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Efficient Market Hypothesis in the Presence of Market Imperfections: Evidence from Selected Stock Markets in Africa

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This paper investigated the weak axiom of the efficient market hypothesis (EMH) as it applies to fifteen (15) leading stock markets in Africa. There are currently over twenty-nine stock exchanges in Africa with a significant degree of disparities ranging from market size, trading volume, number of listed companies, access to funds, access to information to market standardization etc. The article deviated from the conventional linear approach of testing efficient market hypothesis and the method of using the runs test for serial dependency to test the weak-form efficient market hypothesis. The paper adopted the wavelet unit root analysis-tool, which decomposed the stochastic processes into its wavelet components, with varying frequency band. The study found that institutional constraints have implications for the efficient market hypothesis and investment in the African stock market. The conclusions drawn from the study is the relevance of using past historical stock prices to predict the current earnings at stock markets in Africa, a negation of the efficient market hypothesis.

Keywords: Efficient market, information asymmetry, stock prices, wavelet unit root, Africa

JEL: C01, C23, D84, GI4

The African continent has evolved from a description of being "The Hopeless Continent" in the periods between 2000 and 2002 (see Brook, 2000; Williams, 2004) to an optimistic story as the "Aspiring Africa" in 2013 (see Andersen and Jensen, 2014) where investors all over the world see the African continent as the next frontier of economic growth. Africa is an area where substantial growth has been predicted to take place in the stock market. A market where behavioral economists and financial analysts have argued that arbitragers with significant market information could predict future stock prices and profit earnings, also, wealth holders with insight into previous changes in the price level can predict future prices and current profit takings in the market (see Adam, Marcet and Beutel, 2017; Butt, *et al.*, 2010; Dimpfl and Jank, 2016; Kafayat, 2014; Mallick, 2015; Yang, Jhang and Chang 2016; Zindel, Zindel and Quirino, 2014).

The reality, however, is that in a competitive market setting, current prices are known to adjust rapidly in real–time eliminating the ability of investors and arbitragers to use past information available to the reality, however, is that in a competitive market setting, current prices are known to adjust rapi–

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dly in real-time eliminating the ability of investors and arbitragers to use past information available to predict current and future price outcome (Bhargava, 2014; Degutis and Novickytė , 2014; Tiwari and Kyophilavong, 2014).

Eugene Fama introduced efficient market hypothesis (EMH) in his 1960 dissertation. Accordingly, he asserted that at any given time, stock prices are a reflection of all available information in the capital market and are traded at their fair value at all times making it impossible for market participants to consistently choose stocks that will beat the returns of the overall market.

The efficient market hypothesis (EMH), although well-received by financial and behavioral economists from 1970s to 1990s; the theory came under criticism in the late 1990's up until the period of global economic crisis of 2007-2008 following the series of events that happened globally that undermined the assumptions on which the EMH rested. The first of these events was the dot-com bubble and the technology bubble that occurred from 1995 to 2000 – a period of excessive speculation, rapid share price growth and high stock price valuation that allowed investors to make abnormal returns (see McAleer, Suen and Wong, 2016; Schubert *et al*., 2018).

The second is the United States sub-prime mortgage crisis, and the stock market crash of 2007-2010, which triggered the 2007-2008 global economic crises. Economic analysts questioned the relevance of the EMH on the premise that the dot-com bubble and the sub-prime mortgage crisis would not have occurred if the efficient market assumptions were fundamentally correct (Constâncio, 2014; Gilson and Kraakman, 2014; Ouarda, El Bouri and Bernard, 2013).

Despite the criticisms on the assumptions of the EMH, African stock market is on the increase, expanding rapidly and attracting private investment and integration into the global financial market. There are currently over twenty-nine (29) stock exchanges in Africa with a varying degree of disparities in terms of market size, the number of listed firms, trading volume, access to funds, access to information, and market standardization (Boamah, Watts and Loudon, 2017). These institutional constraints alongside the existence of information asymmetry, principal agency problems, regulatory constraints and the presence of weak financial institution have implications for the relevance of EMH and investment in the African stock market.

The gaps in the existing literature on EMH on the African continent prompted this study. Empirical studies conducted for Africa remain inconclusive with mixed reports. This contrary reports are evident in the works (Adigwe, Ugbomhe and Alajekwu, 2017; Bulla, 2015; Bundoo, 2000; Simons and Laryea, 2005; Van *et al*., 2013) which supported weak-form efficient market hypothesis, but many studies documented inefficient market hypothesis (Awiagah and Choi, 2018; Ayentimi, Mensah and Naa-Idar, 2013; Chikoko and Muparuri, 2013; Katabi and Raphael, 2018; Lawal, Somoye and Babajide, 2017;

Nwidobie, 2014; Smith, 2008; Zaman, 2019); while few studies reported mixed results (Abakah *et al.*, 2018; Phiri, 2015; Vitali and Mollah, 2015). Additionally, Kelikume (2016) recorded strong-form efficient market hypothesis. The study prompted by the need to put to rest existing empirical divergences on the African stock market. Also, as the African stock market develops in the presence of imperfect information, investors, regulators and other participants require clarity on how efficient or inefficient the stock market is to avoid a crash shortly.

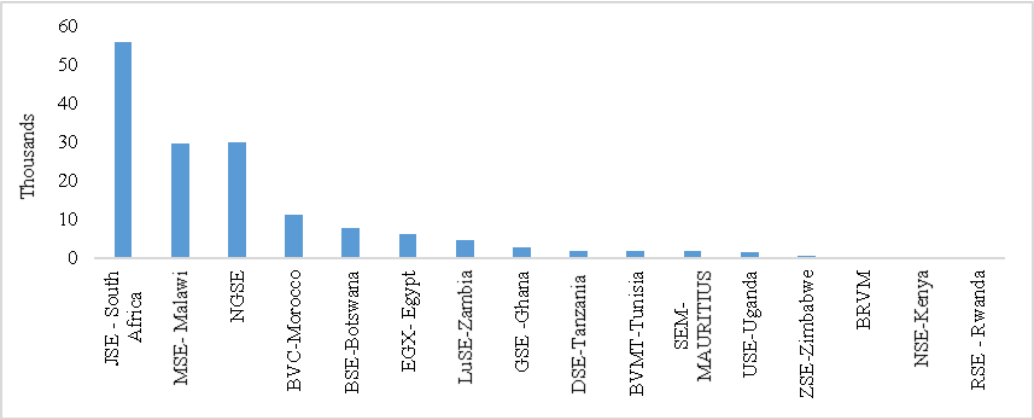
The study's broad objective is to examine the relevance of the efficient market hypothesis in Africa in the presence of information asymmetry and market imperfections. The focus of the research will be to test the weak axiom of the efficient market hypothesis as it applies to selected stock markets in Africa. The study's contribution to knowledge is four-fold. First, it improved on existing studies on EMH in Africa by considering a wider spectrum of 15 stock markets in Africa, which represents 50 percent expansion in sample size against the maximum of 10 stock markets investigated in previous studies (Lawal *et al.*, 2018; Mlambo and Biekpe, 2007). Second, the study adds to empirical literature having adopted an improved method of data analysis (wavelet) against the conventional linear approach and the runs tests employed by Mlambo and Biekpe (2007). The wavelet analysis improves on other unit root tests by decomposing the stochastic processes into its wavelet components with a specific frequency band (Fan and Gencay, 2010). Third, the study contributed significantly to the debate on the relevance of EMH in Africa with important policy suggestions based on the ERS tests, Bai Perron, and variance ratio analysis. Fourth, the findings and policy implications of this study are relevant to economists, financial analysts and investors for stock market investment decisions in the presence of information asymmetry and other market imperfections.

