INTERNATIONAL JOURNAL OF BUSINESS, 19(3), 2014 ISSN: 1083-4346

Did the Economic and Financial Crises Affect Stock Market Sensitivity to Macroeconomic Risk Factors? Evidence from Nigeria and South Africa

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ABSTRACT

This study examines the impact of the economic and financial crises on the sensitivity of the Nigerian and South African stock indices to macroeconomic risk factors including inflation, interest rates, exchange rates, gold prices and oil prices. The study finds that following the economic and financial crises of 2008, the stock markets of Nigeria and South Africa became more sensitive to most of the macroeconomic risk factors, indicating a greater influence of fundamental economic variables in stock market dynamics or a diminution of irrational exuberance. We found both markets to be insensitive to the interbank rate.

JEL Classifications: G12, G15

Keywords: macroeconomic risk factors; Nigerian Stock Exchange; Johannesburg Stock Exchange; arbitrage pricing theory

[*] The views expressed in this paper are those of the authors alone and do not necessarily represent those of the Central Bank of Nigeria or CBN policy.

I. INTRODUCTION

The Arbitrage Pricing Theory or APT (Ross, 1976; Ross and Stephen, 1980; Chen, Roll and Ross, 1986) suggests that there might be a number of macroeconomic variables which are priced in stock markets, unlike the capital asset pricing model's (CAPM) market portfolio (Sharpe, 1964; Lintner, 1965). In applying the APT, however, we trade the simplicity of the CAPM's market portfolio for an undefined and potentially large number of macroeconomic variables that could explain stock returns. Nevertheless, the intuition that stock returns are explained by more than one variable has motivated a large and growing number of investigations of the impact of macroeconomic variables on stock returns.

A study by Ikoku and Hosseini (2013) investigated the sensitivity of the various sectors of the Nigerian stock market to changes in interest rates, inflation, exchange rates and oil prices. The results provided information which was important in determining how the various sectors of quoted stocks on the exchange reacted to the aforementioned macroeconomic factors by estimating their elasticities. While the results of the study were mixed across the sectors, we drew motivation from this study in developing this paper. Unlike the paper by Ikoku and Hosseini, we increased the number of macroeconomic risk factors in this study, determined the sensitivity of the whole market, as against sectors, to the risk factors, and also included the South African stock market for comparison. In addition, we try to determine the impact of the global economic and financial crises (EFC) on the sensitivities of the two equity markets.

In order to address the gap in literature on emerging African markets, we were driven to study select African markets, based on the availability of data, to determine how effective the APT is in estimating the movement of stock prices. Also, motivated by the events associated with the recent global financial crisis, our decision to divide the data into two parts to enable us study the impact of the crisis on sensitivities further enriches our findings and would provide more relevant information to policy makers and investors alike.

This paper seeks to examine whether the EFC had an impact on the sensitivity of two prominent African stock markets to macroeconomic variables. Did the sensitivity of the frontier stock market of Nigeria and the emerging stock market of South Africa to inflation, exchange rates, short-term and long-term interest rates, the price of Gold and Crude oil change as a result of the economic and financial crises that began in 2008? This is an interesting question that deserves a thorough investigation, and this paper seeks to shed more light on the issue.

The rest of this paper is structured as follows. Section II presents a brief review of the literature, Section III discusses the data and methodology employed for this study, and Section IV presents the results of the empirical analysis. In Section V, we offer an interpretation of the results and Section VI concludes.

II. LITERATURE REVIEW

While there has been extensive research on the impact of macroeconomic variables on stock indices in developed markets, the same cannot be said of emerging much less frontier markets. Establishing the impact of oil price shocks on firms' expected returns, Apergis and Miller (2008) set out to add to existing literature by studying the impact of

oil price shocks on a number of stock markets, including but not limited to the United States, Germany, United Kingdom and Japan. They built Vector Autoregressive and Vector Error Correction models to determine long term relationships and used this as a proxy to predicting stock returns in these markets. The results of their analysis revealed that while oil price shocks were significant in predicting stock returns, the magnitude of the coefficients were small.

Gay (2008) studied the effect of macroeconomic variables on the stock market of the BRIC (Brazil, Russia, India and China) nations. The results of his study implied that there was no significant relationship between the indices of these stock markets and exchange rates and oil prices.

