# Fama and French 3-Factor Model and Stock Prices: Empirical Evidence from Nigeria

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***Abstract***
*This study examined the effect of Fama and French 3-Factor model on stock prices in the Nigeria stock market. Time series data were sourced from Central Bank of Nigeria Statistical Bulletin from 1990-2021. Stock prices were modeled as the function of Capital market size, Market capitalization and Market turnover. The study multiple regression models to estimate the relationship that exists between monetary transmission channels and real sector growth. Ordinary Least Square (OLS), Augmented Dickey Fuller Test, Johansen Co-integration test equations, parsimonious vector error correction model and pair-wise causality tests were used to conduct the investigations and analysis. The study found that market turnover and capital market size have positive and significant effect on the stock prices in Nigeria stock market while market capitalization have negative and significant effect on the stock prices in Nigeria stock exchange, this implies that Fama and French three factor model have significant effect the stock prices in Nigeria stock exchange. From the findings, we conclude that Fama and French three factor model have more effect on the stock prices in the Nigeria stock market. We recommend the need to further deepen the operational efficiency of the stock market to reflect Fama and French three factor model.*

***Keywords:*** *Fama and French, 3-Factor Model, Stock Prices, Stock Market Size*

## INTRODUCTION

There are many theories that explained the movement and variation in stock prices. The randomness of stock prices was the result of an efficient market, concluded by more curious among the academic researchers when asked the economic process that produces a random walk (Chandra, 2004). The efficient market hypothesis assumes that information travels in a random, independent fashion and that prices are an unbiased reflection of all currently available information this means that there is little or nothing to be gained from studying past prices. The weak-form efficient market hypothesis -the random walk hypothesis suggests there is no relationship between past and future prices of securities. They are presumed to be independent over time because the random walk hypothesis maintains that current prices reflect all available information and information travels randomly, stock prices exhibit random movements. The Capital Asset Pricing Model (CAPM) introduced by Sharpe (1964), Lintner (1965), Mossin (1966), and Black (1972) contribute significantly to the understanding of risk relationships with returns for academia and practitioners. The return of an asset in the CAPM model is determined only by systematic risk, i.e., beta. The expected return on risk assets is predicted to be positively related to beta. The main purpose of CAPM is to determine the required rate of return on an investment. The market equilibrium by Markowitz (1952) confirms two things, the positive relationship between expected return and beta, and beta as the only measure of risk. Initially, empirical tests generally support the argument that beta is the only predictor of cross sectional differences in stock portfolio returns (Fama & MacBeth, 1973).

The Fama and French (1993) three factor asset pricing model (FF3F) was developed by Eugene Fama and Ken French as a result of increasing empirical evidence that the Capital Asset Pricing Model performed poorly in explaining realised returns. After testing CAPM on thousands of portfolios, Fama and French found that on average, a portfolio's beta explains about 70% of its actual returns. For example, if a portfolio was up 10%, about 70% of the return can be explained by the advance of all stocks and the other 30% is due to other factors not related to beta. Explaining 70% of a portfolios return using CAPM is fine, but Fama and French thought they could do better. They designed a more elaborate model that uses three risk factors. In the Fama- French Three Factor model, beta is still the most important risk factor because it still accounts for 70% of the typical diversified portfolio return. However, the size of the stocks in a portfolio and the price-to-book value of the stocks made significant differences. Fama-French tested thousands of random stock portfolios against their model and found that a combination of beta, size, and value explained 95% of a diversified portfolio's return. In other words, when analyzing
the returns of a diversified stock portfolio against the stock market, 95% of the return could be explained by the portfolio's sensitivity to the market (beta), the size of stocks in the portfolio (size), and the average weighted book-to-market (BtM). The Fama-French Three Factor Model was far better than the 70% explanatory power of beta alone using CAPM. The FF3F model thus provides a highly useful tool for understanding portfolio performance, measuring the impact of active management, portfolio construction and estimating future returns. While studies on the Fama and French three factor models is well established, such study in the emerging financial market is not much in Literature, this study examined how Fama and French three factor model effect stock prices of quoted firms in Nigeria.

## LITERATURE REVIEW

### Fama-French Three-factor Model

In 1993 Fama and French introduced the Three-factor model, which is a multi-factor model. The model was developed in response to the anomalies that had been discovered when testing the CAPM. The Three-factor model adds a market capitalization factor (SMB) as well as a book-to-market ratio factor (HML) to the CAPM. These two factors are based on the size effect and the value effect. In their seminal 1992 paper, Eugene Fama and Kenneth French proposed a new approach to asset pricing and to the arbitrage pricing theory. Their idea was to use the CAPM's $\beta$ in addition to two variables that are specific to each firm in order to proxy for those risk factors that are not linked to the market as a whole, but attain a particular company and cause returns to deviate significantly from the values that the CAPM predicts. These two additional factors are the company's market capitalization (which they refer to as "size") and the ratio of book value of common equity over market capitalization (also called book-to-market). According to Basu, this negative relationship between price/earnings ratio and returns was due to the market overreacting to news of a company's earnings: when they are low, investors oversell their shares, while the opposite happens when earnings are high. This way, low-earnings companies tend to generate higher returns when the situation goes back to normal and their price increases quickly, while high-earnings stocks tend to perform badly.

Stattman (1983) was the first to call this anomaly "value effect", but he used the book-to-market ratio as a proxy for it instead of price/earnings. According to Petkova and Zhang (2003) this anomaly is not due to market overreaction, but rather it is caused by the fact that high book-to-market stocks tend to underperform in case of macroeconomic downturn and thus are rewarded with higher returns to compensate for this enhanced systematic risk. Chan and Chen (1991) seem to agree with this postulate, but do not rule out the possibility that book-to-market and the value factor are really due to the market's irrationality about a company's prospects. Chan, Hamao and Lakonishok (1991) found that the book-to-market helps explaining the cross-section of Japanese stock returns as well (Leesi & Umasom, 2023).
Financial leverage was also proved to be linked with the risk factors that drive stock returns by Bhandari (1988), who tested a regressive model which included a debt/equity ratio, size and β. Fama and French tested the role of leverage as well, but used two asset/equity ratios instead. The first ratio is book assets over book equity (described as a measure of book leverage), while the second one is book assets over market equity (market leverage). The interesting thing about financial leverage being a determinant for average returns is that while it is indeed a measure of risk, its role should be already captured by the β. Until the Fama-French paper was published in 1992, the aforementioned variables were the most used to describe anomalies in the CAPM. They all seemed to be good proxies to explain the part of expected returns that remained unexplained under the Sharpe-Lintner-Black assumptions. However, as Fama and French pointed out these variables were composed by roughly the same fundamentals (price, shares outstanding, book equity and total assets) and some of them might have been redundant.

The conclusions of the Fama-French research is that size and book-to-market are the best proxies for these effects and the roles of the other variables seem to be absorbed by these two catch-all fundamentals (Leesi, 2023). The CAPM's β is still included in the model, but is now almost completely dismissed, as the division in portfolios helps uncover the fact that β's role is almost nullified when its correlation with size is accounted for by dividing the sample in size portfolios. They reach these conclusions in the two separate papers that I mentioned before. In the 1992 version (the one on which I am basing my thesis) they use a cross-sectional approach and build portfolios by ranking stocks based on their size, β and book-to-market. Then they analyze the performance of the portfolios to find some common patterns before running the cross-sectional regressions that legitimate their initial claims. The average returns of the three "big" (large size) portfolios are then subtracted from those of the "small" portfolio to mimic the size effect, which they call SMB (Small-Minus-Big). The same goes for the value effect, which is proxied by subtracting the average returns of the two low-book-to-market portfolios from those of the two high-book-to-market portfolios; they call this HML (High-Minus-Low). The regression equation they tested is:

$$Rit=at+b1t(Rmt-RFRt)+b2tSMBit+b3tHMLit+\epsilon it \quad 1$$

This is done to eliminate any correlation that may exist between size and book-to-market to analyze the two effects separately. The conclusions of the 1992 paper are confirmed: SMB and HML seem to have a relevant effect on average returns, at least in the period 1963-1991. The paper also contains a similar test for bonds, using maturity (TERM) and default risk (DEF) as risk factors, but the results were not satisfying. The Fama-French model shaped the way many approached asset pricing for years and is a cornerstone for the discipline as Cochrane (1999b) spectifies. However, as many models before it, it may not stand the test of time and, more importantly, the test of "place". The European Union is an extremely peculiar and diverse entity and as Modigliani, Pogue and Solnik found in their 1973 test of the CAPM on the European market, the results are very different across countries and the test suffered by the lack of data. This lack of data kept everyone from testing the CAPM before 1973, when the model had been thoroughly tested and expanded throughout the previous seven years in the U.S. market. Moreover, as Foye, Mramor and Pahor (2013) found, there are still many inefficiencies in the European market, with many Eastern European countries failing to reach the weak form of market efficiency defined by Fama (1970).
The issue of data availability has since improved due to the disclosure requirements for stock market quoted companies and the advancement of technology, but the level is not quite that of the United States yet. Europe was also struck by two devastating financial crises in the last 10 years and still has a hard time recovering: the consequence is a widespread mistrust in the financial markets, which is exacerbated by continuous political tension among EU countries, as reported by Bastasin (2015; Davies & Lucky, 2018). Anyway, the test of the model considered anything but conclusive: it is my humble contribution to the discussion on the validity of the Fama-French model and possibly to see if this leads to new evidence on the efficiency and integration of the European stock markets.
**Current Shares Outstanding**: Total number of shares in circulation. This data may have been obtained from annual, semi-annual, and quarterly reports, Edgar filings, press releases, or stock exchanges from May 2000 to present. Prior to May 2000, daily shares outstanding data is populated from Interim and Annual Reports only for all single-share class companies and does not return data for Multiple Share companies. The value is in millions.
**Last Price**: Last price of the security provided by the exchange. For securities that trade Monday through Friday, this field will be populated only if such information has been provided by the exchange in the past 30 trading days. The value is in Euros.
**Dividend Yield**: The most recently announced net dividend, annualized based on the Dividend Frequency, then divided by the current market price. If the security is paying an interim/final dividend, then the indicated yield is calculated by adding the net amount from the most recently announced interim and the most recently announced final, and dividing the sum by the current market price. Abnormal Dividends are not included in this yield calculation. The value is in percentage points.

**EBITDA**: Earnings before Interests, Taxes, Depreciation and Amortization. Calculated by adding Depreciation and Amortization back to the Operating Income, it is an indicator of the profitability of the company. The value is in million Euros.

**Total Common Equity**: The amount that all common shareholders have invested in a company according to the balance sheet. The value is in million Euros.

**Total Assets**: The total of all short and long-term assets as reported on the Balance Sheet. The value is in million Euros. The variables used for the study are constructed using the data I gathered in the following way:
**Risk-Free Rate**: The RFR used is a combination of the EURIBOR for observations from 1999 on and the LIBOR for the pre-1999 period.

**Stock Returns**: Here I used data about price and dividend yield in this way:

$$Rit=[\ln(Priceit)-\ln(Priceit-1)+DividendYieldit-1]\times 100 \quad (2)$$

zactor loadings of a stock contain all the idiosyncratic errors linked to that stock, while the factor loadings of a portfolio will merely contain the weighted average of the errors attached to each stock. The larger the portfolio, the smaller the errors, the pre-ranking βs are calculated each year using return data up to 5, 4, 3 or 2 years prior, depending on data availability, while post-ranking βs for portfolios are computed using the whole sample. Of course, stocks change their post-ranking β by changing the portfolio to which they belong.

**Stock Prices**

The capital asset pricing model is widely used within the financial industry, especially for riskier investments. The model is based on the idea that investors should gain higher yields when investing in more high-risk investments, hence the presence of the market risk premium in the model's formula. Central to the Capital Asset Pricing Model (CAPM) of William Sharpe (1964) and John Lintner (1965) is the risk-return relationship of an asset, precisely the relationship between (systematic) risk and expected return for a financial asset. The development of the model was inspired by Markowitz's (1952; Leesi, 2023) portfolio theory, which is based on optimizing the relationship between risk and return. Sharpe and Lintner propounded that under conditions of market equilibrium, the expected return on a given asset should be both above the risk-free rate and proportional to its non-diversifiable risk (that is, market risk) measured by beta, β. More than half a century since the birth of the model, it is still widely used in the pricing of a risky asset by (a) determining a theoretically required rate of return, (b) making decisions about portfolio management, and (c) estimating a firm's cost of capital.

A stock market allows investors to use various instruments to better satisfy their liquidity and risk preferences, thus, encouraging their savings and providing the non-financial corporations with equity finance possibilities. Singh and Hamid (1993) showed evidence of a significant contribution of equity markets to investment expenditures of the corporate sector in developing countries. The efficiency of savings allocation is ensured through correct share pricing. Better-managed firms should face lower cost of capital while their shares are valued higher. Levine (1991) has shown that a stock market accelerates economic growth through a) elimination of premature liquidation of capital invested in firms, which increases firm productivity; and b) liquidity risk reduction, which encourages investment.

Volatility is a key concept within finance and has consequently received a lot of attention in financial literature. Volatility is used as a quantitative representation of risk and is therefore vital in the aspects of investment decisions, risk management and portfolio selection. This is not the same as to say that volatility equals risk even though a sound understanding of both risk and volatility is important for making financial decisions. A financial instrument is a tradable asset of any kind which includes stocks, cash, options and other evidence of ownership in an entity. Volatility measures the variation of price of these financial instruments over time and is vital for understanding the risk the potential investor would be taking (Lucky, Akani & Anyamaobi, 2015). Volatility is therefore a key concept that is used frequently within finance. A big variation in price (high volatility) equals a big risk, but it also includes a higher probability of a great return. As numerous studies show, high stock price volatility is one of the characteristics of emerging financial markets, one of which is considered to be financial market. The question remains as to the source of this volatility. Can it be explained by fundamental or non-fundamental factors, or is it a shortcoming of the sample estimation

## Theoretical Review

### Arbitrage Pricing Theory (APT)

An important body of research in financial economics has been the behaviour of assets prices, and especially the forces that determine the prices of risky assets. There are also a number of competing theories of asset pricing. These include the original capital asset pricing models (thereafter CAPM) of Sharpe (1964), Lintner (1965) and Black (1972), the Inter-temporal models of Merton (1973a), Long (1974) Rubinstein (1976), Breeden (1979), and Cox, Ingersoll & Ross (1985), and the arbitrage pricing theory (hereafter APT) of Ross (1976). The theory of asset pricing is concerned with explaining the price of financial assets in an uncertain world. Qian (2011) stated that the uncertainty is described by probability distributions, which can be understood as beliefs of economic agents. According to him, the theory of asset pricing studies both the valuation of risk and the structure of these beliefs themselves, which are disciplined by market arbitragers.

According to Granville (2001) it would take the development of organized markets for derivative products for other major advances to be made: there was first, the Black-Scholes (1973) and Merton (1973b) valuation formula of European options; then the recognition of Harrison & Pliska (1981) that the absence of arbitrage was intimately linked to the existence of the martingale probability measure. And a major discovery was finally made by David Heath, Robert Jarrow and Andrew Merton in 1972, since it deals with the stochastic properties of the term structure of interest rate. Heath, Jarrow and Merton's fundamental discovery is the following: arbitrage-free markets imply that, if a winner process drives the forward interest rate, the drift term of the stochastic differential equation cannot be independent; on the contrary, it will be a deterministic function of the volatility.

The earliest theory to receive widespread support as an alternative to the CAPM was the Arbitrage Pricing Theory (APT), developed in the mid-1970s by Stephen Ross (1976, 1977). Mathematically, and intuitively more challenging than the CAPM, the APT begins with the notion that financial markets are frictionless. Investors can buy or sell short any of a large number of assets that trade in this market. Short-selling is a transaction in which an investor sells borrowed assets that must be returned to the lender of the asset at a later date. In the simplest case, short sales are made in an attempt to profit from an expected decline in a given asset's value.

However, asset pricing theory seeks to describe the relationship between risk and expected return. It is refer to asset pricing models to mean the expected return investors require given the risk associated with an investment. In a well-functioning capital markets,' an investor would be rewarded for accepting the various risks associated with investing in an asset. It is express an asset pricing model in general terms based on risk factors as follows:

$$E(R_i) = f\ (F_1, F_2, F_3, \dots F_N) \quad (3)$$

Where $E(R_i)$ is the expected return for asset $i$,

$F_N$ is the risk factor $k$,

$N$ is the number of risk factors.