Following the introductory section, the rest of the paper presents: the performance of the stock market in Africa in next sub-section, theoretical underpinnings and review of the empirical literature on EMH in section 2; the methodology is presented in section 3, while section 4 deals specifically with the results and discussion. Section 5, 6, and 7 present the conclusion, implications and future directions.

Stylized Facts

The equity market in Africa had developed and expanded in recent times. The number of operating stock exchange markets rose from just eight in 1989 to twenty-three in 2007 and twenty-nine in 2019, reaching a total market capitalization of over US$2.1 trillion. Many African stock market returns remain juicy to investors despite their small size, low liquidity and amidst current weak performance (see Figure 1).

African stock market has always been among the top 10 best-performing markets in the world since 1995. In 2004, six African countries (Ghana, Uganda, Kenya, Egypt, Mauritius, and Nigeria)

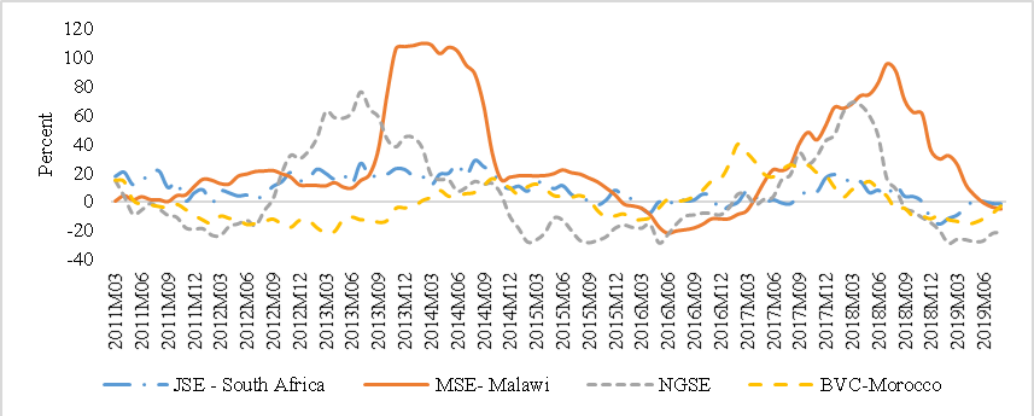


Source: Authors' Computation

Figure 1. All Share Index (ASI) for Selected African Countries for June-2019

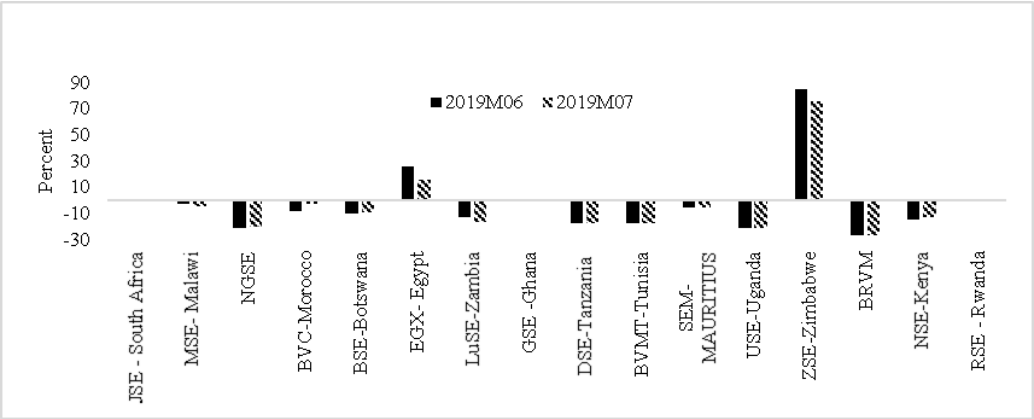
were among the world's ten (10) best-performing stock markets, while in 2005 Egypt, Uganda and Zambia were in the top five (5) ranking. In 2006, Malawi outperformed every other market in the world.

However, the top-performing stock market in order of ranking includes South Africa, Malawi, Nigeria, and Morocco since 2010, although these markets are currently experiencing a downturn (see Figure 2a), and of the nineteen countries, only Egypt and Zimbabwe remain positive (see Figure 2b).



Source: Authors' Computation

Figure 2a. Year on Year Growth Rate of ASI for Top Four African Countries



Source: Authors' Computation

Figure 2b. Year on Year Growth Rate of ASI for Selected African Countries

LITERATURE REVIEW

Theoretical Underpinnings

The efficient market hypothesis (EMH) relates assets prices with information flow. The EMH is one financial market theory with rich historical development. Gyamfi, Kyei and Gill (2016) tracked the evolution of this theory to the earliest works of Cardano (1564) on the principle of equal conditions in gambling, the study of Brown (1828) on rapid oscillatory motion, and Regnault (1863) on stock price deviation and time relation. The efficient market was recognized when shares in the open market are publicly known; its value, as acquired, implies the judgment of the best intelligence concerning them (Gibson, 1889). Other studies that culminated in the evolution of EMH include (Einstein, 1905; Fama, 1965b; Friedman, 1953; Granger and Morgenstern, 1963; Harry, 1959; Keynes, 1923; Mandelbrot, 1963; Sharpe, 1964; Tussig, 1921; von Smoluchowski, 1906). Although Fama (1965b) provided the initial conceptual position of an efficient market, it was Samuelson (1965) who provided a formal economic argument for efficient markets from the standpoint of martingale, rather than a random walk.

Further, Fama and Blume (1966) submitted that measuring the direction and degree of dependence in price variations, serial correlation rule is sufficient. Ultimately, the empirical findings by Fama (1970) lend credence to the conclusion that the stock market is efficient. Fama (1970) posited that in an active market (with many well-informed and intelligent investors), appropriately priced securities reflect all available information, that is a market in which securities price reflect all possible information

quickly and accurately so that it is impossible for market participants to earn abnormal profits. The theory was built on the assumption that returns distributions do not change over time.

Also, the degree of market efficiency depends on existing information conditions in the market environment; therefore, Fama (1970) categorized the information set into three forms (levels) namely the weak, semi-strong, and strong-form. The strong-form efficient market must have: many knowledgeable investors actively analyzing and trading stocks; information is widely available to all investors; events, such as labor strikes or accidents, tend to happen randomly; the fast and accurate reaction of investors to new information. When any of these conditions are absent in the market, we may have weak-form or semi-strong form. The weak-form EMH defines a market as being efficient if current prices fully reflect all information contained in previous stock prices. This form implies that historical prices cannot suffice as a forecasting tool for the stock price. Thus, it is impossible to make abnormal returns by using only past historical prices while the semi-strong form of the EMH states that current market prices reflect all publicly available information.

The strong-form EMH implies that private information (inside information) for making abnormal returns is hard to obtain as a result of the stiff competition amongst participants. However, in reality, some investors or market participants can make abnormal returns; thus, the strong-form EMH is not very likely to hold.

Empirical Literature

A large number of publications have examined the existence of the EMH in various developed and undeveloped markets with varying results (Ananzeh, 2014). Evidence from literature confirms the presence of the weak-form EMH in developed market (Anagnostidis, Varsakelis and Emmanouilides, 2016; Cootner, 1962; Fama and Blume, 1966; Mensi, Tiwari and Al-Yahyaee, 2019; Williamson, 1972; Yang *et al.*, 2019) while empirical evidence from studies conducted in emerging economies yielded mixed results, between accepting or rejecting the null hypotheses of weak-form EMH.

For instance, Dahel and Laabas (1999) documented that stock market in Kuwait displays weak-form EMH, and rejected the weak-form EMH for Bahrain, Kuwait, Saudi Arabia and Oman. Wheeler *et al.* (2002) did not support the weak form of EMH for the stock market of Warsaw (Poland). Also, Abeysekera (2001), and Abraham and Alsakran (2002) in their empirical finding, rejected the null hypothesis of weak-form efficiency for stock markets in Sri Lanka, Bahrain, Kuwait, and Saudi Arabia. On the other hand, Karemera, Ojah and Cole (1999) strongly support the weak form of EMH for the stock market in Turkey. Studies conducted by Iqbal and Mallikarjunappa (2008, 2010, and 2011) on Indian Stock Market, found that the stock market of India is not efficient in weak and semi-strong form.

