

Application of Some Multivariate Techniques On Nexus Between Banks Performance and Consumers Satisfaction

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ABSTRACT: *In Nigeria, commercial banks play a significant role in economic growth. Every bank wants to keep its customers satisfied in order to have an edge over competitors. The researcher looks at Application of some multivariate techniques on nexus between banks performance and consumers satisfaction. Three commercial banks (UBA, UNION and ZENITH) were used for the period 2004 to 2021. The objectives of the study are to find out if there is significant connection between banks performance and consumers satisfaction; to compare banks performance and customer satisfaction using related variables also to ascertain which bank is better than others in efficiency. R software was used to analyze the data using three multivariate Techniques. The result showed that there is a positive correlation of $r=0.9891$ indicating a strong connection between banks performance and customers satisfaction. Further result showed that Zenith bank performed best with Total Liability (26.7) and Total Asset (16.8) having more influence on performance variable and No of ATM (1.6), Total Shareholders' Equity (1.2) and Product/services (1.1) having more influence on satisfactory variables. The result equally revealed that two factors were sufficient for Zenith with factor 1 having 51% and 7 variables loading positively to it. Factor 2 had 42% with 8 variables loading positively to it. The result for UBA followed with Total Liability(12.3) and Total Asset(2.02) having more influence on performance variable and No of ATM(1.001) and No of branches(1.52) having more influence on satisfactory variables. Two factors was sufficient for UBA with factor 1 having 75% and 8 variables loading positively to it. The least Bank was Union Bank with Total Liability(2.8) and Total Asset(2.5) having more influence on performance variable and No of ATM(0.7), No of branches(0.9) having more influence on satisfactory variables. One factor was sufficient for Union with factor 1 having 44% and 7 variables loading positively to it. From the results found, it is evidently clear that Zenith Bank is better and more efficient than the others in this study.*

KEYWORDS: multivariate techniques, economic growth, total liability, total asset, consumers' satisfaction

INTRODUCTION

Banking system is known as the backbone of financial intermediation through the mobilization and channeling of financial resources. The efficiency and success of this financial intermediation is predicated on a sound financial system. Especially in foreign trade management and earning of remittance, banks have to play the most important role. In recent years banking sectors have done a huge development of

their working arena by spreading their branches, implementing new policies and dynamic participation in social work such SME Banking, contribution in disaster management, donation in education, health, house loan, car loan etc and appreciable development in technology such as available ATM booths, USSD banking, internet and Mobile App banking etc. Banks are more likely to earn higher profits if they are able to position themselves in a superior way to their competitors in a particular market. Davies *et al.*, (1995). That is why the subject of banks performance is very important for customers' satisfaction, loyalty and retention Zairi (2000). In fact, customer loyalty stems from the organization's creation of benefit for customers so they will be retained and continue doing business with the organization (Anderson & Jacobsen, 2000).

The then CBN Governor Soludo (2004) attributes the inability of Nigerian banks to play a lead role in the development of the Nigerian economy to weak capital base, poor corporate governance, gross insider abuses, etc. The Central Bank of Nigeria, on July 6, 2004, raised minimum capital requirement for banks operating in Nigeria from N2 billion to N25 billion with a compliance period of 18 months. Sani (2004) and Onaolapo (2008) find significant positive effect of bank recapitalization on the performance of commercial banks. Customer satisfaction is the singular, most important metric for any business, in this case, banking. Every bank in Nigeria make sure they keep their customers satisfied at all times because they have options and are at liberty to do business with as many banks as they wish.

Customers are being attracted by new services, different offers that come up and the availability of branches around the country. This had led banks themselves to keep this from happening by striving to improve customer satisfaction. These they do by creating new products and services to enable them accommodate all kinds of customers and have an edge over competitors.

The significance of customer satisfaction in banks vary from one country to another owing to reasons such as social, economic, political and technological environmental factors. Factors relating to customer satisfaction are significant in some countries but are not in others and this relates to the banking services in Nigeria. Although entrance of technology have enhanced customer satisfaction in the banking sub sector, with impact on increased customers retention, still much is needed to make financial services firms become customer's first preference. Waqarul and Bakhtiar, (2012). It becomes necessary to find out those variables needed more by commercial banks in Nigeria for performance and customers' satisfaction. Hence, this work seeks to apply some multivariate techniques on nexus between banks performance and customers' satisfaction.

