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The Factor-Likelihood Models and the Arbitrage Pricing Theory in the Nigeria Equity Market

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ABSTRACT
This study tests the empirical applicability of the Factor Likelihood Arbitrage Pricing Models in explaining stock prices in Nigeria Equity Market. The study adopts the statistical (latent) factors approach. We used the principal component analysis to derive proxies for the latent factors. The Autoregressive Moving Average Maximum Likelihood technique was applied to the latent factors and monthly security returns of 50 sample-stocks listed in the Nigerian Stock Exchange for the period January 2002 to December 2016. The results reveal that out of the seventeen real factors, three command risk premium. We recommend that despite the Pre-specified Arbitrage Pricing Model has gained influence both in advanced and emerging economies, investors should not neglect the Statistical Factors Arbitrage Pricing Model as an efficient discounting technique.
Keyword: Factor likelihood, arbitrage pricing theory, stock pricing, equity market, Nigeria

INTRODUCTION

The leading works on asset pricing models begins with the development of the capital asset pricing model (CAPM) by Sharpe (1964) and Lintner (1965). The CAPM is a single factor model whose empirical testability hinged on the market portfolio but the argument that the true market portfolio cannot be inspected poses serious limitation to the acceptability of the model. Thus, Ross (1976) argues persuasively that since the market portfolio is not identifiable the CAPM has never been tested and never will be. Roll (1977) extended the criticism up to the point of rejecting the CAPM completely and becomes the ardent supporter of the Ross (1976) Arbitrage Pricing Theory (APT).

Arbitrage is the process of earning profit by taking advantage of differential pricing for the same asset (making money out of nothing without risk (Cvitanic and Zapatero, 2004); and those who do it are called arbitragers (Mayo, 2006; Billingsley, 2006; Gomex, 2008; Cechetti, 2008; 2010). The principle of no arbitrage states that a mathematical model of a financial market should not allow for arbitrage opportunities (Schachermayer, 2008). The absence of arbitrage opportunities is a fundamental principle underlying the modern theory of financial asset pricing (Black and Scholes, 1973; Merton, 1973; Ross, 1976; Cox and Ross, 1976; Roll, 1977, and Ross and Roll, 1977). In particular, this concept is intrinsic to the statement of the fundamental theorem due to Harrison and Kreps (1979), Harrison and Pliska (1981), and Delbaen and Schachermayer (1994). These authors establish conditions and existence of an equivalent martingale measure.

The formalization of this notion and its path-breaking application to finance was accomplished by Ross (1976a, 1976b). It is a general theory of asset pricing which he developed as an alternative model that could potentially overcome the CAPM's problem while still retaining the underlying message of the later (Jecheche, 2012). It is a pricing model that seeks to calculate the appropriate price of an asset while taking into account systematic risks common across a class of assets. The assumption behind the model is that securities prices/returns are generated by a relatively small number of common factors (Chen, Roll and Ross 1986), each factor symbolized by a subscripted F, for which different stocks have different sensitivities, or β_s, along with uncorrelated firm-specific components, the ε_s which contribute negligible variance in well-diversified portfolio. The theory assumes that each stock's (asset's) price/return is influenced by several independent factors. The central thesis of the APT is that more than one systematic factor affects the long-term average returns on financial assets. The problem with this is that the theory in itself provides no indication of what these factors are, so they need to be empirically determined. That is, the theory itself does not tell the investor what these factors are for a particular stock or asset. Therefore, the real challenge for the investor is to identify three items: Each of the factors affecting a particular stock; the expected return for each of these factors; and the sensitivity of the stock to each of these factors. Rather than measuring the performance of the market, Arbitrage pricing theory directly relates the price of the security to the

fundamental factors driving it. The extant literature suggests that a wide range of factors may be relevant. However, in emerging markets, there is argument that not all of these variations are either relevant or appropriate (Bilson, et al., 2000).

Multi-index models are based on the fact that variations in share prices and returns can be traced to other common factors such as industry influences or interest rates. Rutterford (1993) is of the view that multi-index models are generally derived by putting in possible explanatory factors such as industry or interest rate indices and seeing how well the data can be explained. He further stressed that historic data are used to calculate the coefficient of the equation and the equation can then be used to forecast expected return, as with the CAPM.

The main empirical strength of the APT is that it permits the researcher to select whatever factors that provide the best explanation for the particular sample at hand (Groenewold and Fraser, 1997). Additional research has indicated that more than four factors are priced (Cho, Elton and Gruber, 1984). Others contend that the number of securities in the portfolios determines the number of factors that are placed (Dyrymes, Friend and Gultekin, (1987).

The lack of agreement about the appropriate number of factors is not as important as the fact that more than one factor has been found to be statistically significant in pricing of assets. This raises serious questions about the traditional CAPM which depends on one factor, (market model of Sharpe, 1964).

The Arbitrage Pricing Theory has three pricing identifications: the Factor Likelihood APT (FLAPT) model – (statistical approach), the Pre-specified Macroeconomic Variables APT (PMVAPT) model - (observable variable approach) and the fundamental factor models (FFAPT) (DeFusco, *et al.,* 2001). While the FLAPT provides intuitive linear relationship between expected return and asymptotically large latent factors, the PMVAPT shows a relationship between expected return and a set of randomly selected macroeconomic variables. In fundamental factor models, the factors are attributes of stocks or companies that are important in explaining cross-

sectional differences in stock prices. Among the fundamental factors that have been used are book value to price, market capitalization, price-earnings ratio, and financial leverage. PMVAPT is an avenue of empirical research that offers hope of yielding interpretable results hence observable variables approach. The popular opinion of the FLAPT is that the latent factors (the unobservable market factors) explain variations in asset return better than the CAPM beta factors; therefore, in an ideal capital market there are some risk factors which investors cannot observe yet they command risk premium.

The revolutionary contribution of the theory of arbitrage, according to Cvitanic and Zapatero (2004), was the realization that the absence of arbitrage implies a unique price for the claims (securities) that can be replicated in the market. Perhaps equally important for practical applications, the theory of arbitrage pricing (or pricing by no arbitrage) has developed methods for computing this unique price of a security, as well as for hedging risks of holding a position in a security. However, the focus of this study is directed to the FLAPT which is proposed, developed and introduced to the frontier of core finance by Ross (1976, 1977) and Roll and Ross, (1980).

Arewa and Nwakanma (2013) opined that Ross' empirical proof of the FLAPT model is an indication that the linearity assumption of the model is a necessary condition to attain equilibrium in the market where investors arbitrage to take advantage of price differentials in order to maximize their utilities. Therefore, investors hold arbitrage portfolios that allow them to maximize return by varying the proportions of their assets but leaving the total investible income unchanged.

The popular opinion of FLAPT is that the latent factors or the unobservable market factors explain variations in asset return better than the CAPM beta factors, therefore in an ideal capital market there are some risk factors which investors cannot observe yet they command risk premium. The empirical testability of the FLAPT begins with the work of Gehr (1975). He employs Principal Component Analysis (PCA) method to extract the common factors and then regresses them against average return; and finds that only one factor is significant in explaining asset return while Ross and Roll (1980) test provides evidence for three priced factors. The beauty of this model is that it helps to

reveal the market risks that cannot be identified using the CAPM and its subsequent versions.

Statement of the Problem

The research findings with regard to the suitability of the Arbitrage Pricing Models (APM) in explaining stock prices have shown conflicting results across countries (e.g. Shanken, 1982; Carr and Madan, 2005; Kristjanpoller and Morales, 2011) Dobarati and Chawla, 2012; Nkechukwu, et al. 2013; Inyiania and Nwoha, 2014), and this has brought to question the fairness or the empirical applicability of APT models in the Nigerian Equity Market. Specifically, findings of some research on developing economies have been inconsistent (Pooya, et al. 2011; Arewa and Nwakanma, 2013; Ouma and Muriu, 2014).

In attempt to resolve the foregoing controversies, this study therefore considered 50 stocks (see appendix 1A) for statistical analysis and their interaction with equity risk premium. Thus, this study addresses the need and attempt to fill the gap in empirical literature on the applicability of the Factor Likelihood Arbitrage Pricing Models in determining stock prices in Nigerian equity market.

Aim and Objectives of the Study

The aim of this study is to investigate whether volatility in the latent (unobservable) factors affect the stock prices or not; therefore intends to achieve the following specific objectives:

1. To investigate if the factor-likelihood arbitrage pricing model is empirically applicable in Nigerian equity market.
2. To investigate whether the Nigerian equity market has the absorptive capacity for traded stocks using the factor-likelihood arbitrage pricing model.

Research Questions

In view of these objectives the following research questions are addressed:

1. To what extent is the factor likelihood arbitrage pricing model empirically applicable in Nigerian equity market?
2. To what extent does the Nigerian equity market exhibit absorptive capacity for traded stocks using the factor likelihood arbitrage pricing model.

Hypotheses

The study hypotheses are stated in the null form:

1. The factor likelihood arbitrage pricing model is not empirically applicable in Nigerian equity market.
2. The Nigerian equity market does not exhibit absorptive capacity for traded stocks using Factor Likelihood Arbitrage Pricing Model.

