ANALYSIS OF DETERMINANT FACTORS IN THE CHOICE OF FREIGHT SERVICES PROVIDER

M. S. Stephens, Wilfred I. Ukpere***

Abstract

Choice making in freight demand is critical to any firm as transportation cost can reach as much as 75% of the total cost of finished and shipped goods. The knowledge of the factors that influences the choice decision making for shippers will be of particular interest to carriers and the shippers alike. The study therefore set out to determine the factors that influence the choice of carriers for companies; evaluate the factors and degree of influence or level of significance of these factors or attributes. Five (5) firms' decision-making processes were studied for a combined total of 508 road trucking choice decision for what type or who does the shipment of their products and raw materials to and away from their respective manufacturing plants between January and June 2014. The firms were given a set of attributes or factors so that they are ranked using Likert scale of 1 to 5 to identify their level of significance. Multiple regression technique was used to establish the relationship between the factors and the choice of carriers. Regression analyses using analysis of variance, variance inflation factors and t-Test was done at 95% confidence level. The results showed that freight charges, quality of service, trust, price elasticity of freight demand and customer relations were the most significant factors/attributes that influenced the choice of a carrier in the five hundred and eighty shipments recorded for all firms in the study.

Keywords: Hire-And-Carry; Owner-Occupier; Freight Cost; Customer Relationship; Quality Of Service

* *Department of Transport Management Technology, Federal University of Technology, PMB 704 Akure, Nigeria*
** *Department of Industrial Psychology and people Management, Faculty of Management, University of Johannesburg, South Africa*

Introduction

Freight demands have a direct correlation with the type and amount of economic activities with the industries. The amount of goods produced and consumed in an area and the relationship between producers, consumers and intermediate suppliers has great impact on the magnitude and spatial distribution of freight. Freight demand is a direct function of the types of industries in a region or economy. The types of industries in an economy can be broadly classified into goods related and services, each having unique impact on freight flows. Manufacturing industries for example varies in types and quantities of goods produced and consumed as well as the type of transportation service used to meet the demand for production inputs and supply of outputs. An estimation and analysis of freight transport demand if properly done would give an insight into the factors that must be considered to ensure a smooth flow of inputs and outputs to and fro production centres to the final points of consumption at reasonable and sustainable costs.

1. Research objectives

The objectives of the study are therefore:

- To determine the factors that influence the choice of carriers for companies and,
- To evaluate the factors degree of influence or level of significance of these factors or attributes.

2. Theoretical foundation

According to Kanafani (1983), there are three basic approaches to the analysis of commodity transportation demand, namely the input-output approach, spatial interaction modeling and the microeconomic perspective. In the first method, sectorial relationship of the economy was analyzed where transportation was identified as one of the sectors, making it possible to investigate transportation requirements of other sectors, translating same into flows of goods and this approach was used by Liew *et al* (1985).

The second approach of spatial interaction modelling is aggregate in nature. Here, surpluses and deficits of commodities are located at various points of space and a process is then postulated whereby commodities flows occur from points of excess supply

to points of excess demand. The transportation system is explicitly represented as network, with its nodes and arcs, and considerable effort is placed on assigning traffic flows to that network. Studies like the seminal Harvard-Brookings model of Kresge *et al* (1971) and Harker's (1987) generalized spatial price equilibrium model fits this approach.

Thirdly, the microeconomic approach, which is often called econometric where the basic decision unit of analysis is the firm and the firm, is considered the potential user of transportation. Winston (1983) classified the microeconomic models into aggregate and disaggregate models. Aggregated studies used data that consists of total flows by mode at the regional or national level whereas disaggregate studies uses data that are made of information relating to individual shipments. Generally, aggregate models tends to be cost minimizing in nature, exploring firms and their need to save cost of transportation in their choice of modes of shipments. Examples of such studies are those of Oum (1979a, 1979b), Friedlaender *et al* (1980). From a theoretical point of view, disaggregate models seems preferable to aggregate ones, however, aggregate models can turn more useful than their disaggregate counterparts. An aggregate methodology can become the best approach, practically, if cost limitations preclude an adequate sampling of the population of a large-scale policy analysis.

This paper however explores the disaggregate models as they hold a number of conceptual strengths. Firstly, observations are much larger with more precise estimate of parameters. Secondly, the model allows much richer empirical specifications and better capturing of the variation in character of shippers (firms). Lastly the model does not require the unrealistic assumption of identical decision-makers as aggregate models do. We can classify disaggregate models as behavioral and inventory. This study uses the behavioral model, where the decision-maker is the physical distribution manager of the receiving or shipper firm. Shipment size is therefore the choice of the firm and not the agent or the carrier, consequently, mode choice is modelled. The core of the literature pertaining to behavioral models is based on the notion that the decision-maker maximizes utility with respect to choice of mode.

The approach presented by McFadden (1973) is that of utility maximization, where the utility function includes a random component. In this random utility approach the decision-maker makes a discrete choice by choosing among alternative modes i.e. *i* to *j*). The choice of the mode from the *j* available routes is assumed to maximize the decision-maker's utility. The utility function for the individual decision-maker is specified as follows.

$$U_i = V(B, X_i, S) + E(X_i, S) \quad (1)$$

With I = $i \rightarrow j$ and

Where $U_i \rightarrow$ the utility associated with utility function is $V(B, X_i, S)$

and the vector function V consists of a vector of unknown parameters B set of modal attributes

$X_i \rightarrow$ socio-economic characteristics of the decision-maker,

$S \rightarrow$ Systematic utility, that is, the same functional form applying to all shippers. The random portion of the utility function is E (X_i, S) this component of the utility reflects the unobserved tastes, preference and characteristics of the individual decision – maker. Consequently, this term varies across decision makers.