In other words, the expected return on an asset is the function of N risk factors. The trick is to determine what the risk factors are and to specify the precise relationship between expected return and the risk factors.

APT posits that asset returns are driven by a group of different factors but specifies neither the identity nor the number of these factors (that is, APT has been silent about which events and factors are likely to influence all assets prices). As opined by Megginson, Smart & Gitman (2007), APT leaves the identification of these factors as an empirical matter for researchers to sort out; and the nature of these factors is likely to change over time and between economies (Bhat 2008). Furthermore, APT does not offer any guidance about what factors should be important, or even how many factors should be included in equation (3). The risk factors represent sources of systematic risk that cannot be diversified away.

In the world of APT, each asset can be affected by each risk factor. That is, each firm has its own set of "factor betas", and each risk factor is associated with a risk premium. For example, if fluctuations in the price of Premium Motor Spirit (PMS) represent a source of systematic risk, then stocks that are sensitive to that factor will have to pay investors higher returns as compensation. This relationship can be summarized as follows:

$$R_i - R_f = \beta_{i1}(R_1 - R_f) + \beta_{i2}\,(R_2 - R_f) + \beta_{i3}\,(R_3 - R_f) + \cdots + \beta_{in}\,(R_n - R_f) \quad (4)$$

The left-hand side of this equation represents the risk premium on a particular asset. The betas reflect that particular asset's sensitivity to each of the factors, and the terms in brackets stand for the risk premium associated with each factor. APT does not ask which portfolios are efficient. Instead, it starts by assuming that equity's return depends partly on pervasive macroeconomic influences or factors and partly on noise (Brealey, Myers & Allen 2006). The APT model tries to capture some of the non-market influences that cause securities to move together. APT gives a characterization of expected returns on assets based only on the weak assumptions that there are no arbitrage opportunities, returns follow a factor structure and there are homogenous expectations (Gilles & Leroy, 1990). Multi-factor models allow an asset to have not just one, but many measures of systematic risk. Each measure captures the sensitivity of the asset to the corresponding pervasive factor. If the factor model holds exactly and assets do not have specific risk, then the law of one price implies that the expected return of any asset is just a linear function of the other assets' expected return. If this were not the case, arbitrageurs would be able to create a long-short trading strategy that would have no initial cost, but would give positive profits for sure. This arbitrage relies on a fundamental principle, the law of one price, which, according to Drake & Fabozzi (2004), states that a given asset must have the same price regardless of the means by which one goes about creating that asset. Moreover, testing the APT model does not require identification of the true market portfolio.

Equation (4) which is defined as the asset pricing model can be fine-tuned by thinking about the minimum expected return an investor would want from investing. Securities issued by the Nigeria Central Bank offer a known return if held over some period of time. The expected return offered on such securities is the risk-free rate because we believe the securities to have no default risk. By investing in an asset other than such securities, investors will demand a premium over the risk-free rate. That is, the expected return that an investor will require is:

$E(R_i) = R_f + \text{Risk premium};$

Where $R_f$ is the risk-free rate.

The risk premium or additional return expected over the risk-free rate, depends on the risk factors associated with investing in the asset. Thus, we can rewrite the general form of the asset pricing model given in equation (4) as:

$$E(R_i) = R_f + f(F_1, F_2, F_3, \ldots F_N) \quad (5)$$

This risk factor can be divided into two categories. The first category is risk factors that cannot be reduced with diversification. That is, no matter what the investor does, the investor cannot eliminate these risk factors. These risk factors are also known as systematic risk factors or non-diversifiable risk factors. The second category is risk factors that can be eliminated through diversification, which are unique to the asset and known as unsystematic risk factors or diversifiable risk factors.

In conclusion, arbitrage pricing theory is a well-known method of estimating the price of an asset. The theory assumes an asset's return is dependent on various macroeconomic, market and security-specific factors. Arbitrage pricing theory is an alternative to the capital asset pricing model. Stephen Ross developed the theory in 1976.

The Arbitrage Pricing Theory formula is:

$$E(r_j) = r_f + b_{j1}RP_1 + b_{j2}RP_2 + b_{j3}RP_3 + b_{j4}RP_4 + \cdots + b_{jn}RP_n \quad (6)$$

Where:

$E(r_j)$ = the asset's expected rate of return

$r_f$ = the risk-free rate

$b_f$ =the sensitivity of the asset's return to the particular factor

$RP$= the risk premium associated with the particular factor

The general idea behind Arbitrage Pricing Theory is that two things can explain the expected return on a financial asset: (1) macroeconomic/security-specific influences and (2) the asset's sensitivity to those influences. This relationship takes the form of the linear regression formula above. There are an infinite number of security specific influences for any given security including inflation, production measures, investor confidence, exchange rates, market indices or changes in interest rates. It is up to the analyst to decide which influences are relevant to the asset being analyzed. Once the analyst derives the asset's expected rate of return from the Arbitrage Pricing Theory model, he or she can determine what the "correct" price of the asset should be by plugging the rate into a discounted cash flow model. Note that Arbitrage Pricing Theory can be applied to portfolios as well as individual securities.

After all, a portfolio can have exposures and sensitivities to certain kinds of risk factors as well. The Arbitrage Pricing Theory was a revolutionary model because it allows the user to adapt the model to the security being analysed. And as with other pricing models, it helps the user decide whether a security is undervalued or overvalued and so he or she can profit from this information. Arbitrage Pricing Theory is also very useful for building portfolios because it allows managers to test whether their portfolios are exposed to certain factors. Arbitrage Pricing Theory may be more customizable than Capital Asset Pricing Model, but it is also more difficult to apply because determining which factors influence a stock or portfolio takes a considerable amount of research. It can be virtually impossible to detect every influential factor much less determine how sensitive the security is to a particular factor. But getting close enough is often good enough; in fact studies find that four or five factors will usually explain most of a security's return: surprises in inflation, Gross National Product, investor confidence and shifts in the yield curve.

The assumption behind the arbitrage pricing theory model is that securities prices/returns are generated by a small number of common factors, but our challenge is to identify 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. And arbitrage pricing theory did not give us any formal theoretical guidance on choosing the appropriate group of macroeconomic factors to be included in the model, rather left the identification of these factors to us as empirical matter.

The primary advantages of using macroeconomic factors as stated by Azeez & Yonoezawa, (2003) and DeFusco, *et al*. (2004) are: (1) the factors and their prices in principle can be given economic interpretations, while with factor analysis approach it is unknown what factors are being priced; and (2) rather than only using asset-prices to explain asset-prices, observed macroeconomic factors introduce additional information, linking asset-price behaviour to macroeconomic events.

**APT Model Formulation**

The APT models, according to Facardi & Fabozzi (2004), can be divided into two different categories in function of how factors are treated. In the one, factors are portfolios or exogenous variables such as macroeconomic factors; in the other, factors are either modeled or not. They opined that if factors are not given, they must be determined with statistical learning techniques. Given the variance-covariance matrix, if factors are portfolios one can determine factors using e technique of principal component analysis (PCA).

The APT model postulates that an asset's expected return is influenced by a variety of risk factors, as opposed to market risk in the case of the CAPM. That is, the APT model asserts that e return on an asset is linearly related to $k$ "factors". The APT does not specify what these factors are, but it is assumed that the relationship between asset returns and the factors is linear. Specifically, the APT model asserts that the rate of return on asset $i$ is given by the following relationship:

$$R_i = E(R_i) + \beta_{i1}F_1 + \beta_{i2}F_2 \ldots \beta_{ik}F_k + e_i \quad (7)$$

Where $R_i$ is the rate of return on asset $i$

$E(R_i)$ is the expected return on asset $i$

$F_k$ is the $k^{th}$ factor that is common to the returns of all assets $(k = 1, \ldots, k)$

$e_i$ = the unsystematic for asset $i$.

For equilibrium to exist, the following conditions must be satisfied: using no additional funds (wealth) and without increasing risk, it should not be possible, on average, to create a portfolio to increase return. In essence, this condition states that there is no so-called money machine available in the market. Ross derived the following relationship, which is referred to as the APT model:

Ross derived the following relationship, which is referred to as the APT model:

$$E(R_i) = R_f + \beta_i, F_1 \left[E(R_{F1}) - R_f\right] + \beta_i, F_2\left[E(R_{F2}) - R_f\right] + \cdots + \beta_i, F_N\left[E(R_{FN}) - R_f\right] \quad (8)$$

Where, $[E(R_{Fj}) - R_f]$, is the excess return of the $j^{th}$ systematic risk factor over the risk-free rate and can be thought of as the price (or risk premium) for the $j^{th}$ systematic risk factor.

