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MULTIVARIATE ANALYSIS: A VERITABLE TOOL FOR THE ASSESSMENT OF MARKET PRICES OF ORDINARY SHARES

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ABSTRACT

This research was carried out to investigate the significant difference between the mean share prices of the two banks (UBA and FCMB) and to determine which of the two banks is more likely to attract investors. The target population includes the fifteen (15) banks quoted in the Guardian Newspaper market report of the Nigeria Stock Exchange of shares publications from (January 2018 – June 2018). Samples of two banks were selected by the method of simple random sampling without replacement. The data was collected on weekly basis for Twenty-four (24) consecutive weeks from the weekly publication of the Guardian Newspaper market report of the Nigeria Stock Exchange. The closing stock for each week of the two selected bank was taken and recorded for the research. The null hypothesis Ho: there is no significant difference between the mean shares prices of both banks, was tested as against the alternative hypothesis. H_1: there is a significant difference between the mean shares prices of both banks. Hoteling's T-squared test statistic was employed in the analysis/hypothesis testing. The findings indicated a significant difference between the mean share prices of FCMB and UBA. F-calculated 42.48 and $F_{tab\ 2.22}(0.05) = 3.44$. Ho was rejected while H_1 was accepted. Also the 95% confidence interval calculated show that the true mean of UBA is higher than that of FCMB. Thus, UBA shares tend to yield more profit.

Keywords: Stock, shares, analysis, profit, variance, variables, accept

INTRODUCTION

Stock exchange markets are organized secondary market for securities where public offers of companies are quoted. This

provides essential avenues for government and companies to raise funds for the execution of projects through the exchange of securities for cash. There are three type of securities; fixed income securities, variable income securities and hybrid securities. The fixed income securities are debt instrument (bond) where companies and government can raise long term funds. This provides a specific rate of income to holders. Variable income securities are equity stock (shares) which are issues by various types of business organizations. The profit of the holders depends on the profit performance of the issuer (organization) for the period. This implies that variable income securities are subject to a great deal of variability (Okafor 1983). Hybrid securities are the mixture of the income securities and the variable income securities. One of the traded securities in the equity stock is the ordinary shares. Daily prices of ordinary shares are quoted in the Nigeria stock exchange market and exhibited in the newspapers, televisions, internet, among others for the public. United bank of Africa (UBA) has 70 years of providing uninterrupted banking operations, dating back to 1949 when the British and French Bank Limited (BFB) commenced business in Nigeria. First City Monument Bank (FCMB) was first established in 1977 as City Securities limited. In 1982 it was licensed as First City Merchant Bank becoming the first local bank in Nigeria to be established without government support.

Multivariate analysis is an approach of finding solutions to statistical problems which involves a multiple number of variables. It helps in the reduction of univariate test. In statistics, the Hotelling's T^2 - statistic named after Harrod Hoteling, is a generalization of the student's T - statistic

used in Multivariate hypothesis testing. Hoteling T^2 test was later converted to F-test statistic. F-test is a method used in testing statistical hypothesis distributional variance from where the samples have been collected (Rencher, 1995). A large number of fields are concerned by the analysis of share data. In every investment the ultimate goal of investors is the expectation of future financial benefits or profit. Investment in shares can be measured and the expected variability known. One needs to study stock prices to know if these reasons for disparity are true by comparing their tabulated and calculated F-distribution, Multivatriate Analysis of Variance (MANOVA) helps to answer questions such as

a. Do changes in the independent variables have significant effects on the dependent variable?
b. What are the interactions among the dependent variable?

Research on stock market has always been an interesting activity for many researchers all around the globe because of the lucrative gains involved in it. The ability of stocks to absorb and act on information that is immediately reflected in its prices makes them a very interesting investments options. Academicians and researchers have shown keen interest in studying the predictability of stock prices, since it thrown more light in understanding the behaviour and dynamics of the stock markets.

Beaver (1981) states that "A securities market if efficient with respect to a signal Yi, if and only if the configuration of security prices (Pjt) is the same as I would be in an otherwise identical economy (i.e with an identical configuration of preference and developments), except that every individual

receives Yt as well as the information of the individual. Beaver coined the term "information system efficiency".

Latham (1986) observed the logical feasibility of information that leads to offsetting revisions in individual investors portifolios, without any net effect on excess demand and therefore, on prices. He defined efficiency relative to some information set, if revealing it to all agents would neither change equilibrium prices nor portfolios. There is a large body of research carried our suggesting the predictability of stock markets. Lo and Mackinlay (1988) in their research paper claim that stock prices do not follow random walks and suggested considerable evidence toward predictability of stock prices. Fama and French (1992) in their various studies have carried many cross-sectional analyses across the globe and tried to establish the predictability of the stock prices. Studies have tried to establish that various factors like firm size, book to market equity, and macrocconomic variables like short-term interest rates, inflation, yield from short and long term bonds and GNP help in the predictability of stock returns.