According to the utility maximization assumption, the individual shipper chooses a particular mode i only if the utility realized from choosing mode i is greater than the utility realized from any other mode. Thus, the individual will choose mode i if $(U_i > U_{s,} \, for \, all \, i, j)$. Thus, the mode choice probabilities depend, in part, on the random utility difference $(E_i - E_j)$ and their distribution (Small and Winston, 1998). Using this framework, McFadden extends the mode choice model to situations when the decision maker is confronted with more than two alternatives. He accomplishes this by assuming that his distribution of the random component follows the extreme valve distribution.

Ogwude (1986) noted the most determinant modal choice in the Nigerian industry as the freight rates charged and the economic costs of transport services to the industries. He noted the neglect of the rail transport as partly a reason among others for the relatively higher cost of its services compared to road which is also in line with Olanrewaji (1983).

Armstrong (2001) found that trucking prices are largely inelastic, and recommended mode shifting, end-to-end matching, improved carrier negotiation and shipment visibility as other ways to reduce expenses for third party logistics (3PL). Samimi *et al* (2011) in their study on behavioral analysis of freight mode choice decisions examined the way truck and rail competes for commodity in the US. The study made use of two binary mode choice models including some shipment specific variables (e.g. distance, weight and value) mode specific variables (e.g. haul time and cost) as determinants. The study found shipping cost as a central factor for rail shipments while road shipment are found to be more sensitive to haul time. Sensitivity of mode choice decision was further analyzed under different fuel price fluctuations, and concluded that even a 50% increase in fuel cost does not cause a significant modal shift between truck and rail.

Beuthe *et al* (2000) present direct and cross-elasticity estimates for demands on rail, road and inland waterway for ten different categories. Origin-destination models and cost information were used to compute modal elasticity of Belgian freight instead of statistical analysis. The results however shows that truck tonnage demand is inelastic but elastic when

calculated by tons-km, showing as well a dominant position for trucking over shorter distances. Rail demand is elastic but less so than for inland waterways. Rail demand elasticity are larger for rail tonnage than for tons-km. Cross elasticity show that rail demand appears more sensitive to cost variation than the other modes. Roberts (2012) on his study on the key factors and trends in transportation mode and carrier selection focused on modal and carrier choice decision process to determine what factors play the largest role in products deliveries. The study identified cost, service, product characteristics, relationships and capacity as factors for consideration in modal choice decision process. However, an important finding of the study is that the factors play a part in both modal and carrier selection decision making process simultaneously, and not as part of a stepped process as was previously assumed.

However, this study did consider choices made within the same mode (road trucking) as there is very little or no competition between the road and rail modes of transportation in Nigeria. The study considered owner-occupier and hire-and-carry services as alternative means of shipping the goods/products of the firms considered in this study all of which are in the Irete Industrial Layout in Owerri, Imo State Nigeria.

Transportation costs usually form the bulk of the cost of shipped goods/commodity (Stephens, 2003). Making sound decision on choice of means of shipment is therefore a very important decision for shippers. A good knowledge of the factors that influence the choice of carriers an organization seeking to reduce their transportation cost and ultimately the cost of their production in the market particularly those firms that have strong competitors is therefore very vital. It must be noted that there are many decision makers within the freight logistics and industry supply chain network. Shippers, consignees, carriers and other logistics services providers play a critical role in contributing to decision about what, how, when and where transportation services are used to move goods across the supply chain.

3. Methods

The scope of the study was Irete Industrial Layout where five (5) firms' decision-making processes were studied for a combined total of 508 roads trucking choice decision for what type or who does the shipment of their products and raw materials to and fro their respective manufacturing plants between January and June 2014. The firms are: Nigeria Bottling Company Limited (NBC), Camela Vegetable Oil Limited (CVO), GM Cord Aluminum (GMC), KSL Investment Limited (KSL) and Palm Essence Industries Limited (PEI). NBC are the local franchise making the following Coca-Cola products: Coke; Fanta, Sprite; Five Alive; Schweppes; Burn Energy drink; Cappy and Eva Water. CVO produces vegetable and refined oil for both domestic and industrial consumption. GMC makes long span aluminum roofing sheets and other aluminum products. KSL specializes in the manufacturing of Henzo Water products of different size and PEI also produces vegetable oil product.

