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SPATIAL DETERMINANTS OF IMPORT TRAFFIC DISTRIBUTION AT PORT HARCOURT (NIGERIA)

by
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ABSTRACT

This paper highlights the result of a study carried out to examine the Geographic determinants of import traffic distribution at the Port Harcourt Port. A substantial aspect of the study involved building a regression model to estimate import distribution from the Port. The import function was specified in log-linear form. The adequacy of the model was then tested; this, involved statistical experiments to obtain the R-squared, as well as t and f values. Further test on the adequacy of the model was conducted through diagnostic exercises designed to check for multicollinearity and heteroscedasticity, in the data used. Results obtained show that road distance and manufacturing industries are significant Geographic determinants of import Cargo distribution at the study Port. It is therefore important to take the two variables into account in any policy or planning exercise at Port Harcourt Port.

INTRODUCTION

In the past, several studies, have interested in the task of studying Nigerian Ports (Ogundana 1966, Nedeco 1970, Bigosinski 1979 and Sheneerson et al 1979). Inspite of such attemptes very few studies have conducted to examine port traffic from a spatial perspective; that is, few studies have been engaged with examining the role of the hinterland on port traffic. This is inspite of the fact that hinterland correlates (Socio-economic variables) largely determine the volume and direction of flow of imports. Furthermore, effective planning demands that such spatial variables be identified and their significance scientifically tested; it is only within such a framework, that quantitative estimates, can be made, for purposes of policy consideration.

To the best of our knowledge, the (pioneering) work of Onakomaiya and Smith (1972) remains the only work which has scientifically examined import traffic distribution in Nigeria. The study utilized data for 1964 and concerned the distribution of imported Cargo by rail from two Nigerian ports (Apapa and Port

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Harcourt). This study indicated that income from agricultural exports and distance from the two ports were the two most significant variables. However, a number of points are worthy of consideration concerning that study. Firstly the study was conducted at a time when the Nigerian economy was predominantly agricultural. Consequently, it would be expected that agricultural earnings would be significant in explaining import distribution. Besides, at the period, the level as well as concentration of industrial activities was quite low, consequently level of industralization was found not to be significant. Thirdly, the use of railway distance as an impedance variable is in accordance with the importance of the railway at that period. However, given the immense industrial, urban and infrastructural development that has taken place in Nigeria (between the 1970's and 1980) it becomes necessary to further examine the issue of an import distribution function for Port Harcourt.

The specific objective of this paper is to estimate import traffic distribution from Port Harcourt (using more recent data); particular attention is therefore focused on the statistical significance of spatial variables such as population of towns, level of industrial development as well as road distance from the study Port. Furthermore a major distinguishing feature of this paper is the variety of diagnostie test to which the estimated distribution function is subjected to.

CONCEPTUAL AND THEORETICAL ASPECTS

The Gravity, model provides, a conceptual and theoretical base for the model to be tested. The gravity model has been traditionally applied to migration studies (Ravenstein 1885). However, variation of the model have been applied to traffic studies (Britton (1967); Black (1971); O'sullivan and Ralston (1974) and Openshaw (1976)).

In its simplest from the Gravity model states that interaction between any two points is a function of some attractive factor (or mass term) as well as an impedance factor. The attractive variable is usually population while the impedance factor is distance. Consequently, the larger the mass (suitably defined) the higher the traffic; on the other hand, the larger the seperating distance the lower the traffic (all things being equal).

The definition of attractive and impedance variables may however take many forms; the mass term may be defined in terms of population, income, retail sales, number of commercial activities as well as industrial development. The frictional effect of distance may be defined in terms of cost or time involved in overcoming space.

However several problems, are associated with the gravity model. A major problem concerns its predictive ability; the model has been criticized for failure to replicate observed trip patterns (wills 1986; Sikdar and Hutchinson 1981). Another problem has to do with the fact that the model is basically misspecified (Fotheringham 1981, 1983 and Baxter 1983); that is, it fails to take into account the spatial structure of origins and destinations.