Predictability in stock returns are not necessarily due to market inefficiency are over-reaction from irrational investors but rather due to predictability in some aggregate variable that are part of the information set (Fema and French,1993). The aim and objectives of this study is to compare the two banks to know which one is more likely to attract investors and find out if the mean share prices of both banks are significantly different using Multivariate analysis.

Statement of Hypothesis

The following stated hypothesis is used in this study.

Null Hypothesis

H_0: There is no significant difference between the mean share prices in both banks (UBA and FCMB)

Alternative Hypothesis

H_1: There is no significant difference between the mean share prices in both banks (UBA and FCMB)

MATERIALS AND METHODS

The target population includes the fifteen (15) banks quoted in the Guardian Newspaper market report of the Nigerian stock exchange of shares publication from (January 2018-June 2018). Two banks UBA and FCMB were sampled and selected by the method of simple random sampling without replacement (SRSWOR), random sampling method which is the purest form of probability each member of the population has a known non-zero probability of being selected. The reason for this method is to allow each member of the populated equal and known chance of being selected. The data were collected on weekly basis for 24 consecutive weeks from the weekly publications of the Guardian market report of the Nigerian stock exchange. The closing stock for each week of the two selected Bank was taken and recorded for this work.

Operational Definitions of Variable

These are the definition of variable that are used in this study which includes: Multivariate Analysis of Variance (MANOVA).

MANOVA: is used first of investigate whether the population Mean Vectors is the same and if not, which components differ significantly. In Multivariate analysis of variance, more than two population needs to be compared.

Let $X_{11}, X_{12}.....X_{1n}$ 1

$X_{21}, X_{22}.....X_{2n}$

2

$X_{k1}, X_{k2}.....X_{kn}$

3

Be a random sample collected from each of the K populations arranged as

Population 1= $X_{11}, X_{12}.....X_{1n}$

Population 2 = $X_{21}, X_{22}.....X_{2n}$

Data Presentation

This section involves presentation of data. This data was collected from the guardian newspaper market report of the Nigeria stock exchange shares publication from (January 2018 – June 2018). The data on the market price of both banks is presented in Table 1.

Table 1: showing the closing stock of UBA and FCMB (from January – June 2018)

DATE	FCMB	UBA
09/01/18	1.99	11.1
16/01/18	2.79	12
23/01/18	3.59	12.89
30/01/18	3.24	13
06/02/18	2.97	12.35
13/02/18	2.71	8.0
20/02/18	2.53	12.0
27/02/18	2.47	12.5
06/02/18	2.51	12.6
13/03/18	2.61	12.3
20/03/18	2.32	11.2
27/03/18	2.43	11.95

03/04/18	2.38	11.75
10/04/18	2.38	11.85
17/04/18	2.4	10.85
24/04/18	2.51	11.25
08/05/18	2.54	11.7
15/05/18	2.63	11.7
22/05/18	2.55	11.3
29/05/18	2.0	10.4
05/06/18	2.25	11.0
12/06/18	2.4	10.95
19/06/18	2.3	11.0
26/06/18	2.11	11.7

Source: The Guardian Newspaper Stock Exchange (NSE)

Data Analysis

Testing of Hypothesis:

H_0: There is no significant difference between the means of both banks (FCMB and UBA)

H1: There is a significant difference between the means of both banks (FCMB and UBA)

Test Statistic Applied

Hoteling T^2.

Level of significance: $\alpha = 0.05$

Table 2 Mean Closing Stock Price per Share of FCMB and UBA from January – June 2018

DATE	FCMB	UBA
09/01/18	1.99	11.1
16/01/18	2.79	12
23/01/18	3.59	12.89
30/01/18	3.24	13
06/02/18	2.97	12.35
13/02/18	2.71	8.0
20/02/18	2.53	12.0
27/02/18	2.47	12.5
06/02/18	2.51	12.6
13/03/18	2.61	12.3
20/03/18	2.32	11.2
27/03/18	2.43	11.95
03/04/18	2.38	11.75
10/04/18	2.38	11.85

17/04/18	2.4	10.85
24/04/18	2.51	11.25
08/05/18	2.54	11.7
15/05/18	2.63	11.7
22/05/18	2.55	11.3
29/05/18	2.0	10.4
05/06/18	2.25	11.0
12/06/18	2.4	10.95
19/06/18	2.3	11.0
26/06/18	2.11	11.7
Total	60.61	277.34
Mean	2.53	11.56

