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Empirical Relationship between the Stock Markets and Macroeconomic Variables: Panel Cointegration Evidence from African Stock Markets

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Abstract-The research examines the panel data of seven major African stock markets with a view to investigate the long run relationship between these markets and some vital macroeconomic variables. The study covers a period of 24years (1988-2011). Panel residual based test of Pedroni (1999) and error correction based test of Wasteland (2007) are used to establish the fact that there is evidence of cointegration between the stock markets and the variables under investigation. Based on the recommendations of Xiao and Phillips (2002) and Westerlund (2005) a co integrated panel relation is estimated by using the Dynamic Ordinary Least square (DOLS) estimation method. The result shows that in the long run, Foreign Direct Investment (FDI) and External Debt exert a positive impact on the African stock markets while negative impact will be recorded for Money supply. However, the extent is much greater in FDI, as for every 1% increment in its value brings about 2.01% change in market value.

Key words: **Co integrated Panel, Dynamic OLS, Market Value, Posit.**

I. INTRODUCTION

A national index represents the performance of the stock market of a given nation and by proxy, reflects investor sentiment on the state of its economy. The performance of capital markets is of significant importance to investors as they expect good returns on their investment (Capital Market Authority (CMA), 2010). With the current financial meltdown across the globe, the investors are eager to know the size and status of the markets they are to invest in; financial markets with unattractive liquidity will only be limited to narrow the range of global investors. Prasanna, (2008) argues that countries and firms are interested in attracting foreign capital investment because it helps to create liquidity for both the firms and the stock market in general. This leads to lower cost of capital for the firm and allows firms to compete more effectively in the global market place. This directly upgrades the economy and the country. Availability of foreign capital depends on many firm specific factors other than economic development of the country.

To policymakers, stock market parameters such as indices are recognized as leading indicators of economic activity. The African continent's stock markets and public companies collectively represent approximately $1 trillion in market capitalization. Among Africa's 54 countries, there are about 23 active stock markets on which about 1,500 companies are listed, in total.

It is widely held that the stock market is a strong indicator of the level of economic activities within a country and that the direction of broad macroeconomic indicators like interest and exchange rates, savings rates and economic growth is picked up by the stock market (Osinubi and Amaghionyeodiwe, 2002).

As the quest to understand the behavior of stock market and its fundamental became eminent, the study of relations between dynamic stock market and macroeconomic variables in multivariate setting is indispensable. In this recent time, we have revolutionary surge contributions from academia to financial practitioners.

In this regard however, the research set up a statistical model using most recent and efficient panel data analysis procedures for co integrated panels in assessing the performance, in the long run of seven African stock markets in the presence of the macroeconomic variables such as external debt, money supply, and foreign direct investment. The choice of statistical and econometric procedures like panel data is borne out of some reasons which are specified in details in (Baltagi, 2005 and Brooks, 2008). Aside from the fact that statistical models for the analysis of panel data are a rapidly growing on the field of methodological inquiry, the statistical tests involving co integrated panel data have a stronger and higher degree of power, as compared with convectional time series

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procedures of either Dickey Fuller or Augmented Dickey Fuller (Im, Pesaran and Shin, 2003). With the view of the foregoing, the research considers three statistical tests for the confirmation of the integrated panels .i.e. testing if each series in each panel are integrated of order one, $I(1)$ otherwise known as stationarity test. These tests are Levin, Lin and Chu(2002) test, Im,Pesaran and Shin(2003) test and Hadri (2000) test for stationarity. In the same vein, the researcher confirms the cointegration process among the variable series by using following statistical tests (i) Pedironi(1999) Panel Test for testing null of no Cointegration and (ii) Westerlund(2007) Panel Test for testing null of no cointegration using error correction model. Based on the recommendations of Xiao and Phillips(2002) and Westerlund(2005), the researcher estimates the panel cointegration regression using Dynamic Ordinary Least Square, (DOLS) proposed by Kao and Chiang, (2000) in that the DOLS estimator has been made to be asymptotically unbiased, so that error term can be used in the residuals cointegration without the problems of nuisance parameters, this made it to be more efficient and unbiased estimator as compared with Ordinary Least Square estimator (Xiao and Phillips, 2002). The proper process of statistical testing before the cointegration regression estimation, will definitely lead to a reliable and more stable long run relationship which will be capable to determine whether or not the there exists different opportunities from the inefficiencies of stock market mechanisms in the transfer of information between stock markets. This is specified by Maysami et al (2004) as saying the presence of a co integrating relationship between macroeconomic variables and stock prices brings the conclusions of the efficient market hypothesis in doubt, and that the policy makers should note that the behavior of the stock markets may indeed be predictable contrary to Efficient Market Hypothesis (EMH).

However, as for the coverage, the research selects seven African stock markets based on their market - values for the periods under investigation. Nile Capital Management (2011), states the status of the market capitalization of each region in Africa as at 2009 as follows: South Africa has the continent's largest economy with a population of about 50 million. Its 2009 estimated GDP of $277 billion (U.S.) represents about 23% of Africa's total economic output. Along with Egypt, South Africa has by far the continent's largest public stock market by market cap, estimated at $180 billion. The country's market and leading stocks are components of the EAFE Emerging Markets Indexes, and its currency, the rand, is among the most actively traded emerging markets currencies in the world. The country has long been a major source for diamonds and it is the world's largest producer of gold, platinum, manganese, chromium, vanadium and titanium.

The six nations of Northern Africa: Egypt, Morocco, Tunisia, Sudan, Libya and Algeria, are encompassed by the expanse of the Sahara Desert and consist of predominantly Islamic cultures. Egypt is by far the most populous of these nations, with 83 million people, and it also has the largest GDP ($188 billion in 2009). Egypt and Morocco each have fairly active public stock markets, with the second and third largest market capitalizations on the continent respectively, behind only South Africa.

The nations of West Africa are experiencing some of the continent's highest rates of growth as former colonized areas move toward democratic independence and higher standards of living. Nigeria is the most populous nation in West Africa, if not Africa, with a 2009 population estimated at 149 million. It also has the continent's second highest GDP of $165 billion, behind only South Africa. Western Africa has become one of the world's fastest growing oil and gas producing regions in the world, and it also is a source for valuable strategic minerals.

East Africa remains Africa's poorest and least economically developed region. Kenya and Angola are its largest countries by GDP and Kenya is the largest country by stock market capitalization. The recent oil and gas discoveries in Uganda, as well as the development of oil fields in Southern Sudan, will spur significant foreign capital investment in the region.

CMA (2010) specifies for the boom periods of Sub-Sahara African (SSA) (i.e. periods between 2000 and 2007), a robust growth and abundant global liquidity. The region as of the time attracted an increasing number of investors in search of high yields. As a consequence, private capital inflows, including FDI, portfolio equity flows and debt flows (i.e. portfolio bond flows and bank lending) experienced remarkable increases. Private capital inflows took off, driven by a number of domestic and external factors that contributed towards enhancing the region's attractiveness for foreign investors in search of high yields. However, the financial turmoil as a result of burst in the financial cycles, originating in the developed world in August 2007 has since spread to developing countries, and SSA has not been immune to the secondary effects of the global financial crisis (Macias and Massa, 2009). SSA's growth dropped from 6.9% in 2007 to 5.5% in 2008.This should not be astonishing for a good follower of equity –asset returns of the stock markets, as they have their unique characteristic behaviors called the stylized facts. For details on this, see Engle(2001) and (Babayemi and Asare, 2010).