However, many factors have increased the vadility and adoption of the gravity model. For example, Wilson (1967) has proved that the doubly constrained gravity model is equivalent to entropy maximization; Tomlin and Tomlin (1968) showed that the gravity- entropy model is a generalised form of the linear programming transportation problem. This work therefore takes the gravity model as given; the model therefore provides a strong theoretical base for our model specification.

The conceptial model is therefore as follows:

$$Y = f(X_1^{b1}, x_2^{b2}, x_3^{-b3})$$

Where

Y = Quantity of imports flowing from the port to inland locations
X_1 = Population of inland towns
X_2 = Number of manufacturing industries
X_3 = Road distance between the port and inland locations
b_1, b_2, b_3 are coefficients to be estimated

In this work, the use of income of towns as an additional variable was dropped because of the following reason:

(i) The difficulty of obtaining adequate data on income at the urban level (that is, income generated by towns from taxation of individuals, industries and commercial activities).

(ii) Since the study is interested in a function the meets the needs of policy, the variables to be used must be obtainable on a continous basis for the past, present and future.

(iii) The strong possibility of a high correlation between population as well as the number of manufacturing industries on the one hand and income generated on the other. This is because it is assumed the income generated at the urban level is a function of the number of taxable adults as well as the number of industrial and commercial ventures. A high correlation may thus be expected - thus raising the problem of multicollinearity (see Johnson (1984) pp 246-248). (We were further discouraged from using income generated from agricultural exports because of the insignificance of such exports in revenue generation).

With regard to the model earlier specified, we should expect (on theoretical grounds) the following findings:

(a) The coefficient of population (b1) should have a positive sign given the gravity model which postulates a direct relationship between volume of Cargo flow and population.

(b) The coefficient of number of manufacturing industries is also expected to have a positive sign.

(c) The parameter b3 (coefficient of distance) is expected to have a negative sign, this is because theoritically an inverse relationship is expected between quantity of flow and distance.

METHODOLOGY

Methods

Spatial distribution models are usually classified into two groups; these are the multiplicative (or logarithmic) and linear models. The multiplicative models are non linear in nature and the parameters of such models are usually estimated using maximum likelihood methods (Batty and Mackie 1972; Wilson 1970 and Mackett 1979).

On the other hand linear models are usually estimated using least squares method (Cesario 1974, 1975). In practice the two methods are found to be sufficient and yeild similar results (Openshaw 1976). This study therefore uses the least squares method in estimating an import distribution function for Port Harcourt.

Multiple regression is therefore utilized in this study; the specific functional form used is the log-linear function (This function is used to take into account possible non-linearities in the data).

The log - linear model is specified as follows:

In y = b0 + b1 Inx1 + b2 Inx2 + b3 Inx3 + U

Where the b's are coefficients to be estimated

U = error term

(other variable in the function have been earlier defined)

The reliability and adequacy of the regression results are tested at various stages. The first stage relates to the theoritical postulates about the sign of the parameters. The second level makes use of first order statistical test; such test involve the use of the R square, f and t values to assess the reliability of the regression results. Further diagnostic analysis involved testing for multicollinearity and heteroscedasticity in the data used in this study.

Multicollinearity in regression analysis usually occurs when near linear dependencies occur between the independent variables (Koutsoyiannis 1977 p.233). This problem leads to inflated sampling variences, imprecise parameter estimates are reduction in the accuracy of significance test (Hanushek and Jackson 1977 pp.86-96; Johnston 1984 p.240). The seriousness of multicollinearity in the data used was tested for using three methods. The first is the intercorrelation between the explanatory variables; a high correlation index normally indicates the presence of multicollinearity. The second method used is the variance Inflation factors (VIF). This factor is defined as

$$\frac{I}{(1-R^2)}$$

where R^2 is the squared multiple correlation coefficient when an explanatory variable is regressed on the remaining variables (Jhonston 1984 p.247). The VIF index quantifies the magnification of the sampling variance due to collinearity relative to the absence of collinearity VIF = 1 (Rhoads 1991); on the other hand VIF's in excess of 10 are taken as indicating severe multicollinearity (Marguardt 1990). The third method used to test for the severity of multicollinearity is a method due to Koutsoyiannis, (see Koutsoyiannis 1977 pp.238-241); the method is a revised version of Frisch's 1934 confluence Analysis. The method involves to basic steps. The first step is to regress the dependent variable on each one of the explanatory variables seperately. The results of the elementary regressions are then checked on the basis of a priori and statistical criteria: The second step involves adding additional variables and checking their effect on individual coefficients, standard errors and the R squared (Koutsoyiannis 1977 p.239). The presence of multicollinearity is indicated by changes in the signs of coefficient; and a drop in standard errors as more variables are added.

