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Full Length Research Paper

An application of analytic hierarchy process (AHP) to investment portfolio selection in the banking sector of the Nigerian capital market

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The importance of investment to the individual, a nation and the world economy cannot be over emphasized. Investment involves the sacrifice of immediate consumption to achieve greater consumption in the future. The Nigerian banking sector has made tremendous success in the recent past. All the banks that approached the capital market through public offers and right issues to raise their capital base recorded huge success. Investors in bank stocks have enjoyed high returns on investment, despite the slow growth in the nation's economy. However, the recent financial crisis that started in America, which has caused economy meltdown in many nations of the world and sudden fall in share prices, has brought about a higher risk than envisaged on investors, particularly those investing in bank stocks. This study underlines the importance of different criteria, factors and alternatives that are essential to successful investment decisions by applying the Analytic Hierarchy Process (AHP) in the selection of investment in bank stocks in the circumstances of financial crisis. The study provides recommendation on strategic investment decision options.

Key words: Application, analytic hierarchy process, investment, portfolio selection, capital market.

INTRODUCTION

In investment decision making in the capital market, especially the banking sector stocks and all types of investment, time and risks are critical variables to be considered. According to Akintoye (1999), "in evaluating investments and potential investments, the relevant factors to be considered are liquidity; safety; structure; yield; and growth". The banking sector had made tremendous success in the recent past as all the banks that approached the capital market through public offers and right issues to raise their capital base made huge success.

The re-capitalization success of the banks was almost simultaneously followed by increased demand for banking sector stocks thereby giving rise to increased market prices of banking shares, increased earnings and total market turnover greater than 300% being highest among all sectors stocks. However, the primary challenges to an investor in banking sectors would be to know:

i. Which of the banks stocks should be accepted now and for the future?
ii. What total amount of capital or money should one invest and for which stock?
iii. Can any sock arising from loss of investment in case of a financial crisis be absorbed?
iv. How should the portfolio of stocks options be financed?

The decision about portfolio choice and the acquisition of funds ideally must be made simultaneously. Similarly, a yardstick for project or portfolio acceptance cannot be set without considering the cost of funds to the investor, and this cost will be influenced by the characteristics of the investment opportunities available to the investor, Bromwich (1981). Developments, since the Second World War has stimulated the search for criteria or systematic decision rules for investment appraisal.

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Observably, rapid economic growth and technology progress have vastly increased the investment opportunities available to prospective investors having only limited funds.

As part of advancement in the search for decision making techniques, especially those involving uncertainty and human value judgment, Saaty (1980) developed the Analytical Hierarchy Process (AHP). This study adopts the AHP in making decision on investment portfolio selection in the banking sector of the Nigerian capital market.

The choice of AHP as a tool employed by the study is informed by the fact that some of the factors and alternatives are intangible, thus quantifying them numerically and accurately is not possible as other investment appraisal techniques would require.

The problem

The banking industry in Nigeria has for some time experienced boom. Apart from the fact that banks are experiencing structural expansion and high–posted profits, the investors in bank stocks are also enjoying high returns, on investment – in spite of the slow growth in the nation's economy, particularly the real sectors such as agriculture, industry, construction, and so on. Although, commerce and petroleum sectors are currently enjoying banking sector credit patronage, the two sectors have their own inherent volatility. The major problems needing urgent investigation are:

(i) Will the current boom in the banking sector continue, in the medium to long term, in the absence of real sector development?
(ii). What will be the consequences on bank stocks returns for any eventual drop in the profit performance of the banks and the concomitant fall in bank stocks prices?
(iii) Which banks are likely to withstand financial market shocks and emerge the sector leaders?

These questions tend to highlight a critical issue that there exist disconnect between bank sector performance and the real sector of the Nigerian economy. This is at variance with what obtains in the developed economies, as well as a defeat of the macroeconomic policy visions for consolidating the banking sector. Also, investors in bank stocks may face higher risk than may be envisaged if investment plans are not well monitored. The recent financial crisis that has led to economy meltdown in many countries is already taking its toll on Nigerian economy as almost all companies share prices have crashed to an unbelievable level. The banking sector could, therefore, suffer contraction if Nigeria fails to urgently ensure total development of the entire key economic sectors as the petroleum, commerce and communication sectors alone cannot meaningfully sustain the banking sector. There could yet be an imminent shock, if for any reason the Central Bank insists on policy streamlining banking operations, for all banks to render financial-end-of-year-reports at same time. The need to avert investor's loss in the short, medium to long-term necessitates this study.

Objective of the study

At the micro level, the investors are in business to maximize returns for a given degree of risks or minimize risks for a given expected returns. At the macro level, effectiveness of economic policy is measured in terms of the impact on the real economy aggregates. Thus, this study is embarked upon to achieve the following objectives:

(i) Critically evlauate the performance of the banking sector in relation to stock investment returns;
(ii) Determine the level of stability of the current banking sector boom in Nigeria especially in light of recent economy meltdown;
(iii) Make a comparative assessment of the risks and returns associated with investment among the banks stocks in Nigeria;
(iv) Suggest investment rules that will help mitigate loss of investment returns in capital market;
(v) Determine the necessary criteria relevant for investment decisions in banks stocks in the short- term, medium- term and long-term.
(vi) Demonstrate an efficient and effective investment decision approach in stock market, particularly when both quantitative and qualitative factors are involved, using the AHP method;
(vii) Proffer advice toward efficient stock market portfolio management.

