EVALUATING ASSETS PRICING USING THREE STATE MARKOV CHAIN MODEL

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Abstract: The financial stock market is characterized by high volatility; therefore the gain or loss of the stockholder greatly hangs on the understanding of the market by the investor, which turns dependent on his grasp of the stocks market to foresee the changes in prices of an asset that might increase because of many fluctuating features. The study appraises asset pricing using a three-state Markov chain model (TSMCM). The data used for the study comprise returns of eleven (11) stocks quoted on the Nigerian stock exchange (NSE). A TSMCM was used to explore the data. It was learned that the result obtained from matrices of the first vector suggests that if the gain went up, the following day gain will go up, remain stable or fall. It was learned from the behavior of the stock market that there is a disparity in the behavior of the stock price movement given that it will initially rise, fall, or remain stable. We found the predicted long-run returns from all the 11 stocks under study become stable irrespective of the current state. This means that if the current state is a rising state, it is anticipated that a return greater than the overall average return will be gotten the next day, but it will not be conceivable to get a return greater than the average return if in the fall or stable state. We, therefore, conclude that from the derived matrices for the individual stocks one can predict the possibility of going from one point to the next. Irrespective of a stock's current value, in the end, we could foresee that its value will fall, remain unchanged or rise.

Keywords: Markov chain, assets price, fall, rise, stable

Introduction

The vision of everybody capitalizing in the stock market (SM) is to acquire return, nevertheless, there is much instability in the financial stock market (FSM), the achievement or letdown of the stockholder deeply hangs on his resolve which in turn depend on his grasp of the SM to foresee the changes in prices of an asset that might increase because of many fluctuating features (Davou *et al*., 2013). Accordingly, a good number of literature showed that SM is influenced by variables such as Gross Domestic Product, Savings and Investment, Over all Taxes, etc. of the economy about their strength in diverse markets. Hence, a stockholder needs to always be up to date with the comportment of the SM given the outcome which is initiated following the changeability of these variables, a stockholder needs to understand the measures which he has to grab and when he has to make them in order to give him the maximum advantage in making profit while minimizing risks when its elimination is not viable. The variation in the systematic risks of countries might explain the variation in excess returns.

The Asset Pricing Theory is an affiliation between return and risk factors, and involves an exploration for whatever defines the gains in the marketplace. Stockholders buy assets with anticipation of receiving a future dividend in expectation to improve their future depletion. Since stockholders bear risk, a progressive correlation exists betwixt risk and gain, and the purpose of asset valuing is to detect and size the risk, and to explore the correlation betwixt the risk and gains (Gibbons *et al.*, 1989). The emphasis of Asset Valuing Model (APM) is to clarify asset gains as a basis of risk components.

Ajao and Igbinosa (2014) observed that the Fam-French three-factor model performs better than the one-factor CAPM; hence decision makers should be weary of one-factor CAPM as an asset pricing model because it does not represent in entirety the risk aspects influencing asset pricing and returns in the stock market. Davou *et al.* (2013) in their work discovered that for a company's stock to remain in a static state for long periods is not a good sign of performance. However, they failed to consider the long-run panorama of the stock prices as this is the kernel of the Markov chain model, its ability to consider instability for long periods. Markov chain model was used to analyze the long-run prospect of stock prices in the stock market; it was found that the model is useful in evaluating long span predictions on the future prospects of stock prices. However, the three states employed in modeling the movement of prices were decided without the use of a threshold (Eseoghene, 2011).

Abidin and Jaffar (2013) used the GBM to predict stock price behaviour and found that one week's data is enough to forecast share prices, this seems a positive, but it was also found that the GBM can be used to predict at most two weeks closing prices, which is a draw back since investors won't have long term prediction of a stock's price

Mettle *et al.* (2014) castoff Markov chain with limited states for stochastic analysis of share prices. They were able to establish that the states communicate, are aperiodic and ergodic and hence possess limiting distributions. They developed a procedure to determine the expected average gain time for increase in stock price; they posited that decision on investment could be improved if based on high transition chances, low average gain time and high limiting distribution. Moreover, they failed to determine at what point the daily return of a company could say to have increased, decreased or remained unchanged. For more literature on CAPM and multi-factor asset pricing models, see Jieting and Yuichiro (2018); Okonta *et al.* (2017); Simeyo *et al.* (2015); Abidin and Jaffar (2013); Nazarova (2013); Nwude (2013); and Magafas *et al.* (2011).