A major assumption in least squares concerns the pattern of the errors; that is the error is expected to have a constant variance; or the errors should not be correlated with the explanatory variables - that is absence of heteroscedasticity. The presence of heteroscedasticity results in inefficient parameter estimates as well as invalid standard errors. There are various test for heteroscedasticity; such test include those of Breusch - Pagan (1979); Goldfeld - Quandt (1965); Glesjer (1969) and the rank correlation test. In this study, the rank correlation test is used; this is because it is the simplest; besides Johnston (see Johnston 1972 p.22) seems to accept that the rank correlation test as well as the Goldfeld and Quandt test are preferable to other test.

Data

The port traffic data used in this study are for the year 1980; they were obtained from the Nigerian Ports Authority. Although, more recent data are available from the Ports Authority, such data are at an aggregated level. That is, current data, reflect movement of goods from port to states, such Zonal data are associated with the problems especially when applied in regression analysis (Douglas and Lewis 1970). The main problem is that Zonal regression can account for only the variation between zones and not for within zone variations (White and Senior 1973 p.165). As a result, relationships between variables representing aggregated data may be inaccurate (Dalvi and Martin 1977). It is therefore better for analysis to be undertaken at the most spatially disaggregated level possible (Dalvi and Martin 1977).

The preceding discussion therefore justifies the use of 1980 data for estimating port traffic distribution. (The data used in this study are disaggregated and involve flow of goods from Port Harcourt to twenty Nigerian towns. (See appendix I).

Information on population of Nigerian towns were obtained from the National Population Commission for the year 1963. The data were then projected to obtain 1980 estimates using the formulae $Pn = Poe^{rt}$

Where

Pn	=	Future population
Po	=	Present population
e	=	exponential
r	=	rate
t	=	time

(The growth rate of Lagos for 1980 is given as 4.7%; other Nigerian towns have a growth rate 3.2%). Information on industries were obtained from the Federal Ministry of industries; while road distances between Port Harcourt and inland locations were obtained from the Federal Ministry of Work and Housing. (Road distances are used because it is assumed that a large proportion of Port-inland traffic movement now use the highway network rather than the railway).

THE STUDY PORT

Eastern Nigerian rail line and as an outlet for the export of coal from Enugu to Lagos and certain West African Countries. The Port is located 65.6 kilometres up the Bonny River and was named after Louis Harcourt the then British Secretary of State.

Port Harcourt has witnessed extensive development since its established. The first was between 1956 and 1961, the second between 1962 and 1986. The last development took place between 1970 and 1974. The port is capable of berthing eight vessels and has seven stacking areas. The main quay covers an area of 47 hectares and is 1300 metres long. The port remains the most important port in the Eastern part of Nigeria (see Figure 1 for a map of the Port).