Alam and Uddin (2009) also studied the relationship between stock prices and interest rates on 15 developed and developing economies including the Johannesburg Stock exchange using panel data. Interest rates were found to explain approximately 37 percent of the total variation in stock price movements. They further claimed that the general relationship was a negative relationship across the markets due to interest rates being the cost of capital.

In another study, Masih et.al (2010) investigated the interaction between stock prices and the price of oil to determine if there was any long run relationship between the two in the Korean stock market. Having established the presence of a long run relationship, the authors made use of the linear combination of both variables as one of the explanatory variables in modeling stock prices in an error correction model. The results of their analysis revealed that indeed oil prices were statistically significant in modeling stock prices on the Korean market.

Narayan and Narayan (2010) also conducted the same investigation on daily data with the inclusion of nominal exchange rates on the Vietnamese stock market, revealing that all three variables were cointegrated. They subsequently built an error correction model to explain variations in the movements of stock prices in the market, concluding that there was a positive and significant relationship between stock prices and oil prices while the relationship was negative in the case of exchange rates. The discovery of an ARCH effect in the residuals prompted the authors to build a general autoregressive conditional heteroscedasticity (GARCH 1,1) model of the stock prices. The results from the GARCH model also confirmed the significance of the relationship between the variables and stock prices, while the residuals indicated the absence of residual heteroscedasticity in their model.

A study on the frontier market of Cote d'Ivoire revealed a significant relationship between the stock market index and macroeconomic variables. Utilizing granger causality tests and an error correction model, Herve et al. (2011) revealed that among the inflation rate, money supply, interest rates and the index of industrial production, only the inflation rate and the domestic interest rates were significant in predicting stock market prices for that market. The results of a granger causality test showed bi-directional causality between the stock price index and the domestic interest rates indicating that changes in interest rates had a significant influence on stock prices and vice-versa.

Iqbal et al. (2012) argued that there is a significant relationship between returns on the Pakistani stock exchange and a number of economic variables. In a bid to establish this claim, they ran a regression model predicting stock returns using exchange rates, inflation, crude oil prices and money supply as independent variables to

produce betas for the systemic factors. Following this, they went ahead to make predictions of the stock returns over a sample period and compared the results obtained to the actual returns. Since the forecasts were close to the actual returns, the authors concluded that the APT was reliable as a method for predicting stock returns on the exchange.

Oduro and Adam (2012) tested the suitability of using the APT on the Ghana stock exchange in contrast to the CAPM. Using monthly data from January 2000 to December 2009, they used the OLS estimator to determine the sensitivity of stock returns to the inflation, the exchange rate and the 91-day Treasury bill rate. The results of their estimation revealed that the market beta was significant all through the selected stocks for their analysis, while 10 out of the 15 stocks were sensitive to inflation. The liquidity coefficient also had the same number of significant betas for the different stocks as the inflation beta. Making use of the F-statistic, it was found that the model was indeed statistically significant hence implying the reliability of the results obtained from the regression models. With none of the models having an R-Squared below 30%, the authors concluded that the macroeconomic variables did play a significant role and outperformed the traditional CAPM in determining future returns on the equities studied.

Spyridis et al. (2012) also set out to validate the influence of macroeconomic factors on the movement of stock returns in the Athens stock exchange (ASE). Applying a panel data, their findings revealed that some macroeconomic variables did have some influence on the evolution of stock returns over a twelve year period from 1989 to 2010, recording R-squared values above 0.40 for the various factors tested. This finding led to the conclusion that macroeconomic factors had information which could be useful in predicting stock market returns. Gul and Khan (2013) applied the APT to data from 2000 to 2005 of the Karachi stock exchange index (KSE-100) but concluded that the macroeconomic factors tested had no significant relationship with the index.

A relatively early study was conducted by Bilson et al. (2001) on the sensitivity emerging stock market indices, including that of Nigeria, to macroeconomic variables including money supply, the world index, changes in goods prices, exchange rates and real activity. They found that the Nigerian stock market was sensitive to movements in the world index, implying a level of integration in the stock market with international markets.

Apart from Omotor's (2010) investigation of Nigerian stocks, which found support for the Fisher (1930) hypothesis, suggesting a positive relationship between stock returns and inflation, there are a few studies which have gone further to examine the sensitivity of Nigerian stocks to other macroeconomic variables.