The APT model asserts that investors want to be compensated for all the risk factors that systematically affect the return of an asset. The compensation is the sum of the products of each risk factor's systematic risk $(\beta_i, F_k)$, and the risk premium assigned to it by the financial market$[E(R_{Fj}) - R_f]$. The investor is not compensated for accepting unsystematic risk.

Ross showed that in the absence of arbitrage, the following relationship holds:

$$E(R_i) = R_f + \sum_{i=1}^{k} \beta_{ik}\left[E(F_k) - R_f\right] \quad (9)$$

This is referred to as the APT. The expression $E(F_k) - R_f$ is the excess return of the $k^{th}$ systematic factor over the risk-free rate, and as such it can be thought of as the "price" (or risk premium) for the k[th] systematic risk factor. Huberman (1982) opined that, “strictly speaking, this is not fully correct. In particular, the equality holds in the mean-variance sense, when the number of assets approaches infinity”. That is, the APT states that in the absence of asymptotic arbitrage opportunities

$$\lim \frac{1}{N_{n\to\infty}} \sum_{k=1}^{k} \left[ E(r_i) - R_f - \sum_{k=1}^{k} \beta_{ik}\, E(F_k) - R_f \right] = 0 \quad (10)$$

The pre-specified model, assume that market risk can be captured best using multiple macroeconomic factors and estimating betas relative to each. Unlike the factor likelihood, pre-specified do attempt to identify the macroeconomic factors that drive market risk. The APT requires only four assumptions:

(1) Returns can be described by a factor model.
(2) There are no arbitrage opportunities.
(3) There are a large number of securities, so that it is possible to form portfolios that diversify the firm-specific risk of individual stocks. This assumption allows us to pretend that firm-specific risk does not exist.
(4) The financial markets are frictionless. Ross (1976, 1977), Roll (1977), and Roll & Ross (1980) developed the arbitrage pricing model (APM) in order to show that multiple factors (multiple beta models) can explain stock prices/returns. If APM holds, then a risky asset can be described as satisfying the following relation:

$$E(r_i) = r_f + b_{i1}RP_1 + b_{i2}RP_2 + \cdots + b_{in}RP_n \quad (11)$$
$$r_f = E(r_f) + b_{i1}F_1 + b_{i2}F_2 + \cdots + b_{in}F_n + \epsilon_i \quad (12)$$

Where

$E(r_i)$ is the risky asset’s expected return

$RP_k$ is the premium of the factor

$r_f$ is the free risk

$F_k$ is the macroeconomic factor

$b_{ik}$ is the sensitivity of the asset to factor $k$, also called factor loading, and;

$\epsilon_i$ is the risky asset’s idiosyncratic random shock with mean zero (the error term, assumed to be uncorrelated with the factor). This is also the (uncertain) security-specific return. Notice that if the macro factor has a value of 0 (zero) in any particular period (i.e. no macro surprises), the return on the security will equal its previously expected value, $E(r_i)$, plus the effect of firm-specific events only. The nonsystematic components of returns, the $e_i$’s, are assumed to be uncorrelated among themselves and uncorrelated with the factor $F$.

All of the models described begin by thinking about market risk in economic terms and then developing models that might best explain this market risk. All of them, however, extract their risk parameters by looking at historical data. The costs of moving from the factor likelihood APM to a macroeconomic multi-factor model can be traced directly to the errors that can be made in identifying the factors (Damodaran, 2003). The economic factor in the model can change over time as will the risk premium associated with each one. Using the wrong factor(s) or missing a significant factor in a multi-factor model can lead to inferior estimates of cost of equity. Morel (2001) opined that by using this arbitrage reasoning it can be shown that in an efficient market, the expected return is linear combination of each factor's beta. Thus, the APM predicts that "general news" will affect the rate of return on all stocks but by different amounts. In this way the APM is more general than the CAPM, because it allows larger number of factors to affect the rate of return (Cuthbertson, 2004).

Many divergent views trail the issues' of stock price determination and the factors responsible. The proponents of efficient market hypothesis are of the view that stock prices would be determined primarily by fundamental factors such as earnings per share, dividend per share, payout ratio, size of the firm and dividend yield, management and diversification (Srinivasan, 2012). However, sequel of information asymmetry, stock market information may not be available to all stakeholders at the same time. Equity risk premium is the return provided by an individual stock on the overall stock market in excess of the risk-free rate. This excess return compensates investors for taking on the relatively higher risk of the equity market. The size of the risk premium will vary as the risk in a particular stock, or in the stock as a whole, changes, that is, high-risk investments are compensated with a higher premium.

When you invest in equities, the risk in underlying economy is manifested in volatility in the earnings and cash flows reported by individual firms in that economy. Information about these changes is transmitted to markets in multiple ways, and it is clear that there have been significant changes in both the quantity and quality of information available to investors over the last two decades. During the market boom in the late 1990s, there were some who argued that the lower equity risk premium that we observed in that period were reflective of the fact that investors had access to more information about their investments, leading to higher confidence and lower risk premiums in 2000.

**Empirical Review**

Fama and French (2015) compared the performance of the Five-factor model to the three-factor. Fama and French use factor spanning regressions to test for factor redundancy. Model performance is primarily evaluated with the GRS F-test and performance statistics based on Jensen's alpha. The sample covers July 1963 to December 2013. To test how sensitive the results are to different factor definitions, the factors are constructed using three different sorting schemes: 2x2, 2x3 and 2x2x2x2. The test portfolio sets are created using two different sorting schemes: 5x5 for the size-B/M, size-profitability, size-investment and 2x4x4 for the size-B/M-profitability, size-B/M-investment and size-profitability-investment portfolio sets. The results show that the value factor becomes redundant once the profitability and investment factor are added. Fama and French (2015) argue that the value factor, due to market capitalization being sensitive to forecasts of earnings and investment, may be a "noisy proxy" for expected returns. Model performance does not seem to be affected by the factor construction method and they therefore choose to continue using the 2x3 factor construction scheme as it is commonly used in the literature. Overall, the Five-factor model outperforms the Three-factor model regardless of the factor construction method. The Five-factor model's primary problem is that it has trouble explaining the returns of small sized stocks, especially small sized stocks with high investment and low profitability.

Njiforti and Akaolisa (2010) investigated whether the Nigerian stock market has experience a speculative bubble using unit root test, cointegration and GARCH on a time series data for banks from 2008 to 2009. The result reveals speculative bubbles in most of the banks and insurance companies (i.e., the price-dividend ratio, share prices and dividend were non-stationary). Fama and French (2017) used a similar methodology to their 2015 study on a U.S. sample, Fama and French evaluate the performance of the Five-factor model in four regions in the developed markets: North America, Europe, Japan and Asia Pacific. The main difference is that they use a shorter sample period which covers July 1990 to December 2015. The performance of the Five-factor model is compared to the performance of the Three-factor model and a Five-factor model that excludes the investment factor. The results show that the size and investment factors are redundant in Europe and Japan. The size factor is the only redundant factor in Asia Pacific. In general, the Five-factor model outperforms the Three-factor model in all regions except Japan. In Japan, all three models produce insignificant GRS statistics for all sets of portfolios. In Europe, the main problem for the Five-factor model is explaining the returns of the size-investment sorted portfolio set. This is most likely due to the size and investment factor being redundant in that region. Similar to their study in 2015, Fama and French conclude that the primary problem of the Five-factor model is that it is not capable of explaining the returns of small stocks that have similar returns to those with low profitability and high investment.

