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MACROECONOMIC FACTORS AND STOCK MARKET BEHAVIOUR: AN ANALYSIS OF THE 2008 CRISIS

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Abstract. *This study investigates the long term relationship between the behaviour of stock markets during the 2008 crisis and some selected international macroeconomic variables using information from January 2005 to December 2015. The procedures of the Autoregressive Distributed Lag modeling techniques (ARDL) are employed for the analysis. The bounds testing procedure in the ARDL framework is used to test for the existence of long term relationships between stock market behaviour and global economic factors (interest rate, exchange rate, index of industrial production and oil price) as well as the direction of effects, while estimated coefficients are used to test the pattern of long term relationships among the variables. The study revealed that a significant long term relationship exists between stock price movements and these global economic trends while the stock market crash significantly impacted the efficiency of the markets under review. Thus, it is recommended that market fundamentals should remain the capstone of stock market analysis, and policies should encourage the delinking of stock markets from the international commodity market factors.*

Key words: *Stock Market Behaviour, Macroeconomic variables, ARDL Model.*

JEL Classification: GOI, G1, G14

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1. INTRODUCTION

External (non-fundamental) forces have always been acknowledged to have certain levels of influences on stock market behaviour over the years. For instance, it has been demonstrated that the immediate factor behind the 2008 market crashes was the widespread mortgage default in the United States that led to general financial sector collapse which was most extensively reflected on interest rate and exchange rate instability (Kim, Rachev, Bianchi, Mitov & Fabozzi, 2010; Malkiel, 2011). In the same vein, UNCTAD (2012) noted that price boom in international markets for primary commodities has been one of the main features of the world economy since 2002. They noted that such higher prices for primary commodities have an immediate positive impact on most financial markets. Such positive relationship would imply that a sharp negative shock in the price of these commodities could send financial markets spiraling downwards.

Interestingly, price developments in the international stock markets have also coincided with a greater weight on commodity derivatives markets by portfolio managers. The increased linkage of the financial markets with commodity markets has led to 'financialization' of commodity markets (UNCTAD 2012) which was accelerated significantly beginning from the 2002–2004 period. This has led to "increasingly close correlation between returns on investment in commodities and equities, as well as those related to the exchange rates of currencies affected by trade speculation." This kind of arrangement has presented extensive risks for the financial markets and is argued in this study to effectively contribute to market crashes. This may well focus more extensively on development in international commodity markets in determining the future patterns in the stock markets (Obadan & Adegboye, 2016). Other relevant works include Basu & Charola (2012), Chen, Mrkaic, & Nabar (2019), and Sumner (2019). In this study, the effects of macroeconomic variables on stock market behaviour are investigated. The relationship between international macroeconomic variables and stock market crashes over time may be inferred.

2. REVIEW OF RELATED LITERATURE AND THEORETICAL ISSUES

Stock Price Behaviour: In the literature, stock price movement is generally attributed to two major factors: these are the fundamental factors and technical factors. "Prices of securities in the stock market fluctuate daily on account of continuous buying and selling. Stock prices move in trends and cycles" (Kevin, 2001). Fundamental analysis is used to determine the intrinsic value or worth of a share by studying and evaluating the basic information that underlies the company's performance. The essential factors usually studied cut across information on the company itself, the industry it belongs to as well as the economy. In recent times, researchers have attributed a significant percentage of the movement in share prices to a wide range of economy fundamentals. For instance, Osamwonyi & Evbayiro-Osagie (2012) empirically demonstrated that macroeconomic variables influence stock market index in Nigeria. See also Spelta, Pecora & Kaltwasser (2018), and Brownlee, Chabot, Glysels & Kurz (2020). Other relevant studies include Seth & Tripathi (2014), Victor & El Massah (2018), Lee & Wang (2015), Mensi, Hammoudeh, Yoon & Balcilar (2016), and Olokoyo, Ibhagui & Babajide (2020).

Technical analysis is based on the premise that key fundamental factors that are important are already reflected in share prices, and that past patterns in share price movement repeat themselves over time. The technical analysts argue that psychological

factors and other factors, like investors' emotion exemplified in the "sometimes irrational behaviour of investors are also important in determining the behaviour of share prices." Hence, "it is possible to predict the future price of a stock by diligently and carefully carrying out a study of the historical price behaviour of the stock in the market" (Osaze, 2007).

The fundamental and technical approaches to the determination of stock prices challenged the Efficient Market Hypothesis. The random-walk analysts see the stock market as perfect and the stock prices as reflecting all the information available to the market participants. Hence, they conclude that the price changes are completely unrelated and therefore unsystematic (Kendall, 1953; Samuelson, 1965; Fama, 1965 & Malkiel, 1973). For random walk theory, the market has no memory (Eriki, 1995). Osaze (2007) asserts that "in spite of the arguments of the technical and fundamental analysts about the price behaviour of stocks, there is the major underlying theory of stock price behaviour which contends that the market is efficient, so efficient that one cannot beat it." This underlying theory is referred to as the Efficient Market Hypothesis (EMH). The Random Walk Theory argues that there is no serial correlation between past price movements, hence, knowledge of the past price movement cannot help in predicting prices of securities in the future. Fama (1965) asserts that the random walk hypothesis is not likely to provide an exact description of stock price behaviour in the market. However, for realistic reasons the theory "may be acceptable even though it does not fit the facts exactly." This is because successive price change may not be accurately independent but the actual amount of dependency may not be significant. Hence, fundamental analysis would only be of value if the analyst has new information that is not fully reflected in current market prices.