Significance of the Study

Investors and Financial Analysts: The outcome of a study focusing on the identification of return generating factors and to the extent of their influence on share prices, will be a tool for investment analysis in the hands of investors, portfolio managers and mutual funds managers who are mostly concerned with changing share prices.

Policy makers/Corporate governance: As every company management tries to maximize the wealth of the shareholders, a clear idea about the return generating variables and their influence will help management to develop various policies to maximize the wealth of the shareholders.

Researchers: The study will provide more insight into the effects of various unobservable variables on stock returns in anticipation of increasing the conclave of empirical evidence in this regard. The result of this empirical research will help the reader to understand whether the movement of stock prices of the Nigerian Stock Exchange is subject to some latent variables changes.

Scope of the study

The scope of this study which encompasses fifty stocks traded on the floor of the Nigeria equity market captures the impact of latent factors on stock prices in Nigerian Equity Market using monthly data between 2002 and 2016.

Limitations of the study

The following are the major limitations of this study:

(1) The data used are secondary, and their validity and reliability may not be within the powers of the researcher.

(2) The use of historical data may not be a good predictor of future actual prices.

LITERATURE REVIEW

Theoretical Framework

The main idea behind the Ross (1976, 1980) Arbitrage Pricing Theory is that more than one systematic factor affects the long-term average returns on financial assets. The theory assumes that each stock's (asset's) price/return is influenced by several independent factors, and therefore provides an alternative theoretical pricing model to the CAPM (one-factor model) from which a partial equilibrium asset pricing model could be obtained.

The derivation of the APT pricing equation is rooted on two major assumptions: firstly, that there is perfect competition in the capital markets, and secondly, that investors are rational economic agents who always prefer more wealth to less wealth under the context of certainty. Thus, according to Ross (1976), Hubermann (1980), Chen (1980), etc., the return generating process of the APT specification can be expressed as:

$$R_i = C_0 + \beta_i \delta_1 + \beta_j \delta_p + \cdots + e_j \quad (1)$$

Where;

R_j is the return on security i

β_i is defined as the sensitivity of security i to movements in the common factor δ_1

$E(e_j) = 0$

$\mathrm{Cov}(\delta_1, e_j) = 0$

$\mathrm{Cov}(e_i, e_j) = 0$

$\mathrm{Var}(e_j) = \delta^2 < \infty$

It is theoretically assumed that investors consider all assets in a capital market as a set of arbitrage portfolios, which gave them opportunity to rationalize their wealth across array of competitive stocks but their total wealth remained unchanged. Ross (1976) critically observed that if returns are generated by equation (1), then a pricing equation such as equation (2) can directly follow from the orthogonality of risk and return of investment proportions.

$$R_i = C_0 + \lambda_1 \beta_1 + \lambda_2 \beta_2 + \ldots + \lambda_p \beta_p \quad (2)$$

Equation (2) states that the expected return on any asset is linearly related to the sensitivity or covariance of the asset return with the p common factor. Hence, there is a functional similarity between equations (1&2), and if $p = 1$ then CAPM and APT have identical pricing implications.

Few relatively empirical tests of the APT have been performed to date, which have clearly indicated that experimental design of the APT is still emerging. Some of these tests are centered in advanced markets of American, European, emerging Asian countries and very few African countries.

Conceptual Framework

In an ideal capital market there are some risk factors which investors cannot observe yet they command risk premium. These unobservable factors are not directly measurable (Chawla and Sondhi, 2016) but are essentially hypothetical constructs that are used to represent variables (Cattel, 1973; Hardle, et al. 2016). In order to identify an underlying structure or pattern beneath a set of multivariate data that might explain the mutual correlative relation, principal component analyses (PCA) are employed (Fabozzi, Focardi and Kolm, 2006). This factor analysis which uses mathematical procedure for the simplification of interrelated measures to discover patterns in a variable (Child, 2002) operates on the notion that measurable and observable variables can be reduced to a fewer latent variables (without loss of information) that share a common variance, and are unobservable (Udofia, 2011; Bartholomew and Moustaki, 2011).

The tests of the Factor Likelihood APT are conducted on the individual securities returns rather than groups and then, the factor analytic techniques are employed to derive proxies for the APT factor risk.

Figure 2.2.1: Concept Mapping

The broad purpose of factor analyses is to summarize data so that relationships and patterns can be easily interpreted and understood. It is normally used to

regroup variables into limited set of clusters based on shared variance. Hence it helps to isolate constructs and concepts. Attempting to discover the simplest method of interpretation of observed data set is known as parsimony, and this is essentially the aim of factor analysis (Harman, 1976).

The two main factor analysis techniques are Explanatory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). CFA attempts to confirm hypotheses and uses path analysis diagrams to represent variables and factors, whereas EFA tries to uncover complex patterns by exploring the data set and testing predictions (Child, 2006). We employ the EFA because, according to DeCoster (1998), EFA is used when a researcher wants to discover the number of factors influencing variables and to analyze which variables go together. A basic hypothesis of EFA is that there are common latent factors to be discovered in the dataset, and the goal is to find the smallest number of common factors that will account for the correlations (McDoonald, 1985).

Empirical Review

Based on the two steps: that the Factor Likelihood APT are conducted on the individual securities returns rather than groups; and then, the factor analytic techniques are employed to derive proxies for the APT factor risk, Gehr (1975), collected 30 years monthly securities' returns data from the CRSP tape. He adopts the Principal Components Analysis (PCA) method to extract the common factors and the factors are obliquely rotated. In the first step, he regress each industry index on the factor scores to extract the latent factor and their corresponding loadings. In the next step, he conducted Cross-sectional OLS regression to obtain the estimate of the coefficients in the APT model. His results show that only one factor appeared to be significantly priced over the complete 30 years period of investigation.

Roll and Ross (1980), otherwise known as RR have been seen to have performed the most comprehensive test of the APT to date. They conduct the following experiments for each of the groups using daily arithmetic returns adjusted for all capital changes and dividend payments.

1. They compute the covariance matrix for the time series sample for each of 30 securities covering the period of their analysis.

2. They employ Maximum Likelihood Factor Analysis (MFA) technique to extract the number of factors and the corresponding factor loading.
3. Finally, they regressed the factor loading matrix on the average securities returns to provide estimates of the factor risk premier which are evaluated for significance.

In order to test the validity of the systematic risk hypothesis, they repeat the cross sectional regression by importing the standard deviation of returns into the APT model. Their results indicate that out of the four factors being priced cross sectionally, three factors are significantly priced. Thus, their findings provide support to APT and empirically distinguish it from the CAPM on the basis of the pricing equation.

Brown and Weinstein (1981) attempt to replicate part of Roll and Ross (1980) empirical findings based on an alternative method. They discover that a 5 factor return generating process is not evident in any of the grouped securities. Also, the cross-sectional pricing results indicate that the average returns are not consistent with the APT framework for the five or even fewer factors. They finally note that their results are slightly sensitive to normality due to the surprising sensitivity of the APT evidence to the test method or methodology.
Reinganum (1980) also uses alternative methodology to test the APT's validity over time. His test requires that the APT explains the size anomaly which arises from the market efficiency studies that use the equilibrium market model. However, it is noted that Reinganum could not resolve the problem of size normality using the APT methodological framework. it was discovered that the use of more complex return generating model does not do better than the parsimonious one factor model related to CAPM.

Connor and Korajczyk (1986) employ the Principal Component Analysis (PCA) proposed by Chamberlain and Rothchild (1983) and document five factors explaining the asset returns.

Kryzanowski and To (1983) tested APT on the Canadian data and discovered that on the average, the number of factors explaining returns remain approximately the same across various samples of the same size and across

various time intervals, except that the numbers of significant factors increase with group size.

Dhankar and Esq (2005) analyze APT in the Indian stock market using monthly and weekly returns for the period, 1991-2002 and show that the APT with multiple factors provide a better explanation of risk-return relationship than CAPM which used beta as the single measure of risk.
Mohseni (2007) applies the APT on selected firms in the Tehran Stock Market (TSE)

Knowledge Gap

A survey of related literature show that studies on the FLAPT are centered on advanced and Asian countries neglecting most of the African countries particularly Nigeria, and those who made attempts in Nigeria, for example, Asaolu and Ogunmuyiwa (2011) and Izedonmi and Abdullabi (2011), to shrink this gap failed to subject their studies to two-pass regression technique and also their studies were based only on macroeconomic variables. This paper, therefore, studies the empirical application of the Factor Likelihood Model of the arbitrage pricing theory in the Nigerian Equity Market, subjecting it to two-pass regression, thereby finding the effects of latent factors on investors in the pricing of financial assets.

METHODOLOGY

Research Design

The study employed the survey research design in conjunction with econometric procedure. The econometric model in the data analysis is consistent with the studies done by Gehr (1975), Ross (1976), Roll and Ross (1980, Arewa and Nwakanma (2013), etc. The study use investigative econometric research design which undertakes the examination of a data-set, and determine potential relations between ***variables*** using monthly data.

Population

The population of this study comprises all the stocks quoted in the Nigerian equity market.

