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An alternative mean-variance portfolio theoretical framework: Nigeria banks' market shares analysis

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Abstract

The ground-laying objective of portfolio conception is nothing but to allot optimally, the investment among financial assets, and a wide range of products held by investors for immediate or long-time decision. The article aims to provide both the theoretical and experimental analysis of estimating portfolio asset indexes. The technique for estimating mixing weights of each asset for proper optimization of the portfolio was described and the Ordinary Least Squares (OLS) technique was employed in the estimation of their returns and volatilities. Twelve (12) new generation (commercial and merchant) banks' yearly market shares' portfolios from 2001 to 2017 were analyzed. The mixing weights describing the contributing efficient frontiers carved-out U.B.A and Zenith banks to be the frontiers in the commercial banks' shares portfolio with 0.272 and 0.202 mixing weights respectively. Additionally, the 99% confidence level of the Expected-Shortfall (ES), was higher in WEMA, UNION, ACCESS, Diamond, and FCMB banks with 20.6004%, 14.7637%, 14.6458%, 15.3011%, and 16.9373% respectively.

Keywords: Asset; Expected-Shortfall; Mixing Weight; Ordinary Least Squares; Portfolio

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1. Introduction

The ground-laying objective of portfolio conception is nothing but to allot optimally, the investment among financial assets, and a wide range of products held by investors for immediate or long-time decision(s) (Bauder, 2017). Portfolio demonstration, extraction, construction formally propounded by Markowitz (1952) to unveil the association among risks, expected Returns (ER), and Expected-Shortfalls (ES). This was with the view to efficiently construct and carving out these subsets that make up a portfolio (Bastin, 2017). In order words, the Markowitz theory perceived portfolio conception has a two-parameter framework of mean-variance (expected value and covariance matrix of asset from market observations). Portfolio conceptualization is associated with some subjected assets that serve as the foundation to many financial theories, for example, risk-free asset theories, such as Capital Market Line (CML) and Capital Asset Price Model (CAPM) by Tobin (1985) and Sharpe (1964) respectively (Barua, 2017; Jagannathan and Ma, 2003).

DeMiguel and Nogales (2009) reported and explained the instability of the mean-variance portfolio model associated with only mean asset returns and covariance matrix. They elaborated further those estimates of the covariance matrix are not responsive to extract-out estimation errors attached to each asset. To circumvent this problem, many modifications, optimization, adjustments, and addition of concomitant has been made to the portfolio framework. Among the many adjustments is the optimization of the mean-variance theoretical analysis by Kondor *et al*. (2007) & Stefanovits *et al*. (2014). This involved incorporating different optimization criteria and different concepts of risk.

Senneret *et al*. (2016) and Bodnar *et al*. (2017) contributed their quota to the literature when they maintained that carving out estimation error, that it requires ignoring the expected returns since it has been established that errors in estimates of the expected returns have a bigger impact on the portfolio than that of the covariance matrix. By doing so, the optimal portfolio becomes the global minimum variance portfolio, which is a portfolio with the smallest possible variance of all portfolios. In a similar vein, Michaud (1993), Bai *et al.* (2009), DeMiguel and Nogales (2009) proposed alternative approaches via resampling technique and stochastic algorithm programming for robust estimations. They stressed the efficiency of robustifying estimators to suppress the estimation error under the assertion of Gaussian asset returns. Contrary to the robustness of the estimators, they are normally exposed to overly sensitive deviations from the distributional assumption.

1.1. Purpose of study

Emerging from the foregoing considerations, the current work adopts a new approach - Ordinary Least Square (OLS) for the minimization of the estimation error. The adopted approach will describe the estimation procedure as well as when a mixing or factor weight of each of the associated assets was attached to the portfolio. The estimation will then be subjected to the Nigerian commercial and merchant banks' market shares.

1.2. Nomenclature

$R_{1t}, R_{2t}, \cdots, R_{kt}$ = Are the returns of the asset's portfolio

R_{pt} = Is the return on the portfolio.

$\alpha_1, \alpha_2, \ldots, \alpha_k$ are the mixing weights per each asset that gives an insight into the relative contributions of each asset to a portfolio such $\alpha_1 + \alpha_2 + \cdots + \alpha_k = 1$

2. Methods

2.1. Data collection

The dataset of recorded portfolios of 12 commercial (new generation) banks' market shares by the Central Bank of Nigeria (CBN) was used in this work to investigate and reveal facts about the assets embedded. The shares were from January 2007 to December 2017. The banks are Access, Diamond, Fidelity, FCMB, Guaranty Trust Bank (GTB), SKYE, Stanbic IBTC, United Bank of Africa (UBA), Union, Unity, WEMA, and Zenith bank. The quantitative financial series of each of the banks were then treated as a portfolio entity.