Table 3 Computation of Mean Deviation from Table 2

S/N	Y_1	Y_2	$(Y_1-\bar{Y}_1)$	$(Y_2-\bar{Y}_2)$
1.	1.99	11.1	-0.54	-0.46
2.	2.79	12	0.26	0.44
3.	3.59	12.89	1.06	1.33
4.	3.24	13	0.71	1.44
5.	2.97	12.35	0.44	0.79
6.	2.71	8.0	0.18	-0.56
7.	2.53	12.0	0.00	0.44
8.	2.47	12.5	-0.06	0.94
9.	2.51	12.6	-0.02	1.04
10.	2.61	12.3	0.08	0.74
11.	2.32	11.2	-0.21	-0.36
12.	2.43	11.95	-0.10	0.3
13.	2.38	11.75	-0.15	0.19
14.	2.38	11.85	-0.15	0.29
15.	2.4	10.85	-0.13	-0.71
16.	2.51	11.25	-0.02	-0.310
17.	2.54	11.7	0.01	0.140
18.	2.63	11.7	0.10	0.140
19.	2.55	11.3	0.02	-0.260
20.	2.0	10.4	-0.53	-1.160
21.	2.25	11.0	-0.28	-0.56
22.	2.4	10.95	-0.13	-0.61
23.	2.3	11.0	-0.23	-0.56
24.	2.11	11.7	-0.42	0.14
Total	60.61	277.34		

Table 3 Computation of Variance and Covariance Matrix

S/N	$(Y_1-\bar{Y}_1)^2$	$(Y_2-\bar{Y}_2)^2$	$(Y_1-\bar{Y}_1)(Y_2-\bar{Y}_2)$
1.	0.2916	0.2116	0.2484
2.	0.0676	0.1936	0.1144
3.	1.1236	1.7689	1.4098
4.	0.5041	2.0736	1.0224
5.	0.1936	0.6241	0.3476
6.	0.0324	0.3136	-0.6408
7.	0.00	0.1936	0.0000
8.	0.0036	0.8836	-0.0564
9.	0.0004	1.0816	-0.0208
10.	0.0064	0.5476	0.0592
11.	0.0441	0.1296	0.0756
12.	0.010	0.1521	-0.0390
13.	0.0225	0.0361	-0.0285
14.	0.0225	0.0841	0.0435
15.	0.0169	0.5041	0.00923
16.	0.0004	0.0961	0.0062
17.	0.0001	0.0196	0.00140
18.	0.0100	0.0196	0.0114
19.	0.0004	0.0676	0.0052
20.	0.2809	1.3456	0.6148
21.	0.0784	0.3136	0.1568
22.	0.0169	0.3721	0.07983
23.	0.0529	0.3136	0.1285
24.	0.1764	0.0196	-0.0588
Total	2.9557	23.7252	3.4884

Computation of the Covariance Matrix from Table 3 above

$$\sum = \begin{bmatrix} \delta_{11} & \delta_{12} \\ \delta_{21} & \delta_{22} \end{bmatrix}$$

Where, δ_{11}= variance of (Y_1)

δ_{22}= variance of (Y_2)

And $\delta_{11} = \delta_{21}$,= covariance of (Y_1Y_2)

Thus, δ_{11} = variance of (Y_1)

$\frac{\sum(Y1-\hat{Y}1)^2}{n-1}$; n = 24 and $\sum(Y1-\hat{Y}1)^2$ = 2.9557

$\frac{2.9557}{23}$= 0.13

δ_{22}= variance of (Y_2)

$\frac{\sum(Y2-\hat{Y}2)^2}{n-1}$; n = 24 and $\sum(Y2-\hat{Y}2)^2$ = 23.7252

$\frac{23.7252}{23}$ = 1.03

$\delta_{12}=\delta_{21}$,= covariance of (Y_1 Y_2)

$$\frac{\sum(Y1-\bar{Y}1)(Y2-\bar{Y}2)}{n-1}$$

$$\frac{3.4884}{23}$$

= 0.15

Thus, the covariance matrix is now

$$\sum=\begin{bmatrix}\delta_{11} & \delta_{12}\\ \delta_{21} & \delta_{22}\end{bmatrix}$$

From hoteling T^2statistic,

T^2 = n $(\bar{x}-u)$ $S^{-1}(\bar{x}-u)$

Where,

U = population mean

$\bar{x}$ = sample mean

n = sample number

u = $\begin{vmatrix}2 & 11\\ 11 & 7\end{vmatrix}$

$\bar{x}=\begin{vmatrix}2 & 53\\ 11 & 56\end{vmatrix}$

Thus, $(\bar{x}-u)$ $S^{-1}(\bar{x}-u)$

= $\begin{vmatrix}2.53 & -2.11\\ 11.56 & -11.7\end{vmatrix}\begin{vmatrix}0.13 & 0.15\\ 0.15 & 1.03\end{vmatrix}^{-1}\begin{vmatrix}2.53 & -2.11\\ 11.56 & -11.7\end{vmatrix}$