REVIEW OF RELATED LITERATURE

In a research by Ahmmad et al (2013) who applied canonical correlation analysis on banks performance and consumer satisfaction, he concluded from his findings that there is a positive relationship between banks performance and consumer satisfaction.

Sidow(2012) examined the customer satisfaction and performance of commercial banks in selected branches of salaam Somali bank in Mogadishu, Somalia using frequency percentage and regression analysis found out that there is a positive relationship between customer satisfaction and banks performance.

Johnson, Anerson and Fornell (1995) developed and tested alternative models of market-level expectations, perceived product performance, and customer satisfaction which they revealed that in a particular period, satisfaction is positively impacted by performance and expectations.

Ibojo and Asabi (2015) conducted a study on customer satisfaction and loyalty in Nigerian banks. Their studied highlighted a very positive and significant impact of customer satisfaction on customer loyalty. Their study equally revealed that as little as a percentage positive change in customer satisfaction resulted in as much customer loyalty as 67%. It is imperative to keep striving to satisfy banks customers which will lead to loyalty, retention and will as well bring more customers to the bank.

RESEARCH METHODOLOGY

CANONICAL CORRELATION ANALYSIS

As developed by Hotellings(1936), the process of maximizing the correlation between two linear function is called Canonical Correlation analysis.

It is a multivariate tool which measures the strength of association between the two sets of variables.

CANONICAL VARIATES

Let $Y_1 = (Y_1, Y_2, Y_3 \dots Y_p)$ and $X_1 = (X_1, X_2, X_3 \dots X_q)$

$U = a^1 Y$ and $V = b^1 X$ are the two linear functions needed such that the correlation between U and V is maximum. But U and V are of unit variance that is $a^1 \sum_{11} a = 1$ and $b^1 \sum_{22} b = 1$. These functions U and V are called canonical variates.

DISCRIMINANT ANALYSIS

Johnson and Wichern (1992) defined discriminant analysis as multivariate technique concerned with separating distinct set of objects with allocating new objects to previously defined groups.

The equation for discriminant score is as follows:

$$D = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + \dots + b_n X_n$$

Where

D represents the predicted score in the dependent variables.

a is the intercept b_i ($i = 1, 2, 3 \dots n$) are the coefficients associated with the independent variables.

$x_i (i = 1, 2, \dots, n)$ are the independent variables in the equation.

FACTOR ANALYSIS

Charles Spearman (1904) pioneered the work on this subject, which was later developed by L.L. Thurstone(1947). The purpose of factor analysis is to describe if possible the covariance relationships among variables in terms of a few underlying but unobservable random quantities called factors.

The factor model postulates that X is linearly dependent upon a few unobservable random variables F_1, F_2, \dots, F_m called common factors, ($m < p$) and p additional source of variation $\varepsilon_1, \varepsilon_2, \varepsilon_3, \dots, \varepsilon_p$ called specific factors.

The factor analysis model is given by:

$$\begin{aligned} X_1 - \mu_1 &= l_{11}F_1 + l_{12}F_2 + \dots + l_{1M}F_M + \varepsilon_1 \\ X_2 - \mu_2 &= l_{21}F_1 + l_{22}F_2 + \dots + l_{2M}F_M + \varepsilon_2 \\ &\cdot \\ &\cdot \\ &\cdot \\ X_p - \mu_p &= l_{p1}F_1 + l_{p2}F_2 + \dots + l_{pM}F_M + \varepsilon_p \end{aligned}$$

This can be written in matrix form as:

$$X_{(Px1)} - \mu_{(Px1)} = L_{(Pxm)}F_{(mx1)} + \varepsilon_{(Px1)}$$

The coefficient L is called the loading of the i th variable on the j th factor.

The matrix L is the matrix of factor loadings.

RESULTS OF DATA ANALYSIS

TABLE 4.1. Overall Canonical Correlation UBA

Dimension	Corr	F	Df1	Df2	P-Value
1	0.9942	15.297	20	30.800	7.046e-11
2	0.9438	6.069	12	26.749	5.330e-05
3	0.8264	3.231	6	22.000	1.977e-02
4	0.3299	0.733	2	12.000	5.010e-01

Tests of dimensionality for the canonical correlation analysis, as shown in Table 4.1, indicated that three of the four canonical dimensions are statistically significant at the .05 level. Dimension 1, 2 and 3 had a canonical correlation of 0.9942, 0.9438 and 0.8264 respectively between the sets of variables, while for dimension 4 the canonical correlation was much lower at 0.3299.

