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The Effects of Macroeconomic Factors on the Nigerian Stock Returns: A Sectoral Approach

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Abstracts - There is a growing literature on how macro-economic variables can have effects on equity return in both developed and emerging stock markets. The objective of this study is to empirically test the performance of the Arbitrage Pricing Theory (APT) in the Nigerian Stock Exchange (NSE) for the period of 2000 up to 2004 on monthly base. In this paper, 3 macro-economic variables (inflation, exchange rate and market capitalization) are investigated against 20 sectors of the Nigerian Stock Exchange to observe the effects of inflation exchange rate were carried out by Chen Roll & Ross (1986); Gangem, Brooks & Fatt (2000); Tursoy Günsel Rjoub (2008); and Nikolaos, Grigoris, Nikolaos & Nikos (2009). This study in addition, includes Market capitalization variable. Using Ordinary Least Square (OLS) we observed there are no significant effects of those variables on the stocks' return in Nigeria. The results are broadly consistent with similar studies carried for most developed and emerging economies.

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The Effects of Macroeconomic Factors on the Nigerian Stock Returns: A Sectoral Approach

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Abstract - There is a growing literature on how macro-economic variables can have effects on equity return in both developed and emerging stock markets. The objective of this study is to empirically test the performance of the Arbitrage Pricing Theory (APT) in the Nigerian Stock Exchange (NSE) for the period of 2000 up to 2004 on monthly base. In this paper, 3 macro-economic variables (inflation, exchange rate and market capitalization) are investigated against 20 sectors of the Nigerian Stock Exchange to observe the effects of inflation exchange rate were carried out by Chen Roll & Ross (1986); Gangem, Brooks & Fatt (2000); Tursoy Gunsul Rjoub (2008); and Nikolaos, Grigoris, Nikolaos & Nikos (2009). This study in addition, includes Market capitalization variable. Using Ordinary Least Square (OLS) we observed there are no significant effects of those variables on the stocks' return in Nigeria. The results are broadly consistent with similar studies carried for most developed and emerging economies.

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I. INTRODUCTION

The Arbitrage Pricing Theory (APT) is risk-return equilibrium based model. The disagreement by some researchers on the ability of Capital Asset Pricing Model (CAPM) to currently describe expected returns and the interpretation of the cross-section abnormal performance coupled with the inadequacy of the model to adequately test for market efficiency led to the formulation of the Arbitrage Pricing Theory (APT) by Ross in 1976. Chen, Roll & Ross (1986) examined the validity of the APT in the US securities market. They used the US macroeconomic variables as proxies for the underlying risk factors driven stock returns. They discovered that several macroeconomic variables are significant in explaining expected stock returns, particularly in industrial production, changes in riskpremium and twist in the yield curve. Similarly, set oftest is carried out in this study by using Nigerian data, to find out whether some of the findings reported by Chen, Roll and Ross in 1986 for US are valid to Nigerian market.

The objective of this study is to analyze the empirical applicability of the APT to pricing the Nigerian Stock Market (NSE) and identify the set of macro-economic variables which correspond more with the stock market factors in Nigeria. This study developed 3

macro-economic variables which include: inflation, exchange rate and market capitalization. This study concerns macroeconomic factors that have not been extensively explored in influencing the returns of a stock Market in Nigeria.

The structure of this paper is as follows. Section ii presents data sources. Section iii; discuss the literature review, Section iv Presents methodology and variables. Section v presents regression results, vi conclusion.

II. DATA SOURCES

The sample consists of the firms stocks listed in Nigerian Stock Exchange (NSE) for the time period of 2000-2004. Monthly data, with no missing observation after survival test process, 60 stocks left which are classified in 20 sectors. For the macro economic variables, we obtain the data from the Central Bank of Nigeria (CBN). Table 1 presents the market classification and the number of stocks in each sector (Portfolio).

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Table 1: Industry/Sector Classification

S/No	Sector	Number of firms
1	Agric	2
2	Automobile & Tyre	2
3	Banking	6
4	Building material	2
5	Breweries	2
6	Chemical paints	4
7	Commercial services	2
8	Conglomerates	3
9	Constructions	2
10	Engineering	2
11	Food/Beverages & Tobacco	4
12	Health	4
13	Industrial domestic products	4
14	Insurances	7
15	Managed fund	2
16	Packaging	2
17	Petroleum (Marketing)	3
18	Printing & Publication	3
19	Real Estate	2
20	Textiles	2
	Total	60

Gunsel and Cukur (2007) are of the opinion that that lagged effect of macro economic variables on stocks' return should be expected. Therefore, in a stock exchange market, investors usually take decisions base on expectations. If the expectation is realized, there will be no unexpected exchange in stock prices. This is valid for the stock exchange markets which are efficient. However, most of the stock exchange markets are not efficient and they respond to changes with a time lag. The reasons of the lag are that investors may wait until they realize the real effect of the change, to understand whether the changes are permanent or temporary, or some factors show their effects with a time lag because of its characteristics.