Sample size

Theoretically, APM is testable for any subset of the market. For the present study, closing share prices of fifty (50) companies listed in the Nigerian Stock Exchange are collected on a monthly basis. The companies are selected on the basis of certain criteria: (1) the companies continuously constituted the NSE share index; and (2) traded at least for a period of three years. Convenient sampling in conjunction with random sampling technique was used to select the 50 stocks.

Data collection Method

The study is based on secondary data. Time series of share prices data pertaining to these selected companies are considered on the basis of the criteria comprising of the characteristics of the economy, economic significance and its relation with systematic risk. All these variables selected have some impact on the future cash flows or discount rate of an organization. Data related to Nigerian economy for this study are collected from the official publication and websites of Government of Nigeria, Central Bank of Nigeria (CBN) Statistical Bulletin, and Nigerian Stock Exchange Fact book (various issues).

Model Specification

Factor Likelihood Arbitrage Pricing Model is specified. The Principal Component Analysis (PCA) gives the loadings of the market betas in the cross-sectional-factor likelihood (statistical) APT. The PCA is given as follows:

$$R_i=\beta_{i1}F_1+\beta_{i2}F_2+...+\beta_{in}F_n+\lambda\mu_i \quad (3.1)$$

Where R_i is the i^{th} security returns, $\beta_{i1}, \beta_{i2}, \ldots \beta_{in}$ are the latent or unobserved systematic risks, $F_1, F_2, \ldots F_n$, are the associated common factors and μ is the specific factor. Therefore, the cross-sectional APT pricing identification takes the following format:

$$\bar{r_t} = c_0 + \sum_{i=j}^{n} c_i\beta_{ij} + z_t; z_t \quad GWN\ (0, h) \quad (3.2)$$

Equation (3.2) is in compacted form and therefore it can be expanded as follows:

$$\bar{r_t}=c_0 + c_1\beta_1 + c_2\beta_2 + ...+c_n\beta_{in} + z_i \quad (3.3)$$

Where $\bar{r}$ represents the mean or average return, c_1 is the regression constant and z_i is the disturbance term which follows unconditionally Guassian distribution pattern with zero mean and constant variance.

RESULTS AND FINDINGS

In this section, we compute the descriptive statistics of the specified variables at the firm level and the values of the statistics are presented as follows:

Table 4.1: Descriptive Statistical Values of Randomly Selected 50 Stocks' Returns

Stock	X1	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X2
Mean	0.0045	1.3402	0.37	3.9364	0.601	0.8125	0.21775	0.3132	0.40335	3.811	2.914	-0.1981
Median	0	0	0	-0.0062	0	0	0	0	0	6E-04	0	0
Maximum	0.89	102.8	24	429	35.291	77.4	21.6244	20.42	32.6	429	111.9	8.73
Minimum	-1	-1	-1	-1	-0.968	-1	-1	-1	-1	-1	-1	-8.66
Std. Dev.	0.1766	9.5661	2.32	36.376	3.7585	6.8339	1.99798	2.1685	3.02648	36.39	14.71	1.76153
Skewness	-1.628	9.1446	8.173	11.38	7.2274	10.194	9.11077	7.1472	9.08686	11.37	5.463	-0.3648
Kurtosis	20.544	93.034	79.1	133.21	60.306	113.06	95.1706	59.827	93.2264	133.1	33.62	15.5642
Jarque-Bera	1883.8	49940	35843	103373	20666	74126	52229.1	20316	50120.6	1E+05	6254	937.146
Probability	0	0	0	0	0	0	0	0	0	0	0	0

X20	X21	X22	X23	X24	X25	X26	X27	X28	X29	X3	X30	X31	X32
2.3827	1.475	1.8075	4.066	3.062	0.9722	2.599	14.491	0.992	1.4668	0.01295	1.0228	0.2455	1.4529
0	0	0	0	-0.026	0	0	0	0	-0.002	0	0	0	0
176.78	187.9	203	353	249	45.667	158.6	1959	67	139	2.08	77	9.02	69
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
16.664	15.86	17.305	33.83	23.84	5.9372	17.69	164.38	6.515	12.894	0.39429	7.8301	1.4588	8.1234
8.9195	11.56	11.241	9.13	9.003	6.1762	7.224	11.78	8.46	9.5143	1.62679	8.4697	4.5211	6.0424
88.753	136.2	130.61	88.42	87.35	41.408	56.11	139.85	80.47	96.836	11.5709	76.155	23.557	42.743
45391	1E+05	99345	45148	44019	9630.9	17927	114099	37199	54239	497.274	33362	2984	10210
0	0	0	0	0	0	0	0	0	0	0	0	0	0

X33	X34	X35	X36	X37	X38	X39	X4	X40	X41	X42	X43
0.2749	6.95735	0.47036	3.3535	2.6578	1.447	1.0678	0.348	2.5631	0.978	2.2009	4.838
-0.00691	0	-0.0009	-0.0059	0	0.0058	0.0043	0	0	0	0	0
14.7273	937.948	36.16	331	242.9	96.727	61.862	19.78	147.43	99	249	321.34
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1.94771	78.7534	3.94102	28.56944	22.137	9.64	6.2514	2.1231	15.296	8.643	21.041	32.413
6.03772	11.7581	8.02307	10.83905	9.7628	8.3719	7.7834	6.8066	7.4414	10.58	11.498	8.2355
41.7999	139.494	67.8427	123.7799	102.11	76.821	69.715	55.785	63.681	118.8	135.21	74.289
9769.9	113503	26400.5	89091.48	60375	33902	27768	17582	23097	81938	106551	31674
0	0	0	0	0	0	0	0	0	0	0	0

X45	X46	X47	X48	X49	X5	X50	X6	X7	X8	X9
1.558	2.5635	0.685	1.36725	1.0443	0.362	2.181	0.293	0.083	1.8467	2.899
-0.007	0.0028	0	0	0	0	0	0	0	0	0
123.56	252.52	73.05	90.5094	47.561	34.34	146.54	18.35	9.333	94.36	319
-1	-1	-0.997	-1	-1	-1	-1	-1	-1	-1	-1
11.581	22.373	6.252	8.33686	5.8699	3.328	14.93	2.028	1.044	11.082	27.149
9.0309	10.306	11.08	9.10224	6.2444	8.54	8.0427	7.06	6.873	7.285	11.281
90.659	112.72	128.3	94.599	42.956	82.27	71.426	55.96	56.99	57.636	131.35
47395	73740	95803	51603.8	10369	38908	29233	17773	18365	18918	100479
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Source: E-views 9

Key									
7-Up	x1	Diamond Bank	x13	Mbenefit	x25	Total	x37	Wema	x49
Academy	x2	Dunlop	x14	Mobil	x26	UACN	x38	Zenith	x50
Access	x3	Evansmith	x15	Nahco	x27	UAC Prop	x39		
Berger	x4	FBNH	x16	Nascon	x28	UBA	x40		
Bocgas	x5	FCMB	x17	NB	x29	UBN	x41		
Cadbury	x6	Flourmill	x18	Neimeth	x30	Unilever	x42		
CAP	x7	Guaranty	x19	Nestle	x31	Unity Bank	x43		
CCNN	x8	Interbrew	x20	Nigerins	x32	UPL	x44		
Cileasing	x9	J. Berger	x21	Oando	x33	UTC	x45		
Conoil	x10	John Holt	x22	Okomu Oil	x34	Vita Foam	x46		
Continsure	x11	Livestock	x23	Presco	x35	Wapco	x47		
Cutix	x12	Maybaker	x24	Prestige	x36	Wapic	x48		

An overview of table 4.1 indicates that all the 50 companies have positive return except Academy Press that exhibits -0.198 mean return. This simply means that with the exception of Academy Press, the returns of each of the sampled companies display increasing tendency over time. Some of the average returns are negligibly small to attract investments. However, Nahco Nigerian PLC has the highest mean return approximately 14.50, followed by Okomu Oil with average return of 6.96 while 7up has the smallest positive mean return (0.005) among the companies. This suggests that Okomu Oil and Nahco appear fair in terms of return generation. This may likely command the interest of investors.