The respective Supply Chain Managers or Distribution Managers of these firms were given a spreadsheet to capture the factors that were significant in the selection of carrier for each shipment their respective firms did within the period of the study. The factors identified by the research and deemed important in choice decision-making were: freight cost; customer relationship of the service provider; quality of service offered; value of cargo to be shipped; accessibility of service provider; price elasticity of demand for freight; trust or competency index of the service provider; distance of shipment; safety index of the firm. These factors or attributes can be categorized into three broad categories: market-forced attributes, service provider (carrier) attributes and the cargo attributes. Market-forced attributes are the attributes or factors that cannot be influenced by any single firm in the market/industry as all players participating in the market are deemed to be as equals with same knowledge and understanding of prevailing market conditions (perfect market is assumed). The attributes include price or freight cost and price elasticity of demand for and accessibility of service provider. Accessibility of service provider dealt with the availability of choice of carrier for any given shipment, regardless of the distance and nature of the cargo. Service provider attributes are those that can be influenced by the carrier and they include customer relationship index of carrier with the shipper or consignor and the consignee; quality of service offered; trust and safety index of the firm. For the cargo attributes, these are attributes or factors that the cargo imposes on the shipment and the carrier due to its natural circumstances. They include value of cargo and its nature. However, a fourth category of attribute is noted to be shipment specifics and that is captured by the distance of shipment. The distance of shipment affects the travel length and time which could be further affected by the nature of the road and traffic situations. These attributes were ranked on the Likert scale of 1 to 5 with one signifying the least level of importance of the given attribute in deciding which carrier will be used. The carriers are broken down into two categories: owner-occupier and hire-and-carry. Owner-occupier mean the firm owns the vehicle used in the shipment and so provides the services in-house while hire-and-carry mean the vehicle of carriage is owned by another firm that is contracted to do the shipment, that is a third-party logistics service provider.

The sample size was the actual/real life value as it was the exact number of shipments made by all the firms within the January – June 2014 study period. In

all, a total of 508 shipments were made. The data collected was analyzed using multiple regression analysis, analysis of variance and variance inflation factor to carry out this analysis. The aim of the test is to know how the companies make their choice of freight demand and what influences their choice of freight demand.

Consider the following linear model with k independent variables:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \varepsilon \quad (2)$$

The standard error of the estimate of β_j is the square root of the j+1, j+1 element of $s^2(X'X)^{-1}$, where s is the root mean squared error (RMSE) (note that $RMSE^2$ is an unbiased estimator of the true variance of the error term, σ^2); X is the regression design matrix — a matrix such that $X_{i, j+1}$ is the value of the j^{th} independent variable for the i^{th} case or observation, and such that $X_{i, 1}$ equals 1 for all i. It turns out that the square of this standard error, the estimated variance of the estimate of β_j, can be equivalently expressed as

$$\hat{\text{var}}(\hat{\beta}_j) = \frac{s^2}{(n-1)\widehat{\text{var}}(X_j)} \cdot \frac{1}{1-R_j^2}, \quad (3)$$

where R_j^2 is the multiple R^2 for the regression of X_j on the other covariates (a regression that does not involve the response variable Y). This identity separates the influences of several distinct factors on the variance of the coefficient estimate:

- s^2: greater scatter in the data around the regression surface leads to proportionately more variance in the coefficient estimates
- n: greater sample size results in proportionately less variance in the coefficient estimates
- $\widehat{var}X_j$: greater variability in a particular covariate leads to proportionately less variance in the corresponding coefficient estimate

The remaining term, $1 / (1 - R_j^2)$ is the variance inflation factor (VIF). It reflects all other factors that influence the uncertainty in the coefficient estimates. The VIF equals 1 when the vector X_j is orthogonal to each column of the design matrix for the regression of X_j on the other covariates. By contrast, the VIF is greater than 1 when the vector X_j is not orthogonal to all columns of the design matrix for the regression of X_j on the other covariates. Finally, note that the VIF is invariant to the scaling of the variables (that is, we could scale each variable X_j by a constant c_j without changing the VIF). The equation *ii* above shows the total freight demand and the respective factor/attributes that were considered in the decision making for the freight demand. For this study equation *ii* can be written as

$$Y = \beta 0 + \beta 1\ P1 + \beta 2\ C + \beta 3\ R + \beta 4\ Q + \beta 5\ V + \quad (4)$$

$$\beta 6\ A + \beta 7\ E + \beta 8\ T + \beta 9\ D + \beta 10 S + \varepsilon.$$

Where P *is* Cost, C is customer relationship index, V is value of cargo, A is accessibility, E is price elasticity of demand for freight, T is trust, D is distance of shipment and S is the safety index of the firm.

The MegaStat analytical tools was used for the purpose of this research. It is easy and user friendly and gives coloration to test results. The deeper the color intensity the more significance the attribute is.

4. Results And Discussion

The result of the analysis done for PIE showed that cost or freight charges, price elasticity of demand for freight, customer relation, accessibility and quality of service were the most significant factors/attributes that influenced the choice of a carrier in the hundred shipments recorded for the firm. Freight charges were the most significant factor and it was followed by price elasticity of demand for freight, customer relation, accessibility and quality of service. The *VIF* showed that reliability, accessibility, price elasticity of demand for freight, trust and safety index of the carrier were the factors that influence the uncertainty in the coefficient estimates (see table 1).

The demand decision equation for PIE can now be given as:

$$\begin{gathered} Y_{PIE} = -1.8618 - 0.8042P_{PIE} - 0.5461C_{PIE} \\ +0.1242R_{PIE} + 0.4967Q_{PIE} + 0.0493V_{PIE} + \\ 0.2094A_{PIE} + 0.3223E_{PIE} + 0.6792T_{PIE} + \\ 0.3437D_{PIE} + 0.0556S_{PIE} + \varepsilon. \end{gathered} \quad (5)$$

The result of the analysis done for KSL (table 2) showed that cost or freight charges, customer relation, accessibility, price elasticity of freight demands, and safety index of the carrier were the most significant factors/attributes that influenced the choice of a carrier in the hundred shipments recorded for the firm.