The rational expectations hypothesis developed by John F. Muth in the early part of 1960 and extended by Robert Lucas in 1976 is a theory that describes an economic situation in which its outcome is partly a function of people's expectations. The rational expectations hypothesis states that people make decisions based on their reasonable prospect for the future, available information and past experiences. As exemplified by Sargent (1987), and Sargent and Wallace (1975), the value of a currency and the rate at which it depreciates depend partly on people's expectation of what the rate of depreciation would be. This is as a result of the fact that people rush to sell a currency that they expect a loss in value, thereby contributing to its actual loss in value. Similarly, "the price of a security depends partly on what prospective buyers and sellers believe it will be in the future." One of the earliest and most striking applications of the concept of rational expectations is the efficient markets theory. The efficient market hypothesis "uses the concept of rational expectations to reach the conclusion that, when properly adjusted for discounting and dividends, stock price changes follow a random walk."

3. METHODOLOGY

In the analytical framework in this study, the goal is to determine

i. whether a long term relationship exists between stock price movements and the selected economic variables;
ii. whether the economic variables are forcing variables (i.e. exogenous in the determination of stock market movements in the long run); and
iii. the direction of long term impact of the economic variables on stock market movements.

The procedures of the Autoregressive Distributed Lag modeling techniques are employed for the analysis. The bounds testing procedure in the ARDL framework is used to test the existence of long term relationships among the variables as well as the direction of effects, while estimated coefficients are used to test the pattern of long term relationships among the variables.

The Autoregressive Distributed Lags Approach to Cointegration Model: The ARDL modeling procedure simultaneously tests the existence of long term relationships among variables while estimating the short run and long term effects. The system is applied to address the issue of endogeneity between stock market price movement and selected global economic variables that have been empirically shown to have contributed to stock market crashes. After ensuring the direction of movement between stock market price movements and the other variables, the model is also used to test for a long term relationship between them. If stock market price movements are shown to move together over time, with the global economic indicators (which are the forcing variables or explanatory variables), then, it can be argued that the variables contribute to stock market crashes over time. We seek association with four global economic variables, namely, oil prices (*oilp*), international interest rates (*rint*), US output (*usinp*) proxied by index of industrial production, and the real exchange rates (*rint*).

The ARDL is based on the methodology outlined in Pesaran and Shin (1995). "The main advantage of this procedure is that it can be applied regardless of the stationary properties of the variables in the sample and allows for inferences on long-run estimates, which is not possible under alternative cointegration procedures." The bounds testing procedure proposed by Pesaran, Shin and Smith (1996, 2001) is used "to test for the existence of a linear long-run relationship, when the order of integration of the underlying regressors are not known with certainty." The regression model specified in this direction "is an error-correction form of an ARDL model in the variables of interest" (Belke & Polleit, 2005). More specifically, an unrestricted error-correction model (ECM) regression is initially specified from where all the tests and estimations are carried out. Given a dependent variable, *y* and a vector of independent variables, *x*, the ARDL model to be estimated is shown as:

$$\begin{aligned}\Delta y_t = {} & \alpha_0 + \phi y_{t-1} + \delta_1 x_{1,t-1} + \cdots + \delta_k x_{k,t-1} \\ & + \sum_{i=1}^{p-1} \psi_i \Delta y_{t-i} + \sum_{i=1}^{q_1-1} \varphi_1 \Delta x_{1,t-i} + \ldots + \sum_{i=1}^{q_k-1} \varphi_i \Delta x_{k,t-i} + \xi_t\end{aligned} \tag{1}$$

In the model, ϕ and the δ's represent the long-run multipliers which show the long term effects of the independent variables on *y*; ψ and the σ's represents the short-run dynamic coefficients (which help to estimate the error correction mechanism); p, q represent the order of the underlying ARDL-model (p refers to *y*, q refers to *x*); t is a deterministic time trend; k is the number of explanatory variables; and ξ is the disturbance term that is uncorrelated with the *x*'s.

The second step is to test for long term relationship between the dependent variable and each of the independent variables. The null hypothesis of non-existence of a long-term relationship is defined by testing the hypothesis:

$$\Phi = \delta_1 = \ldots = \delta_k = 0 \tag{2}$$

This test is the *bounds testing procedure* introduced by (Pesaran et al., 1996), along with the critical value bounds for these tests. The test is performed by comparing the F-statistic computed from the ARDL equation with the upper and lower 90, 95 or 99 percent critical value bounds (F_U and F_L). "In the case where the F-statistic lies below the lower bound, the long term relationship may be rejected. On the other hand, if the F-statistic is higher than the upper bound of the critical value band the null hypothesis of no long term relationship between the variables can be rejected irrespective of their order of integration. In the case that the F-statistic is between the two bounds then a unit root test would be applied" (Ioannides, Katrakilidis & Lake, 2005).