The first canonical correlation (the correlation between the first pair of canonical variables) is 0.9942 (overall correlation). This value represents the highest possible correlation between any linear combination of the bank performance variables and any linear combination of the customers' satisfaction variables.

Table 4.1.1: Standardized Canonical Coefficients

	Dimensions		
	1	2	3
Performance Variables			
Total Assets(TA)	2.022	-0.080	-9.371
Money at Call(MAC)	-0.544	0.500	-2.980
Total Liability (TL)	-1.197	1.112	12.304
Profits After Tax(PAT)	0.742	-1.332	-0.036
Satisfaction Variables			
Earning Per Share(EPS)	0.575	-1.134	-0.193
No. of Branches (NOB)	-0.880	1.975	1.527
No. of ATM(NOA)	0.808	-1.965	1.001
Products/Services(PS)	0.163	0.340	-0.496
Total Shareholders Equity(TSE)	0.906	-0.001	-1.930

Table 4.1.1 above presented the standardized canonical coefficients for the first three dimensions across both sets of variables. For the Performance variables, the first canonical dimension is most strongly influenced by Total Assets (2.022) and for the second dimension Total Liability (1.112) and for the third dimension Total Liability (12.304). For the satisfaction variables, the first dimension was comprised of Total Shareholders' Equity (0.906), No. of ATM (0.808) and Earning Per Share (0.575). For the second dimension No. of Branches (1.975), Products/Services (0.340) and Total Shareholders' Equity (-0.001). Lastly the third dimension No. of Branches (1.527), No. of ATM (1.001) and Earning Per Share (-0.193) were the dominating variables.

Hence the linear relationship with the canonical variables for maximum canonical correlation becomes $Z = 2.022Z_1(1) - 0.544Z_2(1) - 1.197Z_3(1) + 0.742Z_4(1)$, $\rho_* = 0.9942$

Z

$$Vi = 0.575Z_1(2) - 0.880Z_2(2) + 0.808Z_3(2) + 0.163Z_4(2) + 0.906Z_5(2)$$

TABLE 4.2. Overall Canonical Correlation UNION BANK

Dimension	Corr	F	Df1	Df2	P-Value
1	0.9758	3.845	20	30.800	0.000
2	0.6619	1.166	12	26.749	0.354
3	0.5514	1.129	6	22.000	0.378
4	0.4000	1.143	2	12.000	0.351

Tests of dimensionality for the canonical correlation analysis, as shown in Table 4.2, indicated that one of the four canonical dimensions are statistically significant at the .05 level. Dimension 1, 2 and 3 had a canonical correlation of 0.9758, 0.6619 and 0.5514 respectively between the sets of variables, while for dimension 4 the canonical correlation was much lower at 0.4000.

The first canonical correlation (the correlation between the first pair of canonical variables) is 0.9758 (overall correlation). This value represents the highest possible correlation between any linear combination of the bank performance variables and any linear combination of the consumer's satisfaction variables.

Table 4.2.1: Standardized Canonical Coefficients

	Dimensions		
	1	2	3
Performance Variables			
Total Assets(TA)	2.068	2.465	-4.214
Money at Call(MAC)	-0.037	-0.993	2.141
Total Liability (TL)	-1.145	-1.801	2.825
Profits After Tax(PAT)	0.043	-0.278	-1.583
Satisfaction Variables			
Earning Per Share(EPS)	-0.097	-0.816	-0.816
No. of Branches (NOB)	-0.131	-0.446	0.909
No. of ATM(NOA)	0.720	1.683	0.082
Products/Services(PS)	0.266	-0.426	-1.745
Total Shareholders' (TSE) Equity	0.136	-1.485	0.415

Table 4.2.1 presented the standardized canonical coefficients for the first three dimensions across both sets of variables. For the Performance variables, the first canonical dimension is most strongly influenced by Total Assets (2.068) and for the second dimension Total Assets (2.465) and for the third dimension

Total Liability (2.825). For the satisfaction variables, the first dimension was comprised of No. of ATM (0.720), Products/Services (0.266) and Total Shareholders' Equity (0.136). For the second dimension No. of ATM (1.683), Products/Services (-0.426) and No. of Branches (-0.446). Lastly the third dimension No. of Branches (0.909), Total Shareholders' Equity (0.415), and No. of ATM (0.082) were the dominating variables.