Review of related studies

Bolster et al. (2005) used AHP to determine investor suitability, based on age, to select among seven investment securities. The results of their study showed varying pattern of investment for the different age groups. Kurz et al. (2003) investigated the determinants of stock market volatility and risk premium. The study highlighted the significance of investor's expectation on stock prices and interest rate affecting investment in stocks.

Richard and Mukhtan (2008) applied time series analysis and portfolio selection on mutual savings banks to determine the optimal portfolio choice. They opined that 'an investor should invest in short- term stocks, risk-less assets, and well diversified investment to achieve the highest utility from investable fund. Meziani (2003) investigated the effect of investment barriers on international capital flows using expert driven system. The study adopted the AHP method to determine the critical investment barriers affecting foreign capital flows as well as national markets situations. The hierarchy of Optimal

Investment Portfolio (OIP) criteria was used to develop an AHP structure. The OIP is a frictionless portfolio characterized by an absence of regulatory obstacles, information asymmetries, capital controls, and all such barriers that restrain cross-border investment. However, national market (both macro and micro) environment do affect international investment. The study concluded that among all such impediments, political risks, legal restrictions, liquidity risks, discriminatory taxa-tion and psychological barriers were the critical macro variables more dominant than micro impediments. Boucher and Mcstravic (1991) presented a multi-attribute evaluation within a present value framework and its relation to the analytic hierarchy process. Cambron and Evans (1991) worked on layout design using the analytic hierarchy process.

Putrus (1990) presented a paper on accounting for intangibles in integrated manufacturing (non financial justification based on the analytic hierarchy process). While Triantaphyllou and Mann (1994a) worked on evaluation of the an AHP and revised AHP when the eigenvalue method is used under a continuity assume-ption; Triantaphyllou and Mann (1994b) discussed on some critical issues in making decisions with pair wise comparisons. Wang and Raz (1991) investigated the analytic hieratchy process based on data flow problem. Wabalickis (1988) presented a justification of FMS with the analytic hierarchy process.

METHODOLOGY

The AHP technique of solving problem, which explicitly recognizes and incorporates the knowledge and expertise of the participants in the priority setting process making use of their subjective preferences was adapted as the research methodology. Due to the peculiarity of the AHP technique, a logical procedure for making decision is to make use of primary data. Thus, the data used in the study is the response of investors in banking stocks (based on their scale of preferences) as in the questionnaire distributed.

The population of the study consists of the 24 banks that emerged after the consolidation exercise of 2005. Twelve of these banks were selected using random sampling technique to ensure a good representation of the population. The selection of twelve out of the twenty four banks was aimed at making the hierarchical model not to be unwieldy. Coincidentally, ten out of the selected twelve banks were the top ten on the rating of banks by the Nigerian Stock Exchange. The twelve banks and the notation used for each of them in the study are: Access Bank Plc (AB); AfriBank Plc (AFB), Diamond Bank (DB); First Bank Plc (FB); Guaranty Trust Bank Plc (GTB); Intercontinental Bank Plc (ICB); Oceanic Bank Plc (OB); Platinum Habib Bank Plc (PHB); Skye Bank Plc (SKB); Union Bank plc (UB); United Bank for Africa Plc (UBA); and Zenith Bank Plc (ZB).

Also, given the improved awareness and participation of Nigerians in stock business (buying and selling), the population of those involved had become too large to be covered in a single study as this. Hence, opinions were sort from 750 respondents among different income groups using the judgmental random sampling technique. Also to buttress the quality of the findings of the study, the researchers used random sampling techniques to select five (5) corporate investment organization (that is stock broking firms and capital market investment companies) which include BGL Securities Limited; Rostrum Investment and Security Limited; Hedge Securities Investment Co. Limited; Davandy Financial and Security Limited; and Lagos Stock Exchange.

Questionnaire was designed using the dichotomous or two-way questions, and questions based on Saaty's scale of preference – a form of Likert scaled type question generally adopted for the appli-cation of AHP technique, and a pilot study was first carried out to ensure that respondents understood the issues in consideration. Thereafter, base on suggestions and input from some of the security firms, the questionnaire was updated and then admi-nistered on individual investors and the investment firms. Section A and B of the questionnaire consist of questions on the demography of individual investors and the corporate investment organizations, respectively; while section C dealt with the subject matter. For each corporate investment firms, 5 questionnaires were distributed thus numbering 25 questionnaires. 750 questionnaires were distributed to the individual investors at 250 to each of low income, middle income and high income investors respectively.

Developing the model

Model formulation

The key problem of this study is to ensure the maximization of investment returns from bank stocks through strategic investment decisions either by speculation (short-term trading), medium-term or long-term investment plan. The problem formulation thus entails:

(1) Identifying the objective to be achieved: Maximization of Bank Stocks' Investment Returns.
(2) Identification of factors that affect the objective: These factors are

(i) The banks under consideration for investment
(ii) The criteria considered necessary for portfolio investment among bank –sector stocks, which are: Financial criteria (F); Capital market indices (C); Management efficiency (M) and Technology criteria (IT)
(iii) The sub-criteria considered as factors that influence the criteria necessary for portfolio investment are:

(a) Financial criteria (F): Asset base -A, Gross earnings - Q, Profit after tax - T, Share capital holders fund –S.
(b) Capital market indices (C): Share price -P, Earning per share-E, Market capitalization - K, Bonus ratio policy –B, Dividends policy - D.
(c) Management efficiency criteria (M): Credit policy--R, Corporate image--I, Structure and strategy -- W, Human capacity -- H, Age (generation) of bank – G.
(d) Technology criteria (IT): IT Capability---J, Products/innovation---N, Locations/spread—L.
(iv) The alternative investment plans that would generally maximize returns are:

(a) Speculative (short-term) investment plan for one year and below.
(b) Medium-term investment plan for period more than one year but less than 5 years.
(c) Long-term investment plan for period 5 years and above.