2.2. Analysis

Minimizing and measuring the overall risk of a portfolio's assets is usually estimated via its volatility or otherwise Markowitz mean-variance model. Hurn *et al.* (2015) and Markowitz (1952). Deriving the minimum variance portfolio, considering a two assets portfolio, then the return on the portfolio is given by

$$R_{pt} = \alpha_1 R_{1t} + \alpha_2 R_{2t} \quad (1)$$

In generality, for a "k" number of the asset in a portfolio

$$R_{pt} = \alpha_1 R_{1t} + \alpha_2 R_{2t} + \alpha_3 R_{3t} + \ldots + \alpha_k R_{kt} = \sum_{i=1}^{k} \alpha_i R_{it} \quad (2)$$

Where;

$R_{1t}, R_{2t}, \ldots, R_{kt}$ = Are the returns of the asset's portfolio.

R_{pt} = Is the return on the portfolio.

$\alpha_1, \alpha_2, \ldots, \alpha_k$ are the mixing weights per each asset that gives an insight into the relative contributions of each asset to a portfolio such that $\alpha_1 + \alpha_2 + \cdots + \alpha_k = 1$

2.2.1. Mean, Variance, and Covariance of each Asset

$$\mu_1 = E(R_{1t}),\ \mu_2 = E(R_{2t}), \cdots, \mu_k = E(R_{kt})$$

$$\sigma_1^2 = E(R_{1t} - \mu_1)^2$$

$$\sigma_2^2 = E(R_{1t} - \mu_1)^2$$

$$\vdots \;=\; \vdots$$

$$\vdots \;=\; \vdots$$

$$\sigma_k^2 = E(R_{kt} - \mu_k)^2$$

2.2.2. Covariance

$$\sigma_{21} = \sigma_{12} = E(R_{1t} - \mu_1)(R_{2t} - \mu_2) \qquad \sigma_{23} = \sigma_{32} = E(R_{2t} - \mu_2)(R_{3t} - \mu_3)$$

$$\sigma_{31} = \sigma_{31} = E(R_{3t} - \mu_3)(R_{1t} - \mu_1) \qquad \sigma_{24} = \sigma_{42} = E(R_{2t} - \mu_2)(R_{4t} - \mu_4)$$

$$\vdots \qquad \vdots \qquad \vdots \qquad \vdots$$

$$\sigma_{k1} = \sigma_{1k} = E(R_{kt} - \mu_k)(R_{1t} - \mu_k) \qquad \sigma_{2k} = \sigma_{k2} = E(R_{2t} - \mu_2)(R_{kt} - \mu_k)$$

For all $\sigma_{ki} = \sigma_{ik} \ni i = 1, \ldots, k \ but \ i \neq k$

The Expected Return on the portfolio.

$$\mu_p = E(R_{pt} = \alpha_1 R_{1t} + \alpha_2 R_{2t} + \alpha_3 R_{3t} + \ldots + \alpha_k R_{kt}) \quad (3)$$

$$= \alpha_1 E(R_{1t}) + \alpha_2 E(R_{2t}) + \alpha_3 E(R_{3t}) + \cdots + \alpha_k E(R_{kt})$$

Recall that, $\mu = E(x)$, so

$$\mu_p = \alpha_1\mu_1 + \alpha_2\mu_2 + \alpha_3\mu_3 + \cdots + \alpha_k\mu_k$$

Measuring the portfolio's risk is given by

$$\mu_p = E\left[(R_{pt} - \mu_p)^2\right]$$

$$= E\left[\left(\alpha_1(R_{1t} - \mu_1) + \alpha_2(R_{2t} - \mu_2) + \cdots + \alpha_k(R_{kt} - \mu_k)\right)\right]$$

$$= \alpha_1^2 E(R_{1t} - \mu_1)^2 + \alpha_2^2 E(R_{2t} - \mu_2)^2 + \cdots + \alpha_k^2 E(R_{kt} - \mu_k)^2$$

$$+ 2\alpha_1\alpha_i E(R_{1t} - \mu_1)(R_{it} - \mu_i) + 2\alpha_2\alpha_i E(R_{2t} - \mu_2)(R_{it} - \mu_i) +$$

$$\cdots + 2\alpha_i\alpha_{i-1}E(R_{it}-\mu_i)(R_{i-1t}-\mu_{i-1})$$

$$= \sigma_1^2\alpha_1^2 + \sigma_2^2\alpha_2^2 + \sigma_3^2\alpha_3^2 + \cdots + \sigma_i^2\alpha_i^2 + 2\alpha_i\alpha_{i+1}\sigma_{i+1} \quad (4)$$

For $i = 1,\ldots,k \ni \sigma_{ih} = \sigma_{hi}$, $E(R_t-\mu)^2 = \sigma^2$

2.2.3. Estimating of the Mixing weights of each Asset

Considering a two assets portfolio, such that $\sigma_p^2 = \alpha_1^2\sigma_1^2 + \alpha_2^2\sigma_2^2 + 2\alpha_1\alpha_2\sigma_{12}$

Satisfying the restriction $\alpha_1 + \alpha_2 = 1, \Rightarrow \alpha_2 = 1-\alpha_1$. So,

$$\sigma_p^2 = \alpha_1^2\sigma_1^2 + (1-\alpha_1)^2\sigma_2^2 + 2\alpha_1(1-\alpha_1)\sigma_{12} \quad (5)$$

finding the optimal portfolio that minimizes the risk; that is the optimization of the portfolio.