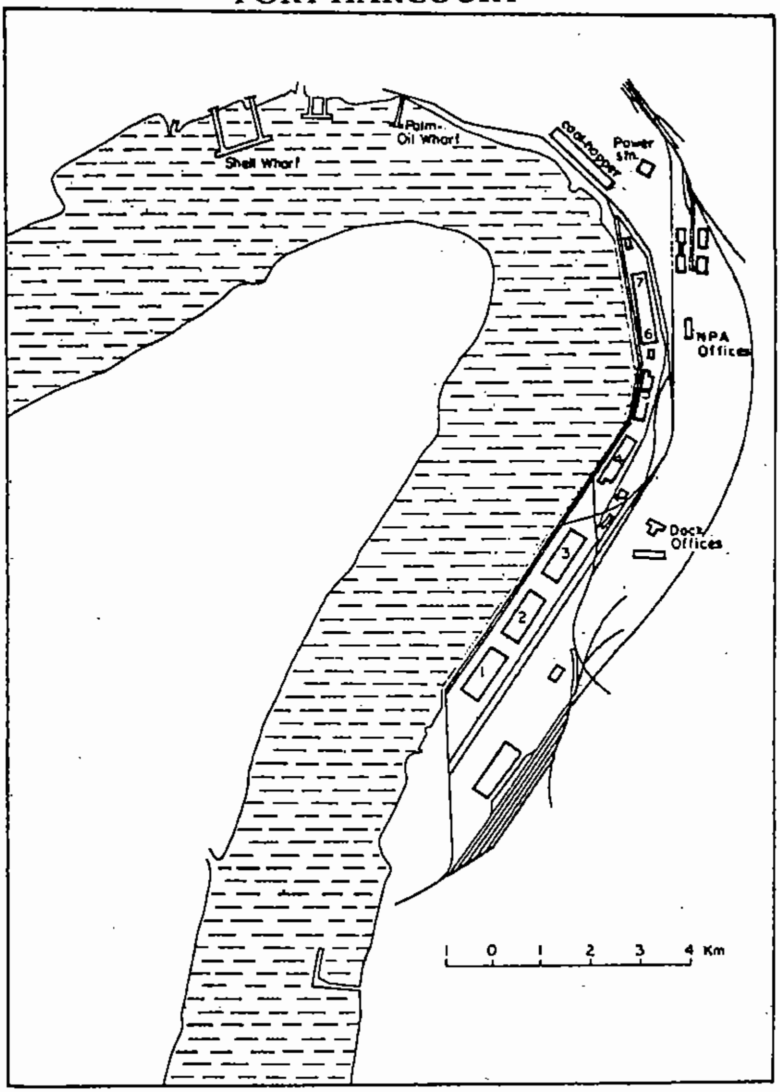
EMPIRICAL RESULTS

Table 1 shows the regression results; equation number 1 in the table relates to the regression results for all parameters. The R squared for the equation is 65.3% and the regression is statistically significant as indicated by the F ratio. Furthermore, all the regression parameters have the correct sign. For example, the population parameter comes out with a positive sign; however, the coefficient of the population parameter is not statistically significant. The industrial parameter also has the correct sign but is not statistically significant; while road distance is statistically significant and also has the expected sign.

Given that the R squared obtained, was far above average and that only one variable was significant, we decided to examine the importance of individual parameters. In order to do this, we estimated simple functions using each variable one at a time. The result of this exercise is shown on Table 1 from equation Number 2 to 4. Equation Number 2 relates to the population parameter. It shows that population alone explains 12% of the variation in the dependent variable; this variable was found to be insignificant (using an F test at the 5% level with 1 and 18 degrees of freedom). Equation Number 3 relates to manufacturing industries; this variable explains 28% of the variation in the import data and was found to be statistically significant. Furthermore, road distance was found to be significant; this variable recorded an R^2 of 34%

The preceding paragraph therefore shows that distance and industries are two important variables that explain the distribution of imported goods from Port Harcourt. However, given that in the complete equation (equation number 1) the industrial parameter was found to be insignificant we decided to further check the adequacy of the result obtained by carrying out diagnostic tests. Such test are important since it is possible to obtain meaningless results despite having high R-squared and significant t and f ratios. Besides a violation of major assumptions governing the application of least squares could to lead to wrong conclusions concerning the variables. For example, we could reject a variable as being insignificant while it is indeed very significant.

PORT HARCOURT



SOURCE – NIGERIAN PORTS AUTHORITY

TABLE 1 Regression Result

In Y = Inbo + biInx, + b2 Inx2 + b3 Inx3 + In U

					SUMMARY STATISTIC			
Equation number	Constant b0	Population b1	Industries b2	Road distance b3	R Squares	Adjusted R squared	R ratio	n
1	1.768 (.31)	1.544 (1.89)	.3915 (.99)	-1.4550 (-3.55)*				
VIF	–	2.1551	2.1186	1.5267	65.3%	58.8%	10.046	20
	bo	b1	b2	b3				
2 Y=f(x1)	-3.1629	.9854			12%		2.5	20
3 Y=f(x2)	4.4027		1.320		28%		7*	20
4 Y=f(x3)	16.6311			-1.3186	34%		9.444*	20