Using quarterly data, Adaramola (2011) studied the impact of macroeconomic variables on stock prices in Nigeria, between 1985 and 2009. He found that interest rates, exchange rates and the international price of oil had a strong influence on Nigerian stock prices while money supply, inflation rate and GDP had a weaker influence on Nigerian stock prices. Izedonmi and Abdullahi (2011) conducted a test of the APT using a sectoral approach and three macroeconomic variables − market capitalization, inflation and exchange rates. Surprisingly, they found that the macroeconomic variables had no impact on stock prices in Nigeria. Using quarterly data from 1985 to 2009 and a vector autoregressive approach, Arodoye (2012)

investigated the relationship between stock prices, GDP, interest rates and inflation. He found both short run and long run relationships among the variables.

Studying South Africa and Nigeria, Kodongo and Ojah (2012) investigated the pricing of exchange rate risk in these markets, pointing out that this risk was unconditionally priced in the South African stock market with little evidence supporting the pricing of this risk for the All-Share index in Nigeria. They opine that the greater integration of the South African stock market with international economies could be a reason for the inconsistency recorded across the two stock markets.

Furthermore, Bartram and Bodnar (2012) investigated the impact of exchange rate exposure on the returns of equities of non-financial firms across 37 developed and developing nations, finding evidence that there was a higher degree of sensitivity to exchange rate exposure as the firm size increased. Their results also showed that these results were more pronounced in developing economies, including South Africa, than in the developed economies studied.

Finally, Gupta and Modice (2013), employing a predictive framework studied the relationship between the South African stock returns and movements in the macroeconomic variables in a modification of the arbitrage pricing theory. They found that a number of interest rates, money supply and oil production growth did have a significant impact on the evolution of stock returns in the Johannesburg stock exchange. Their out of sample results also showed that both the interest rates and money supply had some predictive power over short horizons while inflation showed a very strong ability to produce forecasts of the stock returns from 6 months and beyond.

These studies are interesting but do not investigate the impact of the EFC on the sensitivity of Nigerian and South African stocks to macroeconomic risk factors. This study goes a long way to throw light on this issue.

III. DATA AND METHODOLOGY

A. Data Series on Nigeria

The all-share index (ASI) of the Nigerian Stock Exchange (NSE) was used for this study to measure the sensitivity to a number of macroeconomic factors. Monthly data ranging from January 2003 to December 2012 were obtained from the NSE for this purpose. The macroeconomic factors chosen for this study were the inflation rate, nominal exchange rate between the Naira and U.S. Dollar, gold price, Brent crude price, the interbank rate (short-term interest rate), and the 10-year Treasury bond yield (long-term interest rate). The Central Bank of Nigeria (CBN) was the source of data for the nominal exchange rate and the interbank rate while data on Brent crude and gold prices were obtained from a Bloomberg terminal. Monthly inflation rates used for the study were obtained from the National Bureau of Statistics, and yields on 10-year Treasury bonds were was obtained from the Financial Markets Dealers Association (FMDA) web site.

There were a total of 120 monthly observations, from January 2003 to December 2012, with the exception of the 10-Year Treasury bonds rate which began in July 2007, their date of first issuance.

B. Data Series on South Africa

For South Africa, we utilized the Johannesburg Stock Exchange's all-share index (JALSH) with the same sample data as the Nigerian analysis, i.e., from January 2003 to December 2012. The corresponding macroeconomic variables used to estimate sensitivities for Nigeria were also used to estimate same for the JALSH including the year-on-year South African inflation rates, 10-Year Treasury bond yields, interbank rate, the exchange rate between the South African Rand and the U.S. Dollar, gold price and Brent crude price.

Historical data on the monthly movements of the JALSH was obtained from the Bloomberg database. However, the rate of inflation, interbank rate, 10-Year Treasury bond yields and the nominal exchange rates were obtained from the Reserve Bank of South Africa. As in the Nigerian case, there were a total of 120 monthly observations.