Also, Okomu Oil and Nahco have the highest maximum returns 937.9 and 1959 respectively. This may account for the reason, these two companies manifest the highest standard deviation and as such they are the most volatile stocks. Besides the stocks of 7up and Academy Press (which are negatively skewed), the other 48 stocks are positively skewed. But, all the 50 stocks are leptokurtic with very large tails and asymptotic JB values. Since the p-values of the JB statistics are respectively less than the alpha value at 1 percent, the null hypothesis of normality is rejected with 99 percent confidence. Thus, these stocks are characterized with asymmetry, fat tail and they do not follow Gaussian process. The asymmetric nature of these stocks is shown in figure 4.1:

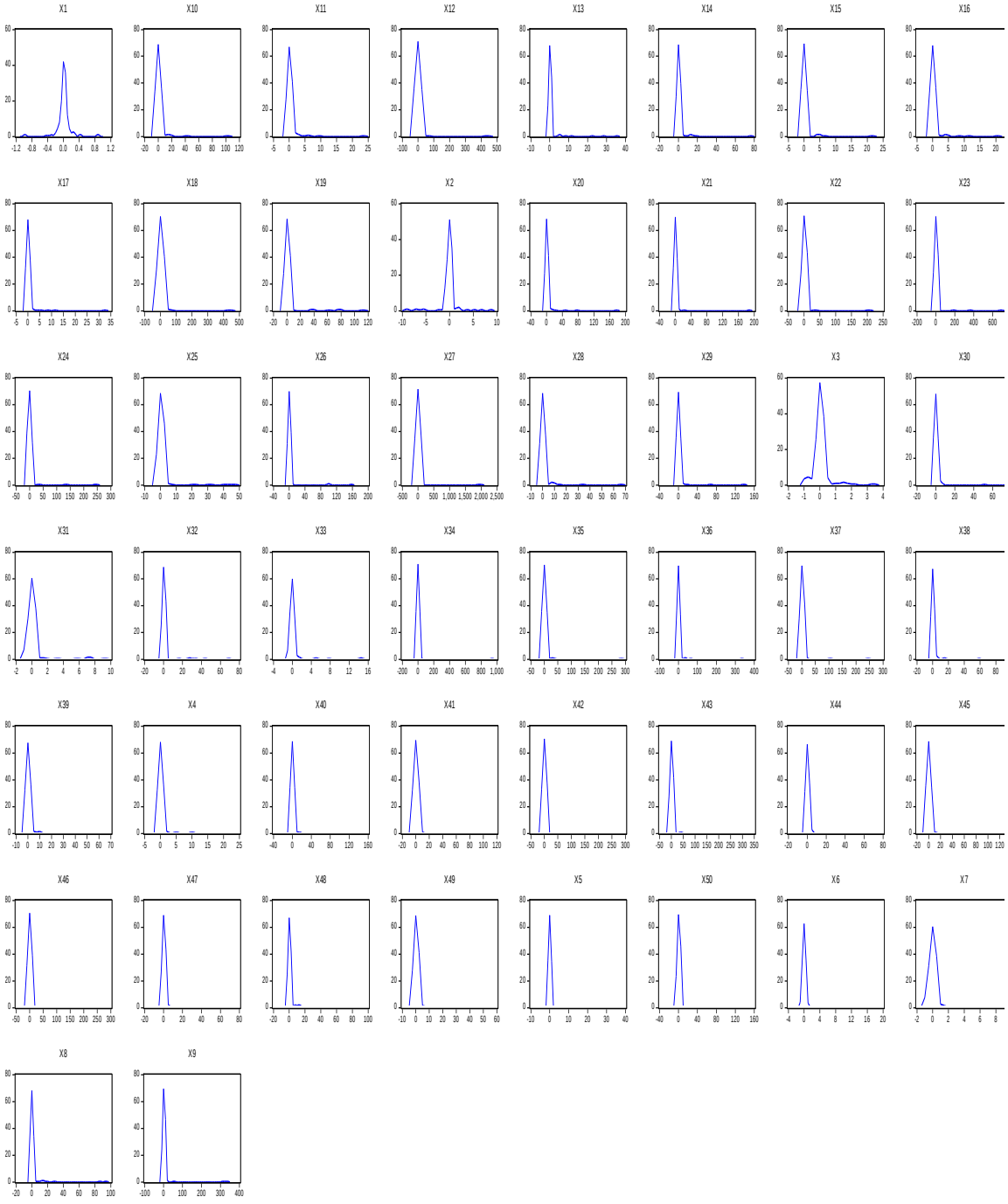

Figure 4.1: Eviews 9- Asymmetric Nature of the selected Stock Returns

The histogram polygons above reveal that only the stock returns of 7up and Academy are negatively skewed or skewed to the left. Every other stock return skewed to the right and this is one of the main characteristics of stocks in less developed or emerging markets. We can see from the polygons that all the tails are very large either to the left or right. This suggests that the distribution of these stock returns is peaked as shown in figure 4.2.

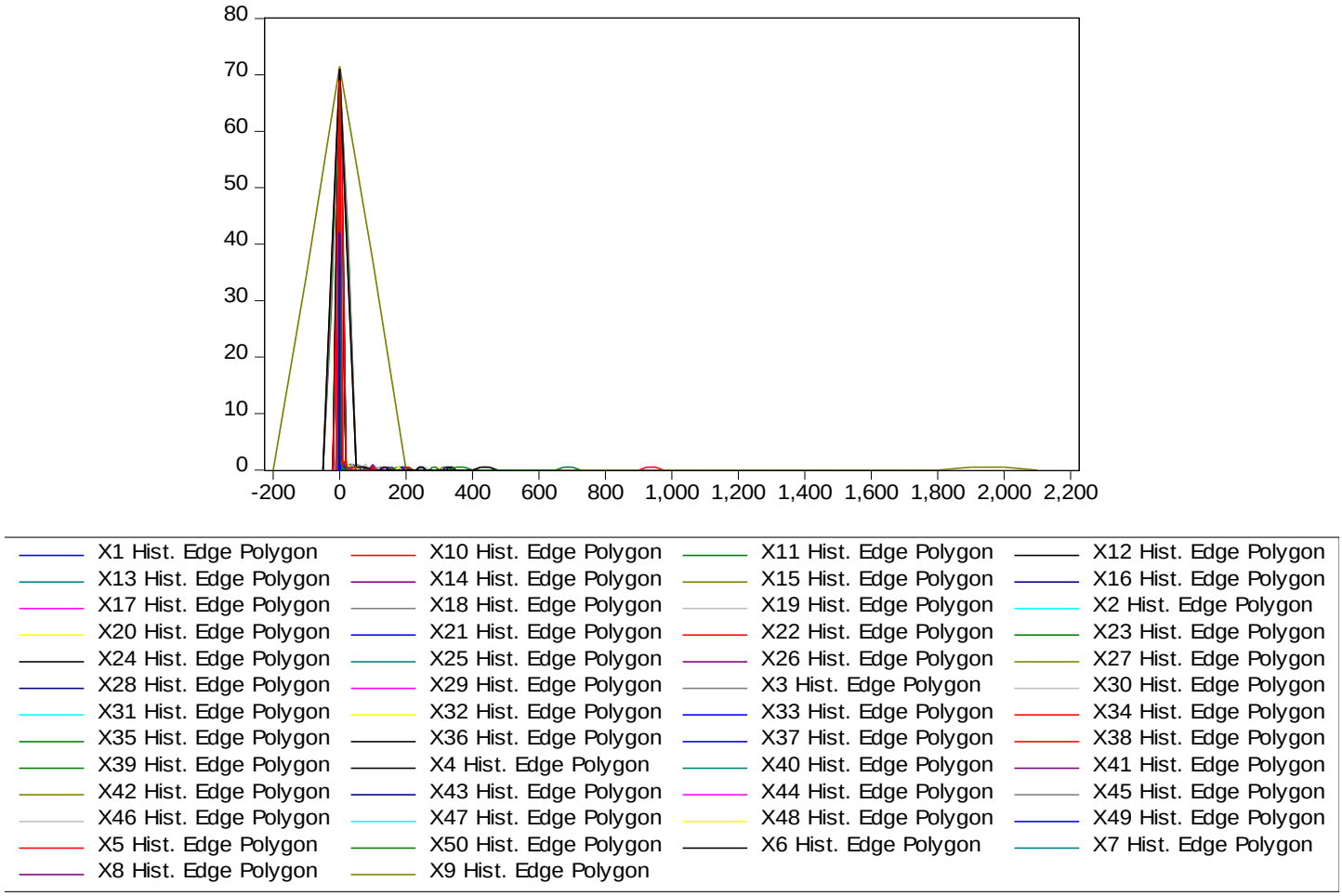

Figure 4.2: Eview 9- showing the Peakness of the selected Stock Returns

To further confirm the company that has the highest maximum return over the period of investigation, the researcher use a pie chart to illustrate this as shown in figure 4.3 below:

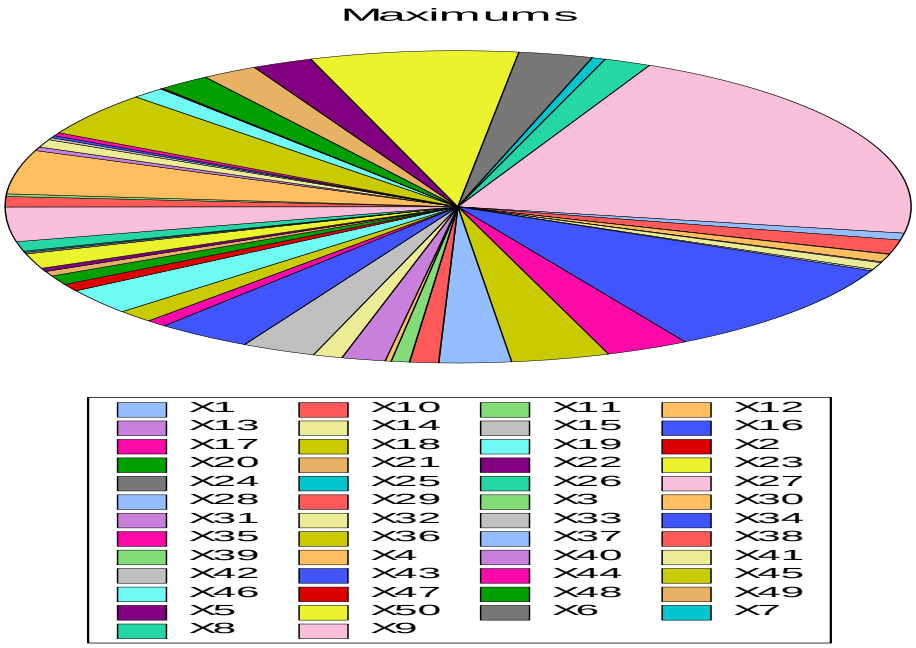

Figure 4.3: Pie Chart showing the Proportion of Returns displayed by the Selected Stocks

In the pie chart above the light purple and blue colors have the highest proportion of returns. The light purple color is associated with Okomu Oil, while the blue, Nahco. This, simply confirm that Okomu Oil has the highest Maximum return, followed by Nahco.