Freight charges were the most significant factor and it was followed by customer relation, price elasticity of freight demand, safety index of the carrier and accessibility. The *VIF* showed that value of cargo, accessibility, distance of shipment and safety index of the carrier were the factors that influence the uncertainty in the coefficient estimates (see table 2). However, value of cargo and accessibility had the strongest *VIF* values.

The demand decision equation for KSL can now be given as:

$$\begin{gathered} Y_{ksl} = 8.3765 - 1.2375P_{ksl} - 0.2320C_{ksl} \\ +0.0177R_{ksl} - 0.00114Q_{ksl} + 0.1059V_{ksl} - \\ 0.1373A_{ksl} - 0.0730E_{ksl} - 0.0244T_{ksl} - \\ 0.0678D_{ksl} + 0.1983S_{ksl} + \varepsilon. \end{gathered} \quad (6)$$

Table 1. Regression Analysis for Palm Essence Industries (PIE)

	R^2	0.869						
	Adjusted R^2	0.855	n	100				
	R	0.932	k	10				
	Std. Error	0.747	Dep. Var.	Y				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	330.7536	10	33.0754	59.21	5.48E-35			
Residual	49.7134	89	0.5586					
Total	380.4669	99						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=89)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	-1.8618	2.7278	-0.683	.4967	-7.2819	3.5584	0.000	
Cost	-0.8042	0.0853	-9.433	4.77E-15	-0.9736	-0.6348	-0.631	3.053
Customer Relation	-0.5461	0.2333	-2.341	.0215	-1.0096	-0.0826	-0.147	2.690
Reliability	0.1242	0.4032	0.308	.7588	-0.6770	0.9254	0.026	4.823
Quality of Service	0.4967	0.2155	2.305	.0235	0.0685	0.9249	0.130	2.156
Value of Cargo	0.0493	0.0992	0.497	.6204	-0.1477	0.2463	0.034	3.230
Accessibility	0.2094	0.0905	2.314	.0230	0.0296	0.3893	0.172	3.774
Price Elasticity of demand for freight	0.3223	0.1007	3.201	.0019	0.1222	0.5224	0.240	3.839
Trust	0.6792	0.5323	1.276	.2053	-0.3785	1.7369	0.114	5.402
Distance of shipment	0.3437	0.2563	1.341	.1834	-0.1656	0.8531	0.091	3.105
Safety Index of the firm	0.0556	0.1998	0.278	.7815	-0.3414	0.4526	0.025	5.429
							Mean VIF	3.750

Source: Field work 2014

Table 2. Regression Analysis for KSL Investment Limited (KSL)

	R^2	0.970						
	Adjusted R^2	0.967	n	100				
	R	0.985	k	10				
	Std. Error	0.299	Dep. Var.	Y				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	257.6690	10	25.7669	287.78	3.07E-63			
Residual	7.9686	89	0.0895					
Total	265.6377	99						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=89)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	8.3765	1.2311	6.804	1.14E-09	5.9304	10.8226	0.000	
Cost	-1.2375	0.0376	-32.951	1.20E-51	-1.3121	-1.1629	-1.023	2.859
Customer Relation	-0.2320	0.0757	-3.066	.0029	-0.3824	-0.0816	-0.080	2.004
Reliability	0.0177	0.1003	0.176	.8604	-0.1816	0.2170	0.005	2.016
Quality of Service	-0.0114	0.1149	-0.100	.9209	-0.2397	0.2168	-0.002	1.856
Value of Cargo	0.1059	0.0887	1.194	.2358	-0.0704	0.2822	0.088	16.271
Accessibility	-0.1373	0.0671	-2.046	.0437	-0.2707	-0.0040	-0.143	14.550
Price Elasticity of demand for freight	-0.0730	0.0311	-2.344	.0213	-0.1348	-0.0111	-0.074	2.936
Trust	0.0244	0.1278	0.191	.8490	-0.2296	0.2784	0.006	3.297
Distance of shipment	-0.0678	0.1165	-0.582	.5618	-0.2992	0.1636	-0.020	3.490
Safety Index of the firm	0.1983	0.0854	2.321	.0226	0.0285	0.3680	0.104	5.948
							Mean VIF	5.523

Source: Field work 2014

The result of the analysis done for GMC (table 3) showed that cost or freight charges, customer relation, reliability of carrier's service, quality of service, price elasticity of freight demands, and trust index of the carrier were the most significant factors/attributes that influenced the choice of a carrier in the hundred shipments recorded for the firm. Freight charges were the most significant factor and it was followed by customer relation, trust index of carrier, price elasticity of freight demand, quality of service, and reliability. The *VIF* showed that all the attributes were the factors that influence the uncertainty in the coefficient estimates (see table 3). However, accessibility, value of cargo, and safety index of carrier had the strongest *VIF* values.

The demand decision equation for GMC can now be given as:

$$Y_{GMC} = 10.0331 - 1.2149P_{GMC} - 0.4751C_{GMC} - 0.3401R_{GMC} - 0.6040Q_{GMC} + 0.0906V_{GMC} - 0.0730A_{GMC} - 0.1172E_{GMC} - 0.5733T_{GMC} - 0.0965D_{GMC} + 0.1204S_{GMC} + \varepsilon. \quad (7)$$

The result of the analysis done for NBC (table 4) showed that cost or freight charges, customer relation, value of cargo, price elasticity of freight demands, trust index of the carrier and safety index of the carrier were the most significant factors/attributes that influenced the choice of a carrier in the hundred and eight shipments recorded for the firm. Freight charges were the most significant factor and it was followed by trust, value of cargo, price elasticity of freight demand, customer relation, and safety index of the firm.