The existence of stock market bubbles and crashes dates back to the 1600s and there is no widely accepted theory to explain the occurrence of bubbles or their bursts (Chioma and Chukwuma, 2009). Interestingly, bubbles occur even in highly predictable experimental markets, where uncertainty is eliminated and market participants should

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be able to calculate the intrinsic value of the assets simply by examining the expected stream of dividends. Catherine, (2011) argues that liberalization and globalization of world markets have resulted in inter-relatedness of financial markets and contagion global events. Numerous examples of stock market crashes, currency crisis and the recent sub-prime crisis have affected financial performances of markets across the globe. In the recent decade, waves of speculative activities are not limited to one market only but they can move from one corner of the globe to another within hours. Now, the argument is, the fact that the period of booms (bubbles) and bursts will come and go, the market will still remain, suggesting that there is still unfilled gap between the researchers and this problem. The study at hand however, is to provide the empirical evidence concerning the relationship between Stock Markets and some vital macroeconomics variables across these selected African countries. This will reflect the performance of these stock markets in terms of selected macroeconomic variables within the investigated periods and give the potential investors in African markets a clear picture on the status of the markets.

A. Statement of the Problems

The financial turmoil originating in the developed world in August 2007 has since spread to developing countries, and Sub Sahara Africa (SSA) has not been immune to the secondary effects of the global financial crisis (Macias and Massa ,2009). When markets are volatile the nature of informational flow from one market to the other across the globe is unprecedented, and the potential investors are wary to take risk as at this time, then there is a need to assess the long run relationship of these markets with some crucial macroeconomic variables as to ascertain their true status and provide the prospective investors with a consistent regulatory frame work. To achieve this, the following research questions are paramount:

i) What impact will these macroeconomic variables pose in the long run?
ii) To what extent will these macroeconomic variables affect the stock markets?

B. Scope

The macroeconomic variables are Stock Market index(mkt_gdp), External Debt,(ex_dbt), Money Supply$(m2)$ and Foreign Direct Investment(fdi) . The African Stock Markets of the following countries are included in the research: (i)Botswana (ii)Egypt, (iii) Ghana (iv) Kenya (v) Morroco, (vi) Nigeria, and (vii) South Africa . The data are annually periodic data and span through 1988-2011. They are collected from the WORLD BANK DATABANK and IMF DATABANK; their websites are www.worldbank.org and www.imf.org respectively.

C. Justification of the study

The justifications are as follows:

i) Academic expected gain is to add to the existing literature on the relationship between Africa stock markets and macroeconomic variables.
ii) Policy makers, financial researchers and wary potential investors will be well informed on the status of the stock markets thereby monitoring the markets on a consistent regulatory frame work.

D. Aim and Objectives

The aim is to examine the panel data of seven major African stock markets and some vital macroeconomic variables for the period of 24 years with a view to achieve the following objectives:

(i) Empirical Long run relationship between the stock markets and the selected macroeconomic variables.
(ii) Impact of these macroeconomic variables in the long run on the stock markets.
(iii) Extent to which these macroeconomic variables affect the stock markets.

II. RELATED LITERATURE

The linkage between Stock Market and the so called Macroeconomic Variables has over the years, gained reasonable academic attention from students, researchers, stock brokers, to mention but a few. The earliest work of researchers in this area has been on different activities of the stock markets with response to either a single or two macroeconomic variables. Most of the findings as of that time were limited to stock markets microstructure neglecting other risk factors. For instance, Fisher (1930) hypothesizes equity stocks to represent claims against real asset of a business and infers that stock may serve as hedge against inflation. Mandelbrot (1963) and Fama (1965) report evidence of large changes of market stock price to be often followed by other large changes which explains cluster effect of the stock. Other pioneering research in this area include the work of Sharpe (1964), Lintner (1965), Modigliani and Cohn (1979), Nelson (1976), Fama and Schwert(1977) , (Fama 1981) and (Chen et al. 1986).

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A fundamental question concerning capital markets is their efficiency. Allocational, operational, and informational efficiencies are the types of market efficiency described in the financial markets literature. However, it has been noted that capital markets with higher informational efficiency are more likely to retain higher operational and allocation efficiencies (Müslümov *et al*, 2004). As for the effect of macroeconomic variables such as money supply, exchange rate and interest rate on stock prices, the efficient market hypothesis suggests that competition among the profit-maximizing investors in an efficient market will ensure that all the relevant information currently known about changes in macroeconomic variables are fully reflected in current stock prices, so that investors will not be able to earn abnormal profit through prediction of the future stock market movements (Chong and Koh 2003). Karolyi (1995) examined volatility transmission effect between the United States S&P 500 and Canadian TSE 300, the result showed that the transmission on the equity return of inter listed versus non- inter- listed stocks are distinctly different. Karolyi used BEKK model to study transmission effect and method is in vogue, see Babayemi et tal(2010) for more details.

Rapach (2002) employed data of 16 OECD countries to determine the direction of the correlations between inflation rates and stock markets of the countries and observe long-run neutrality between them. He made used of Fisher's hypothesis to explain this long run relationship. As innovations continue to trail stock markets at this time, more dynamic and challenging techniques were required in the analysis of stock market and its fundamentals. For instance, Maysami et tal (2004) used a method co integrated analysis to investigate the long-term equilibrium relationships between selected macroeconomic variables and the Singapore stock market index (STI), as well as with various Singapore Exchange Sector indices—the finance index, the property index, and the hotel index. The study concluded that the Singapore's stock market and the property index form cointegrating relationship with changes in the short and long-term interest rates, industrial production, price levels, exchange rate and money supply.

In most African countries however, the market for government securities dominates the securities market and thus plays an important role in providing a basis for a robust and efficient financial system as a whole. This sector contributes mostly to the transformation of savings into investment, disseminating information, managing risk, and supporting activities in other securities (Chabchitrchaidol & Panyanukul 2005). Ologunde, Elumilade and Asaolu (2006), examined the relationships between stock market capitalization rate and interest rate. They found that prevailing interest rate exerts positive influence on stock market capitalization.

Bokpin(2008) used panel data to examine the effect of ownership concentration on corporate performance on Ghana Stock Exchange. The result indicates that the effect of ownership concentration on corporate performance varies with the performance measurement variable. This implies a significant positive relationship between ownership concentration and return on assets.

Omotor (2008) examined the impact of price response to exchange rate changes in Nigeria, using annual data from the period 1970 to 2003.He used a recent method of a vector error model VEC and slope-dummy methodology , the evidence from his paper reveals that exchange rate policy reform is important in the determination of inflation in Nigeria.