$$\frac{\delta\sigma_p^2}{\delta\alpha_1} = 0$$

$$\Rightarrow \frac{\delta\sigma_p^2}{\delta\alpha_1} = 2\alpha_1\sigma_1^2 - 2(1-\alpha_1)\sigma_2^2 + 2(1-2\alpha_1)\sigma_{12} \quad (6)$$

Equating α_1 to zero and factoring it out in eqn. (6)

$$2\alpha_1\sigma_1^2 - 2(1-\alpha_1)\sigma_2^2 + 2(1-2\alpha_1)\sigma_{12} = 0$$

$$2\alpha_1\sigma_1^2 + (-2+2\alpha_1)\sigma_2^2 + 2\sigma_{12} - 4\alpha_1\sigma_{12} = 0$$

$$2\alpha_1\sigma_1^2 - 2\sigma_2^2 + 2\sigma_2^2\alpha_1 + 2\sigma_{12} - 4\alpha_1\sigma_{12} = 0$$

$$2\alpha_1\sigma_1^2 + 2\sigma_2^2\alpha_1 - 4\alpha_1\sigma_{12} = 2\sigma_2^2 - 2\sigma_{12}$$

$$\alpha_1\sigma_1^2 + \sigma_2^2\alpha_1 - 2\alpha_1\sigma_{12} = \sigma_2^2 - \sigma_{12}$$

$$\Rightarrow \alpha_1(\sigma_1^2 + \sigma_2^2 - 2\sigma_{12}) = \sigma_2^2 - \sigma_{12}$$

$$\alpha_1 = \frac{\sigma_2^2 - \sigma_{12}}{\sigma_1^2 + \sigma_2^2 - 2\sigma_{12}} \quad (7)$$

Since, $\alpha_2 = 1-\alpha_1$, then

$$\alpha_2 = 1 - \frac{\sigma_2^2 - \sigma_{12}}{\sigma_1^2 + \sigma_2^2 - 2\sigma_{12}} = \frac{\sigma_1^2 - \sigma_{12}}{\sigma_1^2 + \sigma_2^2 - 2\sigma_{12}} \quad (8)$$

In generality,

$$\alpha_3 = \frac{\sigma_1^2 + \sigma_2^2 - \sigma_{32} - \sigma_{31}}{2\sigma_1^2 + 2\sigma_2^2 - 2\sigma_{32} - 2\sigma_{31}}; \quad \alpha_4 = \frac{\sigma_1^2 + \sigma_2^2 + \sigma_3^2 - \sigma_{41} - \sigma_{42} - \sigma_{43}}{2\sigma_1^2 + 2\sigma_2^2 + 2\sigma_3^2 - 2\sigma_{41} - 2\sigma_{42} - 2\sigma_{43}} \cdots\cdots \text{In that order.}$$

2.2.4. Ordinary Least Squares Estimation of the Return Assets in Portfolios

The concept of the Ordinary Least Squares (OLS) technique for parameter estimation of both linear and non-linear models will be employed in estimating asset returns.

The criterion for LS;

$$Q = \sum_{i=1}^{n} [\varepsilon_t]^2 \quad (9)$$

But in a stochastic setting (risk attached), eqn. (1) can be re-written as

$$R_{pt} = \alpha_1 R_{1t} + \alpha_2 R_{2t} + \alpha_3 R_{3t} + \cdots + \alpha_k R_{kt} + \varepsilon_t = \sum_{i=1}^{k} \alpha_i R_{it} + \varepsilon_t \quad (10)$$

$R_{pt} = f(\alpha_i R_{it}) + \varepsilon_t \Rightarrow \varepsilon_t = R_{pt} - f(\alpha_i R_{it})$, where $\varepsilon_t \sim N(\mu, \sigma^2)$, so

$$Q = \sum_{i=1}^{k} \left[R_{tp} - f(R_{it} - \alpha_i) \right]^2$$

Using Maximum Likelihood (ML),

$$L(R_{it}, \sigma^2 / R_{tp}) = \frac{1}{(2\pi\sigma^2)^{\frac{k}{2}}} e^{-\frac{1}{2}Q} \quad (11)$$

$$= \frac{1}{(2\pi\sigma^2)^{\frac{n}{2}}} e^{-\frac{1}{2}\sum_{i=1}^{k}\left[R_{tp} - f(R_{it} - \alpha_i)\right]^2}$$

The partial derivative of $L(R_{it}, \sigma^2 / R_{tp})$ by $R_{1t}, R_{2t}, \cdots, R_{kt}$ and equating to zero, that is,

$\frac{\partial Q}{\partial R_{it}} = 0$ gives

$$\frac{\partial Q}{\partial R_{it}} = -2\sum_{i=1}^{k}\left[R_{tp} - f(R_{it} - \alpha_i)\right]^2 \left[\frac{\partial f(R_{it},\alpha_i)}{\partial R_{it}}\right]_{R_{it}} \quad (12)$$

$$\Rightarrow \sum_{i=1}^{k} R_{it}\left[\frac{\partial f(R_{it},\alpha_i)}{\partial R_{it}}\right]_{R_{it}} - \sum_{i=1}^{k}\alpha_i R_{it}\left[\frac{\partial f(R_{it},\alpha_i)}{\partial R_{it}}\right]_{R_{it}} \quad (13)$$