The *VIF* showed that freight charges, customer relation, reliability, price elasticity of demand for freight, distance of shipment and safety index of the firm were the attributes that influenced the uncertainty in the coefficient estimates (see table 4).

Table 3. Regression Analysis for GM Cord Aluminum (GMC)

	R^2	0.981						
	Adjusted R^2	0.979	n	100				
	R	0.990	k	10				
	Std. Error	0.242	Dep. Var.	Y				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	265.3783	10	26.5378	451.76	1.00E-71			
Residual	5.2281	89	0.0587					
Total	270.6064	99						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=89)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	10.0331	1.2286	8.166	1.98E-12	7.5919	12.4743	0.000	
Cost	-1.2149	0.0453	-26.843	1.91E-44	-1.3048	-1.1249	-0.983	6.175
Customer Relation	-0.4751	0.1090	-4.359	3.49E-05	-0.6916	-0.2585	-0.162	6.338
Reliability	-0.3401	0.1298	-2.621	.0103	-0.5979	-0.0822	-0.089	5.308
Quality of Service	-0.6040	0.2158	-2.799	.0063	-1.0327	-0.1752	-0.108	6.827
Value of Cargo	-0.0906	0.0709	-1.278	.2045	-0.2315	0.0503	-0.092	24.036
Accessibility	0.0730	0.0728	1.003	.3187	-0.0717	0.2177	0.074	25.192
Price Elasticity of demand for freight	-0.1172	0.0407	-2.877	.0050	-0.1981	-0.0362	-0.120	7.957
Trust	0.5733	0.1652	3.470	.0008	0.2450	0.9016	0.127	6.154
Distance of shipment	0.0965	0.1158	0.833	.4071	-0.1336	0.3266	0.031	6.323
Safety Index of the firm	0.1204	0.0881	1.366	.1752	-0.0547	0.2955	0.076	14.356
							Mean VIF	10.867

Source: Field work 2014

However, reliability, customer relation, distance of shipment, cost, safety index of carrier and price elasticity of freight demand had the strongest *VIF* values.

The demand decision equation for NBC can now be given as:

$$Y_{NBC} = 2.6729 - 1.2399P_{NBC} - 0.8267C_{NBC} - 0.4250R_{NBC} - 0.0836Q_{NBC} + 0.1412V_{NBC} - 0.0156A_{NBC} - 0.01615E_{NBC} - 0.5987T_{NBC} - 0.03759D_{NBC} + 0.2373S_{NBC} + \varepsilon \quad (8)$$

Table 4. Regression Analysis for Nigeria Bottling Company (NBC)

	R^2	0.954						
	Adjusted R^2	0.949	n	108				
	R	0.977	k	10				
	Std. Error	0.388	Dep. Var.	Y				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	304.2187	10	30.4219	202.16	2.60E-60			
Residual	14.5968	97	0.1505					
Total	318.8155	107						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=97)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	2.6729	1.9944	1.340	.1833	-1.2854	6.6312	0.000	
Cost	-1.2399	0.0563	-22.017	1.64E-39	-1.3517	-1.1281	-1.038	4.708
Customer Relation	0.8267	0.3105	2.662	.0091	0.2104	1.4430	0.225	15.083
Reliability	-0.4250	0.3981	-1.068	.2884	-1.2152	0.3651	-0.112	23.472
Quality of Service	-0.0836	0.1612	-0.519	.6052	-0.4035	0.2363	-0.017	2.275
Value of Cargo	-0.1412	0.0407	-3.473	.0008	-0.2219	-0.0605	-0.121	2.564
Accessibility	-0.0156	0.0406	-0.383	.7026	-0.0962	0.0651	-0.011	1.676
Price Elasticity of demand for freight	-0.1615	0.0551	-2.930	.0042	-0.2709	-0.0521	-0.132	4.288
Trust	0.5987	0.1503	3.984	.0001	0.3004	0.8971	0.129	2.229
Distance of shipment	0.3759	0.2120	1.773	.0793	-0.0449	0.7968	0.116	9.027
Safety Index of the firm	0.2373	0.0893	2.657	.0092	0.0600	0.4145	0.124	4.617
							Mean VIF	6.994

Source: Field work 2014

Table 5. Regression Analysis Camela Vegetable Oil (CVO)

	R^2	0.955						
	Adjusted R^2	0.950	n	100				
	R	0.977	k	10				
	Std. Error	0.366	Dep. Var.	Choice				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	251.7774	10	25.1777	187.54	2.68E-55			
Residual	11.9485	89	0.1343					
Total	263.7259	99						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=89)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	2.8570	1.0209	2.799	.0063	0.8285	4.8855	0.000	
Cost	-1.0628	0.0534	-19.916	1.50E-34	-1.1689	-0.9568	-0.902	4.027
Customer Relation	0.4232	0.1390	3.044	.0031	0.1470	0.6994	0.131	3.623
Reliability	0.0152	0.1662	0.092	.9273	-0.3151	0.3455	0.004	3.516
Quality of Service	-0.1087	0.1174	-0.925	.3572	-0.3420	0.1247	-0.040	3.759
Value of Cargo	-0.0117	0.0547	-0.214	.8309	-0.1205	0.0970	-0.012	5.731
Accessibility	-0.0144	0.0505	-0.285	.7760	-0.1148	0.0860	-0.012	3.468
Price Elasticity of demand for freight	-0.0366	0.0397	-0.921	.3596	-0.1155	0.0423	-0.036	2.985
Trust	0.9523	0.1286	7.406	7.07E-11	0.6968	1.2078	0.342	4.200
Distance of shipment	-0.1027	0.1069	-0.961	.3391	-0.3150	0.1096	-0.033	2.258
Safety Index of the firm	-0.3509	0.0962	-3.646	.0004	-0.5421	-0.1597	-0.211	6.601
							Mean VIF	4.017