The AHP model for the study

The AHP technique adopts diagrammatic representation in the form of hierarchy to model real-life situation. Here, the structure identified at the problem formulation stage is put in a generalized form using general concepts, notations and symbols. The model for this study

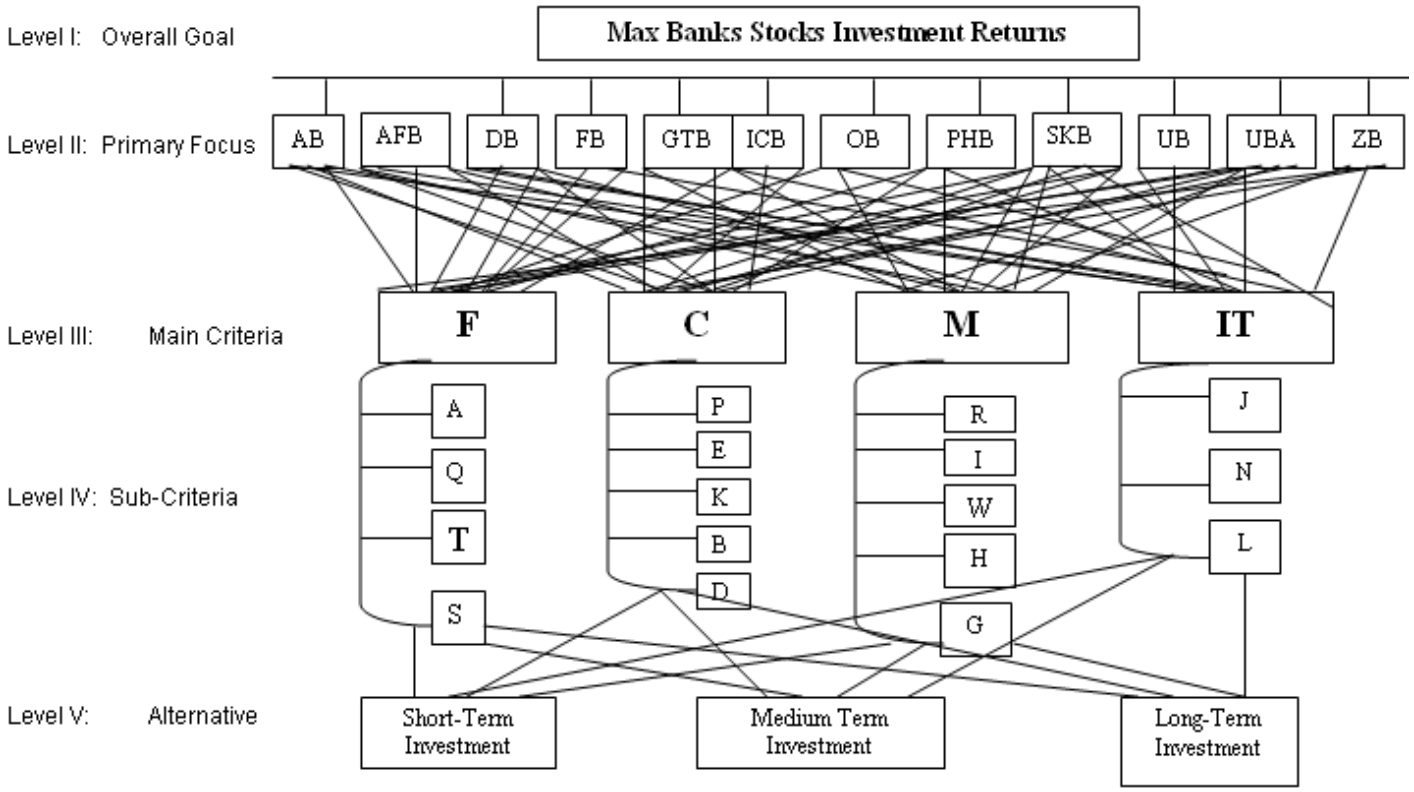

Figure 1. A hierarchy of banks stocks investment decision to maximize returns.

has five levels as follows:

Level I: The objective (maximizing banks' stocks investment returns).
Level II: The banks considered in achieving the objective
Level III: The main criteria considered necessary to achieve the objective.
Level IV: Sub-criteria that will lead to the achievement of the objective.
Level V: The alternative to be used to achieve the objective.

Data analysis technique

The data generated through the questionnaire were analyzed with the aid of the AHP software package "Expert Choice". Expert choice is a computer software package that performs the computation required by the AHP (Figure 1). It is a system for the analysis, synthesis and justification of complex decisions and evaluations. With respect to the goal, these factors span a descent tree of criteria, sub-criteria, factors and alternatives. Expert choice uses the supplied data to device global priorities and informs the user of the consistency of the relative comparisons fed it. Furthermore, it provides reports, histograms and sensitivity analysis as the user wishes.