Hence, the aim of this research work is to estimate assets pricing using Markov chain model. Such that, it examines closing daily returns of stocks using a three-state Markov chain, predicts the stock's price movement (behaviors) and estimate the expected long-run returns of stocks.

Materials and Methods

Data

The data used for this study are from eleven (11) selected stocks quoted on the Nigerian Stock Exchange (NSE) from January 2008 to December 2017. There are 2475 observations from each stock. The stocks were selected using purposive sampling technique.

Theoretical Framework

The CAPM: Theory and evidence

Fama and French (1992) revealed that the cross-section of assets can-not be described by the market solitarily, pointing out that, the asset pricing model remains challenging. The disappointing presentation of the capital asset pricing model, and particularly the discovery that certain characteristics of stock elucidate gains more than the market solitarily, on condition that, the nitty-gritty from the recent investigation on asset estimating is constructed. Notwithstanding, researchers attempt to propose innovative models that however clarify the asset earnings or they review the outdated capital asset pricing model to include more realistic assumptions. The capital asset pricing model supposes that stockholders should concur on the predicted gains and predicted covariance of gains, have a second degree efficacy purpose, or returns should be normally distributed.

The solution offered by some researchers to overcome the deficiency of the capital asset pricing model is to present multifactor models, such as the Asset Pricing Theory of Ross (1976), the intertemporal capital asset pricing model by Merton (1973), furthermore, the works of Fama and French (1993), Carhart (1997), Pastor and Stambaugh (2003). It is contended that, a set of components should consider the market risk which is not completely encapsulated by the market solitarily. In recent times, the overview of provisional models with fluctuating constraints has remain the prominence of research in this area.

Model specification

The Markov chain model

Let the current return be given, then the data concerning earlier return does not influence the chances of ensuing returns. Hence, the model is;

$P\{X_n = j / X_{n-1} = i_{n-1}, \ldots, X_o = i_o\} = P\{X_n = j / X_{n-1} = i_{n-1}\}$ (1)

$P\{X_n = j\} = P_j^{(n)}$ is the probability of outcome P_j, j = 1, 2, 3, … is a scheme of events or set of outcomes at any trial that are independent (Davou *et al.*, 2013).

Estimation procedure

We classify data of daily return obtained from each stock into three (3) states. Namely stock price rises (R), stock price remains the same (S) and stock price fall (F). Then we provide matrix of probabilities to described the behavior of stock price movement as presented in Table 1.

Table 1: Transition frequency

		Current day price			
	S	**R**	**S**	**F**	**Total**
Previous day price	R	Z_{11}	Z_{12}	Z_{13}	T_1
	S	Z_{21}	Z_{22}	Z_{23}	T_2
	F	Z_{31}	Z_{32}	Z_{33}	T_3

Where Z_{ij} = the amount of stretches a transition is made from state i to state j

T_i = the sum of values, for i,j=1,2,3.

We get the Transition Probability Matrix (TPM) as shown below;

$$P_{ij} = \frac{Z_{ij}}{\sum_j Z_{ij}} \qquad (2)$$

Where P_{ij} is the chance of navigating from state i to state j,

The TPM is created by Z_{ij}/ T_i.

Estimating expected long-run returns

The expected long-run returns were obtained using the formula given below (Ibrahim *et al*, 2017; Kilic, 2013).

$$E_R = P_i^{(0)} \pi_{ij} \qquad (3)$$

Where E_R is an expected long-run return, π_{ij} is the steady-state chance and $P_i^{(0)}$ is the initial chance of state i.

Results and Discussion

This research covered the eleven (11) stocks retrieved from the NSE viz: 7up Bottling Company, Afrpaints, Benue Cement Company (BCC), Berger, Conoil, Flourmill, Guinness, Nigerian Breweries (NB), Nestle Nig. ltd, PZ and Vitafoam for the period of 2008 - 2017, which means that for each stock we have 2475 observations.