Hence,

$$\begin{aligned}
\frac{\partial f(R_{it},\alpha_i)}{\partial R_{1t}} &= \alpha_1 \sum_{i=1}^{k} R_{it}\alpha_{i/1} \\
\frac{\partial f(R_{it},\alpha_i)}{\partial R_{2t}} &= \alpha_2 \sum_{i=1}^{k} R_{it}\alpha_{i/2} \\
\vdots \qquad & \qquad \vdots \\
\frac{\partial f(R_{it},\alpha_i)}{\partial R_{kt}} &= \alpha_k \sum_{i=1}^{k} R_{it}\alpha_{i/k}
\end{aligned}$$

Forming a system of equations;

$$\begin{aligned}
\alpha_1 \sum_{i=1}^{k} R_{tp}\left(\sum_{i=1}^{k} R_{it}\alpha_i\right) - \alpha_1\left(\sum_{i=1}^{k} R_{it}\alpha_i\right)^2 &= 0 \\
\alpha_2 \sum_{i=1}^{k} R_{tp}\left(\sum_{i=1}^{k} R_{it}\alpha_i\right) - \alpha_2\left(\sum_{i=1}^{k} R_{it}\alpha_i\right)^2 &= 0 \\
\vdots \qquad\qquad \vdots \qquad\qquad \vdots & \\
\alpha_k \sum_{i=1}^{k} R_{tp}\left(\sum_{i=1}^{k} R_{it}\alpha_i\right) - \alpha_k\left(\sum_{i=1}^{k} R_{it}\alpha_i\right)^2 &= 0
\end{aligned} \quad (14)$$

R_{it} in the system of equations in equation (14) can then be solved for either Row Reduced -Echelon form or by linear method via substitution.

3. Results and Discussion

The time plot of the banks' shares is expressed in Figure 1 below.

Figure 1
Time plot of the Banks' Shares from 2007 to 2017

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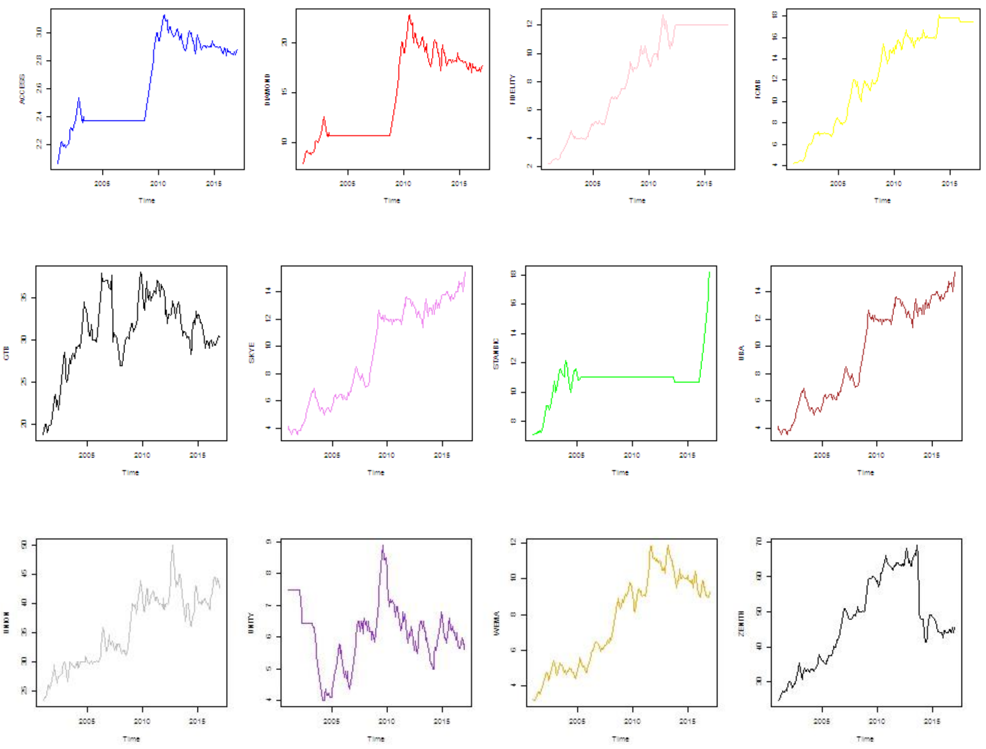


Apart from Fidelity, FCMB, SKYE, and UBA banks' shares that swing increased over the years, Stanbic IBTC's bank shares steadily maintained a constant trend from 2005 to 2015 before its shares skyrocketed sporadically. Other banks' shares retained a zig-zag fluctuating trend of the share price.