ANALYSIS OF RESULTS

We proceeded by making comparisons between criteria and alternatives, a pair at a time to determine the relative weights. The eigenvalues method, mean transformation or row geometric mean became helpful for the mathematical computation of the relative weights. The pair-wise comparisons were based on nine-point–wise comparisons and the scale value for the pair-wise comparisons is the set 9, 8, 7, 6, 5, 4, 3, 2, 1, ½, 1/3, ¼, 1/5, 1/6, 1/7, 1/8, 1/9. Expert choice package was invaluable in providing not only priorities, but also consistency of the relative comparisons, sensitivity analysis and summary reports, while Mathcad software was used to compute the eigenvalues and eigenvectors which aided the computation of consistency ratios of the variables.

Furthermore, since the twelve selected banks operate in the same economy, under the same financial regulations and dully consolidated, they were regarded comparable and equally ranked. Thus, each of them was given a rating of 0.083. Also, considering the sub-criteria with respect to the decision alternatives as they apply to the individual banks, the priorities are the same across the selected banks.

In this regard, the priority used for short-term, medium term and long-term plans remain the same for all the twelve banks. However, considering the investment in the stocks of each bank given the principal criteria, the priorities vary from one bank to another as revealed in the various computations (Tables 1 and 2).

Table 1. Judgment matrix of alternatives with respect to sub-criteria.

Sub-criteria	Alternative	Short-term investment	Medium-term investment	Long-term investment
Asset base	Short-term	1	5	7
	Medium –term	1/5	1	3
	Long-term	1/7	1/3	1
Gross earning	Short-term	1	3	5
	Medium-term	1/3	1	3
	Long-term	1/5	1/3	1
Profit after tax	Short-term	1	1/3	2
	Medium-term	3	1	5
	Long-term	1/2	1/5	1
Share capital holders fund	Short –term	1	1/3	1/5
	Medium-term	3	1	1/3
	Long-term	5	3	1
Share price	Short-term	1	2	9
	Medium-term	½	1	7
	Long-term	1/9	1/7	1
Earning per share	Short-term	1	2	9
	Medium-term	½	1	5
	Long-term	1/9	1/5	1
Market capitalization	Short-term	1	2	3
	Medium-term	½	1	2
	Long-term	1/3	1/2	1
Bonus ratio policy	Short-term	1	1	1
	Medium-term	1	1	1
	Long-term	1	1	1
Dividend policy	Short-term	1	1/5	1/9
	Medium-term	5	1	½
	Long-term	9	2	1
Credit policy	Short-term	1	3	5
	Medium-term	1/3	1	3
	Long-term	1/5	1/3	1
Corporate image	Short-term	1	2	2
	Medium-term	½	1	2
	Long-term	½	½	1
Structure / Strategy	Short –term	1	2	2
	Medium-term	½	1	2
	Long-term	1/2	½	1
Human capacity	Short-term	1	2	2
	Medium-term	½	1	2
	Long-term	1/2	1/2	1

Table 1. Count.

Age of bank	Short-term	1	1/3	1/5
Sub-criteria	Alternative	Short-term Investment	Medium-term Investment	Long-term investment
Age of bank	Medium-term	3	1	1/3
	Long-term	5	3	1
I.T Capability	Short-term	1	2	2
	Medium-term	1/2	1	2
	Long-term	1/2	1/2	1
Product innovation	Short-term	1	1/2	1/3
	Medium-term	2	1	1/3
	Long-term	3	3	1
Location/spread	Short-term	1	1/2	1/7
	Medium-term	2	1	1/5
	Long-term	7	5	1

Table 2. Judgment matrices of the main criteria.

Judgment matrix expressed by the respondents' in respect to Diamond Bank Guaranty Trust Bank, Skye Bank, and Union Bank				
	F	C	M	T
F	1	2	2	2
C	1/2	1	2	2
M	1/2	1/2	1	2
T	1/2	1/2	1/2	1
Judgment matrix expressed by respondents' in respect to First Bank				
	F	C	M	T
F	1	5	5	3
C	1/5	1	2	2
M	1/5	1/2	1	2
T	1/3	1/2	½	1
Judgment matrix of respondents in respect of Afribank Plc.				
	F	C	M	T
F	1	2	2	2
C	1/2	1	2	2
M	1/2	½	1	1/3
T	1/2	½	3	1
Judgment matrix of respondents in respect to Intercontinental Bank				
	F	C	M	T
F	1	3	3	2
C	1/3	1	2	2
M	1/3	½	1	2
T	1/2	1/2	1/2	1
Judgment matrix of respondents' in respect to Oceanic Bank				
	F	C	M	T
F	1	2	2	2

Table 2. Cont'd.