Descriptive Statistics

The summary statistics are reported in percentage terms. Looking at Table 2 it can be seen that the daily mean in the stock index is 0.7994%, the standard deviation is 0.4960% with a Skewness of 0.96031, and Kurtosis of -0.4679, we found range return of 170 and a standard error of 0.99703. For the period under study most indices are found to be positive, only three indices have negative Skewness, BCC (-0.13842), Flourmill (-0.01378), and NB (-0.13411). Also, large values of positive Skewness are reported in Conoil (1.8739), Vitafoam (1.7495), and 7UP (0.96031). The largest negative Skewness is found in BCC with a negative Skewness of –0.13842. If we look at the stocks above the value of the Kurtosis are large, the largest is Conoil (3.7753) and Vitafoam (3.6154), and two distributions are less peaked Berger (1.7304) and PZ (0.08274).

Table 2: Summary statistics of daily returns for 11 stocks from 2008-2017

Stocks	Mean (%)	Std. Dev. (%)	Skewness	Excess Kurtosis	Std. Error	Range
7UP	0.7994	0.4960	0.96031	-0.4679	0.99703	170
AFRPAINTS	0.0296	0.0038	0.20072	-1.3233	0.00766	1.14
BCC	1.3127	0.6439	-.13842	-1.1108	1.2944	235.99
BERGER	0.0844	0.0230	0.21222	1.7304	0.04625	16.52
CONOIL	0.4401	0.2487	1.8739	3.7753	0.49984	154.53
FLOURMILL	0.5244	0.2571	-.01378	-1.4643	0.51685	98.24
GUINNESS	1.6099	0.6194	0.30738	-1.0425	1.2451	237.41
NB	1.106	0.4515	-.13411	-1.3536	0.90748	164.39
NESTLE	6.2815	3.3229	0.22124	-1.1326	6.6793	1451.5
PZ	0.2730	0.0760	0.25414	0.08274	0.15267	48
VITAFOAM	0.049	0.0217	1.7495	3.6154	0.04362	13.36

Table 3: The Stock Price Movement of 7up Bottling Company from 2008-2017

States	Rise in stock's price (R)	Stable in stock's price (S)	Fall in stock's price (F)	Total
Rise in stock's price (R)	172	105	501	778
Stable in stock's price (S)	222	316	615	1153
Fall in stock's price (F)	126	304	114	544

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Pre-estimation results

For compilation and analysis, STATA 15 and scientific workplace version 5.5 were used as shown in Tables 3 to 13.

Table 4: The stock price movement of Afrpaints from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	147	177	209	533
Stable in stock's price (S)	467	518	8	993
Fall in stock's price (F)	156	185	608	949

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 5: The stock price movement of BCC from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	604	148	254	1006
Stable in stock's price (S)	41	513	306	860
Fall in stock's price (F)	205	199	205	609

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 6: The stock price movement of Berger from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	109	585	353	1047
Stable in stock's price (S)	262	170	198	630
Fall in stock's price (F)	88	291	419	798

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 7: The stock price movement of Conoil from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	411	16	421	848
Stable in stock's price (S)	502	120	342	964
Fall in stock's price (F)	67	459	137	663

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 8: The stock price movement of Flourmill from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	209	385	653	1247
Stable in stock's price (S)	260	372	97	729
Fall in stock's price (F)	11	431	57	499

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 9: The stock price movement of Guinness from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	617	115	9	741
Stable in stock's price (S)	337	472	239	1048
Fall in stock's price (F)	280	141	265	686

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 10: The stock price movement of NB from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	15	281	712	1008
Stable in stock's price (S)	140	511	174	825
Fall in stock's price (F)	430	22	190	642

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 11: The stock price movement of Nestle Nig. Ltd from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	271	212	347	830
Stable in stock's price (S)	173	79	69	321
Fall in stock's price (F)	288	417	619	1324

R = Rise in stock's price; **S** = Stable in stock's price; **F =** Fall in stock's price

Table 12: The stock price movement of PZ from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	247	17	109	373
Stable in stock's price (S)	46	618	181	845
Fall in stock's price (F)	189	360	708	1257

R = Rise in stock's price; **S** = Stable in stock's price; **F** = Fall in stock's price

Table 13: The stock price movement of Vitafoam from 2008-2017

States	R	S	F	Total
Rise in stock's price (R)	77	463	171	711
Stable in stock's price (S)	533	294	106	933
Fall in stock's price (F)	386	148	297	831

R = Rise in stock's price; **S** = Stable in stock's price; **F** = Fall in stock's price