Hence the linear relationship with the canonical variables for maximum canonical correlation becomes $U_i = 2.068Z_1(1) - 0.037Z_2(1) - 1.145Z_3(1) + 0.043Z_4(1)$, $\rho^* = 0.9758$

$V_i = -0.097Z_1(2) - 0.131Z_2(2) + 0.720Z_3(2) + 0.266Z_4(2) + 0.136Z_5(2)$

Table 4.3 Overall Canonical Correlation ZENITH BANKS

Dimension	Corr	F	Df1	Df2	P-Value
1	0.9996	42.583	20	30.80	0.000
2	0.9519	8.054	12	26.75	4.124e-06
3	0.8519	4.824	6	22.00	2.783e-03
4	0.5655	2.821	2	12.00	9.901e-02

Tests of dimensionality for the canonical correlation analysis, as shown in Table 4.3, indicated that three of the four canonical dimensions are statistically significant at the .05 level. Dimension 1, 2 and 3 had a canonical correlation of 0.9996, 0.9519 and 0.8519 respectively between the sets of variables, while for dimension 4 the canonical correlation was much lower at 0.5655.

The first canonical correlation (the correlation between the first pair of canonical variables) is 0.9996 (overall correlation). This value represents the highest possible correlation between any linear combination of the bank performance variables and any linear combination of the consumer's satisfaction variables.

Table 4.3.1: Standardized Canonical Coefficients

	Dimensions		
	1	2	3
Performance Variables			
Total Assets(TA)	-5.729	16.799	-28.388
Money at Call(MAC)	0.105	2.393	4.437
Total Liability (TL)	4.751	-18.392	26.693
Profits After Tax(PAT)	-0.119	-1.000	-2.815
Satisfaction Variables			
Earning Per Share(EPS)	-0.069	-0.862	-1.625

No. of Branches (NOB)	-0.048	-0.474	-0.552
No. of ATM(NOAA)	-0.002	-0.253	1.641
Products/Services(PS)	0.036	-0.123	1.096
Total Shareholders Equity(TSE)	-0.948	1.241	-0.810

Table 4.3.1 presented the standardized canonical coefficients for the first three dimensions across both sets of variables. For the Performance variables, the first canonical dimension is most strongly influenced by Total Liability (4.751) and for the second dimension Total Assets (16.799) and for the third dimension Total Liability (26.693). For the satisfaction variables, the first dimension was comprised of Products/Services (0.036), No. of ATM (-0.002) and No. of

Branches (-0.048). For the second dimension Total Shareholders' Equity (1.241), Products/Services (-0.123) and No. of ATM (-0.253). Lastly the third dimension No. of ATM (1.641), Products/Services (1.096), and No. of Branches (-0.552) were the dominating variables. Hence the linear relationship with the canonical variables for maximum canonical correlation

$$\text{becomes } U_i = -5.729Z_1(1) + 0.105Z_2(1) + 4.751Z_3(1) - 0.119Z_4(1), \rho^* = 0.9996 \quad V_i = -0.069Z_1(2) - 0.048Z_2(2) - 0.002Z_3(2) + 0.036Z_4(2) - 0.948Z_5(2)$$

The following results display the correlations between the canonical variables and the original variables.

Table 4.4 Overall Canonical Correlation ALL BANKS

Dimension	Corr	F	Df1	Df2	P-Value
1	0.9891	24.911	20	150.20	0.000
2	0.7448	4.764	12	122.00	2.336e-06
3	0.4042	1.713	6	94.00	1.263e-01
4	0.1696	0.711	2	48.00	4.962e-01

Tests of dimensionality for the canonical correlation analysis, as shown in Table 4.2.7, indicated that two of the four canonical dimensions are statistically significant at the .05 level. Dimension 1 and 2 had a canonical correlation of 0.9891 and 0.7448 respectively between the sets of variables, while for dimension 3 and 4 the canonical correlation was much lower at 0.4042 and 0.1696

Table 4.4.1 Standardized Canonical Coefficients

Performance Variables			
	[,1]	[,2]	[,3]
Total Assest	-1.8992454	2.346529	-9.21647096
Money at call	0.2879632	-1.024962	3.65354617