$|0.42 \quad -0.14|\begin{vmatrix}0.13 & 0.15\\ 0.15 & 1.03\end{vmatrix}^{-1}\begin{vmatrix}0.42\\ -0.14\end{vmatrix}$

$\begin{vmatrix}0.13 & 0.15\\ 0.15 & 1.03\end{vmatrix}^{-1}$

Det ($\sum$) = (0.31 x 1.03 - 0.15 x 0.15)

= 0.1236 - 0.0225 = 0.1011

Adjoint $(\sum) = \frac{1}{0.1011}\begin{vmatrix}0.13 & 0.15\\ 0.15 & 1.03\end{vmatrix}$

$\sum -1 = \begin{vmatrix}10.19 & -1.48\\ -1.48 & 1.29\end{vmatrix}$

And $(\bar{x} - \mathrm{u}) \sum -1 (\bar{x} - \mathrm{u})$

$= \begin{vmatrix}10.19 & -1.48\\ -1.48 & 1.29\end{vmatrix}$

= 0.42 – 0.14 $\begin{vmatrix}10.19 & -1.48\\ -1.48 & 1.29\end{vmatrix}$

Multiplying the matrix

(0.42)(10.19)(-0.14)(-1.48)

=(4.2798)+ (0.2072) = 4.487

And

(0.42)(-1.48) + (-0.14)(1.29)

= -0.6216-0.1806 = -0.8022

Thus

(4.487-0.8022) $\begin{vmatrix}0.42\\ -0.14\end{vmatrix}$

= (4.487)(0.42) + (0.8022)(-0.14)

= 1.88454 – 0.112308

1.772232

T^2 = n-$(\bar{x} - u)$ S-1 $(\bar{x} - u)$

24(1.77)

=42.48

$\frac{(N-P)}{P(N-P)}$ T^2=F (P, n-p)

P= 2, n=24

Decision Rule; reject H_O IF F calculated > F tabulated.

Conclusion; since F calculated = 42.48 is > $F_{tab\ 2.22}$ (0.05) 3.44, we reject H_o and accept H_1. This implies that the mean closing price per share of FCMB and UBA are not equal.

Computing the 95% simultaneous confidence interval

From table 4 on the covariance matrix $\bar{x}$ = (2.53 11.56)

$\sum = \begin{bmatrix} 0.13 & 0.15 \\ 0.15 & 1.03 \end{bmatrix}$

$T^2 = \frac{p\,(n-1)}{(n-p}$ FP, n-p α

P= 2, n= 24

$\frac{2(24-1)}{(24-2)} \times F_{2.\,22}\,(0.08)$

$\frac{2(23)}{(22)} \times$ 3.44 $F_{2.22}\,(0.08)$

$= \frac{46}{22} \times 3.44$

$\sqrt{7.192}$

=2.68

The simultaneous confidence interval for U1

$= \frac{0.13}{24}$

$= \sqrt{0.00542}$

=0.074

C.1 for U1 = 2.53 $\pm$ (2.68)(0.074)

= 2.53 $\pm$0.19832

2.34 $\leq$ U1 $\geq$ 2.73

U_1 = (2.34, 2.73) the simultaneous confidence interval for U2

$U_2 = \frac{1.03}{24}$

$= \sqrt{0.043}$

=0.207

U_2 = 11.56 $\pm$ (2.68)(0.207)

=11.56 $\pm$ 0.55476

11.01$\leq$ U2 + $\geq$ 11.57

U_1 = (11.01, 11.87)

DISCUSSION OF RESULTS

This shows the hypothesis of equal means of share prices of two banks (FCBM and UBA) 24 consecutive weeks.

Test of Hypothesis

H_o: There is no significant difference between the mean closing stock of both banks (UBA and FCMB)

H_1: There is a significant difference between the mean closing stock of both banks (UBA and FCMB)

Hoteling T^2 test statistics in the determination of such difference was applied and later covered to F test statistics which gave a value of $F_{2.22}$ (0.05) = 3.34 tabulated value against our calculated value 42.48 this shows that there is a significant difference in the means of the two banks.

CONCLUSION/ RECOMMENDATIONS

The analysis shows a highly significant difference in the mean share price for First City Monument Bank (FCMB) and United Bank of Africa (UBA). The mean share price of UBA is more than that of FCMB, this implies that UBA has more investors than FCMB. The approach adopted by this study for identifying a better way of customers buying of share, can serve as basis on which the financial sector researchers can investigate factors that determine their differences.

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