Consequently, the TPM for every stock under consideration is given as follows;

i. TPM for 7up Bottling Company

$$P = \begin{pmatrix} .2210 & .1350 & .6440 \\ .1925 & .2741 & .5334 \\ .2316 & .5588 & .2096 \end{pmatrix}$$

ii. TPM for Afrpaints

$$P = \begin{pmatrix} .2758 & .3321 & .3921 \\ .4703 & .5217 & .0080 \\ .1644 & .1949 & .6407 \end{pmatrix}$$

iii. TPM for Benue Cement Company (BCC)

$$P = \begin{pmatrix} .6004 & .1471 & .2525 \\ .0477 & .5965 & .3558 \\ .3366 & .3268 & .3366 \end{pmatrix}$$

iv. TPM for Berger

$$P \begin{pmatrix} .1041 & .5587 & .3372 \\ .4159 & .2698 & .3143 \\ .1103 & .3647 & .5250 \end{pmatrix}$$

v. TPM for Conoil

$$P = \begin{pmatrix} .4847 & .0189 & .4964 \\ .5208 & .1245 & .3547 \\ .1011 & .6923 & .2066 \end{pmatrix}$$

vi. TPM for Flourmill

$$P = \begin{pmatrix} .1676 & .3087 & .5237 \\ .3567 & .5103 & .1330 \\ .0221 & .8637 & .1142 \end{pmatrix}$$

vii. TPM for Guinness

$$P = \begin{pmatrix} .8327 & .1552 & .0121 \\ .3216 & .4504 & .2280 \\ .4082 & .2055 & .3863 \end{pmatrix}$$

viii. TPM for Nigerian Breweries (NB)

$$P = \begin{pmatrix} .0149 & .2788 & .7063 \\ .1697 & .6194 & .2109 \\ .6698 & .0342 & .2960 \end{pmatrix}$$

ix. TPM for Nestle Nig. Ltd

$$P = \begin{pmatrix} .3265 & .2554 & .4181 \\ .5389 & .2461 & .2150 \\ .2175 & .3150 & .4675 \end{pmatrix}$$

x. TPM for PZ

$$P = \begin{pmatrix} .6622 & .0456 & .2922 \\ .0544 & .7314 & .2142 \\ .1504 & .2864 & .5632 \end{pmatrix}$$

xi. TPM for Vitafoam

$$P = \begin{pmatrix} .1083 & .6512 & .2405 \\ .5713 & .3151 & .1136 \\ .4645 & .1781 & .3574 \end{pmatrix}$$

The movement of the value for each vector of 7up Bottling Company is as shown above in the TPM: Rise in stock's price (R), this means, the stock's price that rise will still rise at the probability of 0.2210. The stock's price that rises will remain stable with the probability of 0.1350. The stock's price that rises will fall with the probability of 0.6440, the stock's price that is stable will still remain the same with 0.2741. The stock's price that is stable will fall with 0.5334 the fall in stock's price (F), this means, the stock's price that fall will rise with probability 0.2316. The stock's price that fall will remain stable with probability of 0.5588. The stock's price that fall will still fall with probability 0.2096. Similar explanations can be given for the other 10 stocks.

Estimation results

Behavior of stock's price movement

The $P_{ij}^{(n)}$ of P_{ij} for every stock were obtained so that we can see the performance of the stock's price and the outcomes, see the Powers of TPM for all stocks under considerations.

i. Powers of the TPM for 7up Bottling Company

$$P = \begin{pmatrix} .2210 & .1350 & .6440 \\ .1925 & .2741 & .5334 \\ .2316 & .5588 & .2096 \end{pmatrix}$$

$$P^2 = \begin{pmatrix} .22398 & .42671 & .34932 \\ .21884 & .39918 & .38198 \\ .20730 & .30156 & .49115 \end{pmatrix}$$

$$P^8 = \begin{pmatrix} .21510 & .3641 & .42080 \\ .21509 & .36406 & .42085 \\ .21508 & .36392 & .421 \end{pmatrix}$$

$$P^{12} = \begin{pmatrix} .21509 & .36401 & .42090 \\ .21509 & .36401 & .4209 \\ .21509 & .36401 & .4209 \end{pmatrix}$$

$$P^{13} = \begin{pmatrix} .21509 & .36401 & .4209 \\ .21509 & .36401 & .4209 \\ .21509 & .36401 & .4209 \end{pmatrix}$$

ii. Powers of TPM for Afrpaints

$$P = \begin{pmatrix} .2758 & .3321 & .3921 \\ .4703 & .5217 & .0080 \\ .1644 & .1949 & .6407 \end{pmatrix}$$