Total Liability	0.7704496	-2.836937	5.79096837
Profit after Tax	-0.1818333	1.764936	-0.08010564
Satisfactory variables			
Earning per Share	-0.13209898	0.99264338	0.1343387
No of Branches	0.06166799	-0.41163361	2.0663291
No of ATM	-0.21322711	-0.15440343	-0.1314724
Products/services	-0.25425351	0.13535241	-2.5159303
Total shareholders' Equity	-0.69122326	0.05426497	0.4217877

Table 4.4.1 showed the standardized canonical coefficients for the first three dimensions across both sets of variables. For the Performance variables, the first canonical dimension is most strongly influenced by Total Liability (0.7705) and for the second dimension Total Asset (2.2465) and for the third dimension Total Liability (5.791). For the satisfaction variables, the first dimension was comprised of No of branches (0.0617). For the second dimension earning per share (0.9926), Products/Services (0.1354) and Total Shareholders' Equity (0.0543). Lastly the third dimension Earning per share (0.1343), No. of Branches (2.0663), No. of ATM (-0.1315) and Total shareholders' Equity (0.4218) were the dominating variables.

Hence the linear relationship with the canonical variables for maximum canonical correlation becomes $U_i = -1.899Z_1(1) + 0.288Z_2(1) + 0.771Z_3(1) - 0.182Z_4(1)$, $\rho^* = 0.9891$ $V_i = -0.132Z_1(2) + 0.062Z_2(2) - 0.213Z_3(2) - 0.254Z_4(2) - 0.691Z_5(2)$

FACTOR ANALYSIS

Table 4.5 Loadings of UBA

	Factor1	Factor2
TA	0.998	
MAC	0.970	
TL	0.997	
PAT	0.792	0.514
EPS	0.994	
NOB	0.907	0.108
ATM	0.884	
PS	0.836	0.165
TSE	0.966	
	Factor1	Factor2

SS loadings	6.801	1.312
Proportion Var	0.756	0.146
Cumulative Var	0.756	0.901

From Table 4.5 above, the Test of the hypothesis that 2 factors are sufficient.

The chi square statistic is 90.08 on 19 degrees of freedom.

The p-value is 3.22e-11

The row *Cumulative Var* gives the cumulative proportion of variance explained. These numbers range from 0 to 1. The row *Proportion Var* gives the proportion of variance explained by each factor, and the row *SS loadings* gives the sum of squared loadings. This is sometimes used to determine the value of a particular factor. A factor is worth keeping if the SS loading is greater than 1. The 2 factors here is adequate because it is more than 1, for factor 1 (6.801) and factor 2 (1.312).

Factor 1 accounted for 75% of the total variance and is without doubt the most important factor, of the nine variables in the analysis. Eight of them except EPS loaded positively and significantly on this factor. They included variables usually associated with performance and satisfaction in the banking system such as TA, MAC, TL, PAT, NOB, ATM, PS and TSE.

Factor 2 accounted for 15% of Total Variance. Associated with it were two variables which loaded positively and significantly. These were variables PAT and EPS. Because of the dominant of EPS among the two variables. This factor should be named EPS factor. Table 4.5.1 COMMUNALITY

TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
0.99673	0.948516	0.996685	0.891673	0.995009	0.833857	0.780794	0.72697	0.942450

The communalities, which can be regarded as indication of the importance of the variables in the analysis are generally high (above 50%). This shows that the variables selected for this study are appropriate and relevant. It is also known that the smaller the uniqueness, the better the variables.

Table 4.5.2 UNIQUENESSES

TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
0.00327	0.05149	0.00332	0.10833	0.0050	0.166143	0.21921	0.273035	0.05755

From table 4.5.1 of *uniquenesses* shown above, which range from 0 to 1 which is the noise, corresponds to the proportion of variability, which cannot be explained by a linear combination of the factors. A high

uniqueness for a variable indicates that the factors do not account well for its variance, but in this case the uniqueness accounted well for the variables ranging from 0.005 to 0.273.