Macias and Massa (2009) used panel cointegration analysis to examine the long-run relationship between economic growth and four different types of private capital inflows (cross-border bank lending, foreign direct investment (FDI), bonds flows and portfolio equity flows) on a sample of selected sub-Saharan African. The result showed that FDI and cross-border bank lending exert a significant and positive impact on sub-Saharan Africa's growth, whereas portfolio equity flows and bonds flows have no growth impact. They submitted that the global financial crisis is likely to have an important effect on Sub- Sahara Africa's growth through the private capital inflows channel.

Celik et al (2010) studied the relationship between consumer confidence and economic growth in six emerging economies, namely Brazil, China, Mexico, Poland, South Africa and Turkey. The empirical findings showed that consumer confidence, industrial production and stock exchange have a long-run relationship in emerging economies. Moreover, households in emerging and developed markets exhibit similar behavior.

Olugbenga, (2011) used panel model to examine the impact of macroeconomic variables on stock prices of the selected firms in Nigeria and the empirical findings revealed that macroeconomic variables have varying significant impact on stock prices of individual firms.

However, of the literature surveyed so far, the closest related work are that of Bokpin(2008), Marcia and Massa(2009), Celik et al (2010), and Olugbenga (2011) but are differed in the coverage, statistical estimation procedures and more importantly the interaction levels of the macroeconomic variables involved. Asides from the coverage area of study(i.e. different areas investigated by the reseachers), the method of estimation of parameters for this research work is more robust as compared with OLS method by Bokpin (2008), two stage OLS by Celik et

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al (2010), Generalized Least Square (GLS) by Olugbenga (2011) . The researcher employs DOLS method of estimation of the panel cointegration regression. The response variable in most of the previous work is the growth, GDP express as a function of other macroeconomics variables except Olugbenga (2011) who expressed stock price of some firms in Nigeria as response variable of other form macroeconomics. Though he used panel data approach, his scope, method of estimation, in depth analysis were completely different from the research at hand.

A. Hypotheses

The econometric design and methodology encourages setting up hypotheses in line with theoretical background of the justification for the inclusion of a variable in the statistical model to be estimated. Based on the previous work of the earlier scholars, (such as Chen et al (1986), Fama (1981)), that have studied the empirical evidence establishing relationships between macroeconomic variables and stock markets, we hypothesis the a relation between market value, external debt, money supply and foreign direct investment.

Money Supply

As specified by Mukherjee and Naka (1995), and Maysami and (2002), we hypothesize a negative relation between money supply and stock market. That increase in money supply would lead to inflation, and may increase discount rate and reduce stock prices (Fama, 1981). The negative effects might be countered by the economic stimulus provided by money growth, also known as the corporate earnings effect, which may increase future cash flows and stock prices.

Foreign Direct Investment

Prasanna, (2008) argues that countries and firms are interested in attracting foreign capital investment because it helps to create liquidity for both the firms and the stock market in general. This leads to lower cost of capital for the firm and allows firm to compete more effectively in the global market place. This directly benefits the economy and the country. Availability of foreign capital depends on many firm specific factors other than economic development of the country. This allow us to hypothesize for a positive relation between the market and foreign direct investment which also in line with the result of Macias and Massa(2009).

External debt

A negative relation is hypothesized between external debt and market value as specified by First Securities Discount House; FSDH (2012), that high external debt to Gross National Income GNIratio could affect the economy actitivities in most African countries. The reason would not be far fetched considering the type of government we run in Africa. Nevertheless, if the country's economic managers ensure that all debt contracted are used to promote economic growth and development via the build-up of infrastructure and provision of employment opportunities, the Africa continent will be better for it.

III. METHODOLOGY

To assess the performance of the African Stock Markets using market capitalization to GDP ratio, we employ the panel data analysis approach. The panel data methodology is used in situations where there are data for multiple *N* objects (Stock Markets) observed in two or more *T* periods (years). The dynamic baseline form of our model would be then

$$mkt\_gdp_{it} = \alpha mkt\_gdp_{i,t-1} + \beta' x_{it} + \varepsilon_{it} \quad \ldots(1)$$

For $i = 1, \ldots N$, (N = 7) and $t = 1, \ldots T$ ($T = 24$) and where mkt_gdp_{it} and its lagged quantity measure the market performance in the country *i* at time *t* and t-1 respectively, α is a scalar, β and x_{it} are each $K \times 1$ vectors, and ε_{it} is the error term. The seven African countries from the stock markets include Botwana, Egypt, Ghana, Kenya, Morocco, Nigeria, and South Africa while , external debt, foreign direct investment, and money supply are the explanatory (macroeconomic) variables.

Assuming that the ε_{it} follow a one way error component model:

$$\varepsilon_{it} = u_i + v_{it} \quad \ldots(2)$$

Where, u_i are individual effects, $u_i \sim IID(0, \sigma_u^2)$ and v_{it} is a random error, $v_{it} \sim IID(0, \sigma_v^2)$ independent of each other and among themselves. The parameters β are assumed homogenous and are estimated by the OLS of mkt_gdp_{it} on x_{it} which is called pooled estimation. The estimate is consistent if the random effects are uncorrelated with regressors, .i.e. $E(x_{it}u_i) = 0$ and inconsistent otherwise.

Estimating the model in this form, however, may meet a serious problem. Even if we add numerous independent variables, it is possible that some of the determinants are still omitted, and such a situation leads us to the biased estimation of the model. To overcome this limitation, the fixed effect methods are devised to deal with individual

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effects problems. One of these techniques is the least square dummy variables (LSDV) technique. Others include, Generalized Least Square (GLS) method, Generalized Method of Moment, Two Stage Least Square, Introduction of the first difference of the lagged dependent variables and lagged dependent variables and host of others, see Breitung and Pesaran (2005) for some detailed discussions on some of these models.

A. Panel Unit Root Test

The choice of panel unit root tests arouse from the specification of Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003) that the combination of information from time series and cross- sectional data leads to improvement of power of test and consequently higher t-ratio. In panel setting, a number of tests have been developed in the literature for testing the presence of unit root and stationarity. Most of these tests are usually the extensions of the Dickey Fuller and Augument Dickey Fuller tests which have greatly helped in solving the problems in panel data procedures. Thus, the I(1) and I(0) levels of the panel series would be tested by using three different types of tests, namely LLC (2002), IPS (2003), and Hadri(2000).

Firstly, the LLC test is employed to test the stationarity of the panel for it allows heterogeneity of individual deterministic effects and heterogeneous serial correlation structure of the error terms assuming homogeneous first order autoregressive parameters (Chiawa and Asare 2009) . The coefficient of lagged Y_i, ρ, is limited to be homogenous through all individual units of the panel, and regression is given thus,

$$\Delta Y_{i,t} = \rho Y_{i,t-1} + \sum_{k=1}^{p_i} \varphi_k \Delta Y_{i,t-k} + \alpha_i + u_{it} \quad i = 1, \dots, N \quad t = 1, \dots, T \qquad \dots 3$$

where, T is the length of the sample, N is the cross-section dimension, ρ is the common coefficient of the lagged dependent variables, p_i is the country-specific lag length, the term $\sum_{k=1}^{n} \varphi_k \Delta Y_{i,t-k}$ are the lagged difference dependent variables (with their coefficients, φ_k) included to eliminate serial correlation in the error term, α_i are the country-specific intercepts (fixed effect) and the trend, $\lambda_i t$, may be included if it is suspected that a trend exist. The error term u_{it} is distributed as white-noise random variables across i and .