C. Methodology

In order to determine the sensitivities of the stock markets in these two economies to macroeconomic factors, we ran regressions of the forms given below:

$$\Delta LOG(ASI) = \beta_0 + \beta_1 \Delta LOG(IBR) + \beta_2 \Delta LOG(EXR) + \beta_3 \Delta LOG(INF) + \beta_4 \Delta LOG(GOLD) + \beta_5 \Delta LOG(BRENT) + \varepsilon \quad (1)$$

$$\Delta LOG(JALSH) = \beta_0 + \beta_1 \Delta LOG(IBR) + \beta_2 \Delta LOG(EXR) + \beta_3 \Delta LOG(INF) + \beta_4 \Delta LOG(GOLD) + \beta_5 \Delta LOG(BRENT) + \varepsilon \quad (2)$$

Where β_0 is a constant, $\beta_1..\beta_5$ are coefficients representing the sensitivities of the indices to the factors respectively. We ran the regressions with the first differences of the natural logs of the variables, which is analogous to regressing the percentage changes of the dependent variables on the percentage changes of the independent variables, or elasticities.

In order reduce the impact of multicollinearity, we ran separate regressions using short-term rates (IBR) and long-term rates (TBR) as these two variables were highly correlated in the Nigeria data set (see Blalock, 1963).

We divided the data into two equal halves, January 2003 - December 2007 and January 2008 to December 2012, using the first half of the sample to estimate the sensitivity of the indices to the aforementioned macroeconomic factors prior to the recent EFC, and the second half to estimate the sensitivity of the indices to the factors during the EFC. In a bid to minimize autocorrelation in the error terms of the models, we used autoregressive moving average (ARMA) terms in our model estimations. Finally, we determined the significance of the coefficients by using their probability values.

IV. EMPIRICAL RESULTS

A. Diagnostics Tests

The descriptive statistics of the variables used for this study are shown in Table 1. The Nigerian all-share index had a maximum value of 64,848.70 with a mean of 28532.65 over the sample period, while the Johannesburg all-share had a maximum of 39,266.20 and a mean of 23,084.87. The statistics revealed that the JALSH and the Nigerian inflation rate were the only negatively skewed variables while the other variables were either weakly positively skewed or significantly positively skewed. The results from the Jarque-Bera normality test showed that most of the variables failed the normality test with low probability values, rejecting the hypothesis of normality for the NSE's all-share index, Naira-Dollar exchange rate, Nigerian interbank rate, gold price, South African inflation rate, the Rand-Dollar exchange rate, the South African interbank rate and the JSE's all-share index. However, the assumption of normality could not be rejected for the Nigerian inflation rate or Treasury bond yields and the South African Treasury bond yields. Crude oil was weakly normal, with a prob. value of 0.0563.

The correlation coefficients are reported in Table 2. The correlation coefficients between the Nigerian all-share index and the macroeconomic factors tested showed a high and negative value for the correlation between the ASI and exchange rate at -0.91474, closely followed by -0.60101 between the ASI and inflation. The correlation table shows a very low value between the index and the interbank rate over the sample period. Among the macroeconomic factors however, there is a high correlation between the interbank rate and the Treasury bond rate with a value of 0.7866 which informed our decision to run separate regressions using the two variables. The Johannesburg all-share index (JALSH) on the other hand produced high correlation coefficients with the international macroeconomic variables, including a value of 0.9103 with Brent crude prices and 0.8682 with Gold prices. While the coefficients were not particularly high between the ASI and the interest rates (10-Year Treasury bonds and interbank rate), it did reveal a negative relationship. The relationship among the South African risk factors showed a positive relationship between the two interest rates as well as an insignificant relationship between the inflation rate and the 10-Year Treasury bonds rate.

The test of stationarity in table 3 using both the Augmented Dickey-Fuller test and the Philips-Perron test revealed the presence of a unit root on the levels of all the variables tested with the exception of the Nigerian interbank rate. However, all the variables were adjudged to be stationary at the first differences, or *I*(1).

B. Regression Results

1. Nigerian sensitivities

In the regression with the interbank rate, as the interest variable, on the pre-EFC sample (January 2003 to December 2007), the ASI was largely insensitive to the macroeconomic variables. The only exception to this is the probability value of 0.0904 on gold prices, indicating a rather weak significance at the 10 per cent level. This is given more credence by the low adjusted R^2 of 14.66 per cent which implies that very little of the variations of the market prior to the EFC were explained by the variation in the macroeconomic factors.