Hou and Sun (2014) tested the weak-form market efficiency for Canada and China, and found a mixed result that differs from the sample period to sample period for both markets. Although, almost all testing techniques generated unfavorable results against the weak-form EMH for both countries, however, result from more recent data sample suggests that both markets are efficient. Furthermore, Awan and Subayyal (2016) studied six stock exchanges in the Gulf region, that included Bahrain, Kuwait, Oman, Saudi Arabia, UAE and Qatar for the five years, spanning 2011 to 2015. Their findings support evidence that the stock prices at the Gulf markets do not follow the random walk model.

In 2017, Hawaldar, Rohit and Pinto (2017) tested for the weak-form efficient market hypothesis in Bahrain Bourse using the Kolmogorov-Smirnov (K-S) goodness of fit test, runs test and autocorrelation test. Whereas the K-S test result concluded that the general stock price movement does not follow the random walk, results of the runs test revealed that share prices of seven companies do not follow random walk while the autocorrelation tests revealed that share prices exhibit low to moderate correlation varying from negative to positive values. With the show of mixed result from the different analysis, it was difficult for Hawaldar, Rohit and Pinto (2017) to ascertain the weak form of the efficiency of Bahrain Bourse.

Similarly, in Africa, empirical studies conducted remain inconclusive yielding weak-form efficient (Adigwe *et al.*, 2017; Bulla, 2015; Bundoo, 2000; Simons and Laryea, 2005; Van *et al.*, 2013), inefficient (Awiagah and Choi, 2018; Ayentimi *et al.*, 2013; Chikoko and Muparuri, 2013; Katabi and Raphael, 2018; Lawal *et al.*, 2017; Nwidobie, 2014; Smith, 2008; Zaman, 2019), mixed results (Abakah, *et al.*, 2018; Phiri, 2015; Vitali and Mollah; 2015) and strong-form efficient (Kelikume, 2016) (see Table 1, Appendix-I).

From the empirical review of existing literature, it is obvious that stock market analysis in Africa is still far from harmony. To contribute to the ongoing debate in this research space requires the use of recent data on the stock market, the deployment of modern methods and expanded scope in terms of the numbers of stock markets examined. By these, this study contributes to the literature on EMH.

METHODOLOGY

-Sample and Data

The population of this study is the 29 stock markets in Africa. A sample of 15 stock markets was drawn for analysis. A convenient sampling technique was employed based on data availability. Monthly data for the sampled 15 stock markets in Africa spans the period of January 2010 to June 2018. Data collected from the online site of the *African Markets* (retrieved from https://www.african-markets.com/en/stock-markets). The study uses monthly all share index data for two reasons: (1) the

potential for thin trading in Africa stock markets and (2) using daily/weekly prices in a return series from infrequently traded stocks may lead to significant biases in the results (Mlambo and Biekpe, 2007). In line with the literature, the monthly index returns are computed as follows:

$$r_i = ln\left(\frac{P_i}{P_{i-1}}\right) \times 100\% \qquad (1)$$

Where r_i is a monthly market return for period t, P_i and P_{i-1} denote market prices for period t and period $t-1$ respectively, while ln connotes natural logarithm. The log transformation converts the data into continuously compounded rates. (see Table 2, Appendix-II for Descriptive Statistics)

-Wavelet Unit Root Test

In line with Kelikume (2016), and Tiwari and Kyophilavong (2014) this study employed wavelet unit root technique to investigate the efficient market hypothesis for stock indices. The literature on unit root tests continues to develop one framework after another, with different assumptions and incorporating different levels of nonlinearity, volatility and structural breaks. While the traditional unit root tests in the literature are based on a time-domain analysis, this study uses a different test based on wavelet analysis. The wavelet analysis decomposes the stochastic processes into its wavelet components, with a specific frequency band. To develop the wavelet-based unit root techniques, Fan and Gençay (2010) decomposed the variance of the underlying processes into the variance in its low and high-frequency components through the discrete wavelet transformation (DWT).

Fan and Gençay (2010) defined $\{X\}^{T}_{t=1}$ as a univariate time series which can be defined as

$$x_t = \beta x_{t-1} + \varphi_t \qquad (1)$$

φ_t is a weakly stationary zero mean error with a strictly positive long-run variance which can be defined as

$$\theta^2 = \delta_0 + 2\sum_{j=1}^{\infty} \delta_j \qquad (2)$$

$$\delta_j = E(\varphi_t \varphi_{t-j}) \qquad (3)$$

The test is only applicable to the linear trend and non-zero mean cases.

Assuming that the process $\{x_t\}$ can be defined as:

$$x_t = \xi + \gamma t + x_t^s \qquad (4)$$

x_t^s is produced by model (1).

If the null hypothesis $H_0: \beta = 1$, then $\{x_t^s\}$ is a unit root process. On the other hand, if $H_0: \beta < 1$, then

$\{x_t^s\}$ is a zero mean stationary process.

If $\gamma = 0$, then the demeaned series $(x_t - \bar{x})$ where

$$\bar{x} = \frac{1}{T}\sum_{t}^{T} x_t \qquad (5)$$

defines the sample mean of $\{x_t\}$.

If $\gamma \neq 0$, then the detrended series $(\bar{\bar{x}}_t - \bar{\bar{x}})$ where

$$\bar{\bar{x}}_t = \sum_{j=1}^{T}(\Delta x_j - \Delta\bar{x}) \qquad (6)$$

defines the sample mean of $\{x_t\}$.

$\bar{\bar{x}}$ is the sample mean of $\bar{\bar{x}}_t$ where

$$\Delta x_t = x_t - x_{t-1} \qquad (7)$$

And $\Delta\bar{x}_t$ is the mean of Δx_t.

Based on the unit scale DWT wavelet, Fan and Gençay (2010) introduced two test statistics, for the demeaned and the detrended series.

The test statistics for the demeaned series is defined as:

$$\bar{S}_{T,1}^{LM} = \frac{\sum_{t=1}^{T/2}(B_{t,1}^{M})^2}{\sum_{t=1}^{T}(x_t - \bar{x})^2} \qquad (8)$$

Where $B^{M}_{t,1}$ stands for the scaling coefficient of the demeaned series.

The test statistics for the detrended series is defined as:

$$\bar{S}_{T,1}^{LM} = \frac{\sum_{t=1}^{T/2}(B_{t,1}^{d})^2}{\sum_{t=1}^{T}(\bar{\bar{x}}_t - \bar{\bar{x}})^2} \qquad (9)$$

Where $B^{d}_{t,1}$ denotes the scaling coefficients of the detrended series.

The two are used to test the null hypothesis, $H_0: \beta = 1$ against the alternative hypothesis, $H_1: \beta < 1$ in the model (1).

-Analyses

Figures 3a and 3b (see Appendix-V/VI) show the development of the African stock indices. African stock markets are on the increase, expanding rapidly and attracting private investment and integration into the global financial market. Currently, there are 29 stock markets in Africa with different degrees of differences in terms of market size, trading volume, and the number of listed companies.

RESULTS AND DISCUSSION

The wavelet unit root test is used to investigate the efficient market hypothesis for stock returns, and this follows previous studies on efficient market hypotheses for African stock (e.g., Kelikume, 2016; Lawal *et al*., 2018; Tiwari and Kyophilavong, 2014). The results of the wavelet-based unit root tests are summarized in Table 3 (see Appendix-III). The use of three different lags (10, 20 and 30) ensures the robustness of the results. Despite the different lag lengths, the test statistics accept the null hypothesis of stationarity at 1 percent, 5 percent and 10 percent significance level with the wavelet statistic greater than the corresponding critical values. In other words, stock return series are stationary.