C	1/2	1	2	2
M	1/2	½	1	2
T	1/2	½	½	1
	Judgment matrix of respondents' in respect to United Bank for Africa			
	F	C	M	T
F	1	1/2	2	3
C	2	1	5	5
M	1/2	1/5	1	3
T	1/3	1/5	1/3	1
	Judgment matrix of respondents' in respect to Platinum Habib Bank			
	F	C	M	T
F	1	2	2	2
C	1/2	1	2	2
M	1/2	½	1	2
T	1/2	½	1/2	1
	Judgment matrix of respondents' in respect to Access Bank			
	F	C	M	T
F	1	3	3	3
C	1/3	1	2	2
M	1/3	1/2	1	2
T	1/3	1/2	½	1
	Judgment matrix of respondents in respect to Zenith Bank			
	F	C	M	T
F	1	3	3	9
C	1/3	1	3	6
M	1/3	1/3	1	3
T	1/9	1/6	1/3	1

Analysis of the judgment matrix of sub-criteria

Table 3 shows the judgment matrix of the sub-criteria. For the financial criteria, it could be observed that respondents' were of the opinion that asset base was three times more preferred to gross earning; while profit after tax was five times preferred to asset base, an indication that investors would like to have quick returns in the form of dividend. Similar interpretation follows from the entries in the table for the other sub-criteria.

Analysis of priority in respect of the main criteria

Table 4 contains the preference values for the main criteria with respect to the primary focus. The preference ratios show that respondents considered financial criterion as most critical in terms of investing in the stocks of most of the selected banks except UBA. Respondents would opt for capital market indices before investing in the stock of UBA.

On the relevance of the sub-criteria under the respective main criteria, profit after tax ranked highest under financial criterion with a preference of 0.513. In respect of capital market indices criterion, share price ranked most with a priority of 0.429, while credit policy topped among the management efficiency sub-criteria with a priority of 0.415 information technology (I.T) capability ranked highest among the technology sub-criteria with a priority of 0.615 (Table 5).

Analysis of priorities in respect of the alternatives

The results in Table 6 show that asset base, with a priority of 0.731, and gross earnings (0.637) were of short-term relevance, profit after tax (0.648) was of medium-term relevance, and share capital holders fund,

Table 3. Judgment matrix of sub-criteria in respect of sub-criteria.

Main criteria	Sub-criteria	Asset base	Gross earning	Profit after tax	Share capital fund
Financial criteria	Asset base	1	3	1/5	1/2
	Gross earning	1/3	1	1/5	1/5
	Profit after tax	5	5	1	2
	Share capital fund	2	5	½	1

		Share price	Earning per share	Market capitalization	Bonus ratio policy	Dividend policy
Capital market indices	Share price	1	2	7	3	6
	Earning per share	1/2	1	7	2	3
	Market capitalization	1/7	1/7	1	3	1/3
	Bonus ratio policy	1/3	½	1/3	1	7
	Dividend policy	1/6	3	3	1/7	1

		Credit policy	Corporate image	Structure and Strategy	Human capacity	Age of bank
Management efficiency criteria	Credit policy	1	3	3	2	7
	Corporate image	1/3	1	2	2	7
	Structure and strategy	1/3	1/2	1	2	5
	Human capacity	1/2	1/2	1/2	1	5
	Age of bank	1/7	1/7	1/5	1/5	1

		I.T. Capacity	Products innovation	Location and spread
Technology criteria	I.T. capacity	1	2	9
	Product innovation	½	1	5
	Location/spread	1/9	1/5	1

Table 4. Priorities of the main criteria in respect of the primary focus.

Main criteria	Primary focus (Bank)											
	AB	AFB	DB	FB	GTB	ICB	OB	PHB	SKB	UB	UBA	ZB
Financial criteria	0.490	0.383	0.391	0.580	0.391	0.461	0.431	0.341	0.391	0.458	0.253	0.538
Capital market indices	0.231	0.273	0.276	0.182	0.276	0.236	0.246	0.276	0.276	0.240	0.523	0.280
Managerial efficiency	0.163	0.125	0.195	0.130	0.195	0.168	0.189	0.195	0.195	0.185	0.148	0.134
Technology criteria	0.116	0.219	0.138	0.108	0.138	0.135	0.135	0.138	0.138	0.116	0.076	0.048

with a priority of 0.637, was of long-term relevance. Under the capital market indices, share price, earnings per share and market capitalization were all of short-term relevance with priorities of 0.597, 0.615 and 0.540, respectively. The results also revealed that respondents seemed not to be bothered about bonus policy, while dividend policy was of long-term relevance with a priority of 0.615.

In the case of managerial efficiency sub-criteria, credit policy (0.637), corporate image (0.493), structure and strategy (0.493) and human capacity (0.493) were all of short-term relevance, while age of bank was of long-term relevance. For the technology sub-criteria, information technology (I.T.) capacity (0.493) was of short-term relevance, while products innovation and location/spread of the bank were of long-term relevance with priorities of 0.594 and 0.740, respectively. The overall choice of investment time horizon has revealed by the study suggests that investors in banking stocks would maximize returns in Nigeria by choosing a short-term plan with a priority of 0.398.

Computation of eigenvalues and eigenvectors

The eigenvalues are known as characteristics values of

Table 5. Priorities of sub-criteria in respect of the main criteria by bank.

Main criteria	Sub-criteria	Bank											
		AB	AFB	DB	FB	GTB	ICB	OB	PHB	SKB	UB	UBA	ZB
Financial	A	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142
	Q	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066
	T	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.513
	S	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279
Capital market indices	P	0.429	0.429	0.429	0.429	0.429	0.429	0.429	0.429	0.429	0.429	0.429	0.429
	E	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
	K	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
	B	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261
	D	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
Managerial efficiency	R	0.415	0.415	0.415	0.415	0.415	0.415	0.415	0.415	0.415	0.415	0.415	0.415
	I	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239
	W	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
	H	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140
	G	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037
Technology	J	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615
	N	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319
	L	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066

latent roots, while eigenvectors are the characteristics vectors. The decomposition of a square matrix into eigenvalues and eigenvectors is also known as Eigen decomposition or single value decomposition of Eigen analysis.