Table 1
Descriptive statistics

	ASI	INF (NG)	CRUDE	EXR (N/$)	GOLD	IBR (NG)	TBR (NG)	TBR (SA)	JALSH	IBR (SA)	EXR (R/$)	INF (SA)
Mean	28637.260	12.271	73.982	136.831	907.669	9.580	11.222	8.5666	23497.860	6.484	7.389	5.731
Median	24635.910	12.400	71.410	132.360	831.150	9.630	11.199	8.450	25447.730	6.000	7.326	5.600
Maximum	64848.700	19.400	139.830	156.550	1825.720	39.020	16.340	10.380	40482.920	12.000	10.192	13.700
Minimum	13298.750	4.200	23.680	116.060	335.130	0.310	5.530	7.260	7510.400	3.500	5.636	0.100
Std. Dev.	11824.140	3.540	29.721	12.971	465.174	6.285	2.667	0.767	9000.496	2.351	0.936	2.891
Skewness	1.4679	-0.2078	0.136	0.070	0.509	1.404	0.014	0.369	-0.250	0.727	0.805	0.527
Kurtosis	4.2724	2.876	1.976	1.651	1.898	8.076	2.413	2.513	1.928	2.577	3.699	3.473
Jarque-Bera	52.467	0.962	5.754	9.429	11.532	172.469	0.993	3.998	7.169	11.756	15.788	6.850
Probability	0.0000	0.618	0.056	0.009	0.003	0.000	0.609	0.136	0.028	0.003	0.000	0.033
Sum	3522383.0	1509.3	9099.8	16830.2	111643.3	1178.4	774.3	1053.6	2890237.0	797.5	908.8	704.9
Sum Sq. Dev.	17100000000	1528.5	107768.8	20524.4	26399240	4819.4	483.6	71.8	9880000000	674.5	106.9	1019.5
Observations	123	123	123	123	123	123	69	123	123	123	123	123

Table 2
Correlation coefficients

NIGERIA	ASI	CPI	CRUDE	EXR	GOLD	IBR	TBR
ASI	1						
CPI	-0.601009	1					
CRUDE	0.157098	-0.219956	1				
EXR	-0.914739	0.411794	0.078286	1			
GOLD	-0.621317	0.216172	0.572964	0.781728	1		
IBR	-0.066200	0.062886	0.140051	0.032823	0.180054	1	
TBR	-0.070020	-0.009725	0.419065	0.10197	0.409624	0.786582	1
SA	CPI	CRUDE	EXR	GOLD	IBR	JALSH	TBR
CPI	1						
CRUDE	0.358215	1					
EXR	0.620900	0.17364	1				
GOLD	0.186903	0.82894	0.383072	1			
IBR	0.597904	-0.40300	0.271756	-0.584385	1		
JALSH	0.350080	0.91029	0.298973	0.868236	-0.428077	1	
TBR	0.095038	-0.29021	0.029852	-0.320143	0.452832	-0.459117	1

Table 3
Unit root

Augmented Dickey Fuller						
Null Hypothesis: Variable has a unit root			Null Hypothesis: Variable has a unit root			
	Levels			**First Difference**		
	McKinnon Prob-Values without Trend	McKinnon Prob-Values with Trend		McKinnon Prob-Values without Trend	McKinnon Prob-Values with Trend	**Test Results**
SI	0.2748	0.6029	ASI	0.0004	0.0025	I(1)
JALSH	0.9010	0.7617	JALSH	0.0000	0.0000	I(1)
EXR (N/$)	0.7142	0.6313	EXR (N/$)	0.0000	0.0000	I(1)
EXR (R/$)	0.1268	0.0798	EXR (R/$)	0.0000	0.0000	I(1)
INF (NG)	0.0640	0.1618	INF (NG)	0.0000	0.0004	I(1)
INF (SA)	0.2412	0.3719	INF (SA)	0.0000	0.0000	I(1)
IBR (NG)	0.0000	0.0000	IBR (NG)	0.0000	0.0000	I(0)
IBR (SA)	0.0425	0.1172	IBR (SA)	0.0232	0.0843	I(1)
TBR (NG)	0.5452	0.8348	TBR (NG)	0.0000	0.0000	I(1)
TBR (SA)	0.0511	0.1116	TBR (SA)	0.0000	0.0000	I(1)
GOLD	0.9773	0.3714	GOLD	0.0000	0.0000	I(1)
BRENT	0.3481	0.0543	BRENT	0.0000	0.0000	I(1)