LLC model tests the null hypothesis of the presence of unit roots against alternative of stationarity.

$$H_0: \rho_1 = \rho_2 = \cdots \rho_N = \rho = 0 \qquad \dots 4$$
$$H_1: \rho_1 = \rho_2 = \cdots \rho_N = \rho < 0$$

The null hypothesis is rejected at 5% if p-value is less than 0.05

B. Im, Pesaran and Shin Test (IPS Test)

Im, Persan and Shin (2003) broadened the LLC test by presenting a more flexible and computationally simple test structure that permits the ρ to differ among individuals, i.e. by allowing heterogeneity. The IPS test made the estimation for each of the i sections possible. As a result, their model can be written thus

$$\Delta Y_{i,t} = \rho_i Y_{i,t-1} + \sum_{k=1}^{p_i} \varphi_{ik} \Delta Y_{i,t-k} + \alpha_i + u_{it} \quad i = 1, \dots, N \quad t = 1, \dots, T \quad \dots 5$$

Here, ρ_i is the coefficient of the lagged dependent variable which determines the degrees of persistence. IPS test gives an averaged t-statistic, written as:

$$\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^{N} t_{iT}(p_i, \varphi_i) \qquad \dots (6)$$

IPS tests the null hypothesis of unit root against heterogeneous alternative hypotheses which specify that some series in the panel are non stationary, .i.e.

$$H_0: \rho_i = 0$$
$$\begin{cases} H_{1a} \quad \rho_1 < 0, \dots, \rho_{N_1} < 0 \\ \\ H_{1b} \quad \rho_i = 0 \ \ for \ i = N_1 + 1, .., N \end{cases} \qquad \dots (7)$$

The null hypothesis is rejected at 5% if p-value is less than 0.05.The alternative test clarifies the fact that a fraction of the panel can have unit roots. This is the contrasting point of IPS to LLC. The IPS model is constructed under the restrictive assumption that T should be the same across individuals. Thus, it is significant to note that these procedures are relevant in balanced panel.

C.Hadri Panel Stationarity Test

Hadri (2000) test is distinctive from other two tests mentioned above for testing the absence of unit roots, i.e. variance of the random walk equals to zero. He proposes a parameterization which provides an adequate representation of both stationary and non stationary variables and permits an easy formulation for a residual based Lagrange-Multiplier (LM) test of stationarity. Here, it is assumed that the time series for each cross-sectional unit

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is stationary around a deterministic level or trend, against the alternative hypothesis of a unit root. It is based on the following regression:

$y_{it} = \alpha_i + \sum_{t=1}^{T} u_{it} + \varepsilon_{it}$ …8

where α_i are the individual effects and the error term has two components: ε_{it} which is white noise, and $\sum_{t=1}^{T} u_{it}$ is random walk. The trend term γ_t may be added to equation 8 if it is suspected that it exists in the data. The autocrrelation in ε_{it} is eliminated by considering the long-run variances of the ε_{it} which is estimated by

$\hat{\sigma}_{\varepsilon_i}^2 = \frac{1}{T-1}\sum_{t=2}^{T} \hat{\varepsilon}_{it}^2 + 2\sum_{j=1}^{k} w_{kj} \left(\frac{1}{T-1}\sum_{t=j+2}^{T} \hat{\varepsilon}_{it}^{'} \hat{\varepsilon}_{i,t-1}\right)$ …9

where w_{kj} are weights used to ensure that $\hat{\sigma}_{\varepsilon_i}^2$ are always positive. These Bartlett weights are given by $w_{kj} = 1 - \left(\frac{j}{K+1}\right)$, where k is the bandwidth. The k has to be efficiently choosen in order to get reasonable results. The test statistic is standardize to take the form $\frac{\sigma_u^2}{\sigma_{\hat{\varepsilon}}^2}$ which has a standard normal distribution under the null hypothesis.

The pair of hypotheses is given thus

$H_0: \sigma_u^2 = 0$

$H_1: \sigma_u^2 > 0$ …10

The null hypothesis is rejected at 5% if p-value is less than 0.05.

D.Cointegration Test

Having confirmed the panel integration order or panel stationarity level of our variable series, the next step is to test for the presence of cointegration among the variables in the panel. The panels are tested using residual based test of Pedroni (1999) and error correction test of Westerlund (2007) which is more based on structural dynamics of panels rather than their residuals. The common point of the two tests is that they produce single cointegration relation in panel setting. (see Pedroni, 2004; Chiawa and Asare 2009)

1 Pedroni Panel Cointegration Test

Consider the following regression equation

$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1\,i,t} + \cdots + \beta_{ki} x_{ki,t} + e_{it}$ …(11)

where $i = 1, \ldots, N$; $t = 1, \ldots, T$, y_{it} and $x_{it} = \left(x_{1\,i,t}, \ldots, x_{ki,t}\right)'$ are assumed to be integrated of order one. The parameters $\alpha_i$and δ_i are the individual and time effects, which are set to zero if they do not exist in the data. Under the null hypothesis of no cointegration, the residual e_{it} will be I(l). The approach here is to obtain the residuals by running the auxiliary regression.

$e_{it} = \alpha_i + \rho e_{it-1} + v_{it}$ …(12)

Equation (12) can be written to include lagged difference term as

$e_{it} = \alpha_i + \tilde{\rho}\varepsilon_{i,t-1} + \sum_{j=1}^{p_i} \Gamma_i \Delta e_{it-1} + v_{it}$ …(13)

Pedroni (1999) proposed seven residual based tests for panel cointegration and derived the asymptotic distributions for the tests. He explored the small sample performances of the seven different statistics to test panel data cointegration. Four of the seven statistics are based on pooling the data and are referred to as "Within dimension" (Panel) tests, and the last three are "Between dimensions" (group) tests. These tests are based on the assumption of heterogeneous cointegration relationships between individual members and are defined as:

Within Statistics

(i) **Panel V statistic**

$$T^2 N^{3/2} Z_{\hat{V}N,T} \equiv T^2 N^{3/2} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1}$$

(ii) **Panel □ □ statistic**

$$T\sqrt{N} Z_{\hat{\rho}N,T} \equiv T\sqrt{N} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

(iii) **Panel PP statistic**

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ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

$$Z_{tN,T} \equiv \left(\tilde{\sigma}^2_{N,T} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \hat{e}^2_{i,t-1} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

(iv) **Panel ADF Statistic**

$$Z^*_{tN,T} \equiv \left(\tilde{S}^{*2}_{N,T} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \hat{e}^{*2}_{i,t-1} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \left(\hat{e}^*_{i,t-1} \Delta \hat{e}^*_{i,t} \right) \quad \ldots 14$$