Tests for Empirical Applicability (fairness) and Absorptive Capacity of Arbitrage Pricing Models in Nigeria Equity Market

We examine the relationship between the variables – how closely related the stocks return are to the market index, and also examine whether Nigerian Stock Market has the ability to absorb most frequently traded stocks in the market. The principal method adopted here is the correlation analysis which expresses this relation using a single number. The correlation coefficient measures how closely related the two data series are. Theoretically, a correlation coefficient can have a maximum value of +1 and a minimum value of -1. A correlation coefficient greater than 0 implies a positive linear association between the two variables; when one variable increase (or decrease) the other also tends to increase (or decrease). A correlation coefficient of 0 implies no linear relation between the two variables. The correlation matrix is shown in Appendix 1A. It

is revealed in the matrix that virtually all coefficients are far below either "positive one or negative one". It suggests that the market still have capacity for new stocks to be traded; while if the correlation coefficient is close to 1, it would have suggested that the market has reached the marginal level and trading additional or other stocks in such market can't be possible or will be difficult. Since our results display weak correlation coefficient between the securities such that they lie far below ± 1, it therefore suggests that the market has significant capacity. This is a phenomenon of an emerging market. In advanced countries the coefficients is close to ± 1. Again, some of the coefficients are negative, implying that efficient diversification may hold. That the Nigeria Equity Market has absorptive capacity for traded stocks using Arbitrage Pricing Models means that the Equity market still has capacity to accommodate the trading of other stocks in the market.

Markowitz (1952; 1959) posits that if securities are negatively correlated or if correlation between two securities is negative, diversification is prudent. Conversely, if correlation coefficient is positive, diversification is imprudent. In a case where correlation coefficient is negative, the stocks move in opposite direction hence they are not affected by identical factors or forces.
Fairness is a technical term used in finance for applicability, adequacy, soundness, or significance. Theoretically, for APM to be empirically fair or applicable, at least one of the risk factors must command risk premium; in other words, must be significant. The Factor Likelihood Arbitrage Pricing Model is empirically applicable in the Nigeria Equity market because it is tested and valid as a model that can be used in pricing assets or stocks in the Nigeria Equity market in that some of the real factors command risk premium.

Pre-estimation Tests

We utilize the principal component factor analysis (PCA) to compute the latent factors and to select the spurious factors from the real factors in the factor likelihood APM before applying them to first pass regression. The results of the sample adequacy that pre-test the selection of real factor and loading of the factor is conducted using MSA technique. The results are reported in table 4.3.

Table 4.3: Result of Sample Adequacy

Variable	MSA	Variable	MSA	Variable	MSA	variable	MSA	Variable	MSA
X1	0.376	X19	0.34	X28	0.51	X37	0.60378	X46	0.5382
X10	0.894	X2	0.67	X29	0.374	X38	0.28862	X47	0.58
X11	0.684	X20	0.6	X3	0.642	X39	0.38722	X48	0.2357
X12	0.381	X21	0.16	X30	0.471	X4	0.96804	X49	0.3532
X13	0.447	X22	0.71	X31	0.686	X40	0.26311	X5	0.8825
X14	0.743	X23	0.39	X32	0.246	X41	0.77052	X50	0.2902
X15	0.861	X24	0.41	X33	0.649	X42	0.14244	X6	0.7896
X16	0.387	X25	0.55	X34	0.726	X43	0.24915	X7	0.8409
X17	0.058	X26	0.38	X35	0.734	X44	0.68307	X8	0.6097
X18	0.706	X27	0.85	X36	0.741	X45	0.48806	X9	0.3564
Keiser's MSA=0.516									

Source: E-views 9

Table 4.3 presents the values of individual MSA's and the aggregate MSA for the 50 selected stocks. Some of the individual stock MSA's are less than 50 percent (0.50). This would have made this sample inadequate but because the overall MSA is about 51.6 percent, then it implies that the sample size is just appropriate or adequate for principal component factor analysis. For the application of factor analysis, the value of Kaiser Statistics should be greater than 0.5. The value of Kaiser Statistics takes a value between 0 and 1. A small correlation value of Kaiser shows that correlation between variables cannot be explained by other variables. According to Kaiser's (1960) criterion, only the principal components having latent root greater than one, are considered as essential and should be retained. The factor selection results are presented in table 4.4

Table 4.4: Result of Factor Selection (Real and Spurious Factors)

No-of-factors	Value	Difference	Proportion	Cumulative value	Cumulative proportion
1	6.913152	1.352843	0.1383	6.913152	0.1383
2	5.560309	0.781036	0.1112	12.47346	0.2495
3	4.779274	0.725778	0.0956	17.25274	0.3451
4	4.053496	0.377501	0.0811	21.30623	0.4261
5	3.675995	0.698292	0.0735	24.98223	0.4996
6	2.977703	0.261243	0.0596	27.95993	0.5592
7	2.716459	0.124785	0.0543	30.67639	0.6135
8	2.591675	0.137594	0.0518	33.26806	0.6654
9	2.45408	0.408533	0.0491	35.72214	0.7144
10	2.045547	0.41453	0.0409	37.76769	0.7554
11	1.631017	0.153047	0.0326	39.39871	0.788
12	1.47797	0.08403	0.0296	40.87668	0.8175
13	1.39394	0.116358	0.0279	42.27062	0.8454
14	1.277581	0.109317	0.0256	43.5482	0.871
15	1.168264	0.060561	0.0234	44.71646	0.8943
16	1.107703	0.076813	0.0222	45.82416	0.9165
17	1.03089	0.215616	0.0206	46.85505	0.9371
18	0.815275	0.134857	0.0163	47.67033	0.9534
19	0.680417	0.252897	0.0136	48.35075	0.967
20	0.42752	0.105398	0.0086	48.77827	0.9756
21	0.322122	0.06408	0.0064	49.10039	0.982
22	0.258042	0.060838	0.0052	49.35843	0.9872
23	0.197204	0.056673	0.0039	49.55563	0.9911
24	0.140531	0.042112	0.0028	49.69616	0.9939
25	0.098419	0.033861	0.002	49.79458	0.9959
26	0.064559	0.016189	0.0013	49.85914	0.9972
27	0.04837	0.014787	0.001	49.90751	0.9982
28	0.033583	0.014555	0.0007	49.9411	0.9988
29	0.019028	0.010372	0.0004	49.96012	0.9992
30	0.008656	0.00164	0.0002	49.96878	0.9994
31	0.007015	0.002152	0.0001	49.97579	0.9995
32	0.004863	0.000324	0.0001	49.98066	0.9996
33	0.004539	0.00103	0.0001	49.9852	0.9997
34	0.003509	0.000329	0.0001	49.9887	0.9998
35	0.00318	0.000661	0.0001	49.99188	0.9998
36	0.002518	0.001054	0.0001	49.9944	0.9999

37	0.001464	0.000451	0	49.99587	0.9999
38	0.001013	0.000332	0	49.99688	0.9999
39	0.000681	7.14E-05	0	49.99756	1
40	0.000609	0.000143	0	49.99817	1
41	0.000466	2.52E-05	0	49.99864	1
42	0.000441	0.000166	0	49.99908	1
43	0.000276	2.42E-05	0	49.99935	1
44	0.000251	2.44E-05	0	49.9996	1
45	0.000227	0.000154	0	49.99983	1
46	7.28E-05	2.27E-05	0	49.9999	1
47	5.01E-05	2.24E-05	0	49.99995	1
48	2.77E-05	1.63E-05	0	49.99998	1
49	1.14E-05	4.37E-06	0	49.99999	1
50	6.99E-06	---	0	50	1

Eigenvalues: (Sum = 50, Average =1)

Source: E-views 9

Table 4.4 shows the Eigen values for about 50 factors and average Eigen value is by *a-priori,* unity (1). Any factor or variable with Eigen value less than 1 is spurious. Based on this assumption, we can see that after the seventeenth factor, the Eigen values become smaller than 1. Thus, we have about 17 real latent factors and 33 spurious factors. This is confirmed in figure4.5 below:

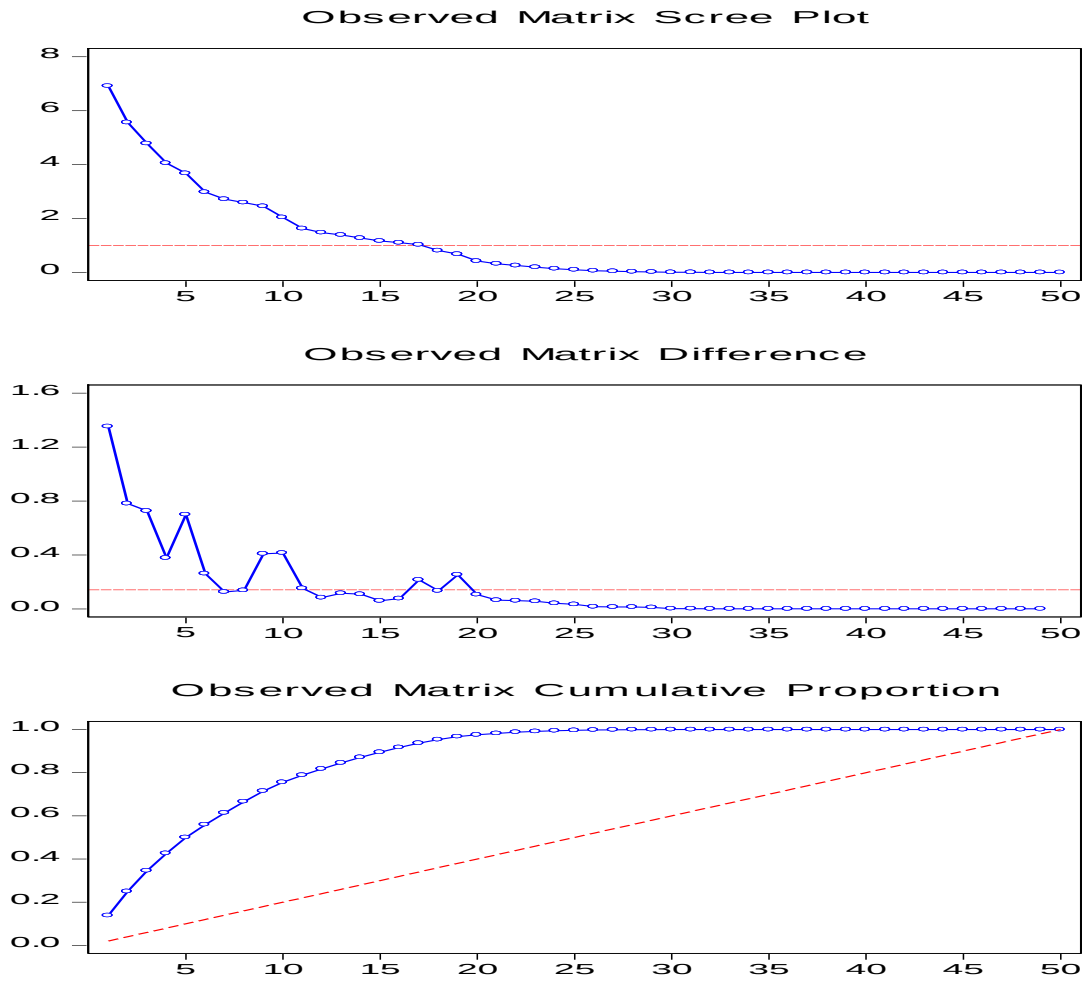

Figure 4.5: Eviews 9- Showing Real and Spurious Factors

The observed matrix screen plot indicates that the screen plot blue line cuts across the red line after the seventeenth factor, likewise, the difference matrix plot gives seventeenth real factors. The cumulative proportion plot shows that the blue line increases up to the seventeenth factor and thereafter, it does not significantly increase because the cumulative proportions are becoming smaller and equal. In a nutshell, seventeen factors are the real factors that are priced in the APT cross-sectional pricing identification. The loadings of these factors are presented in appendix two. From these loading it is clear that the latent factors are orthogonal among themselves but correlate with the observable variables. Since the latent factors are orthogonal, the assumption of strict exegoneity holds in the cross-sectional regression that gives the empirical validity of the factor likelihood APT.

Empirical Test of the Factor Likelihood APM

After, identifying the real factors from the spurious factors, we further examine whether average return can be explained by the APT real factors which are referred to as latent market/systematic factors. Seventeen real factors are identified and regressed cross-sectionally against the average return. The results are presented in table 4.5:

Table 4.5: Results of the Factor Likelihood APM

Variable	Coefficient	St-Error	t-stat	p-value
PC_1	-13.45884	14.82571	-0.907804	0.3715
PC_2	(5.507738)**	3.187305	1.728023	0.0946
PC_3	-0.080877	6.853533	-0.011801	0.9907
PC_4	1.548084	3.988578	0.388129	0.7008
PC_5	-3.000029	4.654210	-0.644584	0.5243
PC_6	-1.707814	2.821794	-0.605223	0.5497
PC_7	3.058919	2.682303	1.140408	0.2634
PC_8	(-5.063371)**	2.849982	-1.776633	0.0861
PC_9	-1.339736	4.141215	-0.323513	0.7486
PC_10	1.912685	2.460233	0.777440	0.4432
PC_11	0.592657	4.083071	0.145150	0.8856
PC_12	(5.951041)***	3.653405	1.628903	0.1142
PC_13	4.746981	3.663565	1.295727	0.2053
PC_14	-4.254033	4.262047	-0.998120	0.3265
PC_15	-3.057162	3.748406	-0.815590	0.4214
PC_16	-4.102291	3.212145	-1.277119	0.2117
PC_17	1.439148	4.265456	0.337396	0.7382
C	3.780189	2.380923	1.587699	0.1232
MA(1)	1.000000	9135.980	0.000109	0.9999
SIGMASQ	3.226879	712.6636	0.004528	0.9964

*Note the critical t-statistics using two tale at 5% and 10% are 1.69 and 1.30 respectively; ** denotes 5% significance and *** implies 10% significance.*

Source: E-views 9

We adopt autoregressive moving average (ARMA) maximum likelihood technique to estimate the APM specifications. This technique is used because it has the potential to deal with error in variables. From table 4.6 above, the confidents of the second and eighth factors correspond to t-values 1.73 and -1.78 respectively. These t-values are in absolute terms larger than the critical t-value (1.69) at 5 percent using two tale tests. This means these two factors are

significantly different from zero at 5 percent. Also, the coefficient of the twelfth factor associates with t-value (1.63) which is larger than the critical t-value (1.30) at 10 percent using two tale tests. Therefore, our findings reveal that out of the 17 latent factors priced, only 3 command significant risk premium. One of these three factors maintains inverse relationship with mean return while others are directly related. Investors who vary the proportion of their assets without necessarily increasing their investable funds are rewarded for taking market risks that are unobservable in nature. The *constant* term which is indication of risk free rate asset is not different from zero. This suggests that risk-free assets in the market do not command risk premium and an investor has two set of securities to invest on: riskless and risky assets.

Summary of Findings

The computed descriptive statistics of fifty (50) sample stocks indicated positive returns, except one (1). Although some of the average returns are negligibly small to attract investments. The closeness of these returns to market index (far below

± 1) suggests that the market still has the capacity to absorb new stocks; and the latent factors command risk premium.

CONCLUSION

We draw conclusions from the major findings and they are stated as follows:

- One of the study's major findings reveals that 17 latent real factors are identified and 3 of these factors are cross-sectionally priced. In view of this, we conclude that the factor likelihood APM is truly a multifactor model and empirically applicable in Nigerian equity market.
- Our findings further document that the statistical (latent) factors command risk premiums. We therefore conclude that any stock market investor in Nigeria is exposed to latent factor risks which cannot be eliminated by diversification.
- Since our results display weak correlation coefficient between the securities such that they lie far below ± 1, it therefore suggests that the market has significant capacity. Some of the coefficients are negative, implying that efficient diversification may hold; implying that the Nigeria Equity Market has absorptive capacity for traded stocks (capacity to accommodate the trading of other stocks in the market).

RECOMMENDATION

Our recommendations are drawn from the above conclusions:

- Based on the conclusion that investors are exposed to both latent and macroeconomic risk factors which they can neither reduce nor eliminate; we recommend that investors should hedge their portfolios using forward contract technique or any other appropriate method(s).
- Finally, we recommend that despite the pre-specified APM has gained influence both in advanced and emerging economies; investors should not neglect the statistical APM as an efficient discounting technique.