Fama and French (2018) analyzed different versions of the Six-factor model's performance, which adds momentum to the Five-factor model. In addition, an alternative definition of the profitability factor is tested, using cash profitability instead of operating profitability. Furthermore, Fama and French test a new performance metric proposed by Barillas and Shanken (2016). This performance metric is the max squared Sharpe ratio of the intercepts from LHS factor return regressions and is mainly used to compare nested and non-nested models. The max squared Sharpe ratio is closely related to the GRS F-test, however, the GRS statistic is not suited for the comparison of non-nested models as it causes an upward bias for models that include more factors. Non-nested models are models that use distinct factors, meaning that the models do not use the same factor definitions. The sample contains data from the U.S. stock market between July 1963 to June 2016. The factor spanning regressions indicate that the momentum factor adds explanatory power to the Five-factor model. Cash profitability is found to outperform operating profitability when analyzed using the Barillas and Shanken metric. A Six-factor model which combines the market and size factor with the small stock spread factors (meaning factors created only using small sized companies) HMLS, RMWS, CMAS, and WMLS outperforms the other models with regards to the max squared Sharpe ratio statistic proposed by Barillas and Shanken. However, Fama and French conclude that this does not justify a permanent switch to these new factor definitions as the base Six-factor model also performs well, overall, the Barillas and Shanken statistic correlates with the GRS statistic, which is not surprising as they are closely related.
Cakici, Fabozzi and Tan (2013) examined size, value and momentum effects are examined in 18 emerging markets divided into three regions: Asia, Eastern Europe and Latin America. The authors use monthly stock data between January 1990 to December 2011. Factor and portfolio summary

statistics as well as factor spanning regressions are used to analyze the factor effects in the emerging markets, global markets and the U.S. In addition, two sets of portfolios (5x5) sorted on size-B/M and size-momentum is analyzed using the CAPM, Three-factor model and Carhart model. The performance of the asset pricing models are also compared using factors created with local, global and U.S. data, which tests for market integration. The GRS F-test, Jensen's alpha based performance metrics as well as a GMM-based test-statistic are used to evaluate and rank the performance of the different models. GMM (Generalized Method of Moments) is used to test for non-normal and serially auto-correlated error terms. The purpose of the GMM statistic is to control the significance level of the GRS statistic. The authors find a statistically significant value effect in all three regions in the emerging markets, with the big sized value premia being slightly larger than the small sized value premia. The reverse is found in the U.S. and global developed markets, where the small sized value premia is larger than the big sized value premia. The momentum effect is found to be significant in all regions except Eastern Europe. The momentum premia are found to be larger in small sized stocks compared to big sized stocks. This pattern of momentum premia regarding size is consistent with results found in the developed markets. Performance evaluation shows that the use of global and U.S. constructed factors decreases the explanatory power of local returns (i.e returns in different regions of the emerging markets). These results indicate that the emerging markets are not fully integrated with the developed or global markets. The Carhart model, which includes the momentum factor, is found to be comparatively successful in explaining the returns of the size-momentum sorted portfolios, especially in Asia. However, overall the momentum factor does not seem to add explanatory power. The GMM results indicate that the significance level of the GRS statistic is robust for local factors and a majority of the results using U.S. and global factors.

**Literature Gap**

From the review of past studies above, there seems to be little empirical evidence on the existence of bubble in the Nigeria stock market. In addition, most of the empirical studies found mixed and inconclusive results, warranting further empirical investigation on the subject matter in Nigeria. The present study advanced on previous studies by employing sequential analytical techniques involving unit root test and cointegration techniques to determine first, the existence of random walks and fundamental deviation in asset prices during the period.

## METHODOLOGY

This study is designed to examine Fama and French 3-factor model and stock prices in Nigeria. The research design adopt in this study is the ex-post facto research method which is largely quasi-experimental. The data used in this study will be collected from secondary sources. The instrument utilized for the collection of secondary data is documentation. Documentary data will be collected via the Nigerian Stock Exchange bulletin (NSE), Security and Exchange Commission (SEC) bulletin Central Bank of Nigeria (CBN) Statistical bulletin and financial statement of traded firms. The study utilizes the secondary source because it provides a basis for purposeful research work and also gives a direction for the research work.

**Data Analysis Procedure**

Statistical evaluation of the global utility of the analytical model, so as to determine the reliability of the results obtained is carried out using the coefficient of correlation (r) of the regression, the coefficient of determination ($r^2$), the student T-test and F-test.

**Stationarity (Unit Root) Tests**

The study investigates the stationarity properties of the time series data using the Augmented Dickey Fuller (ADF) test. According to Nelson and Plosser (1982) and Chowdhury (1994) there exists a unit root in most macroeconomic time series. While dealing with time series, it is necessary to analyze whether the series are stationary or not. Since regression of non-stationary series on other non-stationary series leads to what is known as spurious or nonsense regression causing inconsistency of parameter estimate. The Null hypothesis of a unit root is rejected against the one sided alternative if the t-statistic is less than the critical value. Otherwise, the test Stationarity denotes the non-existence of unit root. We shall therefore subject all the variables to unit root test using the augmented Dickey Fuller (ADF) test specified in Gujarati (2004) as follows.

$$\Delta y_t = \beta_1 + \beta_2 + \delta y_{t-1} + \alpha i \sum_{i-1}^{m} \Delta y_{t-1} + Et \qquad (13)$$

**Where**:

| | | |
|---|---|---|
| $\Delta y_t$ | = | change time t |
| $\Delta y_{t-1}$ | = | the lagged value of the dependent variables |
| $\Sigma_t$ | = | White noise error term |

If in the above $\delta$ =0, then we conclude that there is a unit root. Otherwise there is no unit root, meaning that it is stationary. The choice of lag will be determined by Akaike information criteria.

**Co-integration Test (The Johansen' Test)**

It has already been warned that the regression of a non-stationary time series on another non stationary time series may lead to a spurious regression. The important contribution of the concept of unit root and co-integration is to find out if the regression residual are stationary. Thus, a test for co-integration enables us to avoid spurious regression situation. The study employed the Johansen Multivariate Co-Integration Test to ascertain if there is the existence of a long run equilibrium relationship among time series variables. If the residual is found to be stationary at level, we conclude that the variables are co-integrated and as such has long-run relationship exists among them.

$$SPR_t = w_O + \sum_{i=1}^{i} \vartheta_t CAMP_{t-i} + \mu_{1t} \qquad (14)$$

**Granger Causality Test**

Granger causality test according to Granger (1969) is used to examine direction of causality between two variables. Therefore, in this study, we will carry out granger causality between an independent variables monetary policy and the dependent variables private sector funding in Nigeria from 1990 – 2021.The pair-wise granger causality test is mathematically expressed as:

$$Y_t \pi_o + \sum_{i=1}^{n} x_1^{\ y} \ Y_{t-1} \sum_{i=1}^{n} \pi_1^{\ x} \ x_{t-1} + u_1 \tag{15}$$

and

$$x_t dp_o + \sum_{i=1}^{n} dp_1^y \ Yt-1 \sum_{i=1}^{n} dp1^x x_{y-1} + V_1 \tag{16}$$

Where $x_t$ and $y_t$ are the variables to be tested white $u_t$ and $v_t$ are the white noise disturbance terms. The null hypothesis $\pi_1^y = dp_1^y = 0$, for all I's is tested against the alternative hypothesis $\pi_1^x \neq 0$ and $dp_1^y \neq 0$. if the co-efficient of $\pi_1^x$ are statistically significant but that of $dp1y$ are not, then x causes y. If the reverse is true then y causes x. however, where both co-efficient of $\pi_1^x$ and $dp_1^y$ are significant then causality is bi – directional.

**Error Correction Model Technique**

The presence of co-integrating relationship forms the basis of the use of Error Correction Model. E-views econometric software used for data analysis, implement Vector Auto-regression (VAR)-based co-integration tests using the methodology developed by Johansen (1991,1995). The non-standard critical values are taken from Osterward Lenun (1992).