DIAGNOSTIC TEST

Table 2 shows the correlation matrix between the explanatory variables. The table shows a high collinearity between population and manufacturing industries. Thus the presence of multicollinearity in the data is confirmed. However, other test were carried out to examine the severity of the collinearity in the data. The variance inflation factor (VIF) was used to assess the severity of the multicollinearity. Results in Table 1indicate that the VIF for all the parameters were quite low. For instance no variable had a VIF of up to 10, consequently multicollinearity is not a serious problem. However, we note that all the variables have some collinearity since all the VIF's are above 1.

To further examine the severity of multicollinearity in the data we adopted a method suggested by Koutsoyiannis. The result of the exercise is presented in table 3. We used distance in the first elementary regression (Y = fxi) since it recorded the highest R-square. The introduction of manufacturing industries significantly improves the R-square; the sign of the parameters are correct and both variables are highly significant.

The regression with all there variables shows the effect of multicollinearity. That is the inclusion of population results in the industrial parameter becoming insignificant. Thus population has a detrimental effect on the value of the industrial parameter. However, it should be noted that the inclusion of population the R-square is increased and the signs of the parameters are still correct. Consequently, this method also indicates that multicollinearity is not severe, this is because the addition of collinear data did not result in a change of the signs of the parameters.

Tabel 2. Correlation Matrix of The Explanatory Variables

	X1	X2	X3
X1	1		
X2	.773	1	
X3	.225	- 0.20	1

Table 3. Regression Results

	bo Constant		b1 distance	b2 industries	b3 population	R2
Equation number						
1	Y = f (xi)	16.6311 (6.4851)	-1.3186 (-3.0736)			34%
2	Y = f (xii)	11.3137	-1.0310 (-2.805)	9153 (3.0469)		57.6%
3	Y = f (xiii)	1.768	-1.4550 (-3.55)	.3915 (.99)	1.1544 (1.89)	65.3%

Note : An asterisked coefficient is significant at the 5% Significance level (using a two tailed test).

From the preceding discussion we can therefore state that road distance and manufacturing industries are important variables that explain the distribution of imports from Port Harcourt. The non significance of the industrial parameter in the complete equation is due to the collinearity between population and manufacturing industries. The significance of manufacturing industries is not surprising given the emphasis placed on industrial development. Furthermore, the nature of the industries found in Nigeria sheds more light as to the significance of the industrial parameter most industries in Nigerian assemble components which to large extent are imported; consequently it is expected that there should be a positive correlation between imports and manufacturing industries.

The spearman rank correlation test was used to test for heteroscedasticity in the data. The rank correlation coefficient between the absolute values of the errors and each of the explanatory variables in turn was then computed. A t test was then used to examine the significance of the rank correlation coefficient. The test used is in the form:

$$t_{n-2} = \frac{\sqrt[2]{n-2}}{\sqrt{1-r^2}}$$

where r = rank correlation coefficient
n = sample size
n-2 = refers to the degrees of freedom used in the test

The results obtained show that the rank correlation coefficient for population against the errors was 7%. The t value obtained was 2976. This value was compared to the tabular value at the 5% significance level with 18 degrees of freedom; the calculated t value was found to be insignificant. We therefore conclude that heteroscedasticity did not exist in the population data.

In the case of industries the rank correlation coefficient obtained was -5.1%; the computed t value was found to be insignificant when compared to the tabular value. Consequently heteroscedasticity did not constitute a problem in the industrial data. The test carried out on the data concerning road distance also indicated a lack of heteroscedasticity in the data; (The rank correlation coefficient obtained was -6.76%; at t test indicated that this value was not significant).

CONCLUDING REMARKS

The objectives of this paper has been to provide evidence on the spatial determinants of import traffic distribution from Port Harcourt. We had therefore set out to examine the stastistical significance of variables such as population, manufacturing industries and road distance in explaining the distribution of imports. The main conclusion of the paper are therefore as follows:

In the first place road distance was found to be very significant in explaining the distribution of imports. This finding is plausible given the extent of road development in Nigeria; Most of the major highways have been extensively reconstructed or expanded into Express-ways. This fact has helped to develop the road haulage industry to the extent that importers prefer to patronize haulage companies rather than the railway co-operation. Consequently, any policy on import distribution in Nigeria must take into account road distance.

