerian economy. This means that contrary to our expectations the maritime sector has very weak linkages with the industrial sector and this portends very serious adverse consequences for growth and development in Nigeria. The implicit price deflator for the maritime sector is also seen not to affect growth and this signifies the relative insignificance of the sector in its contribution to growth and other relevant macroeconomic objectives. This calls for a total revamping of the maritime sector to make it more contributory to the objectives of growth and development in the Nigerian economy via the enhancement of its linkages with other sectors of the economy.

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