If the above procedure for testing cointegration is *repeated* for ARDL regressions of *each* element of the vector of *x*'s on the remaining relevant variables (including y), the direction of effects (in terms of which variable is endogenous) can be determined. In relation to the current study, the expanded ARDL model that explains long term relationship between stock returns movements and global economic variables is specified as:

$$\begin{aligned}\Delta r_t = {} & \alpha_0 + \phi r_{t-1} + \delta_1 oilp_{t-1} + \delta_2 usinp_{t-1} + \delta_3 rexrt_{t-1} + \delta_4 rint_{t-1} \\ & + \sum_{i=1}^{p-1} \psi_i \Delta r_{t-i} + \sum_{i=1}^{q_1-1} \varphi_1 oilp_{t-i} + \sum_{i=1}^{q_1-1} \varphi_2 \Delta usinp_{t-i} + \\ & + \sum_{i=1}^{q_1-1} \varphi_3 \Delta rexrt_{t-i} + \sum_{i=1}^{q_1-1} \varphi_4 rint_{t-i} + \xi_t\end{aligned} \tag{3}$$

Where *r* is the returns in a stock market computed as:

$$R_t = ln\left(\frac{SP_t}{SP_{t-1}}\right) * 100$$

where R_t = return on stock market index
SP_t = contemporary market price index
$SP_{t\text{-}1}$ = previous period stock market price index
ln = natural logarithm
oilp = oil prices in the international market (used to represent commodity prices)
usinp = index of industrial production in the US
rexrt = real exchange rate of a given country
rint = real interest rate in the international market (represented by the US Fed rate)

"The conditional long-run model can then be produced from the reduced form solution of (3), when the first-differenced variables jointly equal zero. The long-run coefficients and error correction model are estimated by the ARDL approach to cointegration, where the conditional ECM is estimated using OLS and then the Schwarz-Bayesian criteria is used to select the optimal lag structure for the ARDL specification of the short-run dynamics." This approach has been used by Alqaralleh (2020).

Variables in the Model: Stock market returns are computed as indicated earlier. The stock market index prices are taken as the reported index of the stock market for the given period.

Oil prices (*oilp*) are the prices of oil in the international market and they are used to represent commodity prices. They are measured in dollars per barrel and are expected to move in the same direction with stock returns. In this study as in UNCTAD (2012), it is expected that oil price movements precipitate stock market movements in the long run. Evidence is provided in Yin & Ma (2020), Yin, Peng & Tang (2018), Hoque, Wah & Zaidi (2019), Hu, Liu, Pan, Chen & Xia (2018). Index of industrial production in the US *(usinp)* is the variable used to capture real sector performance in the US. The 2008 stock market crashes all over the world began from the US and the variable is included in the study to capture the influence of the US economic indicator on stock market crashes. Evidence of impact of the market is presented in Basu & Charola (2012), Chen, Mrkaic & Nabar (2019), and Sumner (2019).

Real exchange rate (*rexrt*): one major point of the transmission of foreign or external influences into domestic market is through the real exchange rate effect (Krugman, Obsfeld & Melitz, 2008). Exchange rate depreciation is expected to lead to deterioration in the stock market indices. Supporting evidence is provided in Anetor, Esho & Verhoef (2020), Matlasedi (2017), and Zarei, Ariff & Bhatti (2019). Real interest rate (*rint*): is the real US Fed rate which is used to represent the real interest rate in the international market. Sharp changes in the interest rates during the period of financial crises have strong signaling impact on the stock market. The choice of real interest rate reflects the impact of inflation rate as evidenced in studies such as Singh & Padmakumari (2020), and Ashraf et al. (2019).

Data Sources: Data used in this study covers eleven stock markets that were categorized into advanced, emerging and frontier markets. These are UK, USA, France, Germany, Japan, and Hong Kong (as advanced markets), China and South Africa (as emerging markets), Nigeria, Kenya and Ghana (as frontier markets). Monthly data covering the period 2005 to 2015 were employed for the empirical analysis. The data for stock market indicators were sourced from global stock indices, supplied by Morgan Stanley Capital International (MSCI) and the Dow Jones Indexes Country Classification System. While the data for macroeconomic variables were sourced from the World Bank World Development Indicators and the IMF Financial Structure database.

Test of Hypothesis: The hypothesis in its null form is – *There is no significant long term relationship between stock market crashes and other global economic trends.*

The method of testing this hypothesis was to examine whether a long term relationship exists between stock price movements and the selected economic variables, whether the economic variables are forcing variables (i.e. exogenous in the determination of stock market movements in the long run), and the direction of long term impact of the economic variables on stock market movements. The ARDL model in equation (1) and expanded in equation (3) was used for the general test. The bounds testing procedure is used to test the existence of long term relationships among the variables as well as the direction of effects, while the t-ratios and signs of the coefficients are used to test the pattern of long term relationships among the variables.

4. EMPIRICAL ANALYSIS

Time Series Properties of Stock Returns: A major perspective for analysis of stock return behaviour over time is to examine the time series properties of the data in terms of mean reversion (using unit roots or autocorrelation tests) and long term patterns. In this section, the correlation pattern of the stock returns for each of the markets in the study is evaluated. Autocorrelation tests provide strong background for evaluating the structure of markets in terms of stability or tendencies for crashes within short periods (Mollah, 2007).