Table 1

Descriptive statistics and higher moment

Indexes	ACCESS	DIAMOND	FIDELITY	FCMB	GTB	SKYE	STANBIC
Min.	3.5464	1.9239	1.13	2.32	7.64	2.6509	4.2703
1st Qu.	6.8028	4.7974	2.190	4.785	14.560	4.6418	7.3500
Median	8.6450	7.5000	2.7200	7.2500	17.0400	7.0502	9.3000
Mean	10.5175	8.9331	4.544	8.611	20.075	8.0391	10.229
3rd Qu.	11.5220	10.700	6.475	10.308	24.993	9.6257	11.0000
Max.	25.5037	23.4505	13.00	21.60	40.00	19.8530	23.0000
Jaque Bera	0.7949	0.6700	0.5936	0.7281	0.9812	0.6612	0.5089
Asset Ranking	-0.0500	-0.03408	-0.0242	-0.0164	0.0095	-0.0031	0.0031
S.E Mean	0.1416	0.144027	0.092	0.127	0.1981	0.1100	0.1051
LCL Mean	10.2416	8.651363	4.36171	8.361	19.6870	7.8235	10.0231
UCL Mean	10.7931	9.216397	4.7264	8.8605	20.4643	8.2550	10.4346
Stdev.	5.4448	5.578160	3.60000	4.92651	7.6733	4.2607	4.0622
Skewness	1.1580	0.938678	1.13905	0.98124	0.8716	0.9174	1.5795
Kurtosis	0.1140	-0.171067	-0.3067	-0.3053	-0.4472	-0.2572	1.9296
Beta	0.6729	0.5429	0.6012	0.8563	1.3172	0.4210	1.6865

Covariance							
Beta CoSkewness	0.6293	0.5277	0.5915	0.8320	1.2303	0.4089	1.6401
Beta CoKurtosis	0.5829	0.5080	0.5710	0.8174	1.1000	0.4001	1.6255

	U.B.A	UNION	UNITY	WEMA	ZENITH
Min.	1.64	1.9605	0.5000	0.5000	10.1138
1st Qu.	5.65	4.5851	0.770	0.80750	13.7003
Median	11.0050	7.9000	1.1850	1.42500	1.4250
Mean	18.8620	16.5057	2.679	5.068	24.1027
3rd Qu.	30.2000	32.1329	4.693	36.6750	36.6750
Max.	63.9404	50.330	9.950	15.00	68.9700
Jaque Bera	0.5562	0.9987	0.7542	0.7192	0.8100
Asset Ranking	0.0500	-0.0095	0.03408	0.0164	0.02422
S.E Mean	0.4485	0.3956	0.0678	0.14663	0.3857
LCL Mean	17.9830	15.729	2.5455	4.7802	23.3461
UCL Mean	19.7404	17.2812	2.8116	5.3555	24.8594
Stdev.	17.3498	15.322	2.626	5.6793	14.9398
Skewness	1.0612	0.7968	1.0843	0.8892	1.1395
Kurtosis	-0.374114	-1.069	-0.2664	-0.9525	-0.9525
Beta Covariance	1.1298	0.7236	0.51029	0.9823	1.8337
Beta CoSkewness	1.1010	0.7142	0.5021	0.9728	1.8142
Beta CoKurtosis	1.0009	0.7104	0.4981	0.9658	1.8021

Keys: 1st Qu.= 1st Quarter; 3rd Qu.= 3rd Quarter

From table. 1 above, UBA, Unity, and Zenith bank set the pace in terms of their asset ranking via the shares with positive ranks of 0.02422, 0.03408, 0.0500, respectively. Though, UBA bank happened to be the first of all with enjoyable and beneficial shares by stakeholders and shareholders followed by Union and Zenith bank. GTB and Stanbic IBTC fall in the same category with UBA, Unity, and Zenith in the profitable investments by shareholders but with minimal (rankings: 0.0095, 0.0031) accrued returns compared to the aforementioned three banks over the last eleven (11) years. Unlike the Zenith, UBA, Stanbic IBTC, Unity, and GTB, Access, Fidelity, Diamond, Fidelity, FCMB, SKYE, Union, and WEMA banks, their long-term returns are undecided. Furthermore, the quality control of the returns of these assets (shares) indicated a reasonable and higher Upper Control Limits (UCLs) in Zenith, GTB, UBA, and Unity bank with their UCLs being 24.8594, 20.4643, 19.7404, and 17.2812 respectively than others. However, none of the banks experienced a situation where the Lower Control Limit (LCL) exceeded or equalled the UCL; this indicated that all the banks' shares yielded positive returns in their magnitude of contributions.