To enhance the robustness of the empirical results, this study compares the wavelet results with a battery of traditional tests of efficient market hypothesis well established in the literature, such as Elliott-Rothenberg-Stock (ERS) unit root test, Bai-Perron breakpoint test, and variance ratio tests. From Table 4 (see Appendix-IV), all the tests show the fact that the return series are stationary, irrespective of the levels of the lag length.

CONCLUSION

The key conclusion drawn from the findings of this study is that arbitragers and wealth holders with significant market information and insight into previous changes in the price level can predict future prices and current profit takings in the market. In a competitive market setting, current prices are supposed to adjust rapidly in real-time to eliminate the ability of investors and arbitragers to use past information available to predict current and future price outcome (Bhargava, 2014; Degutis and Novickytė , 2014; Tiwari and Kyophilavong, 2014). However, this study has shown that, for African stock markets, the converse is the case. This study, therefore, debunks and negates Fama's efficient market hypothesis. In sharp contrast to Fama's efficient market hypothesis, the findings of this study has shown that it is possible for market participants in African stock markets to consistently choose stocks that will beat the returns of the overall market, thus, affirming earlier reports by Adigwe *et al*. (2017), Appiah-Kusi and Menyah (2003), Bundoo (2000), Lawal *et al*. (2017), Simons and Laryea (2005), and Smith (2008).

The dot-com bubble and the technology bubble that occurred from 1995 to 2000 (a period of excessive speculation, rapid share price growth, and high stock price valuation that allowed investors to make abnormal returns) further illustrate the failure of the efficient market hypothesis. The United States subprime mortgage crisis and stock market crash of 2007–2010 are other pointers to the failure of the efficient market hypothesis. The 2007–2008 global economic crises, therefore, would not have occurred if the efficient market assumptions were fundamentally correct.

IMPLICATIONS

The findings of this study bear significant theoretical, social change, and practical implications for stock market participants. First, the African stock market performance does not support the efficient market hypothesis. The lack of support for the position of EMH could be justified by a lack of precision on what constitutes efficient price response information. Ball (2009) posits that comparing the returns earned from trading on the information with the returns otherwise expected from passive investing is a measure of efficiency; however, implementing the counterfactual in this way suffers from the bad model problem. The reason earlier studies relied on the capital asset pricing model.

Another implication of our findings is the silence of efficient market hypothesis on an exact sequence that makes an efficient price reaction in Africa. It also does not explain variations and magnitude in fall or recovery in the price of African stock. This is because; the African stock market information is dynamic and changes with the interest rate, risk, security risk and risk premium. The hypothesis does not account for how changes in monetary policy, fiscal policy, demographics of investors, technological innovations, and labor productivity affect expected returns in an efficiently priced market. In Africa where technological changes, labor productivity, investors' characteristics and discretionary policies are volatile, important and exogenous, the EMH remains significantly silent.

Implicit in the Fama's EMH is the assumption that the observed level of risk (ex-post) risk level is the accurate level (Ball, 2009). However, from the result of this study, the EMH does not encompass the correct level of risk that makes security efficiently priced. Modeling and estimating risk parameters is cumbersome due to its dynamic nature (Ji *et al.*, 2018). Also, African stock markets are susceptible to uncertainties occasioned by industrial and legal actions, competitive strategies, and major announcements of earnings (Auwal and Sanusi, 2016; Balcilar *et al.*, 2019). These factors determine whether the market over-assesses or under-assesses risk (Tweneboah, Junior and Oseifuah, 2019), thus account for the weak-form market hypothesis, which departs sharply from the efficient market efficiency.

These research findings are also useful to institutional and individual investors in the African stock market from various perspectives. An understanding of stock market efficiency is relevant for corporate

executives whose decisions and actions affect the perceived value of companies. Also, stock market development models employed in this study are crucial for supervisory and operational benefits. Despite a paradigm shift towards behavioral financial theory in recent year, the EMH remains useful in analyzing stock returns globally.

LIMITATIONS AND FUTURE DIRECTIONS

The key limitation of this study is that it focused on only fifteen (15) stock markets in Africa to test the EMH. Studies interested in testing the validity of EMH in African stock market in the future should extend their analysis to all existing stock markets in the continent, where data availability is not a constraint; this is capable of yielding more robust empirical findings for the formulation of efficient stock market policies. Future study should also depart from the battery tests employed in this study. Other robust battery of unit root tests suggested included those that do not consider structural breaks in the data such as ADF, PP, ADF-GLS, NP4; and the others that allow for endogenously determined structural breaks in the data such as Lumsdaine and Papell (1997), and Clemente, Montañés and Reyes (1998). Clemente *et al*. (1998) tests are based on the framework of the innovative outlier and additive outliers.

REFERENCES

Abakah, E. J. A., Alagidede, P., Mensah, L. & Ohene-Asare, K. (2018). Non-linear approach to Random Walk Test in selected African countries. *International Journal of Managerial Finance,* 14(3): 362-376. https://doi.org/10.1108/IJMF-10-2017-0235

Abeysekera, S. P. (2001). Efficient markets hypothesis and the emerging capital market in Sri Lanka: evidence from the Colombo stock exchange: A note. *Journal of Business Finance and Accounting,* 28(12): 249-261. https://doi.org/10.1111/1468-5957.00373

Abraham, S. & Alsakran, S. A. (2002). Testing the random behavior and efficiency of the Gulf stock markets. *The Financial Review,* 37(3): 469-480. https://doi.org/10.1111/0732-8516.00008

Adam, K., Marcet, A. & Beutel, J. (2017). Stock price booms and expected capital gains." *American Economic Review*, 107(8): 2352-2408. https://doi.org/10.1257/aer.20140205

Adigwe, P., Ugbomhe, U. & Alajekwu, U. (2017). Test of weak form stock market efficiency in selected African stock markets (2013-2015). *Saudi Journal of Business and Management Sciences*, 2(2): 60-69.

Anagnostidis, P., Varsakelis, C. & Emmanouilides, C. J. (2016). Has the 2008 financial crisis affected stock market efficiency? The case of Eurozone. *Physica A: Statistical Mechanics and its Applications*, 447, 116-128. https://doi.org/10.1016/j.physa.2015.12.017

Ananzeh, I. E. (2014). Testing the weak form of efficient market hypothesis: empirical evidence from Jordan. *International Business and Management,* 9(2): 119-123. http://dx.doi.org/10.3968/%25x

Andersen, T. B. & Jensen, P. S. (2014). Is Africa's recent growth sustainable? *International Economic Journal*, 28(2): 207-223. https://doi.org/10.1080/10168737.2013.825308

Appiah-Kusi, J. & Menyah, K. (2003). Return predictability in African stock markets. *Review of Financial Economics*, 12(3): 247-270. https://doi.org/10.1016/S1058-3300(02)00073-3

Auwal, U. & Sanusi, A. R. (2016). The dynamics of volatility spillover between African stock markets in the context of political uncertainty: The case of Nigeria and South Africa. In *International Conference "Corruption, Security and National Development," Ahmadu Bello University, Zaria-Nigeria*, 28-30. http://dx.doi.org/10.2139/ssrn.2895241

Awan, U. & Subayyal, M. (2016). Weak form efficient market hypothesis study: Evidence from Gulf stock markets. http://dx.doi.org/10.2139/ssrn.2787816

Awiagah, R. & Choi, S. S. B. (2018). Predictable or Random?- A Test of the weak-form efficient market hypothesis on the Ghana stock exchange. *Journal of Finance and Economics,* 6(6): 213-222.

Ayentimi, D. T., Mensah, E. A. & Naa-Idar, F. (2013). Stock market efficiency of Ghana stock exchange: An objective analysis. *International Journal of Management, Economics and Social Sciences*, 2(2): 54 -75.