Table 4.5.3 RESIDUAL MATRIX

	TA	MAC	TL	PAT	EPS	NOB	ATM	PS
TSE								
TA	-0.001730 0.002578	0.002626	0.001703	-0.003093	0.000153	-0.004327	-0.006669	-0.003793
MAC	0.002626	0.000000	0.000099	0.024095	0.000050	-0.064087	-0.071187	-0.081322
TL	0.001703	0.000099	-0.001685	-0.001948	-0.000031	0.005473	0.005802	0.006394
PAT	-0.003093	0.024095	-0.001948	0.000000	0.000478	-0.016541	0.017570	-0.032216
EPS	0.000153	0.000050	-0.000031	0.000478	-0.000009	-0.000695	-0.002380	-0.000646
NOB	-0.004327	-0.064087	0.005473	-0.016541	-0.000695	-0.000004	0.176955	0.187733
ATM	-0.006669	-0.071187	0.005802	0.017570	-0.002380	0.176955	0.000002	0.208063
PS	-0.003793	-0.081322	0.006394	-0.032216	-0.000646	0.187733	0.208063	0.000004
TSE	0.002578	0.009934	-0.003856	0.040367	-0.000808	-0.011929	-0.015347	-0.037241

The resulting matrix is called the residual matrix. Numbers close to 0 indicate that our factor model is a good representation of the underlying concept

Table 4.6 Loadings ZENITH BANK

	Factor1	Factor2
TA	0.840	0.541
MAC	0.863	0.502
TL	0.821	0.569
PAT	0.712	0.616

EPS	0.309	0.749
NOB	0.626	0.690
ATM	0.499	0.855
PS	0.586	0.786
TSE	0.922	0.381

	Factor1	Factor2
SS loadings	4.560	3.779
Proportion Var	0.507	0.420
Cumulative Var	0.507	0.927

From Table 4.6 above, The test of the hypothesis that 2 factors are sufficient.

The chi square statistic is 93.72 on 19 degrees of freedom.

The p-value is 7.22e-12

The row *Cumulative Var* gives the cumulative proportion of variance explained. These numbers range from 0 to 1. The row *Proportion Var* gives the proportion of variance explained by each factor, and the row *SS loadings* gives the sum of squared loadings. This is sometimes used to determine the value of a particular factor. A factor is worth keeping if the SS loading is greater than 1. The 2 factors here is adequate because it is more than 1, for factor 1 (4.560) and factor 2 (3.779).

Factor 1 accounted for 51% of the total variance and is without doubt the most important factor, of the nine variables in the analysis. Seven of them except EPS and NO loaded positively and significantly on this factor. They included variables usually associated with performance and satisfaction in the banking system such as TA, MAC, TL, PAT, NOB, PS and TSE. TSE was the dominant variable and should be named TSE factor.

Factor 2 accounted for 42% of Total Variance. Associated with it were eight variables which loaded positively and significantly. These were variables TA, MAC, TL, PAT, NOB, ATM, PS and EPS. Because of the dominant of NO among the eight variables. This factor should be named NO factor.

Table 4.6.1 COMMUNALITY OF ZENITH DATA

TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
0.9982	0.9967	0.9976	0.8862	0.6570	0.8687	0.9793	0.9601	0.9951

The communalities, in table4.6.1 which can be regarded as indication of the importance of the variables in the analysis are generally high (above 50%). This shows that the variables selected for this study are appropriate and relevant. It is also known that the smaller the uniqueness, the better the variables.

Table 4.6.2 UNIQUENESSES OF ZENITH DATA

TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
0.0018	0.0033	0.0024	0.1138	0.34298	0.1313	0.02068	0.03986	0.0049

The *uniquenesses* in table4.6.2 which range from 0 to 1 which is the noise, corresponds to the proportion of variability, which cannot be explained by a linear combination of the factors. A high uniqueness for a variable indicates that the factors do not account well for its variance, but in this case the uniqueness accounted well for the variables ranging from 0.0018 to 0.343.