Between Statistic

(v) **Group □ □ statistic**

$$TN^{-1/2} \tilde{Z}_{\tilde{\rho}N,T-1} \equiv TN^{-1/2} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{e}^2_{i,t-1} \right)^{-1} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

(vi). **Group ADF Statistic**

$$N^{-1/2} \tilde{Z}_{tN,T-1} \equiv N^{-1/2} \sum_{i=1}^{N} \left(\hat{\sigma}^2_i \sum_{t=1}^{T} \hat{e}^2_{i,t-1} \right)^{-1/2} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

(vii) **Group PP statistic**

$$N^{-1/2} \tilde{Z}^*_{tN,T} \equiv N^{-1/2} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{S}^{*2}_i \hat{e}^{*2}_{i,t-1} \right)^{-1/2} \sum_{t=1}^{T} \left(\hat{e}^*_{i,t-1} \Delta \hat{e}^*_{i,t} \right)$$

where

$\hat{\lambda} = \frac{1}{T} \sum_{s=1}^{k_i} \left(1 - \frac{s}{k_i+1}\right) \sum_{t=s+1}^{T} \hat{\mu}_{i,t} \hat{\mu}_{i,t-1}$, $\hat{S}^{*2}_i = \frac{1}{T} \sum_{t=1}^{T} \hat{\mu}^{*2}_{i,t}$

$\tilde{\sigma}^2_{NT} = \frac{1}{T} \sum_{i=1}^{N} \left(\frac{\hat{\sigma}_i}{\hat{L}_{11i}} \right)^2$, $\hat{\sigma}_i = \hat{s}^2_i + 2\hat{\lambda}_i$

$\hat{L}_{11i} = \hat{\sigma}^2_{ui} - \frac{\hat{\sigma}^2_{uie}}{\hat{\sigma}^2_{ei}}$ $S^{*2}_{N,T} = \frac{1}{T} \sum_{t=s+1}^{t} \hat{S}^{*2}_i$

$$\hat{L}^2{}_{11i} = \frac{1}{T} \sum_{t=1}^{T} \hat{\xi}^2_{i,t} + \frac{2}{T} \sum_{s=1}^{k_i} \left(1 - \frac{s}{k_i+1}\right) \sum_{i=1}^{T} \hat{\xi}_{i,t} \hat{\xi}_{i,t-s}$$

$\hat{\lambda}_i$ and $\hat{\sigma}^2_{NT}$ are the two parameters used to adjust the autocorrelation in the model.
$\hat{L}_i$ is defined as the i^{th} component of the Cholesky decomposition of the residual variance covariance matrix.

2. Westerlund Panel Cointegration Test

Westerlund (2007) developed four new panel cointegration tests that are based on structural rather than residual dynamics and, therefore, do not impose any common-factor restriction. The idea is to test the null hypothesis of no cointegration by inferring whether the error-correction term in a conditional panel error-correction model is equal to zero. The new tests are all normally distributed and are general enough to accommodate unit-specific short-run dynamics, unit-specific trend and slope parameters, and cross-sectional dependence. Two tests are designed to test the alternative hypothesis that the panel is co integrated as a whole, while the other two test the alternative that at least one unit is co integrated. It takes care of problem of structural breaks in the panels.

The error-correction tests assume the following data-generating process:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i \left(y_{i,t-1} - \beta_i' x_{i,t-1} \right) + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} \gamma_{ij} \Delta x_{i,t-j} + e_{it} \quad \ldots (15)$$

where $t = i, \ldots, T$ and $i = 1, \ldots, N$ index the time-series and cross-sectional units respectively, while d_t contains the deterministic components, for which there are three cases. In the first case, $d_t = 0$ so that equation 15 has no deterministic terms; in the second case, $d_t = 1$ and Δy_{it} is generated with a constant; and in the third case, $d_t = (1, t)'$ so that Δy_{it} is generated with both a constant and a trend.

x_{it} is K dimensional vector with the assumption that Δx_{it} is independent of e_{it}, and that errors are independent across both i and t. The parameter α_i determines the speed at which the system corrects back to the equilibrium relationship $y_{i,t-1} - \beta_i' x_{i,t-1}$ after a sudden shock. If $\alpha_i < 0$, then there is error correction, which implies that y_{it} and x_{it} are co integrated; if $\alpha_i = 0$ then there is no error correction and, thus, no cointegration. Thus we can state

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

the null hypothesis of no cointegration as $H_o: \alpha_i = 0$ for all i. The alternative hypothesis depends on what is being assumed about the homogeneity of α_i. Two of the tests, called group-mean tests, do not require the $\alpha_i s$ to be equal, which means that H_o is tested against $H_1^g: \alpha_i < 0$ for at least one i. The second pair of tests, called panel tests, assume that α_i are equal for all i and are, therefore, designed to test H_o versus $H_1^p: \alpha_i = \alpha < 0$ for all i.

Group Statistic

$$G_\tau = \frac{1}{N}\sum_{i=1}^{N}\frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)}$$

and

$$G_\alpha = \frac{1}{N}\sum_{i=1}^{N}\frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)}$$

where, $SE(\hat{\alpha}_i)$ is the conventional standard error of $\hat{\alpha}_i$.

Panel Statistic

$P_\tau = \frac{\ddot{\alpha}_i}{SE(\hat{\alpha}_i)}$ and $P_\alpha = T\hat{\alpha}_i$

3. Panel Co integration Estimation Using Dynamic OLS

Considering the residual based cointegration regression

$y_{it} = \alpha_i + \delta_i t + x_{it}'\beta + u_{it}$ for $t = i, \dots, T$ and $i = 1, \dots, N$ …16

and $x_{it} = x_{i,t-1} + v_{it}$

where $\{y_{it}\}$ is p x l, β is a $(p\ X\ 1)$ – vector of parameters, x_{it} are $(p\ X\ 1)$-vectors that are integrated processes of order one for all i, α_i and $\delta_i t$ are constant and time trend respectively. Assume that y_{it} and x_{it} are both l (l) and conintegrated, though there is no cross-correlation among the panel members. The innovation vectors are combined in a two component vector as $w_{it} = (u_{it}, v_{it}')'$.

If y_{it} and x_{it} are co integrated, u_{it} and v_{it} are generally correlated in the long-run. The correlation of u_{it} and v_{it} makes an OLS applied to the panel regression equation to be biased. In the presence of endogeneity between y_{it} and x_{it} and serial correlation between u_{it} and $v_{it}$the OLS estimate becomes biased and inefficient (see Kao and Chiang, 2000; and Erikson 2005). To circumvent this problem, we use DOLS based on recommendations of Xiao and Phillips(2002) and Westerlund (2005), even in the presence of other estimators such as FMOLS, Pooled Mean Group Estimator,(PMGE) and Canonical Co integrating regression(CCR)(see Stock and Watson,1993; Xiao and Philips 2002; Maddala and Kim 2002).

The panel DOLS is based on transforming the regression to eliminate the effects of correlation between u_{it} and v_{it}. If y_{it} and x_{it} are co integrated, u_{it} and v_{it} are stationary and the linerar projection of u_{it} on v_{it}could be made in the following form.