Secondly, number of manufacturing industries significantly influences the volume of imports that flows to an inland location. The importance of this variable is plausible given attempts at developing the industrial land-scape of Nigeria. It is also worth nothing that most of such industries depend almost entirely on imported raw materials. Consequently, it is necessary for policy makers to take into account level of industralization when examining import distribution. Population was found to be insignificant in explaining the variation in the import data. The variable is infact detrimental - since its inco-operation into the import function seriously reduces the significance of the industrial parameter.

Finally, the diagnostic exercise revealed the presence of multicollinearity in the data; the severity of collinearity was found to be slight. However the presence of collinearity especially between population and industries resulted in the non-significance of the industrial parameter. Further diagnostic test showed that heteroscedasticity was not a problem in the data used.

The results obtained in this study, to a large extent, meets theoretical expectations; besides they appear to be reasonably reliable (given the results of the diagnostic exercise). We may therefore conclude that the methodology adopted as well as the results obtained may prove useful for planning a Port Harcourt. (See Figure 1)

REFERENCES

Bigasinski J (1979) 'Nigerian Ports study: Traffic studies and projections' *M.I.T. Center for Transportation studies Report 79-1.*

Black W.R. (1971) 'The utility of the Gravity model and estimates of its parameters in commodity flow studies' *Proceedings of the Association of American Geographers* pp. 28-32.

Britton J.N.H. (1967) *'Regional Analysis and Economic Geography' A case study of manufacturing in the Bristol Region'*, Bell, London.

Breusch T.S and Pagan A.R. (1979) 'A simple Test for Heteroscedasticity and Random Coefficient variation' *Econometrica* vol.47, pp.1287-1294.

Belsey D.A, Kuh, E and Welsch R.E (1980) *Regression Identifying influential observations and sources of Collinearity*. New York, John Wiley.

Baxter M.J. (1983) 'Model misspecification and spatial structure in spatial-interaction model's *Environment and planning A*, 15, pp.319-327.

Baxter M.J. (1985) 'Size effects in the spatial patterning of non principal eigen vectors of planar network '*Geographical Analysis* 17 pp.74-81

Batty, M and Mackie, S (1972) 'The calibration of gravity and related models of spatial interaction' *Environment and Planning* vol.4 No.4, pp.205-233.

Mackett, R.L. (1979) 'Modelling the impact to Transport planning policy upon land use', working paper 115, Institute for Transport studies, University of leeds, Leeds.

Cesario, F.J. (1974) 'More on the Generalized Trip Distribution model' *Journal of Regional Science* 14 pp.389-397.

Cesario F.J. (1975) 'Linear and non-linear regression model of spatial interaction' *Economic Geography* Vol.51 No.1 pp.69- 77

Douglas A.A and Lewis R.J (1970) 'Trip Generation techniques 2 zonal least squares regression Analysis' Traffic *Engineering and control* 12 pp.428-431.

Dalvi M.Q and Martin K.M 'The effects of spatial aggregation on predicting trip rates: Some empirical results' working paper No.72 institute for Transport studies University of Leeds, Leeds.

Fotheringham A.S. (1981) 'Spatial structure and distance decay parameters' *Annals of the association of American Geographers* 71 pp.425-436.

Fotheringham, A.S. (1983) 'A new set of spatial interaction models: The theory of competing Destinations' *Environment and planning A* 15 pp.15-36.

Frisch R. (1934) *Statistical Confluence Analysis by means of complete Regression Systems, Oslo.*

Goldfeld, S.M. and Quandt R.E (1965) 'Some Test for Homoscadasticity *Journal of the American Statistical Association* vol.64, pp.539-323.

Glesjer, H (1969) 'A new Tests for Heteroscedasticity' *Journal of the American Statistical Association* vol.64, pp.316-323.