$$P^5 = \begin{pmatrix} .30528 & .35094 & .34378 \\ .31259 & .35904 & .32838 \\ .30032 & .34544 & .35425 \end{pmatrix}$$

$$P^{10} = \begin{pmatrix} .30614 & .35189 & .34197 \\ .30627 & .35204 & .34169 \\ .30605 & .35179 & .34217 \end{pmatrix}$$

$$P^{16} = \begin{pmatrix} .30615 & .35191 & .34194 \\ .30616 & .35191 & .34194 \\ .30615 & .35191 & .34194 \end{pmatrix}$$

$$P^{17} = \begin{pmatrix} .30615 & .35191 & .34194 \\ .30615 & .35191 & .34194 \\ .30615 & .35191 & .34194 \end{pmatrix}$$

iii. Powers of TPM for BCC

$$P = \begin{pmatrix} .6004 & .1471 & .2525 \\ .0477 & .5965 & .3558 \\ .3366 & .3268 & .3366 \end{pmatrix}$$

$$P^2 = \begin{pmatrix} .45249 & .25858 & .28893 \\ .17685 & .4791 & .34404 \\ .33098 & .35445 & .31457 \end{pmatrix}$$

$$P^8 = \begin{pmatrix} .31377 & .36914 & .31709 \\ .30973 & .37237 & .3179 \\ .31200 & .37055 & .31745 \end{pmatrix}$$

$$P^{17} = \begin{pmatrix} .31171 & .37078 & .3175 \\ .3117 & .37079 & .31751 \\ .31171 & .37079 & .3175 \end{pmatrix}$$

$$P^{18} = \begin{pmatrix} .31171 & .37079 & .3175 \\ .31171 & .37079 & .3175 \\ .31171 & .37079 & .3175 \end{pmatrix}$$

iv. Powers of TPM for Berger

$$P = \begin{pmatrix} .1041 & .5587 & .3372 \\ .4159 & .2698 & .3143 \\ .1103 & .3647 & .5250 \end{pmatrix}$$

$$P^2 = \begin{pmatrix} .28039 & .33187 & .38773 \\ .19017 & .41978 & .39005 \\ .22107 & .35149 & .42744 \end{pmatrix}$$

$$P^8 = \begin{pmatrix} .22281 & .37253 & .40466 \\ .22274 & .37259 & .40466 \\ .22278 & .37255 & .40467 \end{pmatrix}$$

$$P^{10} = \begin{pmatrix} .22278 & .37256 & .40466 \\ .22277 & .37256 & .40466 \\ .22277 & .37256 & .40466 \end{pmatrix}$$

$$P^{11} = \begin{pmatrix} .22277 & .37256 & .40466 \\ .22277 & .37256 & .40466 \\ .22277 & .37256 & .40466 \end{pmatrix}$$

v. Powers of TPM for Conoil

$$P = \begin{pmatrix} .4847 & .0189 & .4964 \\ .5208 & .1245 & .3547 \\ .1011 & .6923 & .2066 \end{pmatrix}$$

$$P^2 = \begin{pmatrix} .29496 & .35517 & .34987 \\ .35313 & .2709 & .37597 \\ .43044 & .23113 & .33843 \end{pmatrix}$$

$$P^5 = \begin{pmatrix} .35865 & .28781 & .35354 \\ .35974 & .28654 & .35372 \\ .36027 & .28697 & .35276 \end{pmatrix}$$

$$P^9 = \begin{pmatrix} .35953 & .28715 & .35332 \\ .35953 & .28715 & .35332 \\ .35954 & .28714 & .35332 \end{pmatrix}$$

$$P^{10} = \begin{pmatrix} .35953 & .28715 & .35332 \\ .35953 & .28715 & .35332 \\ .35953 & .28715 & .35332 \end{pmatrix}$$

vi. Powers of TPM for Flourmill

$$P = \begin{pmatrix} .1676 & .3087 & .5237 \\ .3567 & .5103 & .1330 \\ .0221 & .8637 & .1142 \end{pmatrix}$$

$$P^5 = \begin{pmatrix} .23263 & .54356 & .22381 \\ .23939 & .53777 & .22284 \\ .23856 & .54494 & .21650 \end{pmatrix}$$

$$P^{10} = \begin{pmatrix} .23763 & .54072 & .22165 \\ .23759 & .54075 & .22166 \\ .23760 & .5407 & .22170 \end{pmatrix}$$