$u_{it} = \sum_{j=-\infty}^{\infty}\eta_{ij}'v_{it} + u_{it}^*$ …(17)

Where u_{it}^* is an orthogonal error term. The panel equation (16) above can be rewritten as

$y_{it} = \alpha_i + \delta_i t + x_{it}'\beta + \sum_{-q}^{q}\eta_{ij}'\Delta x_{i,t-j} + u_{it}^*$ …(18)

If the correlation between $v_{i,t+j}$ and u_{it} is zero for $|j| > q$, then the equation can be estimated with q lags and leads of Δx_{it}. Saikkoonen (1991) suggested the use of the information criteria (AIC or SIC) to select the leads and lags. DOLS estimator has been made to be asymptotically unbiased, thus u_{it}^* can be used in the residual cointegration without the problems of nuisance parameters (see Stock and Watson, 1993; Xiao and Phillips, 2002; and Maddala and Kim, 2003, and Westerlund 2005).

IV. EMPIRICAL RESULTS

Before the testing for the presence of unit root in the panels, it is good to look at the visual representation of each variable at level, in the panels and most importantly, their descriptive statistics which should depict the characteristics of financial data. Figures 1 to 4 display the movement of each variable in country's panel view while Table1 shows the descriptive of all variables.

The movement of the lines on the graph displaying market capitalization to gdp ratio (market value) across the panel shows that the movement is more pronounced in South Africa stock market while little or no much fluctuations noticed in other African countries. An upward and steady trend is noticed in this market. This is not

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

astonishing, as South Africa has the largest market capitalization in Africa. CMA(2010) assessed her market capital base to the tune of $180 billion. However, the graphs of external debt show that there are good times ahead for these stock markets provided they maintain the present pace. The graphs across the countries reflect a downward trend. As for money supply, according to econometric theory, money surplus in the circulation will lead to inflation and this will retrain people from buying by stock in the market as specified in Mukakherjee and Naka (1995) and Maysami, in this case Morocco recorded the most conspicuous pattern within the periods under investigation. Expectation on foreign direct investment in Africa is still on high side as line fluctuate about some points across the continent. Table1 depicts high kurtosis for all the variables and skweness that are never zero with non normal distribution, which are some of the usual characteristics possess by financial data.Figure 5 shows the evidence of cross correlation among the variable across the markets.