III. LITERATURE REVIEW

The relationship between economic fundamentals and stock returns has been studied by a large number of researchers (see Chen, Roll & Ross (1986); Fama (1990); Chen (1991); Nasseh & Strauss (2000); Dickinson (2000); Shanken, & Weinstein (2006); Samitas & Kenourgios (2007); Gunsel & Cukar (2007); Leon (2008); Ahmed (2008) ; Nikolaos, Grigoris, Nikolaos & Nikos (2009) and Abdullahi (2011). For instance, Chen, Roll and Ross (1986) studied 'The Effect of Macroeconomic Factors on the London Stock Return (a Sectoral Approach) and concluded that the macroeconomic factors have a significant effect on the UK stock exchange. The effect depends on the sector that the firm belongs to. Samitas and Kenourgios in 2007 expanded the study of Chen Roll and Ross (1986) to cover many European countries and pointed out the importance of economic activity on the formation of

stock returns.

Chen Roll & Ross (1986) hypothesized and test a set of macroeconomic data series to explain US stock return. They investigated the sensitivity of macro economic to stock returns. They tested seven macroeconomic variables; term structure, industrial production, risk premium, inflation, market return, consumption and oil prices in the period of January 1952- Nov. 1984. They assume that the underlying variables are not serially correlated and all innovations are unexpected. In their research, they found that several of these economic variables to be significant in explaining expected stock return during the tested period. They observed that industrial production changes in risk premium, twist in the yield curve, and measure unanticipated inflation and changes in expected inflation during period when these variable, are highly volatile, are significant in explaining expected return!. They found that consumption, oil prices and market index are not priced by the financial market. They conclude that stock returns are exposed to systematic economic news that is priced by the market.

There are other related investigations to confirm the applicability of APT to stock market return generating process. Roll & Ross (1980) claim to fund empirically at least three or four factors adequate for the explanation of stock returns. Dhrymes, Friend & Gultekin (1984) examine the techniques used by Roll & Ross and found out several limitations in this study. They found that the number of 'factors' extracted increase with the number of securities (variables) in the group to which APT factor analytic procedures are applied. As a second major limitation, they identified the difficulty of identifying the

actual number of factors characterizing the return generating process. Dhrymes, Friend, Gultekin and Gultekin (1985) focused on the attention of financial profession on factor analysis. They reach substantially different conclusion from those drawn by Roll & Ross (1980) regarding the empirical evidence supporting arbitrage pricing theory (APT). They found that the number of factors increases with the number of time series observations used to estimate factor loading. They conclude that the evidence on the usefulness of the APT model is at best mixed.

Brown and Wein (1983) estimate and test the APT in the context of the bilinear paradigm introduced by Kruskal (1978). They examine the special case of the APT in which the numbers of factors are pre-specified, using the same data of Roll and Ross (1980) but through forming 60 securities groups instead of 30 grouping securities according to their industrial classifications instead of alphabetical order. They find a 3-factor APT model rejecting the 5 or 7-factors version. Also, they show that specific firm or industry effects that may be diversified are not priced in the APT scenario. This means that there are few rather than many economy wide factors that appears to be priced in the APT. Lehman & Modest (1987) show that of all the decision choices, the number of factors has the least affect on the model estimates. If the factors are specified macroeconomic shocks, one uses simple regression of factor providing security returns on the factor scores to estimate the factor loadings.

Cited in Gungel & Cukur (2007) there are few empirical investigations, namely Diacgiannis (1986), Poon & Taylor (1991), Cheng (1995), Beenstock & Chen (1988), Clare & Thomas (1994), and Priestley (1996) that analyze the variables that are put by Chen, Roll & Ross (1986) as to the applicability of APT to UK stock market. Diacgiannis (1986) employed for 200 securities and he formed 5 master groups for 40 randomly selected securities. Poon & Taylor (1991). Consider monthly and annual growth rate of industrial production, the unanticipated inflation, risk premium, term structure and return on value weighted market index. To incorporate potential lag relationships, the procedure carried out for each of the market indices and macroeconomic factors. Cheng (1995) employ the monthly return of 61 securities, in UK stock market. The results suggest that there are two stock market factors in the UK, but only one factor and the risk-free coefficient are important for pricing. Cheng further concluded that the explanatory power of APT in pricing UK stock is not high.

In general findings of these researchers, Diacgiannis (1986) and Poon & Taylor (1991), have shown that macroeconomic factors Chen, Roll & Ross claimed to detect in the US market do not influence stock market pricing indiscriminately. Also they shown

that these pricing factors do not affect share priced in the UK market in a manner similar to US. These researchers think that some other macroeconomic factors are at work or the methodology in Chen, Roll & Ross is inadequate for detecting such relationship.

On the other hand, Beenstock and Chen (1988) investigated four factors – namely interest rates, money supply (M3), fuel, and material cost, and the retail price index. They found that unanticipated increase in interest rate and fuel and material costs reduce security returns. They conclude that export volume and relative export prizes as risk factors, but were not significant.