Table 4.6.3 RESIDUAL MATRIX OF ZENITH DATA

	TA	MAC	TL	PAT	EPS	NOB	ATM	PS
TSE								
TA	-0.003226 0.000451	0.000747	0.001969	0.001198	0.004642	-0.002635	0.000383	-0.000143
MAC	0.000747 0.000160	-0.001657 0.000074	0.000823	0.000780	-0.009022	0.008434	-0.000958	-
TL	0.001969 -0.000313	0.000823	-0.002633	0.002577	0.006217	-0.002447	0.000363	-0.000103
PAT	0.001198 -0.002141	0.000780	0.002577	-0.000001	0.155494	-0.029787	-0.003954	-0.018157
EPS	0.004642 -0.001585	-0.009022	0.006217	0.155494	0.000008	-0.131589	0.007336	-0.032224
NOB	-0.002635 -0.003599	0.008434	-0.002447	-0.029787	-0.131589	0.000012	-0.004476	0.031674
ATM	0.000383 0.000387	-0.000958	0.000363	-0.003954	0.007336	-0.004476	0.000001	0.000653
PS	-0.000143 0.000241	-0.000160	-0.000103	-0.018157	-0.032224	0.031674	0.000653	0.000000
TSE	0.000451 -0.000098	0.000074	-0.000313	-0.002141	-0.001585	-0.003599	0.000387	0.000241

The resulting matrix in table 4.6.3 is called the residual matrix. Numbers close to 0 indicate that our factor model is a good representation of the underlying concept

Table 4.7 UNIQUENESSES OF UNION BANK

TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
0.005	0.041	0.014	0.005	0.566	0.023	0.021	0.025	0.258

From the above table 4.7, the *uniquenesses* which range from 0 to 1 which is the noise, corresponds to the proportion of variability, which cannot be explained by a linear combination of the factors. A high uniqueness for a variable indicates that the factors do not account well for its variance, but in this case the uniqueness accounted well for the variables ranging from 0.005 to 0.257, except EPS

Table 4.7.1 LOADINGS OF UNION BANK DATA

:	Factor1	Factor2	Factor3
TA	0.705	0.700	
MAC	0.593	0.730	0.272
TL	0.534	0.794	0.265
PAT		0.215	0.971
EPS	-0.210	-0.459	0.423
NOB	0.897	0.414	
ATM	0.914	0.372	
PS	0.919	0.361	
TSE	0.549	0.662	

	Factor1	Factor2	Factor3
SS loadings	3.970	2.790	1.282
Proportion Var	0.441	0.310	0.142
Cumulative Var	0.441	0.751	0.894

Test of the hypothesis that 3 factors are sufficient as seen in the above Table 4.7.1 The chi square statistic is 10.47 on 12 degrees of freedom.

The p-value is 0.575

The row *Cumulative Var* gives the cumulative proportion of variance explained. These numbers range from 0 to 1. The row *Proportion Var* gives the proportion of variance explained by each factor, and the row *SS loadings* gives the sum of squared loadings. This is sometimes used to determine the value of a particular factor. A factor is worth keeping if the SS loading is greater than 1. The 3 factors here is adequate because it is more than 1, for factor 1 (3.970), factor 2 (2.790) and factor 3(1.282).

Factor 1 accounted for 44% of the total variance and is without doubt the most important factor, of the nine variables in the analysis. Seven of them except EPS and PAT loaded positively and significantly on this factor. They included variables usually associated with performance and satisfaction in the banking system such as TA, MAC, TL, NOB, PS, NO and TSE. PS was the dominant variable and should be named PS factor.

Factor 2 accounted for 31% of Total Variance. Associated with it were four variables which loaded positively and significantly. These were variables TA, MAC, TL and TSE. Because of the dominant of TL among the nine variables. This factor should be named TL factor.

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Factor 3 accounted for 14% of Total Variance. Associated with it was one variable which loaded positively and significantly. This was PAT variable making it the dominant among the four variables. This factor should be named PAT factor.

TABLE 4.7.2 Community of union bank data

TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
0.9954	0.9590	0.9856	0.9950	0.4339	0.9765	0.9791	0.9752	0.7425

From the above table 4.7.2 of communalities, which can be regarded as indication of the importance of the variables in the analysis are generally high (above 50%). This shows that the variables selected for this study are appropriate and relevant. It is also known that the smaller the uniqueness, the better the variables. It was noted that EPS is below 50% which indicate the inappropriateness of the variable.