Figure 2

Asset Boxplot of the Banks

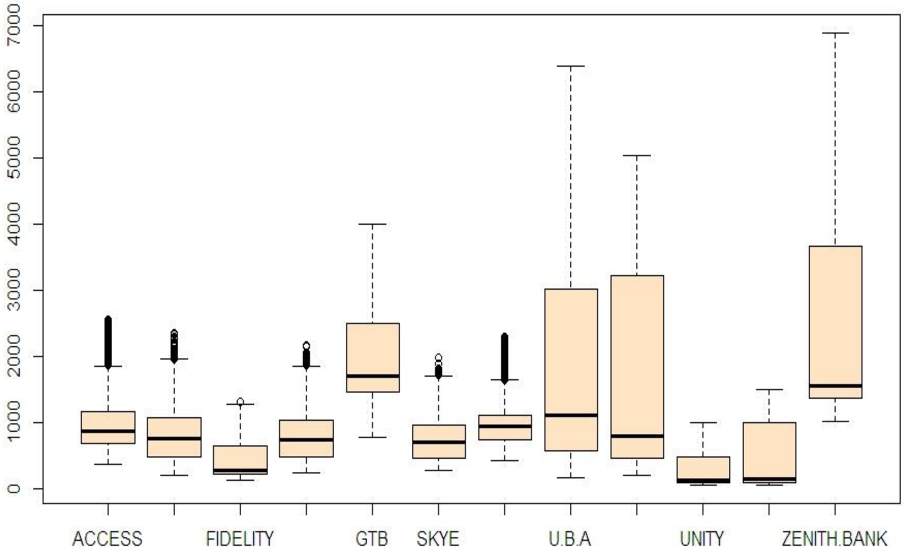
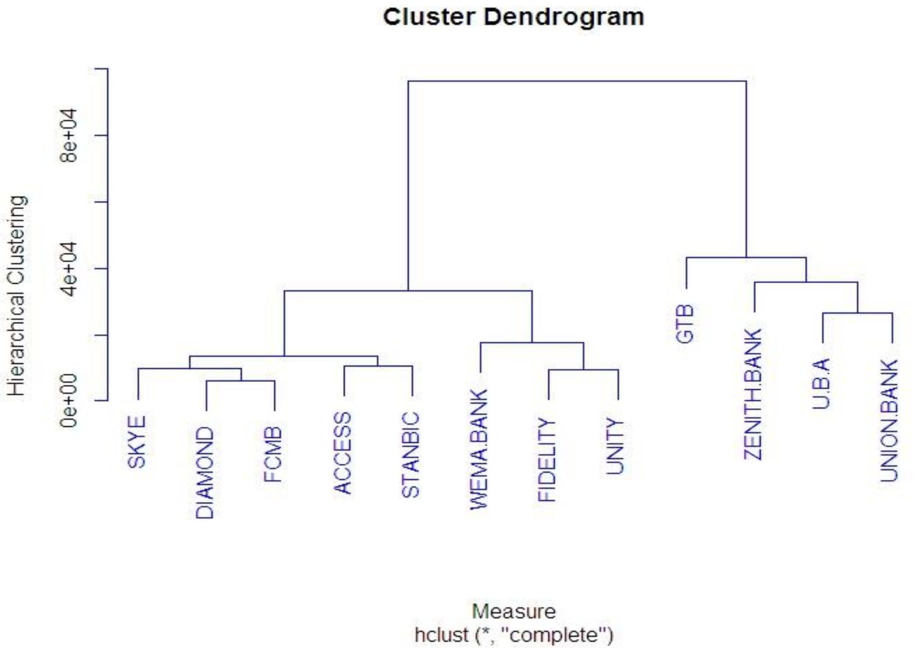


Figure 3

Hierarchical Clustering Measurement



The pictorial figure. 2 of the asset boxplot collaborates with asset ranking and quality control via the UCLs and LCLs as discussed in table 1. Figure 3 intricates on the hierarchy of categories based on the degree of performance collocation of asset shares of these banks. According to cluster dendrogram, GTB leads the classified ladder of most successful and gained market valued asset shares such that UBA, Zenith, and Union bank team up together as the apex gained market valued shares' banks. Next in the grade B category of performance are WEMA, Fidelity, and Unity bank followed by grade C category class that comprises Access, FCMB, SKYE, DIAMOND, and Stanbic IBTC.

Table 2

Estimates of downside risks, volatilities, and Value –at–Risk (VAR) for each of the Asset

	ACCESS	DIAMOND	FIDELITY	FCMB	GTB	SKYE	STANBIC
Semi Deviation	6.7	6.9	7.31	7.8	5.31	7.7	6.7
Gain Deviation	9.44	8.2	8.90	9.3	16.16	9.4	9.8
Loss Deviation	6.9	7.2	7.6	8.6	5.61	8.9	6.9
Idiosyncratic Returns	-0.8923	0.2903	0.7929	-1.025	0.9920	0.5201	0.4535
Weights (α_i)	0.045	0.0104	0.0173	0.0026	0.140	0.047	0.078
Equal weight	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833
Maximum Drawdown	-23.45	-12.89	-19.65	-25.38	-31.09	-42.90	-36.16
Downside Deviation (0%)	3.5	4.7	2.4	6.8	3.7	5.9	6.5
Downside Deviation (MAR=10%)	3.6	4.4	2.5	6.3	3.6	5.2	6.3
Downside Deviation (rl=4%)	2.5	4.2	2.1	6.3	3.1	5.4	6.8
Active Premium	0.0352	0.0781	0.0319	0.0561	0.0871	-0.0492	-0.0477
Tracking Error	0.1037	0.0365	0.0478	0.0463	0.3674	0.4572	0.0374
Treynor Ratio	0.7864	0.0468	-0.9e(-06)	0.0285	0.77201	0.6952	0.4673
VaR (99%)	14.6458	15.3011	10.6553	16.93734	8.3786	17.0029	10.9031
Beyond VaR	14.6458	15.3011	10.6553	16.93734	8.3786	17.0029	10.9031
Modified VaR (99%)	19.6593	20.6858	13.4794	20.4652	51.39834	25.8162	15.8971