Clare & Thomas (1994) are of opinion that a number of factors have been priced in the UK stock and are; oil prices, default risk and the retail price index. UK private sector bank lending, the current account balance and the redemption yield on an index of UK corporate debentures and loans. Priestley (1996) identified seven macro economic and financial factors; namely default risk, industrial production exchange rate, retail sales, money supply (M3), unexpected inflation, change in expected inflation, term structure of interest rate, commodity prizes and market portfolio. He found that with the factor generating from the rate of change approach, all factors are significant in the UK stock market.

Ozcam (1997) cited in Tursoy, Gungel & Rjoub (2008) tested seven macroeconomic variables of Turkish economy. He separated into expected and unexpected series by a regression process then two step testing methodology is implemented on these series. The study covered 54 stocks for the period of January 1989 to July 1995. The result was beta coefficient of expected factors is found to be significant for asset return.

Altay (2003) employed various economic variables which consider the basic indicator of an economy; from those economic variables, he derived the factor analysis process and factor realizations of principle economic phenomenon for two countries Germany and Turkey. The idea behind employing macro economic variables is described to be just quantitative indicators of basic economic phenomena. He tested the period of January 1988 to June 2002 and January 1993 to 2000 for Turkey and Germany respectively. The tested economic variables are: consumer price index, wholesale price index, money market interest rate, imports, export foreign exchange rate, average yield of public bonds and industrial production index. For German Stock Market, he found the evidence of only one factor beta, unexpected interest rate level factor beta, reward in the market. For Turkey Market, the result can not present evidence for statistically significant unexpected macroeconomic factor beta on expected asset returns during the period tested.

IV. METHODOLOGY

In this study three macroeconomic variables are examined. The model below is designed to test economic conditions (inflation, exchange rate and market capitalization).

The variables can be incorporated into a linear model as suggested by Chen, Roll & Ross (1986)

$$R_i = b_{i0} + b_{i1} F_1 + b_{i2} F_2 + b_{i3} F_3 + \epsilon_i$$

Where R_i is the realized return on sectoral portfolio and b_i is the reaction coefficient measuring the change in portfolio returns for a change in risk factor and F_i is the macroeconomic factor.

In this study, the following factors are employed

- F_1 = Market capitalization
- F_2 = Exchange rate
- F_3 = Inflation
- ϵ_i = A residual error for sector portfolio i

The APT introduced by Chen, Roll & Ross (1986), involves identifying the macro-variables which influence stock returns. This macroeconomic activities influence the returns on stocks and utilizing macro variables in the return generating process providing a basis to estimate stock returns. The simplest of theories of pricing a financial asset is by discounting future cash flows. The exogenous variables that affect the future cash flows or the risk discount rate of a firm must be considered to identify the macroeconomic factors that influence the stock market.

V. REGRESSION RESULTS

Model	Coefficients	Standard errors	t-statistic	Prob (t)
(Constant)	0.16	0.077	4.11	0.04
Market capitalization	0.026	0.018	2.58	0.12
Exchange rate	0.0211	0.017	2.42	0.16
Inflation	0.0016	0.010	2.06	0.29

The probability value for market capitalization (0.12), exchange rate (0.16) and inflation (0.29) are all greater than 0.05, which implies that they do not have significant influence on the firms in different sectors' return. Inflation has the highest probability value, which implies that, out of this three predictors of the sectoral returns, inflation has more level of non-influence on the Nigerian stock return followed by exchange rate (0.16) and market capitalization (0.12) has the least level of non-influence. The outcome of this study are in conformity with other studies across the globe (see Chen, Chen and Hsieh (1995), Chen, Roll and Ross (1986); Burnmeister & Wall (1986), Chen and Jordan (1993), Atlay (2003); Ozcam (1997); Gungel and Cukur (2007); Tursoy, Gusel & Rjoub (2008); and Abdullahi (2011) .

Measurement of the model strength

R-squared	S.E. of Reg.	S.D. of dep. Var.	Durbin-watson
0.38	0.36	0.42	2.12

The R-squared (coefficient of determination) for this study is 0.38 which shows that about 38% of the variation in firms in different sectors' returns is explained by the APT model. As a further measure of the APT model fit, compare the standard error of regression (0.36) to the standard deviation of dependent variable (0.42) with the multiple linear regressions, the model error of the estimate is considerably lower which makes the fitted APT model sensible. The Durbin-Watson statistics of 2.12 implies no serial correlations between the variables.

VI. CONCLUSION

The regression results indicate that macro-economic factors tested have no significant influence in the Nigerian stock exchange market. This indicates that other macro-economic factors affect the stock return in Nigeria, stock exchange or the multi factor APT model with macro economic variables fails to explain the effect in the Nigerian stock market. This result supported by Poon and Taylor (1991) and Tursoy, Gungel & Rjoub (2008), which found that there is no relationship between the macroeconomic variables and stock market return. However each factor may insignificantly affect different sector in different manner. That is a macroeconomic factor may insignificantly affect one sector positively, but may insignificantly affect the other sector negatively.

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