Source: Field work 2014

The result of the analysis done for CVO (table 5) showed that cost or freight charges, trust, safety index of the carrier, and customer relation, were the most significant factors/attributes that influenced the choice of a carrier in the hundred and eight shipments recorded for the firm. Freight charges were the most

significant factor and it was followed by trust, safety index of the firm, and customer relation. The *VIF* showed that safety index of the firm, value of cargo, trust, freight charges, quality of service, customer relation, reliability, and accessibility were the factors that influence the uncertainty in the coefficient estimates (see table 5). However, safety index of the firm, value of cargo and freight charges had the strongest *VIF* values.

The demand decision equation for CVO can now be given as:

$$Y_{CVO} = 2.8570 - 1.0628P_{CVO} + 0.4232C_{CVO} + 0.0152R_{CVO} - 0.1087Q_{CVO} - 0.0117V_{CVO} - 0.0144A_{CVO} - 0.0366E_{CVO} + 0.9523T_{CVO} - 0.1027D_{CVO} - 0.3509S_{CVO} + \varepsilon. \quad (9)$$

Camela Vegetable Oil Limited (CVO), GM Cord Aluminum (GMC), KSL Investment Limited (KSL) and Palm Essence Industries Limited (PEI).

Table 6. Regression Analysis for Owner Occupier (OC)

	R^2	0.925						
	Adjusted R^2	0.921	n	221				
	R	0.962	k	10				
	Std. Error	0.471	Dep. Var.	Y				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	573.7375	10	57.3738	258.63	3.58E-112			
Residual	46.5864	210	0.2218					
Total	620.3239	220						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=210)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	4.2153	0.9849	4.280	2.84E-05	2.2738	6.1568	0.000	
Cost	-1.1513	0.0367	-31.361	3.54E-81	-1.2236	-1.0789	-0.962	2.632
Customer Relation	0.0044	0.0959	0.046	.9635	-0.1846	0.1934	0.001	2.616
Reliability	0.0420	0.1225	0.343	.7322	-0.1996	0.2836	0.011	2.812
Quality of Service	0.3895	0.1106	3.522	.0005	0.1715	0.6075	0.084	1.597
Value of Cargo	-0.0385	0.0332	-1.159	.2476	-0.1039	0.0269	-0.034	2.424
Accessibility	0.0028	0.0297	0.094	.9251	-0.0558	0.0614	0.002	1.956
Price Elasticity of demand for freight	-0.0733	0.0299	-2.453	.0150	-0.1322	-0.0144	-0.067	2.117
Trust	0.2471	0.1202	2.056	.0410	0.0102	0.4840	0.059	2.340
Distance of shipment	0.0066	0.0996	0.067	.9468	-0.1896	0.2029	0.002	2.640
Safety Index of the firm	0.0932	0.0728	1.280	.2020	-0.0503	0.2367	0.050	4.266
							Mean VIF	2.540

Source: Field work 2014

The result of the analysis done for OC (table 6) showed that cost or freight charges, quality of service, price elasticity for freight demand, and trust were the most significant factors/attributes that influenced the choice of a carrier in the two hundred and twenty-one shipments recorded for the for OC. Freight charges was the most significant factor and it was followed by quality of service offered by the carrier, price elasticity for freight demand, and trust. The *VIF* showed that safety index of the firm was the only attribute or factor that influenced the uncertainty in the coefficient estimates (see table 6).

The demand decision equation for OC can now be given as:

$$Y_{OC} = 4.2153 - 1.1513P_{OC} + 0.0044C_{OC} + 0.0420R_{OC} + 0.3895Q_{OC} - 0.0385V_{OC} - 0.00028A_{OC} - 0.0733E_{OC} + 0.2471T_{OC} + 0.0066D_{OC} + 0.0932S_{OC} + \varepsilon. \quad (10)$$

Table 7. Regression Analysis for Hire-and-Carry (HC)