Table 1 Time Series Properties Stock Returns (Non-crisis period)

Country	$\hat{\rho}_1$	$\hat{\rho}_2$	$\hat{\rho}_3$	$\hat{\rho}_4$	$\hat{\rho}_6$	$\hat{\rho}_{12}$	Q_{12}	p-value
UK	0.43	-0.242	0.133	0.178	-0.291	-0.277	23.45*	0.02
US	0.357	-0.405	0.407	-0.006	-0.141	-0.224	19.5	0.07
France	0.264	-0.42	0.198	0.083	-0.105	-0.322	27.6*	0.01
Germany	0.216	-0.408	0.19	0.075	0.006	-0.287	24.38*	0.02
Japan	0.349	-0.402	0.265	0.092	-0.18	-0.193	17.85	0.12
Hong Kong	0.397	-0.288	0.237	0.201	-0.193	-0.305	21.53*	0.04
China	0.072	-0.001	-0.007	0.152	0.048	-0.279	7.17	0.84
South Africa	0.165	-0.227	0.103	0.125	0.003	-0.282	12.8	0.37
Nigeria	0.002	0.176	0.345	-0.37	-0.063	-0.165	13.29	0.34
Kenya	0.097	-0.061	0.183	0.071	-0.251	-0.016	7.97	0.78
Ghana	0.122	0.091	-0.329	-0.128	0.027	-0.022	13.71	0.32

Note: The $\hat{\rho}_{is}$ are the autocorrelation coefficients; * indicates significance at 5 percent level

Source: Author's compilation from regression estimates, November 2016

In Table 1, the time series properties of monthly stock returns for the sample period are presented. Again, for the purpose of comparison, the properties are presented for the crisis and non-crisis periods. In the properties reported in Table 1, the first-order autocorrelation is relatively high for the UK, US, Japan and Hong Kong markets. This suggests that for these markets, there may likely be strong persistence of disequilibrium at any given time. In other words, any short-term deviation from the mean returns in these markets may take a relatively long period to be restored. Apart from the returns on the advanced markets in the analysis, the autocorrelation values for each of the markets generally reduce drastically over time (from period 1 to 12). It can be seen that the developed markets exhibit a pattern where autocorrelation initially rises and then falls rapidly. It is also noted that none of the frontier markets have significantly large autocorrelation values for any of the periods in the Table, suggesting that returns in these markets do not heavily or generally rely on market activities in its trend.

In Table 2, the result of the autocorrelation tests for stock returns during the crisis period is reported. Surprisingly, fewer markets in the sample appear to exhibit autocorrelations in stock returns for the crisis period than for the non-crisis period. In this case, only Hong Kong, China, and Ghana have significant joint autocorrelation test coefficient (at 5 percent level). Note that none of the advanced markets exhibited autocorrelation (persistent in stock returns disequilibrium) during the crisis period. This gives an idea with respect to the level of response of developed markets to crisis compared to emerging or frontier markets.

Table 2 Time Series Property Stock Returns (Crisis period)

Country	$\hat{\rho}_1$	$\hat{\rho}_2$	$\hat{\rho}_3$	$\hat{\rho}_4$	$\hat{\rho}_6$	$\hat{\rho}_{12}$	Q_{12}	p-value
UK	-0.169	-0.06	0.153	0.02	-0.013	0.118	14.12	0.29
US	-0.109	-0.073	-0.039	0.053	0.074	-0.043	7.56	0.82
France	-0.087	-0.043	0.054	0.055	-0.048	0.035	6.23	0.91
Germany	0	-0.131	0.056	0.041	-0.124	0.029	13.96	0.54
Japan	0.022	0.01	0.069	-0.107	0.002	-0.14	6.71	0.83
Hong Kong	-0.12	-0.018	0.186	-0.128	-0.196	0.174	23.2*	0.02
China	0.106	0.005	0.084	-0.131	-0.15	0.156	20.75*	0.05
South Africa	-0.078	-0.005	0.102	0.026	-0.038	-0.007	5.45	0.94
Nigeria	0.229	-0.042	0.031	-0.01	0.112	0.062	15.11	0.21
Kenya	0.198	0.199	-0.171	-0.075	0.008	0.096	13.04	0.32
Ghana	0.368	-0.065	0.052	-0.043	0.101	-0.021	22.53*	0.03

Note: The $\hat{\rho}_{is}$ are the autocorrelation coefficients; * indicates significance at the 5 percent level

Source: Author's compilation from regression estimates, November 2016

Preliminary Analysis: The argument in this study is that returns in global stock markets are greatly influenced, if not critically caused, by movements in international macroeconomic variables which have had strong linkages with the markets. Thus, frequent occurrences of market crashes could be as a result of market inefficiency arising from the sharp influences of international macroeconomic variables. As shown in the previous section, four international macroeconomic variables are highlighted as closely linked with long term pattern of movements of stock market returns across the globe. In this sub-section, these variables are estimated as they relate to stock returns for the selected markets in the study.

Table 3 Descriptive Statistics for International Macroeconomic Variables for Non-crisis and Crisis Periods

	Non-crash regime				Crash regime			
	Mean	Std. Dev.	J-B	Prob.	Mean	Std. Dev.	J-B	Prob.
INTR	1.83	2.09	18.27	0	1.533	1.43	2.98	0.23
USINP	0.86	4.97	156.3	0	0.805	4.25	0.84	0.66
OILP	79.75	25.0	9.26	0.01	97.52	20.37	0.53	0.77

Source: Author's compilation from regression estimates, November 2016

The initial analysis is to investigate the characteristics of the variables for the two sub-periods in the study, namely, the non-crash period and the crash period. The result of the descriptive statistics for the variables is presented in Table 3. In the Table, the mean international interest rate (the London Inter-bank Offered Rate) was 1.83 in the non-crash period and 1.53 in the crash period. This shows that the interest rates were lower during the market crash period. Since the market crash was a culmination of the crises in the entire financial system in the global economy, the drop in interest rates can be seen as the general prevailing condition in the market at that period. The standard deviation for the interest rate is higher for the crash period than for the non-crash period, though the average value was higher in the former period. This suggests that the variations in interest rate were larger during the crisis period. The J-B statistics reveal that the interest rates

were normally distributed during the crash period, perhaps due to the fact that a steady decline in the market could result in the nature of the interest rates at this period.