$$P^{13} = \begin{pmatrix} .2376 & .54074 & .22166 \\ .2376 & .54074 & .22166 \\ .2376 & .54073 & .22166 \end{pmatrix}$$

$$P^{14} = \begin{pmatrix} .2376 & .54074 & .22166 \\ .2376 & .54074 & .22166 \\ .2376 & .54074 & .22166 \end{pmatrix}$$

vii. Powers of TPM for Guinness

$$P = \begin{pmatrix} .8327 & .1552 & .0121 \\ .3216 & .4504 & .2280 \\ .4082 & .2055 & .3863 \end{pmatrix}$$

$$P^5 = \begin{pmatrix} .68182 & .22542 & 9.2756\times10^{-2} \\ .65916 & .23150 & .10934 \\ .66581 & .22928 & .10491 \end{pmatrix}$$

$$P^{10} = \begin{pmatrix} .67523 & .22715 & 9.7622\times10^{-2} \\ .67483 & .22725 & 9.7924\times10^{-2} \\ .67495 & .22722 & 9.7834\times10^{-2} \end{pmatrix}$$

$$P^{14} = \begin{pmatrix} .67512 & .22718 & 9.7710\times10^{-2} \\ .67510 & .22718 & 9.7710\times10^{-2} \\ .6751 & .22718 & 9.7710\times10^{-2} \end{pmatrix}$$

$$P^{15} = \begin{pmatrix} .67511 & .22718 & 9.7710\times10^{-2} \\ .67511 & .22718 & 9.7710\times10^{-2} \\ .67511 & .22718 & 9.7710\times10^{-2} \end{pmatrix}$$

viii. Powers of TPM for NB

$$P = \begin{pmatrix} .0149 & .2788 & .7063 \\ .1697 & .6194 & .2109 \\ .6698 & .0342 & .2960 \end{pmatrix}$$

$$P^5 = \begin{pmatrix} .29377 & .27561 & .43062 \\ .31448 & .29052 & .39499 \\ .35045 & .25802 & .39153 \end{pmatrix}$$

$$P^{10} = \begin{pmatrix} .32389 & .27214 & .40397 \\ .32218 & .27299 & .40483 \\ .32131 & .27257 & .40612 \end{pmatrix}$$

$$P^{21} = \begin{pmatrix} .32237 & .27255 & .40508 \\ .32238 & .27255 & .40508 \\ .32238 & .27255 & .40508 \end{pmatrix}$$

$$P^{22} = \begin{pmatrix} .32238 & .27255 & .40508 \\ .32238 & .27255 & .40508 \\ .32238 & .27255 & .40508 \end{pmatrix}$$

ix. Powers of TPM for Nestle Nig. Ltd

$$P=\begin{pmatrix}.3265 & .2554 & .4181\\ .5389 & .2461 & .2150\\ .2175 & .3150 & .4675\end{pmatrix}$$

$$P^5=\begin{pmatrix}.34351 & .27554 & .38096\\ .34351 & .27555 & .38094\\ .34349 & .27554 & .38097\end{pmatrix}$$

$$P^6=\begin{pmatrix}.3435 & .27554 & .38096\\ .3435 & .27554 & .38095\\ .34350 & .27554 & .38096\end{pmatrix}$$

$$P^7=\begin{pmatrix}.3435 & .27554 & .38096\\ .3435 & .27554 & .38096\\ .3435 & .27554 & .38096\end{pmatrix}$$

x. Powers of TPM for PZ

$$P=\begin{pmatrix}.6622 & .0456 & .2922\\ .0544 & .7314 & .2142\\ .1504 & .2864 & .5632\end{pmatrix}$$

$$P^5=\begin{pmatrix}.28787 & .34105 & .37107\\ .19374 & .45999 & .34627\\ .22426 & .41762 & .35813\end{pmatrix}$$

$$P^{10}=\begin{pmatrix}.23216 & .41003 & .35781\\ .22254 & .42228 & .35518\\ .22578 & .41814 & .35608\end{pmatrix}$$

$$P^{28}=\begin{pmatrix}.22587 & .41804 & .35610\\ .22587 & .41804 & .35609\\ .22587 & .41804 & .35609\end{pmatrix}$$

$$P^{29}=\begin{pmatrix}.22587 & .41804 & .35609\\ .22587 & .41804 & .35609\\ .22587 & .41804 & .35609\end{pmatrix}$$