	R^2	0.916						
	Adjusted R^2	0.913	n	287				
	R	0.957	k	10				
	Std. Error	0.523	Dep. Var.	**Choice**				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	829.2337	10	82.9234	302.64	2.03E-142			
Residual	75.6239	276	0.2740					
Total	904.8575	286						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=276)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	4.5441	0.8021	5.665	3.69E-08	2.9650	6.1232	0.000	
Cost	-1.0464	0.0369	-28.386	7.57E-84	-1.1189	-0.9738	-0.840	2.892
Customer Relation	-0.2545	0.0969	-2.627	.0091	-0.4453	-0.0638	-0.075	2.683
Reliability	-0.1824	0.1183	-1.541	.1244	-0.4154	0.0506	-0.044	2.737
Quality of Service	0.0978	0.0933	1.048	.2955	-0.0859	0.2814	0.028	2.284
Value of Cargo	-0.0251	0.0344	-0.731	.4653	-0.0928	0.0426	-0.022	3.032
Accessibility	0.0811	0.0334	2.427	.0159	0.0153	0.1469	0.071	2.809
Price Elasticity of demand for freight	-0.0550	0.0313	-1.757	.0800	-0.1167	0.0066	-0.049	2.531
Trust	0.5433	0.1113	4.879	1.80E-06	0.3241	0.7625	0.138	2.641
Distance of shipment	0.2039	0.0929	2.195	.0290	0.0210	0.3868	0.060	2.430
Safety Index of the firm	-0.1181	0.0585	-2.018	.0445	-0.2333	-0.0029	-0.065	3.448
							Mean VIF	2.749

Source: Field work 2014

The result of the analysis done for HC (table 7) showed that cost or freight charges, trust, customer relations, accessibility, distance of shipment, safety index of the carrier were the most significant factors/attributes that influenced the choice of a carrier in the two hundred and eighty-seven shipments recorded for the for HC. Freight charges were trust, customer relations, accessibility, distance of shipment, safety index. The *VIF* showed that safety index of the firm was the only attribute or factor that influenced the uncertainty in the coefficient estimates (see table 7).

The demand decision equation for HC can now be given as:

$$Y_{HC} = 4.5441 - 1.0464P_{HC} - 0.2545C_{HC} - 0.1824R_{HC} + 0.0978Q_{HC} - 0.0251V_{HC} + 0.0811A_{HC} - 0.0550E_{HC} + 0.5433T_{HC} + 0.2039D_{HC} - 0.1181S_{HC} + \varepsilon. \quad (11)$$

The result of the analysis done for all firms in the study (table 8) showed that cost or freight charges, quality of service, trust, price elasticity of freight demand and customer relations were the most significant factors/attributes that influenced the choice of a carrier in the five hundred and eighty shipments recorded for all firms in the study. Freight charges were followed by quality of service, trust, price elasticity of freight demand and customer relations. The *VIF* showed that safety index of the firm was the only attribute or factor that influenced the uncertainty in the coefficient estimates (see table 8).

The demand decision equation for all firms in the study can now be given as:

$$Y_{ALL} = 4.5441 - 1.0464P_{ALL} - 0.2545C_{ALL} - 0.1824R_{ALL} + 0.0978Q_{ALL} - 0.0251V_{ALL} + 0.0811A_{ALL} - 0.0550E_{ALL} + 0.5433T_{ALL} + 0.2039D_{ALL} - 0.1181S_{ALL} + \varepsilon. \quad (12)$$

Table 8. Regression Analysis for all firms

	R^2	0.905						
	Adjusted R^2	0.904	n	508				
	R	0.952	k	10				
	Std. Error	0.539	Dep. Var.	**Choice**				
ANOVA table								
Source	*SS*	*df*	*MS*	*F*	*p-value*			
Regression	1,382.3853	10	138.2385	475.90	3.22E-247			
Residual	144.3664	497	0.2905					
Total	1,526.7517	507						
Regression output					*confidence interval*			
Variables	*coefficients*	*std. error*	*t (df=497)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	4.4558	0.6159	7.235	1.77E-12	3.2458	5.6659	0.000	
Cost	-1.0993	0.0278	-39.595	8.1526438447 5406E-156	-1.1538	-1.0447	-0.897	2.698
Customer Relation	-0.1511	0.0720	-2.099	.0364	-0.2926	-0.0096	-0.046	2.525
Reliability	0.0052	0.0863	0.061	.9517	-0.1643	0.1748	0.001	2.442
Quality of Service	0.2851	0.0715	3.988	.0001	0.1447	0.4256	0.074	1.786
Value of Cargo	-0.0244	0.0253	-0.964	.3355	-0.0741	0.0253	-0.022	2.624
Accessibility	0.0368	0.0237	1.555	.1206	-0.0097	0.0834	0.033	2.297
Price Elasticity of demand for freight	-0.0715	0.0229	-3.119	.0019	-0.1166	-0.0265	-0.064	2.235
Trust	0.2821	0.0818	3.447	.0006	0.1213	0.4428	0.070	2.174
Distance of shipment	0.1358	0.0707	1.922	.0552	-0.0030	0.2746	0.041	2.342
Safety Index of the firm	-0.0603	0.0478	-1.262	.2076	-0.1543	0.0336	-0.033	3.575
							Mean VIF	2.470

Source: Field work 2014

5. Conclusion

In summary, the study showed that cost or freight charges, quality of service, trust, price elasticity of freight demand and customer relations were the most significant factors/attributes that influenced the choice of a carrier in the five hundred and eighty shipments recorded for all firms in the study. Freight charges was followed by quality of service, trust, price elasticity of freight demand and customer relations and the *VIF* showed that safety index of the firm was the only attribute or factor that influenced the uncertainty in the coefficient estimates.