Hutchinson B.J. and Smith D.P (1979) 'Empirical studies of Journey to work in urban canada' *Canadian Journal of Civil Engineering* 6 pp.303-318.

Hanushek, E.A and Jackson, J.E (1977) *'Statistical Methods for social scientists'*, New York; McGraw - Hill.

Johnston J. (1972) *Econometric methods*, 2rd ed, New York; McGraw-Hill.

Johnston J. (1984) *Econometric methods*, 3rd ed, New York, McGraw-Hill.

Koutsoyiannis, A. (1977) *Theory of Econometrics* London Macmillan.

Maruardt, D.W. (1970) 'Generalized Inverses, Ridge Regression, Biased Linear Estimation and non Linear Estimation' *Technometrics* 12 pp.591-612.

Necedo (1970) *Development of the Ports of Nigeria 1970-1990; A study of Port Development and Related studies.* Volharding Jijimegan, The Netherlands

Ogundana, B. (1966) 'Changing Port outlets of Nigerian export commodities' *Nigerian Geographical Journal* vol.9 pp.25-43.

Onakomaiya, S.A and Smith, R.H.T (1972) 'The rail distribution of imported goods in Nigerian' *Nigerian Geographical Journal* vol.2 No.2 pp.115-134.

O'Sullivan P and Ralston, B (1974) 'Forecasting inter-city commodity transport in the USA' *Regional Studies* vol.8 pp.191-195.

Openshaw S. (1976) 'An empirical study of some spatial interaction models' *Environment and Planning* A 8 pp.23-41.

Rhoads, B.L. (1991) 'Multicollinearity and parameter Estimation in Simultaneous Equation models of fluvial systems' *Geographical Analysis* vol.23 no.4 p.349

Ravenstein E.G (1885) 'The laws of migration *Journal of the Royal statistical society* vol.48 pp.167-227.

Sikdar, P.K and Hutchinson, B.G (1981) 'Empirical studies of work trip distribution models' *Transportation Research* A 15 pp.233-233.

Sheneerson D, Boutherlier, F, Marcus, H and Roberts, P.O (1979) 'Nigerian Port Planning: Economic and Financial Analysis, Phase II Report' *MIT center for Transportation Studies Report 79-100.*

Tomlin J.A and Tomlin S.G (1968) 'Traffic distribution and entropy' *Nature* 220 pp.974-976.

White H.P and Senior M.L (1983) *Transport Geography* London, Longman.

Wilson A.G (1967) 'Astatistical theory of spatial distribution models' *Transportation Research* 1, pp.253-269.

Wilson A.G (1970) '*Entropy in urban and Regional modelling*' London, Pion.

Wills M.J. (1986) 'A Flexible Gravity-opportunities model for Trip distribution' *Transportation Research* B vol.20 No.2 pp.89-111.

APPENDIX I

DATA USED IN THE REGRESSION ANALYSIS

No.	Towns	Quantity of imports from Port Harcourt to towns (1980)	Population (1980)	Number of Manufacturin industries (1980)	Road distance from Port Harcourt (1980)
		Y	X1	X2	X3
1.	Port Harcourt	774934	319406	338	15
2.	Aba	318832	233028	180	64
3.	Umuahia	3072	51307	35	116
4.	Onitsha	248720	290001	60	206
5.	Enugu	108557	246287	105	253
6.	Lagos	378756	1550089	824	689
7.	Calabar	6127	135932	47	198
8.	Uyo	16033	59068	40	122
9.	Sokoto	241	159766	12	1509
10.	Kaduna	3369	266659	59	1007
11.	Zaria	82	295583	21	1093
12.	Kano	2281	525514	215	1274
13.	Benin	1809	179114	150	350
14.	Warri	1727	98285	51	383
15.	Asaba	153	46264	6	217
16.	Jos	6357	160807	163	846
17.	Makurdi	11002	95996	12	507
18.	Ibadan	4689	1115981	103	658
19.	Ilorin	1852	370961	15	846
20.	Offa	5030	153732	3	682

Sources: 1. Nigerian Porst Authority
2. National Population Commission
3. Federal Ministry of Industries
4. Federal Ministry of Works and Housing