Table 3 (continued)

Philips Perron						
Null Hypothesis: Variable has a unit root			Null Hypothesis: Variable has a unit root			
	Levels			First Difference		
	McKinnon Prob-Values without Trend	McKinnon Prob-Values with Trend		McKinnon Prob-Values without Trend	McKinnon Prob-Values with Trend	**Test Results**
ASI	0.3402	0.6960	ASI	0.0000	0.0000	I(1)
JALSH	0.8761	0.6028	JALSH	0.0000	0.0000	I(1)
EXR (N/$)	0.8035	0.7561	EXR (N/$)	0.0000	0.0000	I(1)
EXR (R/$)	0.0963	0.0662	EXR (R/$)	0.0000	0.0000	I(1)
INF (NG)	0.1509	0.3649	INF (NG)	0.0000	0.0000	I(1)
INF (SA)	0.1154	0.1895	INF (SA)	0.0000	0.0000	I(1)
IBR (NG)	0.0000	0.0000	IBR (NG)	0.0001	0.0001	I(0)
IBR (SA)	0.2483	0.5515	IBR (SA)	0.0000	0.0000	I(1)
TBR (NG)	0.4879	0.7855	TBR (NG)	0.0000	0.0000	I(1)
TBR (SA)	0.0783	0.1847	TBR (SA)	0.0000	0.0000	I(1)
GOLD	0.9869	0.2160	GOLD	0.0000	0.0000	I(1)
BRENT	0.4475	0.1369	BRENT	0.0000	0.0000	I(1)

With the EFC sample (January 2008 to December 2012), the sensitivity of the Nigerian equity market to the macroeconomic factors seemed to have improved. The coefficient of the exchange rate factor was estimated at -1.4905 and was highly significant, with a probability value of 0.0053. There was also a highly significant and positive elasticity between the ASI and Brent crude at 0.3297. The elasticities of the other factors were insignificant. The improvement in the explanatory power of the model in the EFC sample is indicated by the higher adjusted R^2 of 0.3405.

The regression results for the model with the 10-Year Treasury bond yields had a reduced number of observations due to the unavailability of data prior to July 2007, when with 10-year bond was first issued in Nigeria. As a result of this, the elasticities estimated using the TBR for the interest rate variable were effectively generated based on an EFC data set. The results revealed similar findings to those of the model with the interbank rate with significantly negative elasticity for the exchange rate and a positive elasticity for the Brent crude prices with values of -0.9083 and 0.4205, respectively. Unlike the post crisis interbank elasticity model, the TBR elasticity was weakly significant with a probability value of 0.0617 and a coefficient of -0.1713. The adjusted R^2 of the TBR model was slightly lower than the IBR model, at 0.3183.

2. South Africa sensitivities

Following the same methodology, separate regressions were run for the South African data set, using the interbank rate and the Treasury bond yield. The interbank rate elasticity model showed that, prior to the EFC, there was a positive and very significant

Table 4
Elasticity

Dependent Variable: DLOG(ASI)
Method: Least Squares
Pre-EFC Sample: January 2003 - December 2007
EFC Sample: January 2008 - December 2012

	Pre EFC		**EFC**	
	Coefficient	Prob.	Coefficient	Prob.
C	0.0305	0.0083	0.0003	0.9759
DLOG(IBR)	0.0008	0.8745	0.0027	0.9149
DLOG(INF)	0.0000	0.9209	-0.0155	0.8958
DLOG(EXR)	0.7331	0.3808	-1.4905	0.0053
DLOG(CRUDE)	0.0270	0.7513	0.3297	0.0066
DLOG(GOLD)	-0.2656	0.0904	-0.0058	0.9765
AR(1)	-0.9763	0.0000	-0.6308	0.0000
AR(2)	-	-	0.4318	0.0063
AR(3)	-	-	0.8388	0.0000
AR(4)	-	-	-	-
MA(1)	1.4708	0.0000	0.5807	0.0000
MA(2)	0.4915	0.0004	-0.5394	0.0000
MA(3)	-	-	-0.9635	0.0000
Adj. R-squared	0.1467		0.3405	
F-Statistic	2.2246		3.7689	
AIC	-2.8639		-2.1763	
SIC	-2.5444		-1.7574	
Durbin-Watson	2.0505		2.0728	