The demand decision equation for all firms in the study can now be given as:

$$Y_{ALL} = 4.5441 - 1.0464P_{ALL} - 0.2545C_{ALL} - 0.1824R_{ALL} + 0.0978Q_{ALL} - 0.0251V_{ALL} + 0.0811A_{ALL} - 0.0550E_{ALL} + 0.5433T_{ALL} + 0.2039D_{ALL} - 0.1181S_{ALL} + \varepsilon. \quad (13)$$

For hire-and-carry (HC) carriers or "*transporter*" should not charge excessive freight rates, should build customer trust and good customer relations, be sure to have their services available to shippers as at when needed (accessibility), have roadworthy vehicles that can travel to whatever distance, and have safety as their watchword and standard to keep. On the other hand, owner-occupier (OC) was seen to have cost or freight charges, quality of service, price elasticity for freight demand, and trust to be the most significant factors/attributes that influenced the choice. It is noteworthy, that shipper using OC are very sensitive to changes in quantity (number of freight movement made) for the marginal change in freight rate/charges (fare/price). This is true for all firms in the study except for CVO. NBC for example has its own vehicles and also patronizes Leventis Motors, a third-party logistics service provider. Price elasticity of freight demand is one of the strong determinant factors in choice of carrier.

CVO had 80% of its shipments made by HC the remaining by OC. NBC recorded 75% percent usage of OC and the remaining used HC for its shipments. GMC ships its consignments using 92% of HC and OC had 8%. KSL does 100% OC shipments and PIE had 90% for HC and the remaining used OC shipments. From the study it was found out that most of the companies go on HC (57% of the shipments) and OC (43%).

6. Recommendation

Base on the result of the study, the following recommendations can be made:

– Road trucking freight rate should be very competitive as it was the most significant factor in the choice decision making for carrier.

– Fluctuations in fares and market responses were also a strong factor in deciding which carrier to be used. Firms (carriers) should try as much as possible to maintain a stable fare regime. This might be difficult because of the volatile nature of prices of petroleum products.

– Carriers should keep great corporate image and relationship with the general public and the customers in particular. This should include maintaining great quality of service and trust.

– Denial of service is a strong turn-away for would-be customers in the future, hence carriers should make available and accessible their services to intended customers when and where needed.

References

1. Armstrong, R., (2001). Economics 103PL. Traffic World. 265 (17): 23.
2. Beuthe, Michel., Jourquin, Bart., Geerts Jean-Francois., Koul a Ndjang Ha, Christian. (2000). Freight Transportation Demand Elasticities: A Geographic Multimodal Transportation Network Analysis. Transportation Research Part E 37: 253-266.
3. Cristina B. and Luis P. 2004 analyzing the determinants of freight shipper's behavior: own account versus purchase transport. Publishers and address Machmilian Lagos.
4. Don Benson (2001) sustainably distributed. An UK sustainable Distribution policy World transport policy and practice vol. 6 No. 2 (www.ecoplain.org/wtpp) PP 5-12.
5. Friedlaender, A F. and Spady, R. H. (1980), "A derived demand function for freight transportation", Review of Economics and Statistics vol.62, nº3, pags.432-441.
6. Kanafani, A. K. (1983), Transportation Demand Analysis, New York: McGraw-Hill
7. Kresge, D. T. and Roberts, P. O. (1971), "Systems analysis and simulation models", in Techniques of transport planning, vol.II J. R. Meyer (editor), pp.1-228.
8. Liew, C. K. and Liew, C. J. (1985), "Measuring the development impact of a transportation system: a simplified approach", Journal of Regional Science vol.25, nº2, pp.241-257.
9. Ogwude, I. C. (1986), "Industrial demand for freight transport in Nigeria". Unpublished Ph. D. Dissertation. Dept. of Economics, University of Ibadan.
10. Olanrewaju, S. A. (1983), "Economic regulation of road haulage industry in Nigeria". *Odu, A Journal of African Studies* July, pp. 30 – 43.
11. Oum, T. H. and Water W.G and Jong say Yong 1990 survey of recent estimates of price elasticities of demand for transport.
12. Oum, T. H., (1979a), "Derived demand for freight transport and inter-modal competition in Canada", Journal of Transport Economics and Policy, vol.13, nº2, pp.149-168.
13. Oum, T. H., (1979b), "A cross sectional study of freight transport demand and rail-truck competition in Canada", The Bell Journal of Economics vol.10, no.2, pp.463-482.
14. Oum, T. H., W. G. Waters II and Jong say young say Youg (1992), "Concepts of price Elasticities of Transport Demand and recent Empirical Estimate, Journal of Transport Economics May, 1992 pp 139 - 154
15. Roberts, (2012). Key factors and trends in transportation mode and carrier selection. Pursuit: The Journal of Undergraduate Research at the University of Tennessee Copyright © The University of Tennessee.
16. Samimi *et al* (2011). "A behavioural analysis of freight mode decisions". Transport Planning and Technology Vol 34, No 8, 2011, 857-869 2011 Taylor & Francis http://www.tandfonline.com
17. T&E (2000) Towards more sustainable freight transport European Federation for Transport and environment.
18. Transport Research Board (1998) policy options for intermodal freight Transportation, Transportation research Board special Report 252, Transportation research Board (www.trb.org)
19. Winston, C. (1983), "The demand for freight transportation: models and applications", Transportation Research vol.17 A, nº6, pp.419-427.
20. Wikipedia (2014), Variance Inflation Factor. Accessed on 25th November 2014 at http://en.wikipedia.org/wiki/Variance_inflation_factor
21. Zlatoper, T. J. and Austrian, Z. (1989), "Freight transportation demand: A survey of recent econometric studies", Transportation, vol.16, pp.27-29