**Specification of Models**

Based on the objective of the study, we formulate the following regression models:

$$SP = \beta_0 + \beta_1 X_1(CS) + \beta_2 X_2(MCR) + \beta_3 X_3(MTO) + u_3 \tag{17}$$

Where
SP = Stock prices measured by changes in all share price index
CS = Capital market size
MCR = Market capitalization
MTO = Market turnover
$\mu i$ = Error term

## RESULTS AND DISCUSSION

**Table 1: Testing for Unit Root (Stationarity Test)**

| Variable | ADF Stat | MacKinnon 1% | 5% | 10% | Order int | ADF Stat | MacKinnon 1% | 5% | 10% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
| | ADF at Level | | | | | ADF at difference | | | | |
| SMV | - 4.576516 | -3.639407 | - 2.951125 | - 2.614300 | | - 5.415901 | -3.699871 | - 2.976263 | - 2.627420 | |
| MTO | - 4.150935 | -3.646342 | - 2.954021 | - 2.615817 | | - 8.468142 | -3.661661 | - 2.960411 | - 2.619160 | |
| MCR | - 1.322652 | -3.639407 | - 2.951125 | - 2.614300 | | - 9.885010 | -3.646342 | - 2.954021 | - 2.615817 | |
| CS | - 2.252134 | -3.699871 | - 2.976263 | - 2.627420 | | - 5.252134 | -3.699871 | - 2.976263 | - 2.627420 | |

**Source: Computed from E-View 9.0**

Stationarity test or unit root test is one of the conditions to be satisfied in time series data analysis to ensure accuracy and to avoid spurious regression. A time series is said to be stationary when it's mean and variance do not vary systematically over time (Gujarati 2004). A Unit root test was carried out to check for stationarity. In order to avoid problems of autocorrelation as may arise from using Dickey-Fuller test, the researcher used Augmented Dickey- Fuller Unit root test.

The Null hypothesis is that, Unit root is present in the variable under test. Alternative hypothesis is that there is No unit root. The critical value at 5 percent is the base for guideline on unit root test. When the absolute value (not considering the sign) of the Test statistics is higher than the absolute value (ignoring the sign) of the critical value at 5 percent, we reject null hypothesis, we instead accept alternative hypothesis that there is no unit root. The results performed using E-view version 9.0, as shown above. The first Unit root test conducted was Augmented Dickey-Fuller Test at Level for each variable. And the results as shown in the table above indicate that the variables are stationary, because all the absolute values of the Test statistics, regardless of their signs were above than the values of the 5% critical value. Therefore, the variables are stationary at first difference. We reject the null hypothesis of non stationarity and conclude that there is stationarity at first difference.

**Table 2: Johansen Co-Integration Test Results: Maximum Eigen**

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.698395 | 79.50461 | 47.85613 | 0.0000 |
| At most 1 * | 0.413550 | 39.94954 | 29.79707 | 0.0024 |
| At most 2 * | 0.342898 | 22.33850 | 15.49471 | 0.0040 |
| At most 3 * | 0.226638 | 8.481273 | 3.841466 | 0.0036 |

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| None * | 0.698395 | 39.55507 | 27.58434 | 0.0009 |
| At most 1 | 0.413550 | 17.61105 | 21.13162 | 0.1451 |
| At most 2 | 0.342898 | 13.85722 | 14.26460 | 0.0579 |
| At most 3 * | 0.226638 | 8.481273 | 3.841466 | 0.0036 |

**Source: Computed from E-View 9.0**

The guideline is that when the trace statistics is more than 5 % percent Critical value, we reject the null hypothesis. In all the three equations, we see that the trace statistics are higher than the critical values at 5 percent; we can then reject the null hypothesis, because variables are cointegrated. Trace test indicates 3 cointegrating equations at the 0.05 level when the maximum Eigen value is more than the critical value at 5 percent, we reject the null hypothesis.

**Table 3: Granger Causality Test**

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| MTO does not Granger Cause SMV | 33 | 2.31125 | 0.1178 |
| SMV does not Granger Cause MTO | | 12.7429 | 0.0001 |
| MCR does not Granger Cause SMV | 33 | 0.83299 | 0.4452 |
| SMV does not Granger Cause MCR | | 1.70061 | 0.2009 |
| CS does not Granger Cause SMV | 33 | 0.09077 | 0.9135 |
| SMV does not Granger Cause CS | | 0.14859 | 0.8626 |

**Source: Computed from E-View 9.0**

From the model, the study found a uni-directional causality from stock prices to market turnover rate while other variables have no causal relationship, we accept the null hypothesis, none causal relationship could be traced to market anomalies.

**Table 4: Parsimonious Error Correction Results**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| MTO | 0.072549 | 0.025695 | 2.823478 | 0.0084 |
| MCR | -0.627908 | 0.200082 | -3.138254 | 0.0038 |
| CS | 2.388632 | 0.622725 | 3.835774 | 0.0006 |
| C | -0.613202 | 1.432029 | -0.428205 | 0.6716 |
| ECM(-1) | -0.093529 | 0.040631 | -2.301929 | 0.0285 |
| R-squared | 0.894148 | Mean dependent var | | 7.696314 |
| Adjusted R-squared | 0.880034 | S.D. dependent var | | 0.967573 |
| S.E. of regression | 0.335129 | Akaike info criterion | | 0.782964 |
| Sum squared resid | 3.369353 | Schwarz criterion | | 1.005156 |
| Log likelihood | -8.701868 | Hannan-Quinn criter. | | 0.859665 |
| F-statistic | 63.35356 | Durbin-Watson stat | | 1.629992 |
| Prob(F-statistic) | 0.000000 | | | |

**Source: Computed from E-View 9.0**

From the table, in the model the Error correction term is negatively which is confirm to expectation, that is to say it has a negative sign, implying that the error obtain has high possibilities of moving much further away from the equilibrium path as time goes on and on. Also the ECM (-

1) coefficient shows that 0.880034 percent of the error produced in the previous period are corrected in the current period, the error term however is not statistically significant ECM (-1) is speed of adjustment towards equilibrium or error correction term. The independent variables can explain 88 percent variation on the dependent variable market turnover and capital market size has positive effect while market capitalization has negative effect on stock prices.

### Discussion of Findings

The estimated model found that Fama and French three factor model 88 percent variation in assets prices in the Nigeria stock exchange; this implies that 18 percent are explained by factors not captured in the model. The independent variables can explain 88 percent variation on the dependent variable market turnover and capital market size has positive effect while market capitalization has negative effect on stock prices. We expected a positive effect of the variables on the dependent variable based on theories and empirical studies. Empirically, the findings is in line with the findings of Glosten, Jagannathan and Runkle (2013) found that unexpected stock market returns are negatively related to unexpected changes in volatility, while arriving at similar results with Glosten et al. (2013) that an increase in stock market volatility raises required stock returns and lowers stock prices, Glosten, et al. (2013) that unanticipated returns result in reduction in a conditional volatility, while negative unanticipated returns lead to upward movements in conditional volatility. Kim and Kon (2014) indicated that significant foreign influence on the time-varying risk premium for US stocks but no significant relationship between the conditional expected excess returns and conditional volatility. The findings of Wang and Liv (2015),Bai, Russell and Tiao (2013) that volatility clustering and conditional non-normality contribute symmetrically and non-linearly to the overall kurtosis, Long (2018) that the ARCH model shows a statistically high persistence of volatility in the stock returns but when the iterated cumulative sums of squares (ICSS) algorithm is employed, the highly persistent volatility in return rate is reduced, Emenike (2014) modelled the volatility of stock returns in NSE using GARCH models and recorded volatility persistence in the market, Onwukwe, Bassey and Isaac (2011) did the same in four Nigerian companies using GARCH (1.1) and noted volatility clustering and leverage effects in the companies. Osazevbaru (2019) used TGARCH and monthly stock data to investigate the impact of market news on volatility in Nigeria but noticed no asymmetry (leverage effect). Fang and Nguyon (2018)

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

This study examined the effect of asset pricing models on stock prices of quoted firms in Nigeria. The study used time series data from 1990-2021. The variables were tested using the Augmented Dickey Fuller unit root test and the test found that the variables were stationary at first difference. The cointegrattion test indicated that there is long run combination of the variables while the granger causality test proved that there unidirectional causality in the model. The study found that 88 percent variation in stock prices were traced to Fama and French three factor model, the independent variables can explain 88 percent variation on the dependent variable market turnover and capital market size has positive effect while market capitalization has negative effect on stock prices. The study conclude that market risk and total traded equities have positive but no significant effect on stock prices, financial market size and book value of equities have positive and significant effect on stock prices while total assets have positive and no significant effect on the stock prices in Nigeria stock exchange.

**Recommendations**

1. The capital market regulatory authorities should ensure that Nigeria stock market operate with international best practice, all barriers to inflow of foreign portfolio investment should be discouraged to further deepen the Nigeria stock market to reflect the opinions of Fama and French 3-factor model.
2. Policies should be directed toward increasing the openness of the stock market. In fact Nigeria should, as a matter of urgency, deploy resources towards gathering reliable and accurate information which would facilitate development of comprehensive strategies to manage investment inflows.