Let A be a linear transformation represented by a square matrix A. If there is a vector $X \in R^x \neq 0$ such that $AX = \lambda$, with eigenvalue λ, then the corresponding eigenvectors satisfy the system

$$(A - \lambda I) X = 0,$$

where I is the square identity matrix. As shown in Cramer's rule, a linear system of equations has m x n trivial solutions if the determinant varnishes. So the solutions of the above system are given by

$$\text{Det } (A - \lambda I) X = 0 \quad (1)$$

Equation (1) is known as the characteristic equation of λ, and the left hand side is the characteristic polynomial. $A \bar{x} = \lambda X$ are called the eigenvectors; [A – λI] is the characteristic determinants of A; [A – λI] = 0 is the characteristics equation; and the values of λ are called the eigenvalues.

The characteristics vectors for a 4 x 4 matrix is given by

$$AX = \lambda X$$

$$\lambda \neq 0 \ (i = 1, 2, 3, 4) \quad (2)$$

MathCAD version 7 was employed to solve for the eigenvectors.

Computation of consistency ratios

We have matrices 3 x 3, 4 x 4 and 5 x 5, which have the characteristic of being positive reciprocal matrices, homogenous (b = 0), symmetric ($a_{ij} = 1/a_{ij}$), irreducible, singular, non-trivial and consists of ones ($a_{ij} = 1$ for i = j). If the pair wise comparison matrix which is the judgmental values given by the respondents is consistent, then small variables of a_{ij} (which is the computation of the eigenvalues and eigenvectors) keep the largest eigenvalues close to n (where n is the order of the square matrix) and the remaining eigenvalues close to zero (the presence of complex numbers being due to the matrix having reciprocal values). The highest eigenvalues, λ_{max}, is used to calculate the consistency index, CI, for each matrix and the CI is used to calculate the consistency ratio, CR. Both CI and CR are given by

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (3)$$

$$\text{and} \quad CR = \frac{CI}{RI} \quad (4)$$

Table 6. Priorities of alternatives in respect of the sub-criteria.

Sub-criteria	Alternative	Bank											
		AB	AFB	DB	FB	GTB	ICB	OB	PHB	SKB	UB	UBA	ZB
Asset base (A)	Short term	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731	0.731
	Medium term	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188
	Long term	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081
Gross Earnings Q	Short term	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637
	Medium term	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258
	Long term	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
Profit after tax π	Short term	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230
	Medium term	0.648	0.648	0.648	0.648	0.648	0.648	0.648	0.648	0.648	0.648	0.648	0.648
	Long term	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122
Share capital S	Short term	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
	Medium term	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258
	Long term	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637
Share-price P	Short term	0.597	0.597	0.597	0.597	0.597	0.597	0.597	0.597	0.597	0.597	0.597	0.597
	Medium term	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346	0.346
	Long term	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
Earning/Share E	Short term	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615
	Medium term	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319
	Long term	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066
Market capitalization K	Short term	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540
	Medium term	0.297	0.297	0.297	0.297	0.297	0.297	0.297	0.297	0.297	0.297	0.297	0.297
	Long term	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163
Bonus ratio policy B	Short term	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333
	Medium term	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333
	Long term	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333
Dividend policy D	Short term	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066
	Medium term	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319	0.319
	Long term	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615
Credit policy, R	Short term	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637
	Medium term	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258
	Long term	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105

Table 6. Cont'd.

Corporate image I	Short term	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493
	Medium term	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311
	Long term	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
Structure and strategy W	Short term	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493
	Medium term	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311
	Long term	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
Human Capacity H	Short term	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493
	Medium term	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311
	Long term	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
Age of Bank (G)	Short term	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
	Medium term	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258
	Long term	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637	0.637
I0.T0. Capacity J	Short term	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493	0.493
	Medium term	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311
	Long term	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
Product Innovation, N	Short term	0.157	0.157	0.157	0.157	0.157	0.157	0.157	0.157	0.157	0.157	0.157	0.157
	Medium term	0.249	0.249	0.249	0.249	0.249	0.249	0.249	0.249	0.249	0.249	0.249	0.249
	Long term	0.594	0.594	0.594	0.594	0.594	0.594	0.594	0.594	0.594	0.594	0.594	0.594
Location/Spread L	Short term	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094
	Medium term	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
	Long term	0.740	0.740	0.740	0.740	0.740	0.740	0.740	0.740	0.740	0.740	0.740	0.740

where RI is the random index given by

$$RI = \frac{1.99(n-2)}{n} \quad (5)$$

When CI = 0.1 it is assumed that the judgmental values of the respondents are consistent. The eigenvectors of λ_{max} are the vectors of λ_{max} that correspond to λ_{max}, and the set of all vectors in the eigenvector is called the eigen space of λ_{max} corresponding to λ_{max}.

Furthermore, the eigenvectors satisfy the equation.

$$AX = \lambda_{max} \quad (6)$$

If CR ≤ 0.1, the level of inconsistency is = acceptable, otherwise the inconsistency of the judgmental values of the respondents is high. Using expressions (3) and (4) we compute the CI and CR, respectively, as shown in Table 7.