Balcilar, M., Gupta, R., Kim, W. J. & Kyei, C. (2019). The role of economic policy uncertainties in predicting stock returns and their volatility for Hong Kong, Malaysia and South Korea. *International Review of Economics and Finance*, 59, 150–163. https://doi.org/10.1016/j.iref.2018.08.016

Ball, R. (2009). The global financial crisis and the efficient market hypothesis: what have we learned? *Journal of Applied Corporate Finance*, 21(4): 8–16. https://doi.org/10.1111/j.1745-6622.2009.00246.x

Bhargava, A. (2014). Firms' fundamentals, macroeconomic variables and quarterly stock prices in the US. *Journal of Econometrics*, 183(2): 241–250. https://doi.org/10.1016/j.jeconom.2014.05.014

Boamah, N. A., Watts, E. & Loudon, G. (2017). Regionally integrated asset pricing on the African stock markets: Evidence from the Fama French and Carhart models. *Journal of Economics and Business*, 92, 29–44. https://doi.org/10.1016/j.jeconbus.2017.04.002

Brooks, D. (2000). Hope for the "hopeless continent": Mercenaries. *Traders: Journal for the Southern African Region*, 3, 1–9.

Brown, R. (1828). A brief account of microscopical observations made in the months of June, July and August 1827, on the particles contained in the pollen of plants; and on the general existence of active molecules in organic and inorganic bodies. *The Philosophical Magazine*, 4(21): 161–173.

Bulla, D. (2015). Random walk hypothesis in emerging stock markets: Evidence from the Nairobi securities exchange. *International Journal of Economics, Finance and Management*, 4(2): 99–104.

Bundoo, S. K. (2000). The Mauritius stock exchange: An assessment. *University of Mauritius Research Journal*, 3, 67–80.

Butt, B. Z., urRehman, K., Khan, M. A., & Safwan, N. (2010). Do economic factors influence stock returns? A firm and industry level analysis. *African Journal of Business Management*, 4(5): 583–593.

Cardano, G. (1564). *Liber de ludo aleae*. Opera Omnia.

Chikoko, L. & Muparuri, W. (2013). Zimbabwe stock exchange and efficiency in the multiple currency exchange rate regime. *Journal of Business and Economic Management*, 1(3): 41–47.

Clemente, J., Montañés, A. & Reyes, M. (1998). Testing for a unit root in variables with a double change in the mean. *Economics Letters*, 59(2): 175–182. https://doi.org/10.1016/S0165-1765(98)00052-4

Constâncio, V. (2014). The European crisis and the role of the financial system. *Journal of Macroeconomics*, 39, 250–259.

Cootner, P. (1962). Stock prices: Random vs. systematic changes. *Industrial Management Review*, 3, 24–45.

Dahel, R. & Labaas, B. (1999). The behavior of stock prices in the GCC markets. *Economic Research Forum*, Working paper No. 9917.

Degutis, A. & Novickytė , L. (2014). The efficient market hypothesis: A critical review of literature and methodology. *Ekonomika*, 93(2): 7–23.

Dimpfl, T. & Jank, S. (2016). Can internet search queries help to predict stock market volatility? *European Financial Management*, 22(2): 171–192. https://doi.org/10.1111/eufm.12058

Einstein, A. (1905). On the electrodynamics of moving bodies. *Annalen Der Physik*, 17(10): 891–921.

Fama, E. F. (1965b). The behavior of stock-market prices. *The journal of Business*, 38(1): 34–105.

Fama, E. (1970). Efficient capital market: A review of theory and empirical work. *Journal of Finance*, 25(2), 382–417. https://doi.org/10.1111/j.1540-6261.1970.tb00518.x

Fama, E. F. & Blume, M. E. (1966). Filter rules and stock-market trading. *The Journal of Business,* 39(1): 226–241.

Fan, Y. & Gençay, R. (2010). Unit root tests with wavelets. *Economic Theory*, 26, 1305–1331. https://doi.org/10.1017/S0266466609990594

Friedman, M. (1953). *The methodology of positive economics*. Cambridge University Press.

Gibson, G. (1889). *The stock markets of London, Paris and New York.* New York: GP Putnam's Sons.

Gilson, R. J. & Kraakman, R. (2014). Market efficiency after the financial crisis: It's still a matter of information costs. *Virginia Law Review*, 100(2): 313–375.

Granger, C. W. & Morgenstern, O. (1963). Spectral analysis of New York stock market prices *Kyklos*, 16(1): 1–27. https://doi.org/10.1111/j.1467-6435.1963.tb00270.x

Gyamfi, N. E., Kyei, K. A. & Gill, R. (2016). African stock markets and return predictability. *Journal of Economics and Behavioral Studies*, 8(5): 91–99. https://doi.org/10.22610/jebs.v8i5(J).1434

Harry, M. (1959). *Portfolio selection: Efficient diversification of investments*. New York: John Wiley.

Hawaldar, I. T., Rohit, B. & Pinto, P. (2017). Testing of weak form of efficient market hypothesis: Evidence from the Bahrain Bourse. *Investment Management and Financial Innovations*, 14(2), 376–385. http://dx.doi.org/10.21511/imfi.14(2-2).2017.09

Hou, B. & Sun, M. (2014). *Testing the weak-form market efficiency hypothesis for Canadian and Chinese stock markets*. M.Sc project, Simon Fraser University.

Iqbal, H. I. & Mallikarjunappa, T. (2008). The behavior of Indian stock prices and returns: Is the stock market efficient? *Scour,* 2(2): 39–46.

Iqbal, H. I. & Mallikarjunappa, T. (2010). A study of efficiency of the Indian stock market. *Indian Journal of Finance*, 4(5), 32–38.

Iqbal, H. I. & Mallikarjunappa, T. (2011). *Efficiency of stock market: A study of stock price responses to earnings announcements.* Germany: Lambert Academic Publishing Company.

Ji, Q., Liu, B. Y., Zhao, W. L. & Fan, Y. (2018). Modelling dynamic dependence and risk spillover between all oil price shocks and stock market returns in the BRICS. *International Review of Financial Analysis*. https://doi.org/10.1016/j.irfa.2018.08.002

Kafayat, A. (2014). Interrelationship of biases: effect investment decisions ultimately. *Theoretical and Applied Economics*, 6(595): 85–110.

Karemera, D., Ojah, K. & Cole, J. A. (1999). Random walks and market efficiency tests: Evidence from emerging equity markets. *Review of Quantitative Finance and Accounting*, 13(2): 171–188. https://doi.org/10.1023/A:1008399910942

Katabi, M. M. & Raphael, G. (2018). An empirical analysis of weak-form efficiency of Dar es Salaam stock exchange. *African Journal of Economic Review*, 6(2): 115–134.

Kelikume, I. (2016). New evidence from the efficient market hypothesis for the Nigerian stock index using the wavelet unit root test approach. *The Journal of Developing Areas*, 50(5), 185–197. https://doi.org/10.1353/jda.2016.0041

Keynes, J. M. (1923). *A tract on monetary reform*. London: Macmillan.

Lawal, A. I., Nwanji, T. I., Adama, I. J. & Otekunrin, A. O. (2018). Examining the nigerian stock market efficiency: Empirical evidence from wavelet unit root test approach. *Journal of Applied Economic Sciences*, 6(52): 1680–1689.

Lawal, A. I., Somoye, R. O. & Babajide, A. A. (2017). Are African stock markets efficient? Evidence from wavelet unit root test for random walk. *Economics Bulletin*, 37(4): 2665–2679.