Table 4.7.3 RESIDUAL MATRIX

	TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
TA	-0.0004	0.0010	0.0008	0e+00	-0.0010	-0.0017	0.0017	0.0002	-0.0034
MAC	0.0010	0.0000	-0.0039	3e-04	-0.0413	-0.0024	-0.0055	0.0072	0.0273
TL	0.0008	-0.0039	0.0000	0e+00	0.0226	0.0033	-0.0008	-0.0033	-0.0056
PAT	0.0000	0.0003	0.0000	0e+00	-0.0001	-0.0001	0.0000	0.0001	0.0004
EPS	-0.0010	-0.0413	0.0226	-1e-04	0.0000	-0.0037	0.0237	-0.0157	-0.1908
NOB	-0.0017	-0.0024	0.0033	-1e-04	-0.0037	0.0000	0.0005	0.0022	0.0204
ATM	0.0017	-0.0055	-0.0008	0e+00	0.0237	0.0005	0.0000	-0.0027	-0.0186
PS	0.0002	0.0072	-0.0033	1e-04	-0.0157	0.0022	-0.0027	0.0000	0.0067
TSE	-0.0034	0.0273	-0.0056	4e-04	-0.1908	0.0204	-0.0186	0.0067	0.0000

The resulting matrix is called the residual matrix. Numbers close to 0 indicate that our factor model is a good representation of the underlying concept.

4.4 LINEAR DISCRIMINANT ANALYSIS

In discriminant analysis, we combine the data from the three banks Table 4.8

Prior Probabilities of Groups:

UBA	UNION	ZENITH
0.4390244	0.3170732	0.2439024

As seen in the above table 4.6.1, 43.9% belongs to UBA group, 31.71% belongs to union groups and 24.39% belongs to zenith groups

Table 4.8.1 Group Means:

	TA	MAC	TL	PAT	EPS	NOB	ATM	PS	TSE
UBA	0.1422	0.1813	0.1413	-0.0595	-0.1230	0.3870	0.9360	0.1762	-0.1647
Union	-0.6240	-0.6576	-0.6001	-0.5244	-0.3439	-0.9079	-0.7425	-0.8695	-0.2620
Zenith	0.3779	0.4023	0.3436	0.39371	0.6082	0.3954	-0.34531	0.5369	0.4322

Table 4.8.2 Coefficients of Linear Discriminants:

	LD1	LD2
TA	0.195561855	1.3737506
MAC	-1.332902519	3.2378525
TL	0.457083476	-2.5464192
PAT	-0.034447364	-0.5305286
EPS	0.008937848	0.5824908
NOB	0.999561131	1.9973989
ATM	-5.242708678	-1.1572904
PS	2.837009737	0.2991439
TSE	1.416187345	-2.3012470

The first discriminant function is a linear combination of the nine variables. Coefficients of linear discriminants shown in the above table 4.8.2 display the linear combination of predictor variables that are used to form the decision rule of the LDA model.

Below are the LDA models

LD1: $0.2*TA - 1.33*MAC + 0.46*TL - 0.3*PAT + 0.01*EPS + 0.99*NOB - 5.24*NO + 2.84*PS + 1.42*TSE$

LD2: $0.21.37*TA + 3.24*MAC - 2.55*TL - 0.53*PAT + 0.58*EPS + 1.99*NOB - 1.16*NO + 0.30*PS - 2.30*TSE$

4.8.3 Proportion of Trace:

LD1	LD2
0.8651	0.1349

From the above table, Percentage separations achieved by the first discriminant function is 86.51% and second is 13.49%

CONCLUSION

The work looked at application of Multivariate Techniques (Canonical correlation, Discriminant Analysis and factor analysis) on nexus between Banks performance and consumers satisfaction. The analysis focused on three commercial banks in Nigeria (UBA, Union and Zenith Bank). Data from the three banks were analyzed separately and the results showed a positive correlation between Bank performance and consumer satisfaction variables. We obtained two LDA models used to separate the group. The Percentage separations achieved by the first discriminant function is 86.51% and second is 13.49%. We equally

obtained 2 factors which were sufficient for both ZENITH and UBA Group while 3 factors are sufficient for UNION BANK. More variables loaded positively and significantly on factor 1 and they included variables usually associated with performance and satisfaction in the banking system. From the results found, it is evidently clear that Zenith Bank is better and more efficient than the others in this study. Based on the findings of the study, We recommend that commercial banks in Nigeria increase their Total Assets, Total Liability followed by money at call which are banks performance variables and also number of ATM, number of branches, share holders' equity and user friendly products and quality services which are consumer satisfaction variables. When these are done, it will increase consumer loyalty, retainership and referrals. Further research can include more variables especially the use of electronic channels by customers since Nigeria has commenced the cashless policy and Naira re-design.

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