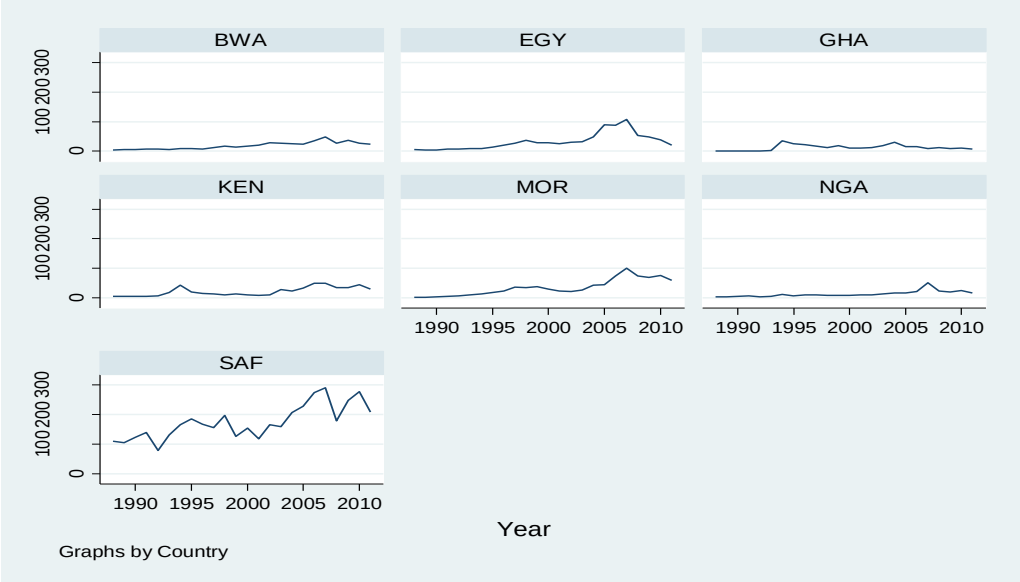

Fig1 Market Capitalization to GDP ratio at level

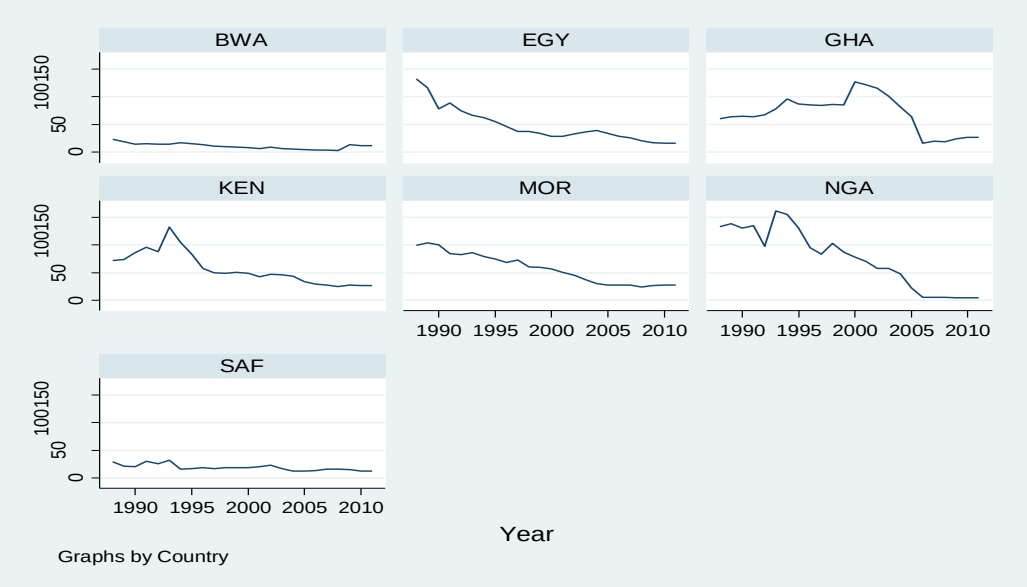

Fig 2 External debt at level

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

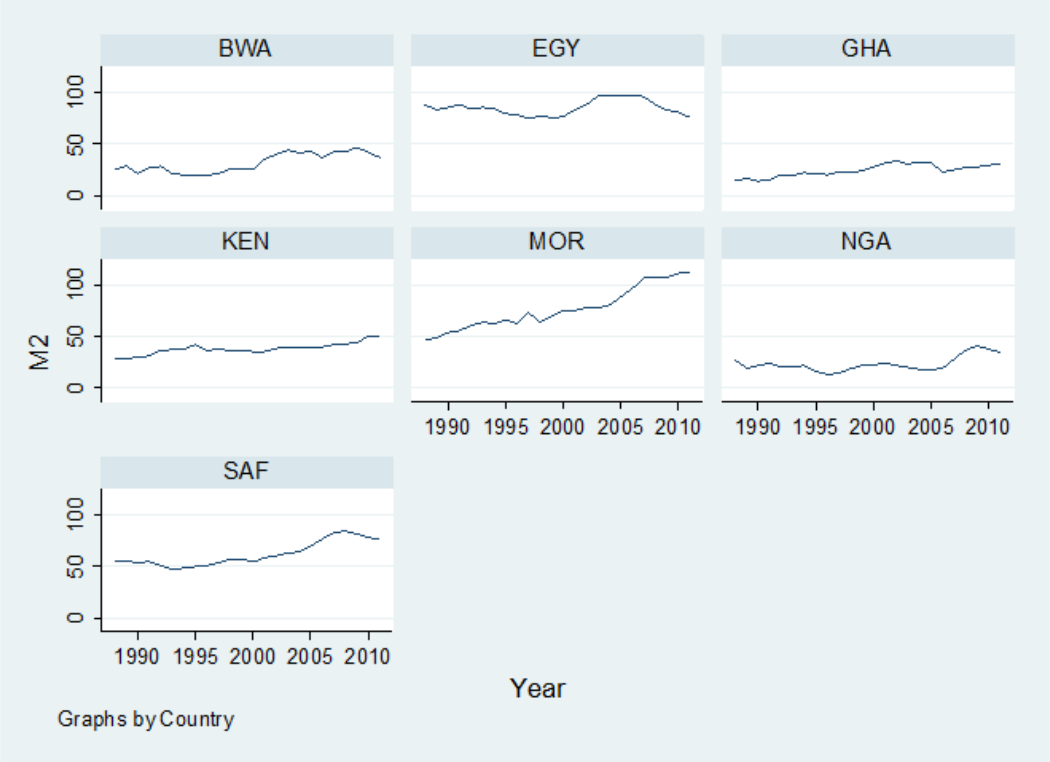

Fig 3 Money supply at level

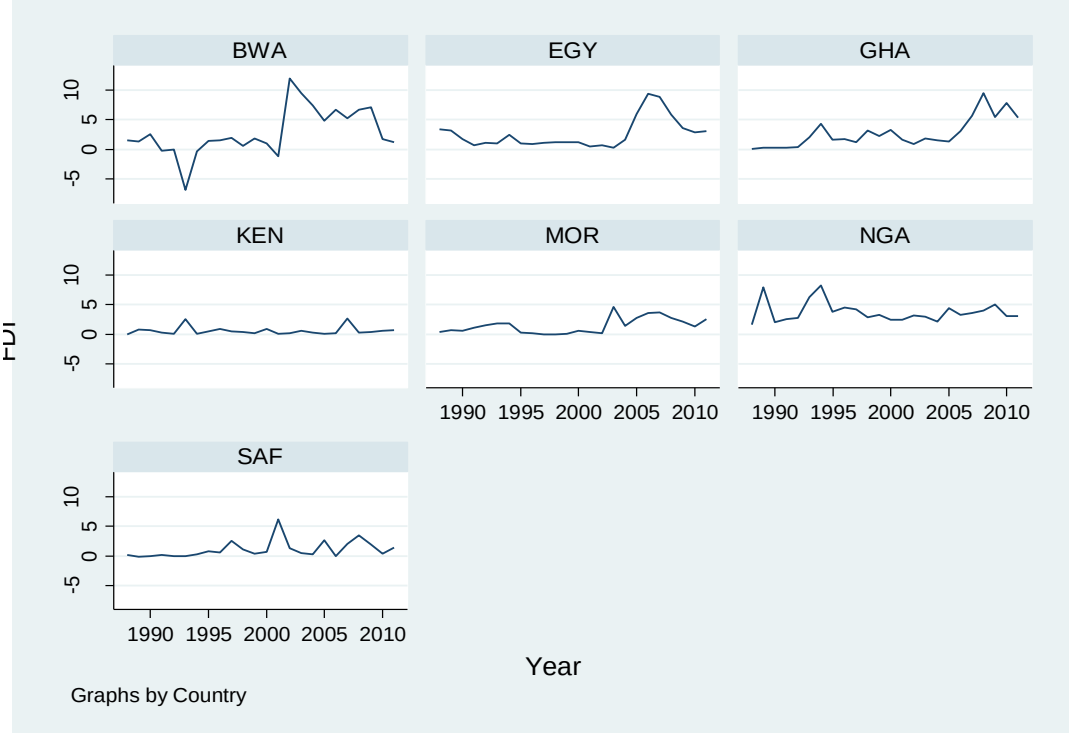

Fig 4 Foreign Direct Investment at level

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

Table 1 Descriptive Statistics of the variables in the panels

Variable	Obs	Mean	Std. Dev.	skwe	Kur	Jaque B.
mkt_gdp	168	44.14971	60.78103	2.2197	7.4298	0.000
m2	168	48.84051	25.98687	0.6225	4.2218	0.000
ex_rate	168	22.87346	37.09019	2.0228	6.0221	0.000
ex_dbt	168	48.33427	37.70366	0.9951	4.0241	0.000
fdi	168	2.149373	2.452891	1.1537	5.8710	0.000

MKT_GDP,EX_DBT(-i)	MKT_GDP,EX_DBT(+i)	i	lag	lead
****|. |	****|. |	0	-0.4109	-0.4109
****|. |	****|. |	1	-0.4023	-0.3877
****|. |	****|. |	2	-0.3932	-0.3455
****|. |	***|. |	3	-0.3814	-0.3072
****|. |	***|. |	4	-0.3767	-0.2716
****|. |	**|. |	5	-0.3738	-0.2175
****|. |	**|. |	6	-0.3678	-0.1602
****|. |	.*|. |	7	-0.3506	-0.1145
***|. |	.*|. |	8	-0.3281	-0.0808
***|. |	.*|. |	9	-0.3008	-0.0634
***|. |	.*|. |	10	-0.2791	-0.0491
***|. |	. |. |	11	-0.2515	-0.0374
**|. |	. |. |	12	-0.2214	-0.0239
**|. |	. |. |	13	-0.1900	-0.0047
**|. |	. |. |	14	-0.1614	0.0184

Fig 5. Evidence of cross correlations among variable across the markets

A. Panel Unit Root Tests

For the heterogeneity across the countries and heterogeneous serial correlation structure of error term, as discussed earlier, we employ three different panel unit root tests namely LLC test, IPS test and Hadri test. Table 2 depicts the results of panel unit root tests for each variable in the panel at level and at first difference. The results show that all the panels contain unit roots at level. However, at a differenced level, the panels are said to be stationary, though there may be possibility of non stationary series in a stationary panel as the panel unit root test will not identify the particular series that is not stationary. This is only draw back of the panel unit root test, nevertheless stronger and higher degree of power is gained in panel setting than in the usual single crossectional setting. This is as a result of the combination of information from time series and crossectional data which leads to improvement of power of test (Im, Pesaran and Shin, 2003). The tests are conducted in two folds. First, carried out with the inclusion of individual effects followed by the inclusion of individual effect plus deterministic time trend as the trend pattern is so conspicuous in some of the line movements displayed in our plots. For instance, the results may not be too welcoming if the panel containing market value or external debt variable does not include the time trend as this has been arguably justified by their line movement patterns. The results show that some of the panels contain unit root only at the inclusion of time trend while others confirm the presence of unit root at both levels of testing.