xi. Powers of TPM for Vitafoam

$$P=\begin{pmatrix}.1083 & .6512 & .2405\\ .5713 & .3151 & .1136\\ .4645 & .1781 & .3574\end{pmatrix}$$

$$P^5=\begin{pmatrix}.36452 & .42047 & .21501\\ .38216 & .40619 & .21165\\ .37933 & .40793 & .21274\end{pmatrix}$$

$$P^{10}=\begin{pmatrix}.37512 & .41177 & .21311\\ .37482 & .41202 & .21317\\ .37486 & .41198 & .21316\end{pmatrix}$$

$$P^{15}=\begin{pmatrix}.37494 & .41192 & .21314\\ .37494 & .41191 & .21314\\ .37494 & .41192 & .21314\end{pmatrix}$$

$$P^{16}=\begin{pmatrix}.37494 & .41192 & .21314\\ .37494 & .41192 & .21314\\ .37494 & .41192 & .21314\end{pmatrix}$$

From the matrices above, it is observed that after a period of 13 years, equilibrium is attained for 7UP Bottling Company. We can therefore conclude that, the chance that a stock price that will rise (R) given that in the first instance it falls (F) is 0.4209, as suggested above a stock price that will remained stable (S) given that it initially rises (R) is 0.36401 and as suggested above a stock price that will fall (F) given that in the first instance it remained stable (S) is 0.21509. In the same manner, the remaining 10 stocks under study can be viewed as such.

Estimating expected long-run return for 7UP Bottling Company

Assuming that the stock price is positioned with an initial chance $P^{(0)}=(.3333,\ .3333,\ .3333)$ then the chance of stock price increasing after 13 years is as follows;

$$P^{(0)}\pi_{ij}=(.3333,\ .3333,\ .3333)\begin{pmatrix}.21509 & .36401 & .4209\\ .21509 & .36401 & .4209\\ .21509 & .36401 & .4209\end{pmatrix}$$

$$=(.21507\quad .36397\quad .42085)$$

$$=\begin{pmatrix}Rise & Stable & Fall\\ .2151 & .3640 & .4209\end{pmatrix}$$

It can be seen that there is 21.51% Rise in the stock price, 36.40% Stable in stock price and 42.09% Fall in stock price of the 7UP Bottling Company.

Estimating expected long-run return for Afrpaints

From the power matrices above, we learned that after a period of 17 years, equilibrium is attained.

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.30615 & .35191 & 0.34194\\ .30615 & .35191 & 0.34194\\ .30615 & .35191 & 0.34194\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .3061 & .3519 & .3419\end{pmatrix}$$

It can be deduced that there is 30.61% Rise in the stock price, 35.19% Stable in stock price and 34.19% Fall in stock price of the Afrpaints.

Estimating expected long-run return for BCC

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.31171 & .37079 & .3175\\ .31171 & .37079 & .3175\\ .31171 & .37079 & .3175\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .3117 & .3708 & .3175\end{pmatrix}$$

It is clear from the above that there is 31.17% Rise in the stock price, 37.08% Stable in stock price and 31.75% Fall in stock price of the BCC.

Estimating expected long-run return for Berger

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.22277 & .37256 & .40466\\ .22277 & .37256 & .40466\\ .22277 & .37256 & .40466\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .2227 & .3725 & .4046\end{pmatrix}$$

It is clear from the above that there is 22.27% Rise in the stock price, 37.25% Stable in stock price and 40.46% Fall in stock price of the Berger

Estimating expected long-run return of Conoil

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.35953 & .28715 & .35332\\ .35953 & .28715 & .35332\\ .35953 & .28715 & .35332\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .3595 & .2871 & .3533\end{pmatrix}$$

It is clear from the above that there is 35.95% Rise in the stock price, 28.71% Stable in stock price and 35.33% Fall in stock price of the Conoil

Estimating expected long-run return for Flourmill

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.2376 & .54074 & .22166\\ .2376 & .54074 & .22166\\ .2376 & .54074 & .22166\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .2376 & .5407 & .2216\end{pmatrix}$$

It is clear from the above that there is 23.76% Rise in the stock price, 54.07% Stable in stock price and 22.16% Fall in stock price of the Flourmill