For the index of industrial production in the US – indicates the rate of global economic performance, the average rate for the periods were 0.86 for the non-crash period and 0.81 for the crash period. Surprisingly, the growth rate of the US index was quite close for the two periods, though that of the crash period is lower. This shows that industrial production growth was lower during the market crash period than during the period without crash in the market. The standard deviations for the two periods are also similar, but the J-B value for the non-crash period is significant while that of the crash period is not significant. This implies that there were not many large opposite directional movements in this index during the crisis period. Indeed, the J-B values for each of the variables for the crash period are significant and imply normally distributed functions.

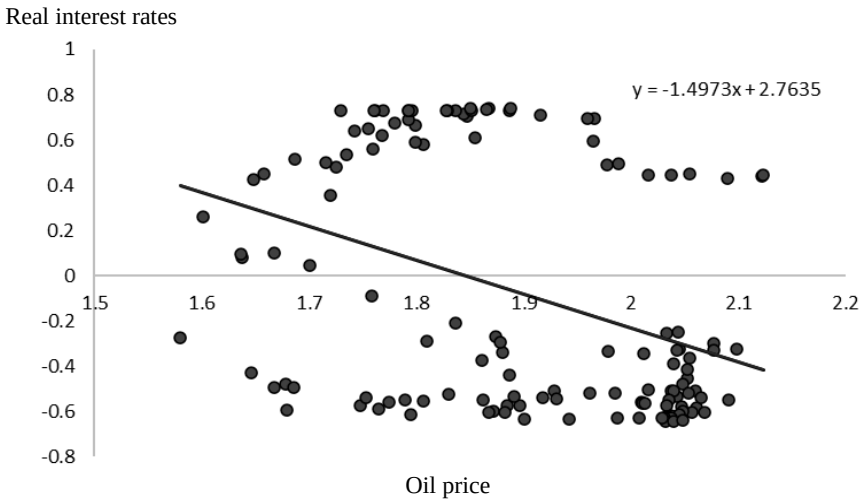

Fig. 1 Oil price and real interest rates
Source: Authors' Analysis

The oil price index was higher in the crisis period than during the non-crash period. Average oil price was 79.75 dollars for the non-crash period but was 97.52 dollars for the crisis period. Although the directions of causality are not tested, many studies have shown the oil price movements usually precede stock market volatility in most markets (see UNCTAD, 2012; Obadan & Adegboye, 2016).

In Fig. 1, the correlation chart and regression line for the relationship between oil prices and real interest rates in the international market is presented. A negative slope is shown for the relationship, indicating that increase in one of the variables leads to decline in the other variables. This confirms the results from the descriptive statistics where the drop in interest rate during the crash period was accompanied by rise in oil prices. The implication of this is that rising oil prices and falling interest rates may combine to generate stock market crashes or act as reinforcement for on-going crashes in the market.

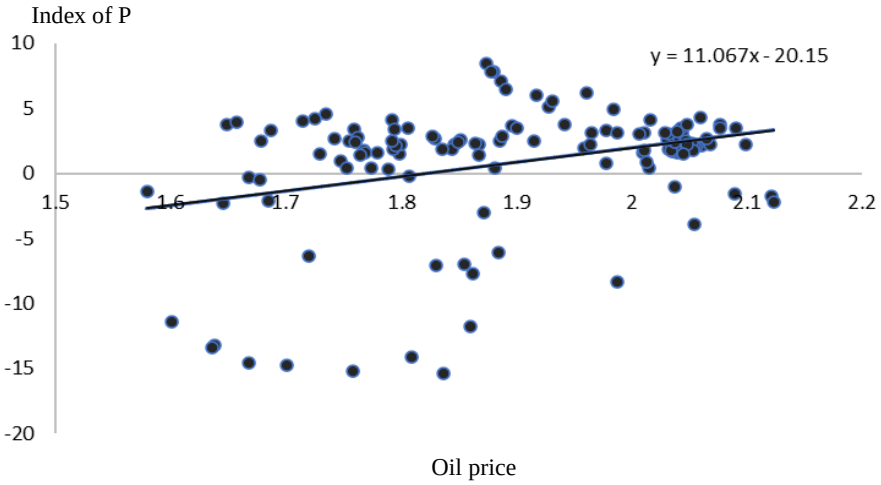

Fig. 2 Oil price and index of industrial production
Source: Authors' Analysis

In Fig. 2, the result of the correlation between oil prices and index of industrial production in the US is presented. The positive slope of the regression line indicates that increase in one variable goes hand-in-hand with increase in the other variable. Thus, oil price spikes are likely to be accompanied by increased global output. This result is surprising though it has interesting implications for the stock markets. Positive correlation between oil prices and index of US industrial production shows that stock markets may have positive responses to oil price spikes since industrial production or global economic activities tend to improve during these periods. Essentially, if the rise in economic performance is greater than the rise in oil prices, then this will be beneficial to the stock markets.