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

Table 2 Results of the Panel Unit Test

Variable	LLC Test		IPS Test		Hadri Test	
	NT	T	NT	T	NT	T
mkt_gdp	0.022 (-4.3310)	0.1788 (-6.5525)	0.3199 (-0.4158)	0.3192 (-0.4699)	0.000 (13.165)	0.0301 (1.591)
$\Delta\, mkt\_gdp$	0.0000 (-5.688)	0.0173 (-2.1131)	0.0000 (-6.584)	0.0000 (-3.739)	0.2771 (0.5915)	0.1882 (0.8845)
ex_dbt	0.0008 (-4.8739)	0.0099 (-6.7002)	0.2117 (-0.8052)	0.2103 (-0.8052)	0.0000 (15.3356)	0.0000 (9.0619)
Δex_dbt	0.0785 (-1.4154)	0.0000 (-4.350)	0.0000 (-6.5854)	0.0000 (-5.27811)	0.2368 (0.7167)	0.6997 (-0.5234)
$m2$	0.6008 (-2.1112)	0.2803 (-5.2782)	0.9435 (1.5847)	0.8638 (1.0976)	0.0000 (15.2165)	0.0000 (7.5982)
$\Delta m2$	0.0112 (-2.2822)	-0.088 (-1.355)	0.002 (-3.546)	0.0340 (-1.8299)	0.0000 (7.4267)	0.0136 (2.2088)
fdi	0.8750 (-2.518)	0.8105 (-4.634)	0.6336 (0.3415)	0.5885 (0.2330)	0.0000 (7.9048)	0.0239 (1.9795)
Δfdi	0.000 (-6.678)	0.0000 (-6.750)	0.0000 (-8.575)	0.0000 (-6.664)	0.4685 (0.9052)	0.213 (2.047)

All the variables are tested at 5% level of significance and the p –values displayed with their corresponding t-statistic in parenthesis.

Panel Co integration Test

Table 3 shows the results of Pedroni (1999) cointegration test for all the panels under investigation. Schwarz Information criteria (SIC) selects the maximum lag of 4 without the inclusion of deterministic trend and intercepts in co integrating relation and results reveal that the panels are co integrated since six out of the seven statistics provided fail to accept the null of no cointegration at 5% level of significance. However, all the four panel statistics of Westerlund test at lag and leads of 1 reject the null of no cointegration at 5% level of significance.

Table 3 Results of the Cointegration Test

Pedroni Cointegration Test			**Westerlund Cointegration Test**		
Within stat	stat.	P-value	**Stat**	t-sta	p-value
Panel rho	-3.245	0.022	G tau	-5.821	0.021
Panel v	0.55170	0.2908	G alpha	-12.315	0.000
Panel PP	-5.216	0.0000	P tau	-13.111	0.0000
Panel ADF	-6.237	0.0000	P alpha	-22.470	0.0000
Between Stat					
Group rho	-3.7540	0.000			

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

Group PP -4.563 0.012

Group ADF -6.880 0.000

All variables in the panel are 5% level of significance with their corresponding t statistic in parenthesis.

DOLS Estimation of a Co integrated Relation

To circumvent the problems in the presence of endogeneity between y_{it} and x_{it} and serial correlation between u_{it} and v_{it} (as specified in equation (16), the DOLS estimator becomes necessary as OLS will be biased and inefficient (see Kao and Chiang, 2000; and Erikson 2005). The results of DOLS estimation and its residuals are given in the in tables 4 and 5 respectively.

Table 4 Results of DOLS Estimation

OLS Hom. Panel data Coint. Estimation results Number of obs = 168

Group variable: id Number of groups = 7

Wald chi2(3) = 36.0 Obs per group: min = 24

Prob > chi2 = 0.000 avg = 24

max = 24

R-squared = 0.8489

Adj R-squared = 0.70113

mkt_gdp	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
ex_dbt	.5837132	5.726621	5.39	0.000	-1.455983 .688556
m2	-.764922	16.15035	2.51	0.007	-1.69509 3.22492
fdi	2.01317	60.82936	1.75	0.041	-11.27859 7.252255

Linear combination for cointegration relation

HO: Series are cointegrated

(1) -0.58371*ex_dbt +764922*m2 -2.01317*fdi

mkt_gdp	st Err.	z	P>|z
(1)	.05166	-0.04	0.969

$$mkt\_gdp = 0.58371 * ex\_dbt - 0.76922 * m_2 + 2.01317 * fdi$$

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 2, Issue 4, July 2013

Interpretation

Foreign Direct Investment (FDI) and External Debt exert a positive impact on the African stock markets while negative impact will be recorded for Money supply. However, the extent is much greater in FDI, as for every 1% increment in its value brings about 2.01% change in market value. 1% change in external debt will result in an increment of 0.5% in the Africa stock capitalization to GDP ratio. The result of the money supply effect is as expected in the hypothesis which confirms the previous work of Mukherjee and Naka (1995), and Maysami and (2002). The effect of external debt shows that , if the country's economic managers ensure that all debt contracted are used to promote economic growth and development via the build-up of infrastructure and provision of employment opportunities, the Africa continent will be better for it.

V. CONCLUSION

The panel data of seven major African stock markets is examined for the period of 24 years(1988 - 2011) with a view to investigate the long run relationship between these stock markets and some vital macroeconomic variables. The researcher implements a residual based approach to panel cointegration proposed by Pedroni (1999) and error correction based cointegration procedure proposed by Westerlund (2007). The visual representations of all variables in each panel are thoroughly inspected, after which the panel unit root testing procedures of LLC (2002) , IPS(2003) and Handri(2000) are carried out to ascertain the presence of unit root in all the panels under investigation. The results of the panel unit roots reveal that most of the panels investigated contain unit root at level with or without inclusion of individual effects (intercepts) across the Africa stock markets and deterministic trend, nevertheless, with the inclusion of the deterministic trend and individual effect across the African stock markets at a differenced level, most of the panels under investigation appeared stationary. The results of Pedroni panel cointegration test reveal that the six out of the seven panel statistics reject the null of no cointegration at 5% level of significance and while all the four panel statistics in Westerlund test reject the null of no cointegration at the same level of significance. Panel residual based test of Pedroni (1999) and error correction based test of Westerlund (2007) are used to establish the fact that there is evidence of cointegration between the stock markets and the variables under investigation. Based on the recommendations of Xiao and Phillips (2002) and Westerlund (2005) a cointegrated panel relation is estimated by using the Dynamic Ordinary Least square (DOLS) estimation method. The result shows that in the long run, Foreign Direct Investment (FDI) and External Debt exert a positive impact on the African stock markets while negative impact will be recorded for Money supply. However, the extent is much greater in FDI, as for every 1% increment in its value brings about 2.01% change in market value.

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