3. Orderly market rules should be made and enforced in the stock market, this is because orderly market rules help maintain liquidity and prevent destabilizing market events. Orderly market rules are inclusive of: requirements on dealers to maintain bid and ask quotes at all times on a trading day; price limits for derivatives exchanges; fair credit reporting rules; prohibitions against predatory lending and deposit insurance.

**REFERENCES**

Abeysekera, S. P. & Arvind, M. (1988). A test of the arbitrage pricing theory in pricing UK stocks, *Journal of Business Finance & Accounting*, 4(2), 377-391.

Adaramola, A. 0. (2011). The impact of macroeconomic indicators on stock prices in Nigeria. *Developing Country Studies*, 1(2), 1-14.

Ade, I., & Dallah, H. (2010).Modelling and forecasting the volatility of the daily returns of Nigerian insurance stocks. *International Business Research,3(2),106-116.*

Adjasi, C. K. D. &Biekpe, B. N. (2005). Stock market returns and exchange rate dynamics in selected African countries: a bivariate analysis. *The African Financial Journal*, 1(4):23-44.

Ahmad, E. & Rosser, B.J. (1995). Non-linear speculative bubbles in the Pakistan stock markets.*Pakistan Development Review*, 34 (1), 25-41.

Akani, H. W., & Lucky, A. L., (2014). Money supply and aggregate stock prices in Nigeria: An analysis of co-integration and causality test. *Research Journali's Journal of Finance, 2 (10), 1 – 24.*

Akbar, M., Ali, S.& Khan, M. (2012). The relationship of stock prices and macroeconomic variables revisited: Evidence from Karachi stock exchange, *African Journal of Business Management*, 6(4).

Al-Sharkas, A. (2004). The Dynamic Relationship Between Macroeconomic Factors and Jordian Stock Market. *International Journal of Applied Econometrics and Quantitative Studies, 5(3),89-100.*

Amagoh, M. N.,Odoh, C. M.&Okuh, B. A. (2014). Modeling petroleum product prices and the Nigerian economy. *JOSR Journal of Mathematics (JOSR-JM)*, 10 (1):72-79.

Amanullah, S. & Kamaiah, B. (1998). Asset price behaviour in the Indian stock market: is the CAPM still relevant. *Journal of financial Management and Analysis, 1(1), 32-47.*

Antoniou, A., Garrette, I. & Priestley, R. (1998). Macroeconomic variables as common pervasive risk factors and the empirical content of the Arbitrage pricing Theory: *Journal of*

Arouri, M. E. H. & Jawadi (2010). On the impact of crisis on the risk premium: Evidence from the U.S Stock Market using a Conditional CAPM, *Economic Bulletin*, 30(2):1032-1043.

Arowoshegbe, A. & Imafidon, K. (2010). Arbitrage Pricing Theory: Theory and Empirical Evidence on the Nigerian capital market. *Knowledge Review*, 21, 3.

Asprem, M. (1989). Stock prices, asset portfolios and macroeconomic variables in ten European countries. *Journal of Banking and Finance*, 13, 589-612

Awwaliyah, I. N., & Husodo, Z. A. (2011). On the robustness of the extended Fama-French three factor model. Unpublished Working Paper. Universitas Indonesia.

Aziz, T. & Ansari, A. V. (2019). Idiosyncratic volatility and stock returns: Indian evidence. *Cogent Economics and Finance.Journal, 5, 1420998.*

Baklaci, H. F. &Kasman, A. (2002). An Empirical Analysis of Trading Volume & Return

Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics, 9(1), 3-18.*

Basu, S. (1983). The relationship between earnings yield, market value, and return for NYSE common stocks: further evidence. Journal of Financial Economics, 12(1), 129-156.

Bhandari, L. C. (1988). Debt/equity ratio and expected common stock returns: Empirical evidence. *Journal of Finance, 43(2), 507-528.*

Black, F. (1993). Beta and return. Journal of Portfolio Management, 20(1), 8-18.

Brailsford, A. & Faff, M. D. (1999).An evaluation of volatility forecasting technique of banking and finance, 2(4), 419- 438.

Brailsford, A. (1996). An Evaluation of Volatility Forecasting Technique of Banking and Finance. 419- 438.

Brandt, M. W.& Wang, K. Q. (2003). Time-varying risk averson and unexpected inflation. *Journal of Monetary Economics*, 50: 1457-1498.

Brav, A., Geczy, C., & Gompers, P. A. (2000). Is the abnormal return following equity issuances anomalous? *Journal of Financial Economics, 56(2), 209-249.*

Brooks, C. (2002). Introductory Econometrics for Finance, 3rd ed. *Cambridge: Cambridge University Press.*

Brown, S. J. &Otsuki, T. (1990). Macroeconomic factors and Japnese Equity Markets: The CAPMD project, in E.J.Elton and M. Gruber (eds). *Japanese Capital markets*, Harper & Row: New York.

Bundoo, S. K. (2009). Testing the Arbitrage Pricing Theory in an emerging stock market: The case of Mauritius. *Afro-Asian Journal of Finance and Accounting*, 1(4).

Burmeister, E. & Wall, K. D. (1986). The arbitrage pricing theory and macroeconomic factor measures, *The Financial Review*, 21:1-20.

Cakici, N., Fabozzi, F. J., & Tan, S. (2013). Size, value, and momentum in emerging market stock returns. Emerging Markets Review, 16(3), 46-65.

Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance, 52(1), 57-82.*

Chan, L. K., Hamao, Y., & Lakonishok, J. (1991). Fundamentals and stock returns in Japan. *Journal of Finance, 46(5), 1739-1789.*

Cochrane, J. H. (2005). Asset Pricing (Revised Edition). New Jersey: Princeton University Press.

Daniel, K., Titman, S., & Wei, K. C. (2001). Explaining the cross-section of stock returns in Japan: Factors or characteristics? *Journal of Finance, 56(2), 743-766.*

Davies, S. D., & Lucky, A. L., (2018). Corporate characteristics and influence on share based payment of financial service firms in Nigeria. *Asian Finance & Banking Review, 2 (1), 18-29.*

De La Grandville, O. (2005). *Bond pricing and portfolio analysis: Practicing Investors in the long-run*. New Delhi: Prentice-Hall of India Private Limited.

Debarati, B.& Chawla, D. (2012). An empirical test of the arbitrage pricing theory: The case of Indian stock market. *Global Business Review*, 13 (3): 421-432.

Dhankar, R.S. & Singh, R. (2005). Arbitrage pricing theory and the capital asset pricing model — evidence from the Indian stock market. *Journal of Financial Management and Analysis*, 18, 14-27.

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *Journal of Finance, 47(2), 427-465.*

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics, 33(1), 3-56.*

Fama, E. F., & French, K. R. (1996). Multifactor explanations of asset pricing anomalies. *Journal of Finance, 51(1), 55-84.*

Fama, E. F., & French, K. R. (1998). Taxes, financing decisions, and firm value. *Journal of Finance, 53(3), 819-843.*

Fama, E. F., & French, K. R. (2012). Size, value, and momentum in international stock returns. Journal of Financial Economics, 105(3), 457-472.

Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. Journal of Political Economy, 81(3), 607-636.

Florin, D. P. (2012). Empirical testing of the APT model with pre-specifying the factors in the case of Romanian stock market. *International Journal of Advances in Management and Economics,* 1 (2), 27-41

Gan, C., Lee, M., Yong, H.& Zhang, J. (2006). Macroeconomic variables and stock market interactions: New Zealand Evidence. *Investment Management and Financial Innovations,* 3(4), 20-36.

Gibbons, M. R., Ross, S. A., & Shanken, J. (1989). A test of the efficiency of a given portfolio. Econometrica, 57(5), 1121-1152.

Gilles, C.&LeRoy,S. F. (1990). The arbitrage pricing theory: A geometric interpretation, Working paper, (Carleton University, Ottawa, Ontario).

Gjerdr, O.&Frode S. (1999). Causal relation among stock returns and macroeconomic variables in small, open economy. *Journal of International Financial markets, Institutions and Money*, 9: 61-74.

Glosten, J. (2013). On the relationship between the expected value and of nominal excess return on stocks. *Journal of Finance, 46, 1749 - 1801.*

Glosten, L. R., Jagannathan, R. &Runkle, D. E. (1993). On the relation between the expected value and volatility of nominal excess return on stocks. *The Journal of Finance, 48(5),* Griffin, J. M., & Lemmon, M. L. (2002). Book-to-market equity, distress risk, and stock returns. Journal of Finance, 57(5), 2317-2336.