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APPENDIX 1A: 50 Sample Stocks (quoted in the Nigerian Equity Market)

1. 7-Up Bottling Company
2. Access Bank Plc
3. Academy Press
4. Berger Plc
5. Bocgas
6. Cadbury
7. CAP
8. CCNN
9. Cileasing
10. Conoil
11. Continsure
12. Cutix
13. Diamond Bank
14. Dunlop
15. Evan Smith
16. FBNH
17. FCMB
18. FLOUR Mill Guaranty Trust Bank
19. International Brewery
20. J. Berger
21. John Holt
22. Livestock
23. May & Baker
24. M. Benefit
25. Mobil
26. Nahco
27. Nascon
28. NB
29. Neimeth
30. Nestle
31. Niger Insurance
32. Oando
33. Okomu Oil
34. Presco
35. Prestige

36. Total
37. UACN
38. UAC
39. Prop
40. UBA
41. Union Bank
42. Unilever
43. Unity Bank
44. UPL
45. UTC
46. Vita Foam
47. Wapco
48. Wapic
49. Wema Bank
50. Zenth Bank

APPENDIX IB: CORRELATION MATRIX

	X1	X10	X11	X12	X13	X14	X15	X16	X17	X18
X1	1									
X10	0.012488	1								
X11	0.105563	-0.016766	1							
X12	-0.00293	-0.022086	0.031516	1						
X13	0.348561	0.401078	-0.054294	-0.020605	1					
X14	0.048358	-0.033312	0.090706	0.045714	-0.02823	1				
X15	0.084767	-0.05602	0.221832	0.029736	-0.091558	0.875341	1			
X16	0.135441	0.086681	-0.028044	-0.009926	0.289521	0.446431	0.363416	1		
X17	0.001515	0.11579	-0.049644	0.001146	0.023376	-0.050182	-0.04688	0.072458	1	
X18	0.140147	-0.025694	-0.016341	0.000726	0.082938	0.079772	0.049595	0.092947	-0.025356	1
X19	0.052807	0.595767	0.140496	-0.020003	0.285131	0.048665	-0.084414	0.289748	0.06266	0.202553
X2	-0.185819	-0.261551	-0.384609	-0.001636	-0.4115	0.077567	0.215993	-0.021852	-0.011499	-0.008783
X20	0.033051	0.143091	-0.009408	-0.01065	0.156309	0.00696	-0.013103	-0.058726	-0.023986	0.005647
X21	-0.01501	-0.023632	0.047381	0.040402	-0.043746	-0.014578	-0.056738	-0.058542	-0.042615	0.109537
X22	0.036519	-0.015441	0.138017	0.030346	-0.031972	0.942014	0.885947	0.454184	-0.045927	0.097144
X23	0.312809	-0.000862	-0.056597	0.035762	0.353199	0.064536	0.222387	0.075309	-0.015109	-0.002144
X24	-0.033647	0.793008	0.000356	0.045612	0.199696	0.097694	-0.020004	0.100823	0.105123	-0.016846
X25	0.088704	-0.009019	0.218153	0.036002	0.052749	0.432497	0.525609	0.202212	-0.030988	0.027847
X26	0.018639	-0.031763	-0.022249	-0.017188	0.0429	0.041787	0.036818	0.018547	-0.036579	0.739043
X27	0.143115	-0.018558	-0.031479	-0.007347	0.108644	-0.005956	-0.034376	0.064535	-0.016183	0.988275
X28	0.00635	0.147346	0.09118	0.131135	-0.004856	0.265008	0.206974	0.001503	-0.002108	-0.014734
X29	-0.00661	-0.010256	0.017788	0.910565	-0.010409	-0.011436	-0.03874	-0.038349	-0.009931	0.036189
X3	0.130898	0.266591	-0.117381	0.054741	-0.027863	-0.055175	-0.018641	-0.061338	0.050342	-0.209743
X30	0.04179	-0.02699	0.268482	0.036288	-0.019391	0.534299	0.466473	0.213771	-0.055754	0.072844
X31	0.173997	-0.072519	0.097632	0.461267	0.058756	0.064363	-0.029546	0.005751	-0.024711	0.512664
X32	0.043263	0.219928	0.520707	0.009565	0.071505	-0.017231	0.002106	0.052757	0.169107	-0.014873
X33	0.075862	0.640104	0.144696	-0.008405	0.170207	0.014601	0.005229	0.069185	0.067436	-0.054704
X34	0.137651	0.016138	-0.032889	-0.007337	0.105368	-0.020116	-0.048164	0.060481	-0.010485	0.986301
X35	0.026544	0.274829	-0.053882	-0.003428	0.325206	-0.0445	-0.045291	-0.079742	-0.036717	0.005233
X36	0.246075	-0.022511	0.049838	-0.005563	0.244949	-0.001462	0.00425	0.084458	-0.025239	0.958524
X37	-0.185075	0.05936	-0.01414	-0.011265	-0.009971	-0.0273	0.156354	-0.049978	-0.006113	-0.008005
X38	-0.010057	0.029089	0.329487	0.506236	0.081631	0.002066	-0.051893	0.026484	-0.011016	-0.020372
X39	0.04923	-0.009826	0.154433	-0.027646	0.125301	0.105424	-0.051733	0.027226	0.075728	0.084603
X4	0.046068	-0.029753	0.040654	0.150608	0.087793	0.776561	0.771358	0.340117	-0.04101	0.066095
X40	-0.167667	0.06093	0.052474	0.025756	-0.046762	-0.026792	0.123496	-0.068122	0.025211	0.033796
X41	0.065134	0.057372	0.087922	0.039706	-0.021808	0.938755	0.937236	0.43108	-0.028994	0.08529
X42	-0.002736	0.010829	0.002377	0.003176	0.025825	0.175354	-0.0035	0.118834	-0.017734	0.001048
X43	0.077856	-0.033262	0.516515	-0.00992	-0.016885	0.28913	0.221488	0.069331	0.042278	0.001178
X44	0.127991	0.186013	0.065868	0.024767	0.083951	0.431541	0.400527	0.254948	0.023891	0.790504
X45	0.008458	0.575519	0.060379	-0.006043	0.539643	-0.024209	-0.064324	0.012062	0.027062	-0.02496
X46	-0.056425	0.036007	0.0311	0.115989	-0.007471	0.191568	0.01329	-0.032408	-0.017785	-0.017725
X47	0.051331	0.020484	0.043505	-0.020313	-0.00839	-0.031825	-0.022484	-0.063269	-0.033103	0.105711
X48	-0.028514	0.0792	-0.059287	-0.020782	0.17664	0.128301	0.13012	0.75133	0.002245	0.071211
X49	-0.056726	0.602986	0.073017	0.113318	0.128192	0.096578	0.03494	0.084471	0.480252	-0.025324
X5	0.026827	-0.041685	0.786416	0.101673	-0.071798	0.054853	0.321858	-0.022388	-0.043516	0.00563
X50	0.156575	0.05182	0.823072	-0.019484	0.067735	-0.030069	0.12324	-0.025275	-0.044844	0.118519

X6	0.051115	-0.042892	0.03091	0.023287	-0.083487	0.236835	0.115717	-0.019729	-0.001146	-0.027219
X7	0.26079	0.067775	0.007844	-0.086475	0.171665	-0.098841	-0.091775	-0.074177	-0.0099	0.537642
X8	-0.030846	0.024911	0.58636	0.005764	-0.026627	0.007421	0.295744	0.012898	-0.03342	-0.021044
X9	0.438919	0.031885	-0.041268	-0.003671	0.773195	0.027978	0.028767	0.159254	-0.006107	-0.008884

X19	**X2**	**X20**	**X21**	**X22**	**X23**	**X24**	**X25**	**X26**	**X27**
1									
-0.17272	1								
-0.038738	0.177136	1							
-0.024634	0.24566	0.132963	1						
0.017511	0.055031	-0.014626	0.005329	1					
0.004406	0.114219	-0.004302	-0.018662	-0.009253	1				
0.607956	-0.339558	-0.008963	-0.021924	0.008284	-0.007896	1			
0.218426	0.242776	-0.037783	-0.01682	0.419361	0.558313	0.002528	1		
0.365663	0.171036	0.016636	0.021401	0.003613	-0.025942	-0.009408	-0.036479	1	
0.211884	-0.060269	-0.012644	-0.00712	0.003191	-0.006207	-0.011886	-0.019726	0.746513	1
0.109147	-0.1414	-0.004994	-0.00252	0.066849	0.373328	0.553438	0.336465	-0.047475	-0.026112
-0.028684	0.121193	0.052799	0.41678	-0.014321	-0.017345	-0.015019	-0.027697	-0.010284	-0.010674
0.169154	0.04519	0.292173	-0.132252	-0.182216	0.216541	0.498323	0.036095	-0.098526	-0.187762
-0.001492	-0.1803	-0.008822	0.154095	0.685543	-0.009506	-0.019456	0.296998	-0.005874	-0.000521
0.141956	-0.203589	0.325036	0.014539	0.098697	-0.013146	0.116288	0.002044	0.351792	0.509014
0.285063	-0.409959	-0.035632	0.053484	0.111123	-0.022304	0.230255	0.207282	-0.016972	-0.022774
0.42747	-0.123617	0.24841	-0.04817	0.01974	-0.013978	0.560167	0.111435	-0.067215	-0.053778
0.236092	-0.067226	-0.007982	-0.007142	-0.009446	-0.013059	0.0227	-0.023649	0.744021	0.998893
-0.048344	0.089855	0.844988	0.153569	-0.033199	-0.039476	-0.020176	-0.068986	0.004607	-0.012696
0.205609	-0.135845	-0.01143	-0.010431	-0.000664	0.162489	-0.019719	0.032991	0.715391	0.972002
0.141393	0.39636	0.054198	0.01103	-0.008527	-0.01804	0.036648	-0.009493	0.423853	-0.007948
0.459024	-0.030802	-0.027549	0.028552	0.012544	-0.011433	0.08083	0.459351	0.051984	-0.022683
0.615033	0.037327	-0.029335	-0.002592	0.013423	0.050841	0.015084	0.322549	0.472042	0.089441
-0.01994	0.14919	-0.031839	0.016539	0.763923	0.052472	0.085821	0.308795	0.14133	-0.005271
0.087243	0.443743	0.064655	0.4287	0.006834	-0.028228	0.005442	0.029291	0.373063	-0.016267
0.04539	0.162141	-0.025665	-0.027191	0.941674	0.217346	0.089738	0.588984	-0.032815	-0.005613
0.024735	0.050619	0.244023	-0.007864	0.027341	-0.019101	0.032254	-0.020794	0.017821	0.013563
0.382334	-0.178567	-0.026397	0.00739	0.197657	-0.016575	0.010815	0.096149	0.373582	-0.013432
0.293143	0.004654	-0.007394	-0.025379	0.470174	-0.02833	0.122401	0.195668	0.568682	0.756641
0.313341	-0.161437	0.326897	-0.014378	-0.026675	0.014712	0.248344	0.176954	-0.018626	-0.015336
0.095725	-0.239887	0.012136	-0.01654	0.006031	0.009604	0.47962	0.002481	-0.024939	-0.014159
-0.008287	0.13851	0.902115	0.0732	0.007708	-0.029512	-0.034311	-0.012888	0.073296	0.089696
0.321041	0.192128	0.135825	-0.019835	0.106932	0.085461	0.091875	0.101572	0.250286	0.0666
0.39157	-0.173445	0.012279	-0.013499	0.042691	-0.004654	0.707217	-0.003864	-0.045054	-0.026528