Table 7 shows that the judgmental values of the respondents are consistent since the consistency ratios of the pair-wise comparison matrix for all variables satisfy the required condition, that is, CR ≤ 0.1.

Table 7. Consistency index and consistency ratios.

Main focus	Criteria	Sub-criteria	λ_{Max}	CI	CR
	Financial	Asset base	3.065	0.0325	0.0492
		Gross earnings	3.039	0.0195	0.0295
		profit after tax	3.004	0.002	0.0030
		Shareholders fund	3.039	0.0195	0.0295
			4.113	0.0377	0.0380
	Capital market indices	Share price	3.022	0.011	0.0167
		Earnings/share	3.001	0.0005	0.00076
		Market capitalization	3.009	0.0045	0.0068
		Bonus ratio Policy	3	0	0
		Dividend Policy	3.001	0.005	0.0076
			5.4	0.007	0.0842
	Managerial efficiency	Credit Policy	3.039	0.0195	0.0295
		Corporate Image	3.054	0.027	0.0409
		Structure and Strategy	3.054	0.027	0.0409
		Human Capacity	3.054	0.027	0.0409
		Age of Bank	3.039	0.0195	0.0295
			5.246	0.0615	0.0518
	Technology	I.T. Capability	3.054	0.027	0.0409
		Production Innovation	3.054	0.027	0.0409
		Location/Spread	3.014	0.007	0.0106
			3.001	0.005	0.00076
Access Bank			4.121	0.0403	0.0407
Afribank			4.162	0.054	0.0545
Diamond Bank			4.121	0.0403	0.0407
First Bank			4.247	0.0823	0.0832
Guaranty Trust Bank			4.121	0.0403	0.0407
Intercontinental Bank			4.215	0.0717	0.0724
Oceanic Bank			4.215	0.0717	0.0724
Platinum Habib Bank			4.121	0.0403	0.0407
Skye Bank			4.121	0.0403	0.0407
Union Bank			4.143	0.0403	0.0482
UBA			4.113	0.0377	0.0380
Zenith Bank			4.277	0.0923	0.0933

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

Summary of findings

The major aim of the study was to determine whether the boom experienced in stock investment in recent time, particularly the banks' stocks, would continue in the medium to long-term in the absence of real sector development, in the light of the financial crisis that had resulted to serious economic meltdown in several sectors. We also investigated the time horizon of the appropriate investment plan for an investor in banks' stocks in the Nigerian capital market, such that it would maximize returns, and which major criteria do influence investment decisions in banks' stocks. The study revealed that:

(i) All the banks selected were well capitalized and their stocks profitable for investment particularly during and immediately after the consolidation era;
(ii) The banks operated under the same financial system and regulations and were equally rated in terms of risks associated with portfolio choice except a major economic

downturn that could cripple any of the banks occurs;
(iii) The Nigerian economy was highly underdeveloped (particularly the real sector such as agriculture and manufacturing) and very volatile;
(iv) The underdeveloped Nigerian economy would not be able to support any transitory boom in bank profits and returns from investment in banks' stocks;
(v) Most investors in Nigerian capital market were passive investors who just buy shares and keep, and not really speculating for capital gains; hence they stood at high risk of losing their capitals for any unexpected fall in stock prices or boom reversal;
(vi) Financial criterion was found to be the most critical in terms of investing in stocks of commercial banks in Nigeria. Hence, investors in bank stocks must give due consideration to all the sub-criteria under the financial criterion before investing their money in the stock of any bank;
(vii) Investors should consider the profit-after-tax declared by banks (over a period of time) as it ranked highest among the sub-criteria. Of course, profit-after-tax determines the rate of dividend per share and/or the bonus share ratio;
(viii) Investment in banks' stock would be maximized within the short-term plan than the medium to long-term as the synthesis values supported;
(ix) Capital market indices, particularly share prices, and bank management efficiency were other relevant variables determining investment decisions;
(x) The situation in the Nigerian capital market showed that investors would experience colossal loss for choosing long-term plans, given the weak economy, and for any eventual economy downturns, except the real sector experience real and sustainable growth;
(xi) Risk likely to adversely affect capital market and banks' shares included: changing government monetary policy; foreign capital flow reversal; poor profit of banks leading to liquidity problems; global economic recession; fall in the international price of crude oil; negative expectation effects or attitude leading to investors' apathy on capital market;
(xii) The outcome of the research supported short-term investment plan as the ultimate to maximize returns from portfolio investment in banks' stocks.

Conclusion

From the above findings, we conclude that investors in bank shares stand a high risk of losing their investment in the event of any financial crisis occurring in Nigeria. This is particular in given the unstructured Nigeria economy that rely only on sales of crude oil for foreign exchange earning rather than developing the real and agricultural sectors of the economy that would require a lot of assistance from banks in terms of finance. Currently, most banks concentrate in given loans to trades involved in importation of finished goods. In the event of policy change by government by banning such goods, it becomes difficult for banks to retrieve the loans back. Hence, investors in bank stocks are advised to concentrate only on short-term investment rather than medium to long terms investments.

It is expected that a virile capital market operation and expedient portfolio investment decisions would lead to national as well as individual economic prosperity. This had been the case for most advanced nations, and incidentally in Nigeria during and immediately after the banks consolidation era.