Estimating expected long-run return for Guinness

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.67511 & .22718 & 9.7710\times10^{-2}\\ .67511 & .22718 & 9.7710\times10^{-2}\\ .67511 & .22718 & 9.7710\times10^{-2}\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .6751 & .2271 & 9.7710\times10^{-2}\end{pmatrix}$$

It is clear from the above that there is 67.51% Rise in the stock price, 22.71% Stable in stock price and 9.78% Fall in stock price of the Guinness

Estimating expected long-run return for NB

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.32238 & .27255 & .40508\\ .32238 & .27255 & .40508\\ .32238 & .27255 & .40508\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .3223 & .2725 & .4050\end{pmatrix}$$

It is clear from the above that there is 32.23% Rise in the stock price, 27.25% Stable in stock price and 40.50% Fall in stock price of the NB.

Estimating expected long-run return for Nestle Nig. Ltd

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.3435 & .27554 & .38096\\ .3435 & .27554 & .38096\\ .3435 & .27554 & .38096\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .3435 & .2755 & .3809\end{pmatrix}$$

It can be deduced from the above that there is 34.35% Rise in the stock price, 27.55% Stable in stock price and 38.09% Fall in stock price of the Nestle Nig. Ltd

Estimating expected long-run return for PZ

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.22587 & .41804 & .35609\\ .22587 & .41804 & .35609\\ .22587 & .41804 & .35609\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .2258 & .4180 & .3560\end{pmatrix}$$

It can be observed from the above that there is 22.58% Rise in the stock price, 41.80% Stable in stock price and 35.60% Fall in stock price of the PZ

Estimating expected long-run return for Vitafoam

$$P^{(0)}\pi_{ij} = \begin{pmatrix}.3333 & .3333 & .3333\end{pmatrix}\begin{pmatrix}.37494 & .41192 & .21314\\ .37494 & .41192 & .21314\\ .37494 & .41192 & .21314\end{pmatrix}$$

$$= \begin{pmatrix}Rise & Stable & Fall\\ .3749 & .4119 & .2131\end{pmatrix}$$

It is clear from the above that there is 37.49% Rise in the stock price, 41.19% Stable in stock price and 21.31% Fall in stock price of the Vitafoam.

Table 14: Summary of the expected long-run return of all the 11 stocks under study

Stocks	Rise	Stable	Fall
7UP	0.2151	0.3640	0.4209
AFRPAINTS	0.3061	0.3519	0.3419
BCC	0.3117	0.3708	0.3419
BERGER	0.2227	0.3725	0.4046
CONOIL	0.3595	0.2871	0.3533
FLOURMILL	0.2376	0.5407	0.2216
GUINNESS	0.6751	0.2271	9.7710×10^{-2}
NB	0.3223	0.2725	0.4050
NESTLE	0.3435	0.2755	0.3809
PZ	0.2258	0.4180	0.3560
VITAFOAM	0.3749	0.4119	0.2131

The expected long-run returns for all the 11 stocks used for the study are shown in Table 14. Returns in the table are for the situations when returns are stable regardless of current state. It can be deduced that if the current state is a rise state, it would be anticipated that a gain greater than the overall mean gain will be realized after only two days, but it will not be possible to notice again bigger than the mean gain if in the fall or stable state. It signifies that ifan investor purchases shares from the 11 stocks under study in Nigeria, and is on the increase, the investor has to wait for two days without vending it so that he/she can get a gain that is up above the overall mean daily gain.

Conclusion and Policy Recommendations

Conclusion

As a result of this research work, we conclude that; from the derived matrices for the individual stocks one can predict the chance of going from a given point or state to next point for a shift. Nonetheless, the present cost of a stock, in the end, it could be forecasted that its cost will go down (fall), remain unchanged or rise. From the behaviors of stocks price it can be seen clearly that the chance of the cost of the individual stocks in the country's capital market value kept on improving up until steadiness was achieved.

Recommendations

Based on the conclusion the following recommendations were made;

i) Unlike Nigeria capital markets, developed markets have huge capitalization and many listed stocks. We recommend that there should be a large capitalization and a lot of listed stocks in Nigeria capital market in other to attract more investors.

ii) Regardless of the behaviors of Nigerian stock markets, it can be reasoned that Nigeria indices are yielding up good returns. Even though a lot need to be for the improvement of the Nigeria stock markets.

iii) The estimated model shows that it is not possible to diversify jump risk, additional requirements are needed in order to improve upon their productivity so as to attract more stockholders in the near future.

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