Halliwell, J., Heaney, J., & Sawicki, J. (1999). Size and book to market effects in Australian share markets: A time series analysis. *Accounting Research Journal, 12(2), 122-137.*

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance, 48(1), 65-91.*

Khalid, M. (2012). Long-run relationship between macroeconomic variables and stock returns: Evidence from Karachi Stock Exchange (KSE). *School of Doctoral Studies (European Union) Journal*, 95-105.

Khudoykulov, K. (2017). The analysis of the arbitrage pricing model on the stock return: a case of Athens stock market. *American Journal of Finance and Accounting*, 5(1),.51-63.

Kim, D. &Kon, S. I. (2014).Alternative models for conditional heteroskedasticity of stock returns.*Journal of Business, 69(1), 563-598.*

King, B. F. (1966). Market and industry factors in stock price behaviour. *Journal of Business, Supplement,* 139-190.

Kothari, S. P., Shanken, J., & Sloan, R. G. (1995). Another look at the cross-section of expected stock returns. *Journal of Finance, 50(1), 185-224.*

Leesi, L. (2023). Financial deepening on the liquidity of nigerian stock market: a multi-dimensional study. *International Journal of Economics and Financial Management (IJEFM), 8(3), 99-117.*

Leesi, L. (2023). Monetary policy transmission channels on the performance of Nigerian stock market. *International Journal of Economics and Financial Management (I JEFM), 118-139*

Leesi, L., & Umasom, P. (2023). Stock market anomalies and efficient market hypothesis: empirical analysis of Monday effect of selected securities from Nigeria. *International Journal of Banking And Finance Research, 9(2), 22-33.*

Lettau, M., & Ludvigson, S. (2001). Resurrecting the (C)CAPM: A cross-sectional test when risk premia are time-varying. *Journal of Political Economy, 109(6), 1238-1287.*

Liew, J., & Vassalou, M. (2000). Can book-to-market, size and momentum be risk factors that predict economic growth? *Journal of Financial Economics, 57(2), 221-245.*

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. Review of Economics and Statistics, 47(1), 13-37.

Lintner, J. (1965). The valuation of risky assets and the selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics, 47, 13-37.*

Lucky, A. L., Akani, H. W., & Anyamaobi, C., (2015). Prudential determinants of stock prices of commercial banks in Nigeria: An application of fundamentalists and macroeconomic view. 1980 – 2014. *IIARD International Journal of Banking and Finance Research, 1 (7), 1 – 27.*

MacKinlay, A. C. (1995). Multi-factor Models do not explain Deviations from the Capital Asset Pricing Model. *Journal of Financial Economics*, 38, 3-28.

MacKinlay, A. C. (1995). Multifactor models do not explain deviations from the CAPM. Journal of Financial Economics, 38(1), 3-28.

Mandimika, N.Z. and Chinzara, Z. (2010).Risk-return trade-off and the behaviour of volatility on the South African Stock Market.*Evidence From both Aggregate and Disaggregate Data. South African Journal Of Economics80(3):345–366.*

Markowitz, H. (1952). Portfolio selection. Journal of Finance, 7(1), 77-91.

Merton, R. (1973). An Intertemporal Capital Asset Pricing Model. Econometrica, 41(5), 867- 887.

Mohammad, B. A. (2011). Impact of micro and macroeconomic variables on emerging stock market return: A case of Dhaka Stock Exchange (DSE). *Interdisciplinary Journal of Research in Business*, 1(5): 8-16

Mohammad, S. D; Naqvi, S. H., Lal, I. & Zehra, S. (2012). Arbitrage Price Theory (APT) and Karachi Stock Exchange (KSE). *Asian Social Science*, 2, (2): 253-258.

Mossin, J. (1966). Equilibrium in a capital asset market. Econometrica, 34(4), 768-783. doi: 10.2307/1910098

Mpohamba, B. (1955). Financial markets in development, and the development of financial markets. *Journal of Economic Dynamics and Control*, 21, 141-181.

Mukherjee,T. K. & Naka, A. (2005). Dynamic relations between macroeconomic variables and the Japanese stock market: an application of a vector error correction model. *The Journal of Financial Research*, 18(2), 223-237.

Newey, W. K., & West, K. D. (1987). A simple, positive semi-definite, heteroscedasticity and autocorrelation consistent covariance matrix. Econometrica, 55(3), 703-708.

Ouma, W. N. &Muriu, P. (2014). The impact of macroeconomic variables on stock market returns in Kenya. *International Journal of Business and Commerce*, 3 (11):1-31.

Oyejide, T.A. (1994). The financial system and economic growth in the context of political transition.*Central Bank of Nigeria Economic and Financial Review, 12 (3) pp 260- 267.*

Oyetayo, O. & Adeyeye P. (2017). The robust application of the Arbitrage Pricing Theory: Evidence from Nigeria. *Journal of Economics and Behavioural Studies*, 9(1), 141-151.

Page, M.J. (1986). Empirical testing of the Arbitrage Pricing Theory using data from the Johannesburg stock exchange. *South African Journal of Business Management*, 17(1), 38-42.

Petkova, R. (2006). Do the Fama-French factors proxy for innovations in predictive variables? Journal of Finance, 61(2), 581-612.

Radulescu, A.& Daniel, T. P. (2014). An econometric model for estimating the equity risk premium. *Procedia Economics and Finance,* 10: 185-189.

Reinganum, M. R. (1981). Misspesification of capital asset pricing: empirical anomalies based on earnings yield and market values. Journal of Financial Economics, 9(1), 19-46.

Ricardo, S. (2010). Reality check for volatility models. Lecture notes of department of economics and finance. *University of California, San Diego.http://www.weber.ucsd.edu /econs508/ note580.*

Roll, R. (1977). A critique of the arbitrage pricing theory's tests, Part 1: On past and potential testability of the theory. *Journal of Financial Economics*, 4(2): 129-176.

Roll, R. (1984). A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market. *Journal of Finance, 39 (4) 1127- 1139.*

Rosenberg, B., Reid, K., & Lanstein, R. (1985). Persuasive evidence of market inefficiency. Journal of Portfolio Management, 11(3), 9-16.

Rubio, G. (1988). Further international evidence on asset pricing: the case of Spanish capital market. *Journal of Banking and Finance*, 12, 221-242.

Saed, S. & Akhter, N. (2012). Impact of macroeconomic factors on banking index in Pakistan. Interdisciplinary *Journal of Contemporary Research in Business. Institute of Interdisciplinary Business Research*, 4(6):2-34

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. Journal of Finance, 19(3), 425-442.

Singh, T., Mehta, S. & Varsha, M. S. (2011). Macroeconomic factors and stock returns: evidence from Taiwan. *Journal of Economics and International Finance*, 2(4), 210-217, April.

Srinivasan, P. (2012). Determinants of equity share prices in India: A panel data approach, *The Romanian Economic Journal*, 205: 18-28

Stattman, D. (1980). Book values and stock returns. The Chicago MBA: A Journal of Selected Papers, 4(1), 25-45.

Umoru, D. & Iweriebo S. (2017), Econometrics test of Arbitrage Pricing and its Volatility in the Nigerian Equities Market. *CARD International Journal of Management Studies, Business & Entrepreneurship Research*, 2(2), 2545-5885,

Uwubanmwen, A. & Obayagbona, J. (2012). Tests of the Arbitrage Pricing Theory using macroeconomic variables in the Nigerian Stock Market. *Ethiopian Journal of Economics*, 24(1), 40-60.

Wermers, R. (1997). Momentum investment strategies of mutual funds, performance persistence, and survivorship bias. Unpublished Working Paper. University of Colorado.

Zhou, C. (1996). Stock Market Fluctuations and the Term Structure, Board of Governors of the Federal Reserve System.*Finance and Economics Discussion Series*, 96/03.

Zivot, E. (2008). Practical issues in the analysis of univariategarchmodels.*John Wiley, New York.Table 1. Unit root testing for daily return and closing prices*

Zubair, A. (2013). Causal relationship between stock market index and exchange rate: Evidence from Nigeria. *CBN Journal of Applied Statistics*, 4(2), 87-110.