In terms of the effects of the macroeconomic variables on stock market returns, the study proposed the test of long term autoregressive pattern of relationship. The first analysis therefore is to examine whether a long term relationship exists between stock returns for each market and the selected macroeconomic variables.

Table 4 shows the result of the Bounds test of long term effects for the ARDL specification. The evaluation of the results is based on the critical F-statistic values for the lower and upper bounds as also reported in the results. According to the empirical value of the F-values in Table 4, we find that the null hypothesis of no long-term relationship in the case of unrestricted regressions of the stock market returns on the entire macroeconomic variables is rejected for all the markets at the 5 percent level. These results reveal that for each of the markets, the macroeconomic variables had strong long term relationships with the stock returns. Apparently, stock market returns move along with these variables and when these variables change sharply, the returns in the markets tend to follow suit.

Table 4 Testing the Existence of a Long-Term Relationship between Stock Market Returns and International Macroeconomic Variables

Market	Lower bound (5% critical val. = 2.86)	Upper bound (5% critical val. = 4.01)
US	22.15	15.90
UK	2.51	4.62
Japan	22.24	10.16
France	22.51	25.30
Germany	11.51	11.51
Hong Kong	12.41	6.15
China	25.23	20.35
South Africa	35.95	29.07
Nigeria	13.74	13.20
Kenya	34.54	35.03
Ghana	10.82	10.82

Source: Authors' compilation from regression estimates

The ARDL Results: The Bounds test for long term relationships show that the selected macroeconomic variables in the study actually move together with stock market returns across all the markets in the study. This gives the mandate to proceed for the estimation of the long term ARDL models that were specified in Chapter Three. The optimum lag length for the model was selected based on the Shwarze-Bayesian Information criterion (SIC). The results of the estimates are again presented in Table 5 for the market groupings.

In Table 5, the estimates of the ARDL model for the advanced markets are presented. The goodness of fit statistics for the results for each of the markets is generally low although it is quite high for the UK. The performance of each of the macroeconomic variables in explaining stock market returns for the markets is determined by the pattern of the individual coefficients in the model. For the lagged return variables, the coefficients are significant for most of the markets. Only the lagged coefficient for Japan fails the significance test at the 5 percent level. This indicates that for Japan, disequilibrium in the system tends to revert to long term pattern very rapidly. The indexes of industrial US production were significant for Japan result up till the fourth lag, and for the first lag for the US. The coefficients are mostly positive, implying that industrial production tends to stimulate stock returns for the markets.

The exchange rate did not have significant impact on stock returns in the US but has significant and mostly negative impacts on the other markets in the advanced markets. This indicates that exchange rate has strong negative impacts on the stock returns in the markets. Real interest rate also exerts oscillatory effects on stock return, with initial effects on the markets being positive, then it moves to negative and back to positive.

For oil prices, the significant effects in the US are negative, but positive current impact in UK and Japan, while the lag effects for these markets are also negative. For France, the current impact is positive and significant. These results suggest that oil prices have strong positive short term impacts on stock returns in the advanced markets. The coefficient of exchange rate is negative and significant only for Hong Kong market, suggesting that depreciation in exchange rate significantly depletes returns in the market. For oil prices, the effect in the Hong Kong market is initially positive, and then negative subsequently.

Table 5 ARDL for Advanced Economies - Panel 1

	US		UK		Japan	
Variable	Coef.	Pr.	Coef.	Pr.	Coef.	Pr.
R(-1)	-0.11	0.22	0.65	0	0.08	0.39
R(-2)	-0.22	0.02	0.25	0.00	-	-
R(-3)	-	-	-	-	-	-
R(-4)						
USINP	-0.23	0.47	0.00	0.09	-0.14	0.70
USINP(-1)	0.60	0.20	-	-	0.52	0.32
USINP(-2)	0.41	0.40	-	-	0.60	0.26
USINP(-3)	-0.66	0.03	-	-	-1.78	0.00
USINP(-4)	-	-			1.01	0.00
EXRT	1.89	0.97	-0.56	0.00	81.56	0.03
EXRT(-1)	5.99	0.92	-0.19	0.50	-90.93	0.11
EXRT(-2)	39.62	0.51	-0.09	0.74	85.36	0.13
EXRT(-3)	23.46	0.68	0.59	0.00	-82.96	0.02
-EXRT(-4)	-102.58	0.01	-	-	-	-
RINTR	-10.82	0.13	-0.09	0.01	-28.17	0.00
RINTR(-1)	11.02	0.12	0.04	0.53	25.19	0.08
RINTR(-2)			0.11	0.08	25.01	0.10
RINTR(-3)			-0.08	0.04	-42.43	0.01
RINTR(-4)					19.53	0.04
OILP	19.17	0.06	0.12	0.03	21.20	0.03
OILP(-1)	0.75	0.96	-0.15	0.01	-32.77	0.00
OILP(-2)	-25.17	0.03				
OILP(-3)	-	-	-	-	-	
C	17.90	0.00	0.75	0.00	35.79	0.08
R-squared	0.341			0.96	0.431	
Adj. R-sq.	0.246			0.95	0.372	
F-statistic	3.6		196		5.382	