-0.024487	-0.182309	-0.012002	-0.003638	0.105932	0.010166	-0.043512	0.058678	0.191139	-0.001965
0.094679	-0.35408	-0.027165	0.008556	-0.020163	0.015566	-0.021628	0.141706	0.074011	0.12289
-0.080056	0.122936	0.787277	0.075362	0.092845	0.004793	0.150596	0.023422	-0.040246	-0.047348
0.121462	-0.019523	0.680729	-0.036482	-0.084466	0.021528	0.02063	-0.046562	0.39127	0.551388
0.060969	0.026218	0.071429	-0.012226	-0.017975	0.158943	0.09146	0.111527	0.272262	-0.020323
0.053931	-0.293906	0.004218	-0.013614	-0.004654	0.62065	0.024028	0.094772	-0.020195	0.005316

X28	**X29**	**X3**	**X30**	**X31**	**X32**	**X33**	**X34**	**X35**	**X36**
1									
0.003604	1								
0.532786	-0.050209	1							
0.008819	0.012413	-0.22648	1						
0.247067	0.343267	0.183257	0.351907	1					
0.044822	-0.030885	-0.010855	0.580764	0.266988	1				
0.122759	-0.045141	0.211239	0.018009	0.091686	0.203272	1			
-0.020121	-0.010889	-0.169677	-0.007445	0.509759	-0.010869	-0.027707	1		
-0.004779	0.080648	0.203122	-0.049478	0.201663	-0.060729	0.132826	-0.010861	1	
0.017498	-0.015015	-0.176582	-0.002151	0.50322	-0.001653	-0.044382	0.967924	-0.022753	1
0.027012	-0.005157	0.11584	-0.011117	0.015659	-0.025223	-0.046016	-0.012448	0.066405	-0.013734
0.023098	0.454662	0.01384	0.117331	0.310004	0.367204	0.195354	-0.019547	-0.040535	-0.031134
0.014901	-0.028129	-0.071547	-0.011928	0.039136	0.102943	0.019695	0.088278	-0.0224	0.092989
0.204644	0.097688	-0.038638	0.434353	0.115586	-0.030106	0.046342	-0.020406	-0.044806	0.016777
0.003922	0.181265	-0.034965	0.10782	0.005036	0.040337	0.138638	-0.020289	0.067482	-0.022393
0.232841	-0.018796	-0.052149	0.515532	0.004633	8.23E-05	0.081162	-0.015375	-0.043209	0.012856
-0.017255	0.047802	-0.002831	0.071894	-0.062804	-0.006676	-0.039201	0.009124	-0.004462	0.004541
0.048297	-0.012592	-0.071869	0.081849	-0.055238	0.157886	-0.02995	-0.017114	-0.035109	0.034912
0.030078	-0.002838	-0.245174	0.281495	0.41852	0.001933	0.300566	0.754954	-0.022886	0.734442
0.053352	0.028825	0.092671	-0.024502	-0.06981	0.167364	0.188875	-0.008036	0.66295	-0.022965
0.853335	-0.002121	0.436401	-0.015961	0.367696	-0.02342	0.058651	-0.01505	0.034344	-0.010961
-0.049702	-0.011605	0.276832	0.098788	0.502706	0.082103	0.314325	0.098054	0.635744	0.08454
0.051111	-0.032849	0.089659	0.021278	0.028795	-0.013127	0.060432	0.070432	0.065281	0.065487

0.326603	0.068862	0.239482	0.00354	0.049589	0.153155	0.535005	0.000127	-0.033055	-0.033139
0.074389	0.071894	-0.036434	0.17941	0.046015	0.362339	-0.05141	-0.005589	-0.042951	0.084122
0.059311	-0.016416	-0.172778	0.007102	0.00183	0.289218	0.324756	0.120493	-0.0496	0.220577
0.320998	0.016279	0.428763	0.037265	0.370289	-0.058044	0.247692	-0.045201	0.439848	-0.046436
-0.070543	-0.09242	0.189361	-0.05725	0.557148	0.005473	0.223611	0.560547	0.463174	0.561945
0.284489	-0.026132	0.194139	-0.04252	-0.010587	0.183366	-0.013925	-0.021561	0.033379	0.066095
0.060111	-0.019431	-0.001221	0.017298	0.080407	-0.006485	0.073434	-0.008303	-0.034286	0.206365

X37	**X38**	**X39**	**X4**	**X40**	**X41**	**X42**	**X43**	**X44**	**X45**
1									
0.008245	1								
0.095761	0.47705	1							
0.311772	0.046426	0.006229	1						
0.841212	0.053682	0.077814	0.295298	1					
-0.017157	0.010549	0.005102	0.744408	-0.011206	1				
0.020822	-0.012901	-0.017487	0.025031	0.003143	0.024837	1			
-0.009204	0.181003	0.720294	0.109105	-0.002959	0.15584	0.007003	1		
0.096557	-0.012527	0.075448	0.385461	0.174071	0.470166	0.00217	0.052167	1	
0.035387	0.289212	0.165879	-0.042406	-0.002473	0.01395	0.061734	0.02773	-0.000907	1
0.120259	0.023788	0.023531	0.191253	0.059113	0.050819	-0.017931	-0.001072	0.030864	0.015252
-0.017814	0.020798	-0.02014	-0.065104	0.006022	-0.037561	0.054234	-0.035386	0.082089	0.035839
0.262593	-0.012139	0.127678	0.138661	0.215089	0.103205	0.154289	0.11667	0.094628	0.006744
-0.039423	0.095231	0.010384	0.103982	-0.019074	0.105331	0.071996	0.024967	0.124578	0.16447
0.384054	0.055413	-0.013959	0.174963	0.349698	0.067533	-0.002405	0.451506	0.050055	-0.046428
-0.02213	0.163479	0.0787	-0.029132	0.146173	-0.003083	-0.020171	0.422202	0.254505	0.053325
-0.032147	-0.027763	-0.051644	0.125449	-0.014616	0.109978	0.478063	0.00894	0.001608	-0.037662
-0.088519	-0.04837	0.057185	-0.106122	-0.124596	-0.100049	0.068273	-0.009535	0.367	0.03178
0.61873	-0.011503	0.017595	0.195128	0.518437	0.030777	0.005846	0.351932	0.00597	-0.003305
-0.008329	-0.018778	0.054522	0.166569	-0.019597	0.036514	-0.003432	-0.005789	2.13E-05	0.002669

X46	**X47**	**X48**	**X49**	**X5**	**X50**	**X6**	**X7**	**X8**	**X9**

1									
-0.030312	1								
-0.014306	0.117331	1							
0.236828	-0.02051	0.084785	1						
-0.029633	-0.002187	0.126128	-0.049527	1					
-0.017065	0.004531	-0.036911	-0.048696	0.709367	1				
0.338328	0.754704	0.093719	0.141226	-0.026115	-0.021694	1			
-0.08189	0.794833	0.067843	-0.00697	-0.007049	0.087207	0.55907	1		
0.161599	0.027136	0.302857	0.020623	0.888586	0.562249	0.080235	0.005372	1	
0.020023	-0.021037	0.003149	0.027507	-0.02569	0.061069	-0.006143	0.108855	0.017659	1

Reference to this paper should be made as follows: Agbam, A. S. and C. Anyamaobi (2017), The Factor-Likelihood Models and the Arbitrage Pricing Theory in the Nigeria Equity Market. *Intl J. of Management Studies, Business & Entrepreneurship Research,* Vol. 2, No. 4, 2017, Pp 32-68