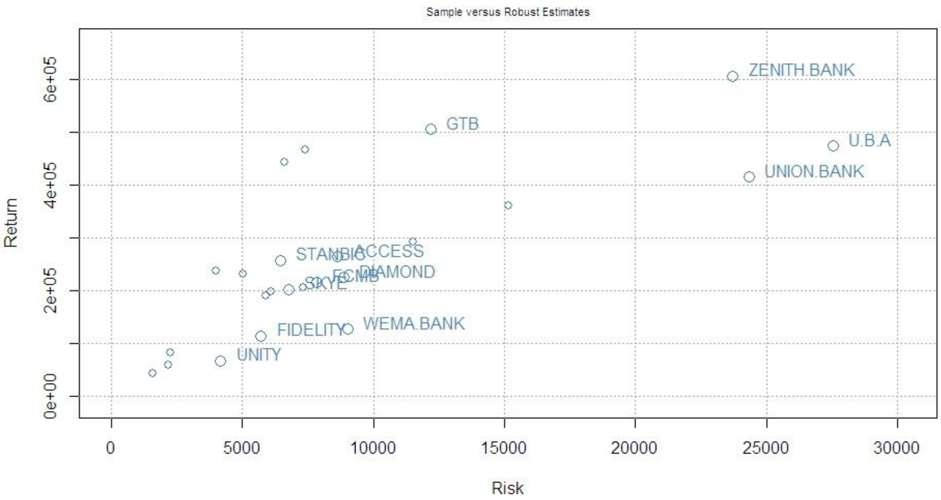
	U.B.A	UNION	UNITY	WEMA	ZENITH
Semi Deviation	5.83	6.3	8.7	9.6	6.21
Gain Deviation	21.53	15.5	7.4	7.3	19.9
Loss Deviation	5.99	4.9	4.5	6.8	5.85
Idiosyncratic Returns	1.1029	0.8673	1.0029	0.2901	1.4522
Weight (ω_i)	0.272	0.0791	0.071	0.0256	0.202
Equal weight	0.0833	0.0833	0.0833	0.0833	0.0833
Maximum Drawdown	-19.8	-20.51	-31.30	-28.82	-34.06
Downside Deviation (0%)	5.5	8.4	5.9	7.3	9.4

Downside Deviation (MAR=10%)	5.4	8.1	5.7	7.5	9.5
Downside Deviation (rl=4%)	4.8	8.7	6.2	7.1	9.7
Active Premium	0.0378	0.0471	0.0162	0.0182	0.0518
Tracking Error	0.3822	0.1649	0.0439	0.0203	0.0593
Treynor Ratio	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
VaR (99%)	8.0149	14.7637	8.9753	20.6004	7.9973
Beyond VaR	8.0149	14.7637	8.9753	20.6004	7.9973
Modified VaR (99%)	12.9094	17.7584	14.4958	25.4081	12.4028

No doubt, prospective shareholders, stakeholders, and investors normally ask for some level of confidence in terms of risk. Value-at-risk (VaR) helps in measuring the economic loss (es) attached to the evaluation of assets in a portfolio. The 99% confidence level of the VaR, which is the estimated Expected Shortfall (ES), was higher in WEMA, UNION, ACCESS, Diamond, and FCMB with 20.6004%, 14.7637%, 14.6458%, 15.3011%, and 16.9373%. In addition, the Beyond VaR that measures the relationship of mean expected tail loss that adds VaR and ES is approximately the same magnitude of defalcation with VaR at 0.01% significant error. The Semi-Deviation that measures the possibility of downside volatility (stumbling), that is the downward trend, this trend flew in the ointment with minor influences UBA, Zenith, Union, GTB, and Stanbic IBTC bank with (5.83%, 6.21%, 6.3%, 5.31%, and 6.7%) respectively. The same banks expect Stanbic IBTC carpeted profitable deviations and gaining insights of 21.53%, 19.9%, 15.5%, and 16.16% respectively. Furthermore, the ratio of assets' excess return that describes the portions of returns of each asset (Treynor ratio) that could be directly attributed to the returns of tractable investments in the benchmark recorded ratios that exceeded 0.5 with (0.7864, 0.77201, 0.6952, 0.7042, 0.5831 and 0.6999) for Access, GTB, SKYE, U.B.A, Union, and Zenith, respectively. Moreover, the investment's annualized return minus the benchmarks annualized return (active premium) indexes recorded negative estimates with SKYE and Stanbic IBTC, suggesting non-annual returns to stakeholders, shareholders, and investors. Lastly, the unequal factor weights (α_i) describing the contributing efficient frontiers carved out UBA and Zenith banks have been the frontiers in the commercial banks' shares portfolio with 0.272 and 0.202 weighting respectively.