Our experience with the Nigerian investment scenario shows that the real sectors remain underdeveloped, thus making portfolio investment riskier, particularly, in the medium to long-term. The banking sector which appears to be the driving sector in the economy, as well as the capital market, cannot be said to be stable given economy vagaries and public policy uncertainties. This tends to exacerbate the fear and propensity for capital loss for any long-term investment decision.

Currently, the prices of stocks have crashed and investors are already lamenting. The global economic recession has further worsened the situation. Market capitalization is dwindling, while stock broking firms are retrenching and even the banks themselves are shivering due to falling profits. There must be appropriate macro-economic and structural policies to support real sector economic growth. Infrastructure supplies, small and medium scale enterprise promotion, and agricultural development are inevitable in this regard. Government and quoted firms should help to bail out the capital market to mitigate against its collapse and investors' further loss.

RECOMMENDATIONS

This study actually started before the dawn of the current global economic meltdown, and as if it was a premonition, the realities of the focus problem of the study had become not only glaring but devastating. The fears being entertained by people about the seemingly booming Nigeria capital market soon became manifest. This no doubt informs the nature and scope of recommendations necessary to address the capital market investment cum economic problems of Nigeria.
There is need to recall that the current global recession is rooted to the mortgage loan crisis (sub-prime loans) which became heightened in the US in the early 2004 until the mid 2007 when the bubble burst. During the early 2004, the mortgage industry in the US enjoyed an unprecedented boom whereby mortgage brokers enticed prospective buyers with inadequate income or poor credit history into taking mortgage loans with little or no down payment. These sub-prime loans were later repackaged and sold to banks and other financial institutions which then created collateral Debt Obligations (CDOs) and sold these financial instruments to world-wide investors who

unsuspectingly relied on the strength of the sellers rather than the risk rating of the underlying financial instrument. “The bubble burst in mid 2007 when sub-prime mortgage borrowers unable to service their loans, which were then due for refinancing, began to default en-mass. The mass default triggered the beginning of the global crisis because the investment banks who sold the CDOs could no longer service the debts package as repurchase notes from commercial banks” (Pedro, 2008).

Central to the crisis were two institutions – the Federal National Mortgage Association (Fannie Mae) and its sister institution, Freddie Mac, that are both government sponsored institutions set up by the US congress to facilitate and promote mortgage lending to poor or low income home buyers. The seemingly financial distress in the US crept into financial sector in the UK and further spread to other countries. The effects of the global financial crisis soon began to devastate the entire global economy.

In the context of the Nigerian economy, the macroeconomics issues have to do with problems relating to high rate of inflation; sluggish growth in output, high unemployment rate, unstable interest and exchange rates, debt burden, huge fiscal deficits, low capacity utilization, and adverse balance of payments. However, the reform efforts of the Obasanjo’s regime had some credit records in terms of reducing some of these problems as Nigeria exited the Paris and London clubs debt gulags; the banking system became more solid; capital market boomed; exchange rate became reasonably stable; interest rate fairly stable; inflation manageably low; foreign exchange reserve increased as a result of increase in oil prices. The economy became more promising and predictable given these positive outcomes from the monetary –cum-fiscal measures which propelled the reforms.

Today, most of these positive indices have reversed, no thanks to the current global economic recession. Oil price now hovers between $40 and $50pb from over $140pb by mid – 2008; exchange rate drastically increased from about ₦120 to a dollar by December 2008 to ₦181 to a dollar by March 16th, 2009; interest rate has risen and inflation has also risen. These coupled with general fall in production and shrinking capital market have brought about high investment risks, thus causing a general investors’ apathy.

In the light of the findings of the research and the current exigencies associated with the global economic downturn, the following recommendations are offered:

(i) For the capital market functions to effectively perform its roles and ensure investors’ gains in the face of the current economic recession and within the framework of the economy, it requires sound macroeconomic policies (fiscal and monetary) to aid the real sector;

(ii) On fiscal policy, tax incentives should be given to companies to reduce production costs and raise output;

(iii) Government should increase expenditure for the provision of infrastructures, such as electricity and good roads to aid industrialization;

(iv) On monetary policy, the lending rate should be lowered for investors to expand production and attract new investments;

(v) There should be measures to reduce inflation, possibly through properly guided foreign exchange deregulation to reduce import induced inflation;

(vi) Government should take measures to bail out any ailing bank or stock broking firm as a way of protecting investors’ to reduce the apathy in investment in stocks;

(vii) The Central Bank of Nigeria and government should help to bail out the capital market through a temporal active participation in capital market transactions to raise capitalization and boost stock prices;

(viii) Commercial banks should be directed to loan more money to the real sectors (agriculture, manufacturing and construction) to ensure a more productive and sustainable growth for the entire economy;

(ix) Government should give necessary encouragement to the small and medium scale enterprise sector in terms of availability of funds from banks, as well as tax relieve, so that the sector can contribute positively to the overall Gross Domestic Product (GDP);

(x) The monetary authority should institute measure to check sharp practices in the ways and manners businesses are transacted in both the money and capital markets to ensure discipline and transparency in markets’ operations;

(xi) On the side of the investors in capital market, the best option in Nigeria would be a short-term investment plan;

(xii) An investor needs to utilize or engage the service of stock brokers and finance experts when taking investment decisions;

(xiii) Investors need to be abreast with changes in capital market indices in order to minimize the risks on investment.

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