Lumsdaine, R. L. & Papell, D. H. (1997). Multiple trend breaks and the unit-root hypothesis. *Review of economics and Statistics*, 79(2): 212–218. https://doi.org/10.1162/003465397556791

Mallick, L. R. (2015). Biases in behavioural finance: A review of literature. *Journal of Advances in Business Management*, 1(3): 100–104. https://doi.org/10.14260/jadbm/2015/13

Mandelbrot, B. (1963). New methods in statistical economics. *Journal of Political Economy*, 71(5):421–440.

McAleer, M., Suen, J. & Wong, W. K. (2016). Profiteering from the dot-com bubble, subprime crisis and Asian financial crisis. *The Japanese Economic Review*, 67(3): 257–279. https://doi.org/10.1111/jere.12084

Mensi, W., Tiwari, A. K. & Al-Yahyaee, K. H. (2019). An analysis of the weak form efficiency, multifractality and long memory of global, regional and European stock markets. *The Quarterly Review of Economics and Finance*, 72, 168–177. https://doi.org/10.1016/j.qref.2018.12.001

Mlambo, C & Biekpe, N. (2007). The efficient market hypothesis: Evidence from ten African stock markets. *Investment Analysts Journal,* 6(6): 5–18. https://doi.org/10.1080/10293523.2007.11082489

Nwidobie, B. M. (2014). The random walk theory: An empirical test in the Nigerian capital market. *Asian Economic and Financial Review*, 4(12): 1840–1848.

Obayagbona, J. & Igbinosa, S. O. (2014). Test of random walk hypothesis in the Nigerian stock market. *Current Research Journal of Social Sciences*, 7(2): 27–36.

Ouarda, M., El Bouri, A. & Bernard, O. (2013). Herding behavior under markets condition: Empirical evidence on the European financial markets. *International Journal of Economics and Financial Issues*, 3(1): 214–228.

Phiri, A. (2015). Efficient Market Hypothesis in South Africa. *Managing Global Transitions,* 13(4): 369–387.

Regnault, J. (1863). *Calcul des chances et philosophie de la bourse*. Mallet-Bachelier.

Samuelson, P. A. (1965). A theory of induced innovation along Kennedy-Weisäcker lines. *The Review of Economics and Statistics*, 343–356. https://doi.org/10.2307/1927763

Schubert, W., Gavurová, B., Kováč , V. & Už ík, M. (2018). Comparison of selected market indicators during the dot-com bubble. *Management from an Emerging Market Perspective*, 93. https://doi.org/10.5772/intechopen.71381

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3): 425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Simons, D. N. & Laryea, S. (2005). Testing the efficiency of African markets. e United Nations Development Programme (UNDP) publication, 1–35. http://dx.doi.org/10.2139/ssrn.874808

Smith, G. (2008). Liquidity and the informational efficiency of African stock markets. *South African Journal of Economics,* 76(2): 161–175. https://doi.org/10.1111/j.1813-6982.2008.00171.x

Sung, M. & Johnson, J. E. V. (2006). *A new perspective on weak form efficiency: Empirical evidence from the UK bookmaker-based betting market*. The 13th International Conference on Gambling & Risk Taking, 22–26 May, 2006. Retreived from http://eprints.soton.ac.uk/id/eprint/42541

Taussig, F. W. (1921). Is market price determinate?. *The Quarterly Journal of Economics*, 35(3): 394–411. https://doi.org/10.2307/1884093

Tiwari, A. K. & Kyophilavong, P. (2014). New evidence from the random walk hypothesis for BRICS stock indices: a wavelet unit root test approach. *Economic Modelling*, 43, 38–41. https://doi.org/10.1016/j.econmod.2014.07.005

Tweneboah, G., Junior, P. O. & Oseifuah, E. K. (2019). Integration of Major African Stock Markets: Evidence from Multi-Scale Wavelets Correlation. *Academy of Accounting and Financial Studies Journal*, 23(6): 1–15.

Van, D.H., Rodrigues, J., Hockly, D., Lambert, B., Tjaart, T. & Phiri, A. (2013). *Efficient market hypothesis in South Africa: Evidence from a threshold autoregressive (TAR) model*. MPRA Paper No. 50544.

Vitali, F. & Mollah, S. (2010). Stock market efficiency in Africa: Evidence from random walk hypothesis. *South Western Finance*, 1–54.

Von Smoluchowski, M. (1906). Zur kinetischen theorie der brownschen molekularbewegung und der suspensionen. *Annalen Der Physik*, 326(14): 756–780. https://doi.org/10.1002/andp.19063261405

Wheeler, F. P., Bill, N., Tadeusz, K. & Steve, R. L. (2002). The efficiency of the Warsaw Stock Exchange: the first few years 1991–1996. *The Poznan University of Economics Review*, 2(2): 37–56.

Williams, P. (2004). *Britain and Africa after the cold war: Beyond damage limitation?* In Africa in International Politics. Routledge.

Williamson, J. P. (1972). Measurement and forecasting of mutual fund performance: choosing an investment strategy. *Financial Analysts Journal*, 28(6): 78–84. https://doi.org/10.2469/faj.v28.n6.78

Yang, C. Y., Jhang, L. J. & Chang, C. C. (2016). Do investor sentiment, weather and catastrophe effects improve hedging

performance? Evidence from the Taiwan options market. *Pacific-Basin Finance Journal*, 37, 35-51. https://doi.org/10.1016/j.pacfin.2016.03.002

Yang, Y. H., Shao, Y. H., Shao, H. L. & Stanley, H. E. (2019). Revisiting the weak-form efficiency of the EUR/CHF exchange rate market: Evidence from episodes of different Swiss franc regimes. *Physica A: Statistical Mechanics and Its Applications*, 523, 734-746. https://doi.org/10.1016/j.physa.2019.02.056

Zaman, S. (2019). Weak form market efficiency test of Bangladesh Stock Exchange: an empirical evidence from Dhaka Stock Exchange and Chittagong Stock Exchange. *Journal of Economics, Business and Accountancy Ventura,* 21(3): 285-291. https://doi.org/10.14414/jebav.v21i3.1615

Zindel, M. L., Zindel, T. & Quirino, M. G. (2014). Cognitive bias and their implications on the financial market. *International Journal of Engineering and Technology*, 14(3): 11-17.