Dependent Variable: D(ASI)
Method: Least Squares
Sample: July 2007 - December 2012

	10YR-TBR Model	
	Coefficient	Prob.
C	-0.0070	0.4226
DLOG(TBR)	-0.1713	0.0617
DLOG(INF)	-0.0024	0.9806
DLOG(EXR)	-0.9083	0.0760
DLOG(CRUDE)	0.4205	0.0006
DLOG(GOLD)	-0.1110	0.5805
AR(1)	0.2501	0.1337
AR(2)	0.4312	0.0007
AR(3)	-0.5494	0.0000
AR(4)	-0.2766	0.0315
MA(1)	-0.4876	0.0000
MA(2)	-0.5065	0.0000
MA(3)	0.9722	0.0000

Adj. R-squared	0.3183
F-Statistic	3.3349
AIC	-2.1378
SIC	-1.6879
Durbin-Watson	2.0201

sensitivity between the JALSH and gold prices with a coefficient of 0.5121 and a probability value of 0.0002. The elasticity for the exchange rate was also positive at 0.2680 and highly significant; indicating that depreciation in the exchange rate of the Rand led to an increase in the value of the JALSH. The coefficients of the other factors in this model were insignificant. The model had an adjusted R^2 of 0.4032.

Interestingly, in the EFC sample, the elasticity of the exchange rate became negative with a significant value of -0.2802 while Brent crude recorded a significant elasticity of 0.2321. All the other factors however produced insignificant elasticities, including gold which was highly significant in the earlier sample. The adjusted R^2 of model improved to 0.5656.

The Treasury bond yield model produced similar results to those recorded for Nigeria TBR elasticity model. Prior to the crisis, the elasticity of the TBR was negative and highly significant with a value of -0.6965. There were also positive and significant elasticity's for the exchange rate, Brent crude price and gold price at 0.1674, 0.0622 and 0.1924 respectively. Inflation, however, was insignificant in this model. This model recorded an adjusted R^2 of 0.5043.

With the EFC sample, however, only the elasticity of Brent crude price movement was significant in estimating the movement of the JALSH with a value 0.2946. This was also reflected in a lower adjusted R^2 of 0.4726 after the onset of the EFC.

V. INTERPRETATION OF REGRESSION RESULTS

Our regression results indicate the stock markets of Nigeria and South Africa are not sensitive to short term interest rates. A number of reasons could be adduced for this, including the tendency of sophisticated firms to hedge against adverse movements in short term rates and the fact that the firms which would be most sensitive to short term rates are only a subset of the sample. Ikoku and Hosseini (2013) found some sensitivity to interbank rates among banks in Nigeria, but no sensitivity to interbank rates in the other sectors of the Nigerian stock exchange.

The lack of sensitivity to inflation in the pre- and EFC samples in both Nigeria and South Africa is somewhat surprising but not entirely unexpected. Some studies of the Nigerian equity market have found some sensitivity to inflation (Omotor, 2010; Arodeye, 2012) while others have found no sensitivity to inflation (Adaramola, 2011; Izedonmi and Abdullahi, 2011). Ikoku and Hosseini (2013) found that the Food and Beverage and Insurance sectors were sensitive to inflation, while the Banking and Oil and Gas sectors were not.

Table 5
Elasticity

Dependent Variable: DLOG(JALSH)
Method: Least Squares
Pre-EFC Sample: January 2003 - December 2007
EFC Sample: January 2008 - December 2012

	Pre EFC		**EFC**	
	Coefficient	Prob.	Coefficient	Prob.
C	0.0163	0.0000	0.0031	0.5651
DLOG(IBR)	-0.8830	0.1571	0.0007	0.9948
DLOG(GOLD)	0.5121	0.0002	0.0487	0.5665
DLOG(EXR)	0.2680	0.0035	-0.2802	0.0170
DLOG(CRUDE)	0.0453	0.3754	0.2321	0.0007
DLOG(INF)	-0.0045	0.5437	-0.0446	0.3412
AR(1)	-	-	0.1139	0.4028
AR(2)	-	-	-0.2504	0.0266
AR(3)	-	-	0.1118	0.2613
AR(4)	-	-	-0.5506	0.0000
MA(1)	-0.4673	0.0000	-0.3161	0.0000
MA(2)	0.2795	0.0219	0.4026	0.0000
MA(3)	-0.0378	0.7478	-0.3067	0.0000
MA(4)	-0.7020	0.0000	0.9714	0.0000
Adj. R-squared	0.4032		0.5656	
F-Statistic	5.3547		6.9093	
AIC	-3.7679		.3.6498	
SIC	-3.4158		-3.1611	
Durbin-Watson	1.6542		2.0905	