Source: Author's compilation from regression estimates

Table 5 ARDL for Advanced Economies - Panel 2

	France		Germany		Hong - Kong	
Variable	Coef.	Pr.	Coef.	Pr.	Coef.	Pr.
R(-1)	-0.23	0.01	-0.08	0.37	-0.13	0.17
R(-2)	-0.17	0.05	-0.20	0.02	0.02	0.83
R(-3)	-	-	0.11	0.17	0.07	0.43
R(-4)					-0.21	0.02
USINP	0.19	0.19	0.23	0.15	0.07	0.88
USINP(-1)	-	-	-	-	1.27	0.07
USINP(-2)	-	-	-	-	-1.00	0.03
USINP(-3)	-	-	-	-		
USINP(-4)	-	-	-	-		
EXRT	-188.8	0.00	-183.2	0.01	-2994.9	0.01
EXRT(-1)	231.3	0.00	205.4	0.00	2249.6	0.04
EXRT(-2)	-	-	-	-		
EXRT(-3)	-	-	-	-		
-EXRT(-4)	-	-	-	-		
RINTR	-28.80	0.01	-19.87	0.11	-43.96	0.00
RINTR(-1)	10.41	0.59	3.28	0.88	43.23	0.00
RINTR(-2)	44.19	0.03	47.03	0.03		
RINTR(-3)	-50.48	0.01	-53.12	0.02		
RINTR(-4)	23.38	0.06	21.50	0.11		
OILP	33.78	0.03	24.86	0.15	28.87	0.05
OILP(-1)	-20.95	0.36	-7.22	0.77	-5.32	0.82
OILP(-2)	3.27	0.88	-27.29	0.11	-38.71	0.01
OILP(-3)	-22.52	0.11	-	-		
C	17.31	0.11	21.44	0.07	692.7	0.22
R-squared	0.401		0.356		0.35	
Adj. R-sq.	0.327		0.276		0.27	
F-statistic	5.399		4.461		4.26	

Source: Author's compilation from regression estimates

The results for the emerging markets are reported in Table 6. In the result the lags are significantly less than those of the advanced markets, indicating that the effects of the variables on market returns are quite more immediate in the emerging markets than in the advanced markets. The goodness of fit statistics is also low, with R squared values a 0.30 for South Africa and 0.19 for China. This implies that there are other determinant (external) variables that affect the dependent variable that are not captured in the study.

For the significance of the variables, the results show that the effect of the index of US industrial production on the returns is delayed and is only felt after two months have elapsed. The coefficients are negative for the two markets and show that a rise in US industrial production will cause stock market returns to fall significantly after some time in these markets. The impact of international real interest rate on stock returns appears to be very strong, especially for South African market. Real exchange rate is significant for the two lags in both markets; it is initially positive and then turns negative after a lag. The result also shows that as oil prices rise, stock market returns in the country initially fall, but as the prices persistently increase, stock returns begin to improve in the markets.

Table 6 ARDL Results for Emerging Markets

	SA		China	
Variable	Coef.	Pr.	Coef.	Pr.
R(-1)	-0.20	0.03	-0.03	0.78
USINP	-0.36	0.53	-0.13	0.84
USINP(-1)	1.65	0.06	1.90	0.04
USINP(-2)	-1.18	0.04	-1.51	0.02
EXRT	63.28	0.05	-58.97	0.24
EXRT(-1)	-56.49	0.08		
RINTR	-34.09	0.01	-30.37	0.03
RINTR(-1)	20.00	0.41	34.16	0.01
RINTR(-2)	47.74	0.07	-	-
RINTR(-3)	-58.16	0.02	-	-
RINTR(-4)	23.51	0.13	-	-
OILP	67.79	0.00	29.38	0.12
OILP(-1)	-80.14	0.00	-22.91	0.44
OILP(-2)	-	-	-27.66	0.16
C	17.98	0.16	90.45	0.08
R-squared	0.30		0.19	
Adjusted R-squared	0.22		0.12	
F-statistic	3.72		2.77	

Source: Authors' compilation

The result for the Frontier market is presented in Table 7. The results are also generally average in terms of overall fit. The F-values for each of the results are, however, significant at the 5 percent level. The result shows that the impact of the USINP has delayed impacts on the markets with the impact being mostly negative. Exchange rate also has delayed negative impacts on the stock returns for most of the markets. The impact of international real interest rate on stock returns appears to be very strong, especially for Nigeria and Ghana. The results are basically positive, suggesting that as the interest rates rise, stock returns tend to rise also. Apparently, investment in international money market instrument appears to be competitive with investment in the stock markets.

The effects of oil prices are also mixed for the frontier markets with positive and negative alternating between periods. The overall effects appear to be positive and stimulating. This shows that periods of impressive oil price performance in the international markets tend to mark period of higher stock market returns for the frontier markets.