Appendix–I

Author and Year	Methodology Applied	Data / Country Examined	Key Findings
Bundoo (2000)	Serial correlation test	Mauritius, 1992-1998	Weak-form efficient
Appiah-Kusi and Menyah (2003)	EGARCH-M	Botswana, Egypt, Ghana, Ivory Coast, Kenya, Mauritius, Morocco, Nigeria, South Africa, Swaziland and Zimbabwe	Egypt, Kenya, Mauritius, Morocco and Zimbabwe are weak-form efficient
Simons and Laryea (2005)	K-S goodness of fit test, runs test, autocorrelation test, multiple VAR test, auto-regression test	Egypt, Ghana, Mauritius, South Africa, 1990-2003	weak-form efficient
Smith (2008)	Wright's joint VAR tests, Kim's wild bootstrap approach on Chow-Denning multiple VAR test	Botswana, Egypt, Ghana, Ivory Coast, Kenya, Mauritius, Morocco, Nigeria, South Africa, Tunisia and Zimbabwe, 2000-2006	Not weak-form efficient
Ayentimi, Mensah, and Naa-Idar (2013)	Kolmogorov-Smirnov and runs test	Monthly for Ghana covering Jan. 2007 - Jun. 2012	Not weak-form efficient
Chikoko and Muparuri (2013)	Runs test and Autocorrelation test	Daily and weekly data for Zimbabwe covering Feb. 19, 2009 to Dec.31, 2012	Not weak-form efficient
Van, Rodrigues, Hockly, Lambert, Tjaart and Phiri (2013)	Threshold Autoregressive (TAR) model	Weekly data for South Africa over 2000 and 2013	Weak-form efficient
Nwidobie (2014)	Augmented Dickey-Fuller	Monthly for Nigeria covering Jan. 2000 - Dec. 2012	Not weak-form efficient
Obayagbona and Igbinosa (2014)	Auto-correlation test, Ljung-Box Q test, LM serial correlation, unit roots test and Runs test	Monthly for Nigeria covering Jan. 2006 - Dec. 2011	Not weak-form efficient
Vitali and Mollah (2015)	Unit root, auto-correlation, runs and variance ratio	Daily data for Egypt, Kenya, Mauritius, Morocco, Nigeria, South Africa and Tunisia over the period 1999-2009	South Africa may be regarded as a weak-form efficient while other markets are inefficient
Bulla (2015)	Serial correlation, and Runs test	Weekly data for Nairobi over 2000 and 2009	weak-form efficient
Phiri (2015)	Classical augmented Dickey-Fuller tests, Two-regime threshold Autoregressive unit root tests and Three-regime unit root tests	Weekly data for South Africa over Jan. 31, 2000 to Dec. 16, 2014	Linear framework indicated weak-form efficient for South Africa while nonlinearity accounted for weak-form inefficient
Kelikume (2016)	wavelet-based unit root tests	Monthly data for Nigeria Stock Market over the sample period 1985 to 2015	Strong-form efficient
Adigwe, Ugbomhe, and Alajekwu,(2017)	Jarque-Bera statistics test and Augmented Dicker Fuller test	Monthly data for 13 African Stock Exchange covering Jan.2013 to Dec. 2015	African stock markets are weak-form efficient
Lawal, Somoye and Babajide (2017)	wavelet-based unit root tests	Monthly data on seven Africa stock markets,	African stock markets are inefficient
Katabi and Raphael (2018)	Serial correlation test-The Ljung-Box test, Unit root tests, non-parametric runs test and the variance ratio test	Daily closing stock prices of the market index (All share Index-DSEI) for Dar es Salaam covering Jan. 2009 – Mar. 2015.	Weak form inefficient
Awiagah and Choi (2018)	Ljung-Box autocorrelation test, unit root tests, the runs test, and variance ratio tests (such as Wright's rank and sign and Lo-Mac Kinlay)	Daily, weekly, monthly, and quarterly returns Ghana covering 1990 – 2017	Inefficient at weak-form
Abakah, Alagidede, Mensah, and Ohene-Asare (2018)	Non-Linear Fourier unit root test	Weekly returns of S&P/IFC return indices for five African countries over the period 2000-2013	South Africa, Nigeria and Egypt are weak-form efficient whilst Ghana and Mauritius are weak-form inefficient.
Zaman (2019)	Descriptive statistics, Autocorrelation test, Run test	Daily data for two Bangladesh stock market covering Jan. 2013 – Aug. 2017	Weak form inefficient

Source: Authors' Compilation

Table 1. Studies Conducted on EMH in Africa

Appendix–II

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
BRVM	0.0015	0.0029	0.0727	-0.0740	0.0332	0.0116	2.4615	1.3797	0.5016
BSE	0.0005	-0.0001	0.0543	-0.0964	0.0187	-0.7353	8.9009	175.6696	0.0001
BVC	0.0004	-0.0012	0.0998	-0.0663	0.0278	0.3108	3.5461	3.2518	0.1967
BVMT	0.0041	0.0033	0.0830	-0.0889	0.0307	-0.2211	4.6168	13.3463	0.0013
DSE	0.0041	0.0033	0.0830	-0.0889	0.0307	-0.2211	4.6168	13.3463	0.0013
EGX	-0.0064	-0.0074	0.1772	-0.2107	0.0637	-0.2373	3.4762	2.1472	0.3418
GSE	-0.0006	0.0165	0.5988	-2.1939	0.2716	-4.6634	39.0607	6589.9830	0.0001
JSE	-0.0002	0.0080	0.0863	-0.7802	0.0811	-7.8550	76.5174	26845.1600	0.0001
LUSE	0.0050	0.0008	0.0742	-0.1535	0.0318	-0.7865	7.3880	103.2103	0.0001
MSE	0.0159	0.0113	0.2417	-0.1259	0.0412	1.7823	12.0156	446.4432	0.0001
NGSE	0.0025	-0.0052	0.1734	-0.1258	0.0506	0.5709	3.6113	7.9684	0.0186
NSE	0.0058	0.0104	0.0901	-0.0946	0.0385	-0.4112	2.9445	3.2275	0.1991
SEM	0.0006	0.0002	0.0855	-0.0526	0.0205	0.8019	4.7103	26.1134	0.0001
USE	0.0065	0.0082	0.1221	-0.1346	0.0464	-0.2272	2.8879	1.0401	0.5945
ZSE	0.0124	-0.0066	0.4615	-0.2914	0.0956	1.7204	9.4451	253.5476	0.0001

Source: Authors' Computation

Table 2. Descriptive Statistics of Stock Returns

Appendix–III

	$\overline{S}_{T,1}^{LM}$			$\overline{S}_{T,1}^{Ld}$		
Lags	**10**	**20**	**30**	**10**	**20**	**30**
BRVM	-42.31†	-43.33†	-28.39*	-155.65†	-101.58†	-44.43*
BSE	-34.48*	-27.73*	-15.83	-137.63*	-37.45*	-28.02
BVC	-67.33†	-54.13†	-49.18*	-244.83†	-239.80†	-205.18†
BVMT	-44.00†	-41.45†	-40.60†	-173.92†	-147.74†	-152.59†
DSE	-46.45†	-43.81†	-40.32†	-154.13†	-147.08†	-121.21†
EGX	-76.85†	-58.97†	-44.96†	-132.31†	-112.68†	-92.35†
GSE	-45.85†	-40.03†	-30.81*	-112.30†	-47.29*	-24.10
JSE	-40.03†	-38.31*	-33.68*	-104.14†	-46.79*	-30.82*
LUSE	-44.22†	-41.66†	-34.02*	-138.86†	-109.62†	-97.53†
MSE	-40.68†	-41.88†	-14.32	-145.97†	-138.62†	-106.89†
NGSE	-65.33†	-50.52†	-40.43†	-131.92†	-121.99†	-99.71†
NSE	-48.89†	-40.86†	-43.73†	-148.21†	-140.51†	-131.39†
Kenya						
SEM	-53.73†	-50.38†	-31.73*	-137.29†	-135.05†	-116.96†
USE	-46.75†	-42.69†	-43.55†	-154.33†	-131.46†	-89.62†
Uganda						
ZSE	-48.62†	-32.59*	-36.69*	-179.70†	-153.63†	-141.32†
			Critical Values			
1%	-40.38			-50.77		
5%	-27.38			-36.54		
10%	-21.75			-30.23		

Source: Authors' Computation

Note: *, and † denote level of significance of 5% and 10%, respectively.