Figure 4

Risk plot of each asset returns



4. Conclusion

It is indubitable to infer that the returns of Zenith dictated the pace for UBA, GTB, and Union banks' returns to follow as the apex investors' bank over the eleven years. The higher the returns expected the higher the viable risk to be taken. From the preceding, it is safe to maintain that out of the twelve shares asset of the Nigeria commercial and merchant banks' portfolios - apart from the fact that the contributing factors of Zenith, UBA, GTB, and Union to the shares' portfolio are substantial - their long-time returns might be an 'eye catching' phenomenon for shareholders, investors, stakeholders, and financial analysts.

Further research could also be extended to risk budgeting, transactions, and positions with profit and loss. Lastly, the method of moments (be it higher moments) cannot solely rely on the extraction of market indexes of a portfolio.

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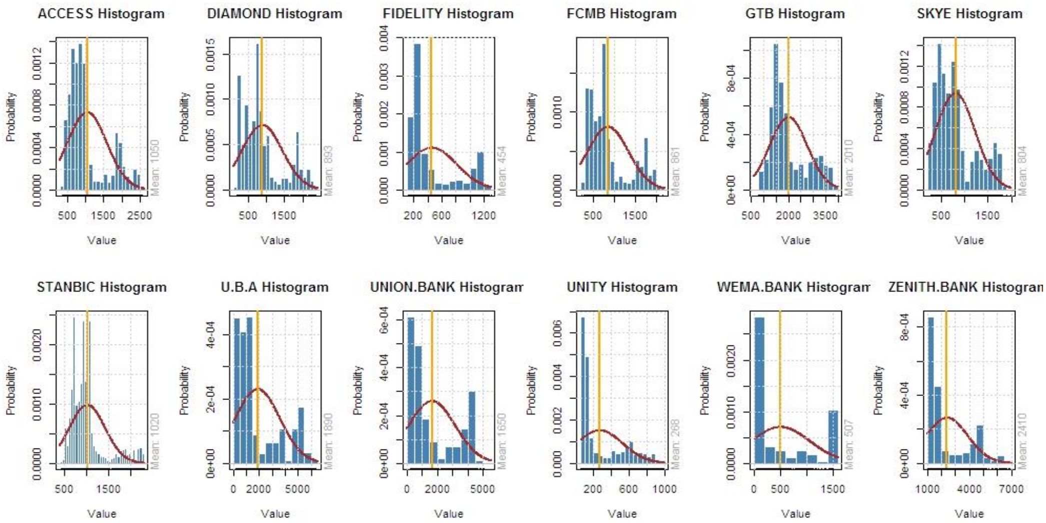
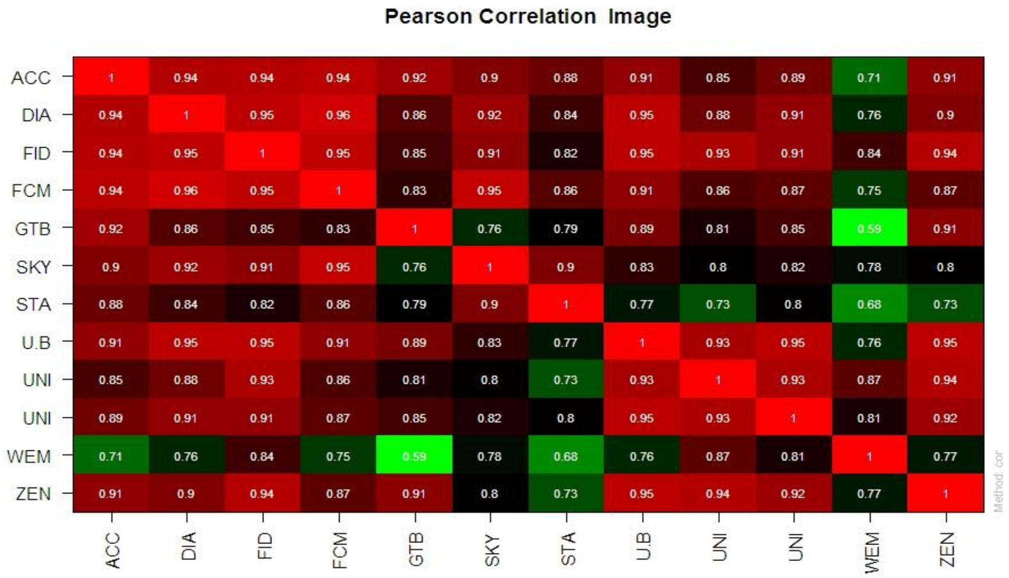
Appendix A: *The Probability Integral Transformation (PIT) of each of the corresponding Banks' shares*



Appendix B: Pearson Correlation Image among *the corresponding Banks' shares*



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