Table 7 ARDL Results for Frontier Market

	Nig		Kenya		Ghana	
Variable	Coef.	Pr.	Coef.	Pr.	Coef.	Pr.
R(-1)	0.08	0.33	-0.17	0.06	0.31	0.00
R(-2)	-0.18	0.03				
R(-3)	0.07	0.37				
R(-4)	-0.35	0.00				
USINP	1.45	0.05	-0.21	0.70	-0.72	0.35
USINP(-1)	-0.96	0.18	1.40	0.07	2.12	0.04
USINP(-2)			0.02	0.98	0.47	0.64
USINP(-3)			-1.81	0.02	-1.33	0.05
USINP(-4)			0.79	0.14		
EXRT	-195.7	0.08	-350.7	0.00	9.73	0.23
EXRT(-1)	427.1	0.01	215.5	0.01		
EXRT(-2)	-359.5	0.03	-4.96	0.95		
EXRT(-3)	210.0	0.05	135.5	0.01		
RINTR	-29.21	0.07	-21.33	0.06	-9.95	0.51
RINTR(-1)	21.26	0.45	20.04	0.10	10.15	0.70
RINTR(-2)	75.27	0.01		0.80	14.06	0.60
RINTR(-3)	-127.27	0.00		0.81	-61.22	0.03
RINTR(-4)	70.14	0.00			60.31	0.00
OILP	70.67	0.00	-1.44		-25.80	0.24
OILP(-1)	-33.07	0.32			121.0	0.00
OILP(-2)	-32.44	0.14			-94.46	0.00
C	-185.8	0.03	12.90		0.58	0.97
R-squared	0.50		0.44		0.42	
Adjusted R-squared	0.42		0.38		0.31	
F-statistic	5.99		6.92		3.85	

Source: Authors' compilation.

Hypothesis Testing: *There is no significant long term relationship between stock market crashes and other global economic trends.*

The analysis of the Bounds test of long term effects for the ARDL specification addresses the hypothesis of this study. The evaluation of the results is based on the critical F-statistic values for the lower and upper bounds. From the F-values obtained at 5 percent level of significance, the results indicate that the selected macroeconomic variables in the study actually move together with stock market returns across all the markets in the study. In particular, all the variables in the study moved steadily with stock market crashes over time while oil prices and real interest rates have very strong de-stabilizing impacts on stock markets across the globe. The null hypothesis of no long-term relationship is thus rejected in this section since the statistical test have confirmed that there is a significant long term relationship between stock market crashes and other global economic trends.

5. CONCLUSION

Macroeconomic factors with international linkages have been increasingly related to stock market patterns around the world, leading to questions on the implications for stock markets efficiency. Their roles in stock market crashes have also been a major issue for consideration. Apparently, long term movements in the stock returns in major markets could be determined by observing long term trends in such macroeconomic variables. This study employed data on eleven stock markets that were categorized into advanced, emerging and frontier markets, to investigate the effects of the macroeconomic variables on stock markets behaviour across the globe. The analysis of the study was done along this line of demarcation in order to observe any differences that may exist in the behavioural patterns of the different market segmentation. Moreover, the Autoregressive Distributed Lags (ARDL) approach was adopted in determining the long term effects of the macroeconomic variables on stock market for the selected countries.

The findings from the study have shown that there is a significant long term relationship between stock market behaviour and global economic trends. Essentially, all the variables in the study moved steadily with stock market activities over time, thus suggesting that these variables could be either stimulating factors or response elements in stock market crashes over time. The strong link between the macroeconomic variables and stock market activities reveals that these variables tend to explain or demonstrate the pattern of stock markets around the globe. Moreover, it was shown in the study that oil prices and real interest rates have very strong de-stabilizing impacts on stock markets across the globe. Thus, strong changes in these variables have been shown to exhibit capacity to generate market crashes, especially for emerging and African markets.

Based on the findings of this study, there is need for the monetary authorities to adopt measures to, at least, limit the impact of the movement of other macroeconomic variables, especially external ones. Policies that have been found useful include diversification, and the use of sovereign wealth fund to manage the impact of oil market volatilities on national budgets, Other measures would have to include exchange rate management techniques that will ensure sustainability of international financial transactions even when oil prices are down (or rising rapidly). In the same vein, prudential regulation of financial institutions at the national level for each country needs to be intensified in the face of increased interlinkages between real sector markets and the stock market. Adequate regulation of the stock market for instance, would ensure that practices that could jeopardize market stability and efficiency are prevented. Finally, the realization that modern markets (whether financial or commodities) are strongly interlinked is particularly relevant in terms of market functioning. Such inter-linkages result from global interactions as well as investors' appetite in modern markets. A more feasible means of dealing with undesirable outcomes of such interactions would be to devise instruments that could fine-tune the relationships and foster unique patterns for future interactions.

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MAKROEKONOMSKI FAKTORI I PONAŠANJE NA BERZI: ANALIZA KRIZE IZ 2008. GODINE

Ovaj rad istražuje dugoročnu vezu između ponašanja na berzi tokom krize 2008. godine i nekih odabranih makroekonomskih internacionalnih varijabila koristeći informacije od januara 2005. godine do decembra 2015. U analizi su korišćene procedure ARDL tehnike (autoregresivni distribuirani lag). Procedura testiranja granica u okviru ARDL je korišćena da se testira postojanje dugoročnih veza između ponašanja na berzi i globalnih ekonomskih faktora (kamatne stope, kursne razlike, indeksa industrijske proizvodnje i cene nafte), kao i smer efekata, dok su procenjeni koeficijenti korišćeni za testiranje obrazaca dugoročnih veza među varijablama. Studija je otkrila da značajne dugoročne veze postoje između kretanja na berzi i ovih globalnih ekonomskih trendova, dok je krah berze značajno uticao na efikasnost tržišta koje su predmet ispitivanja. Prema tome, preporuka je da tržišne osnove ostanu kruna analza berzanskih kretanja, a donosioci odluka trebalo bi da ohrabre kidanje veze između berzi i faktora međunarodnih robnih tržišta.

Ključne reči: *ponašanje na berzi, makroekonomske varjabile, ARDL model*