Table 3. Wavelet Unit Root Tests

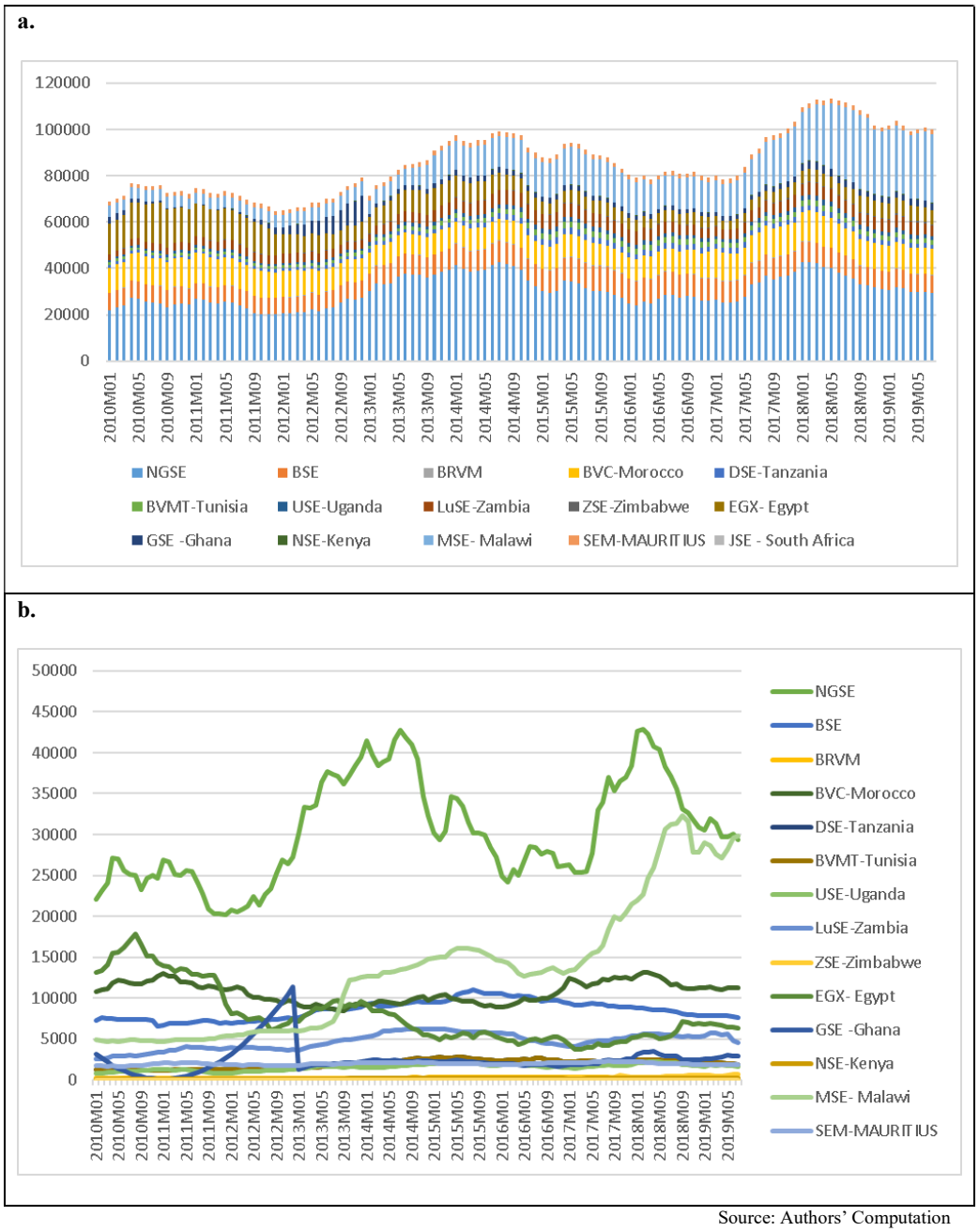
Appendix–IV

	ERS Test	Bai-Perron Test	Variance ratio test
BRVM	1.51†	-8.62†	3.96†
BSE	3.08*	-8.56†	2.13
BVC	1.59†	-8.89†	3.85†
BVMT	1.48†	-9.28†	3.13†
DSE	1.49†	-9.29†	3.12†
EGX	1.53†	-8.63†	3.67†
GSE	1.84†	-8.88†	1.02
JSE	158.87	-26.13†	6.99†
LUSE	2.82†	-8.42†	3.45†
MSE	4.04†	-5.07†	1.70
NGSE	1.98†	-7.89†	3.04†
NSE Kenya	2.92†	-8.89†	4.37†
SEM	1.93†	-8.13†	2.63*
USE	1.83†	-9.33†	4.26†
Uganda			
ZSE	0.93†	-9.48†	2.25**

Source: Authors' Computation
Note: **, *, and † denote level of significance of 1%, 5% and 10%, respectively.

Table 4. Traditional EMH Tests

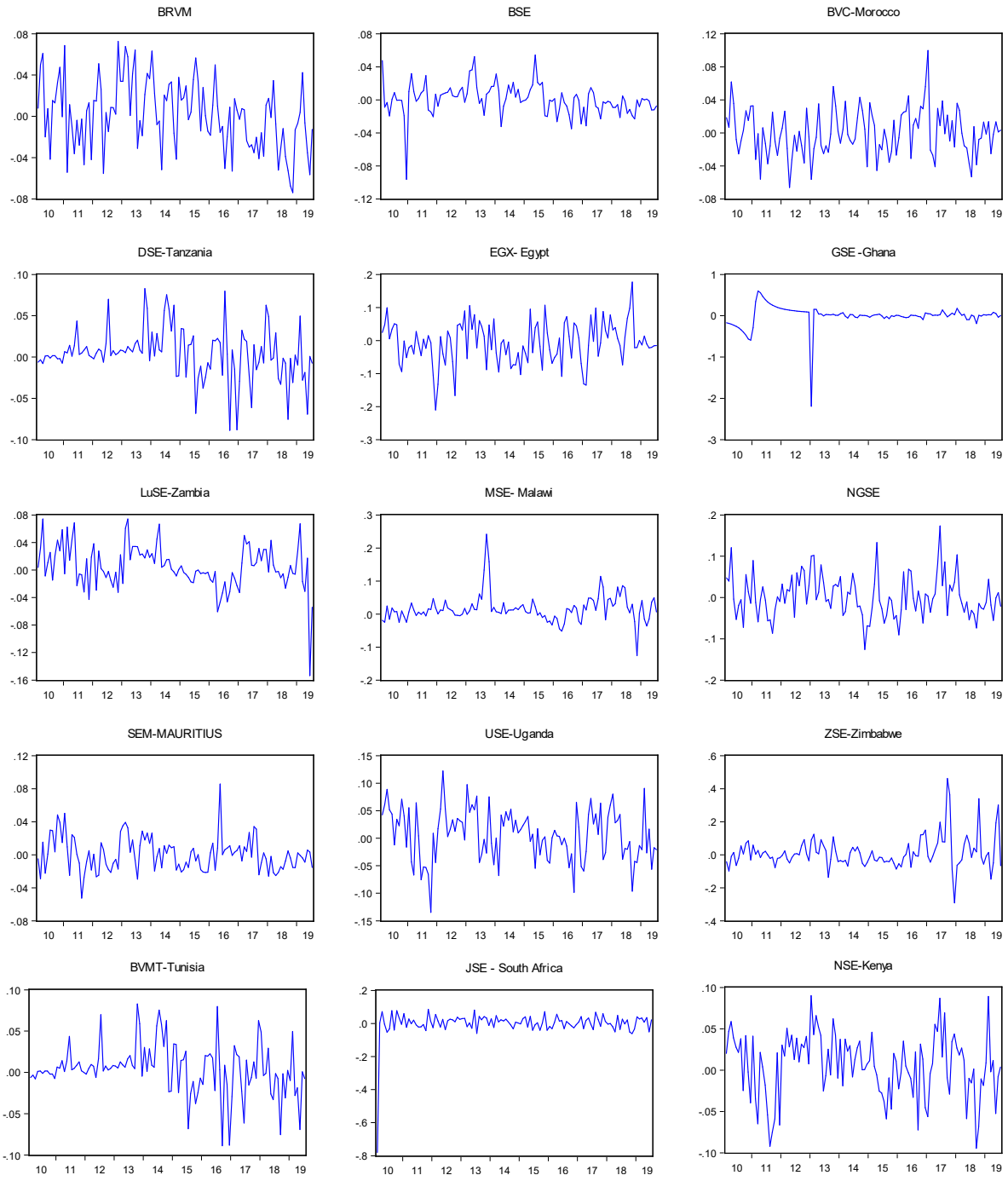
Appendix–V



Source: Authors' Computation

Figure 3a & 3b. Development of African Stock Indices

Appendix–VI



Source: Authors' Computation

Figure 4. The Evolution of Stock Returns across the 15 Stock Exchanges