Dependent Variable: DLOG(JALSH)
Method: Least Squares
Pre-EFC Sample: January 2003 - December 2007
EFC Sample: January 2008 - December 2012

	Pre EFC		**EFC**	
	Coefficient	Prob.	Coefficient	Prob.
C	0.0151	0.0287	0.0055	0.2998
DLOG(TBR)	-0.6965	0.0000	-0.2436	0.1737
DLOG(GOLD)	0.1924	0.0864	-0.0682	0.5070
DLOG(EXR)	0.1674	0.0396	-0.1807	0.1705
DLOG(CRUDE)	0.0622	0.0809	0.2946	0.0001
DLOG(INF)	0.0042	0.5129	0.0238	0.6660
AR(1)	-1.3814	0.0000	0.2275	0.0113
AR(2)	-0.8681	0.0004	-0.7669	0.0000
AR(3)	-0.2449	0.0872	-	-

AR(4)	-	-	-	-
MA(1)	1.3447	0.0000	-0.3835	0.0000
MA(2)	1.3382	0.0000	0.9611	0.0000
MA(3)	1.2542	0.0000	-	-
MA(4)	0.8771	0.0000	-	-
Adj. R-squared	0.5043		0.4726	
F-Statistic	5.6627		6.8753	
AIC	-4.0398		-3.5059	
SIC	-3.5697		-3.1568	
Durbin-Watson	1.9416		2.0953	

Being an alternative to equity for investors, the price of gold was the only factor which affected the movement of stock prices with a negative sensitivity, implying that foreign investors could have been using gold as a hedging instrument against the volatility of the stock market. The observation of a high adjusted R^2 in the EFC model also gives credence to this claim; if local investors became more sensitive to variation in macroeconomic factors, this would increase their influence on stock prices.

The negative elasticity of the 10-Year TBR suggests that, with the onset of the EFC, investors fled to the safe haven of long term government bonds after the stock market crash. There is strong evidence of this in Nigeria as yields on government bonds fell to unsustainable levels, far below the rate of inflation. Thus the bursting of the equity market bubble led to the formation of the bubble in the sovereign debt market.

The results observed on the South African data also revealed that, prior to the EFC, there was a positive relationship between the JALSH and the exchange rate and a negative relationship with the onset of the EFC. This may have been due to the influence of deterioration in the exchange rate on the profits of foreign investors.

It is surprising that the South African stock exchange was weakly sensitive to the price of gold before the EFC but not sensitive with the onset of the EFC. Some of the coefficients may have been affected by data problems. Also, Nigeria's stock market seemed to have become more sensitive to the price of crude with the onset of the EFC. The lack of significant elasticities to macroeconomic variables in the stock market could be as a result of omitted explanatory variables which could contain information central to explaining the variations in the stock market (Lyon's and Evans, 1999).

VI. CONCLUSION

The goal of this study was to determine how the EFC that began in 2008 has affected the sensitivity of the Nigerian and South African stock markets to macroeconomic factors. While there have been a number of studies on the sensitivity of these markets to the macroeconomic risk factors, this is the first paper to examine the impact of the economic and financial crises on the factor loadings. The results are mixed, but suggest a return to fundamentals in determining the trajectory of the Nigerian and South African stock markets with the onset of the EFC.

Further research in this area could investigate the sensitivity of stock markets to the slope of the yield curve (the spread between long-term and short-term interest rates)

and the spread between lending and deposit rates. Also, more work could be done to explore the sensitivities of the various sectors of the market to these macroeconomic risk factors. Different industries could have differing sensitivities to macroeconomic risk factors due to market structure, exposure to foreign trade, and adoption of hedging strategies. Ikoku and Hosseini (2013) is an attempt to conduct such a study of the Nigerian equity market.

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