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THE ADAPTIVE MARKET HYPOTHESIS AND PREDICTABILITY OF AFRICAN STOCK MARKETS

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DECLARATION

I, Axola Myendeki, declare that this research article is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the Graduate School of Business Administration, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Axola Myendeki

Signed at ……Cape Town……

On the ……28…….. day of ……February…… 2018…..

DEDICATION

To Bukelwa Myendeki, my late grandmother, who I have never had the opportunity to meet, your prayers and supplications have survived generations. To the late Nontuku Sonamzi, your toil Makhulu, was not in vain. To my loving son, Hlumelo Babalo Myendeki, for the inspiration.

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ABSTRACT

The weak-form Efficient Market Hypothesis postulates that stock price movement is random and future returns cannot be predicted based on past returns. On the other hand, the Adaptive Market Hypothesis proposed by Lo (2004) postulates that stock market efficiency is not an all-or-nothing condition but is a phenomenon that varies continuously over time depending on market conditions. The study examines the AMH and stock return predictability on eight African stock markets: Johannesburg Stock Exchange (JSE), Nigerian Stock Exchange (NSE), Ghana Stock Exchange (GSE), Stock Exchange of Mauritius (SEM), Namibian Stock Exchange (NSX), Botswana Stock Exchange (BSE), Egyptian Exchange (EGX), and the Casablanca Stock Exchange (CSE). The study uses autocorrelation, wild bootstrapped automatic variance ratio, and generalised spectral tests on price returns over the period 4 January 2011 to 30 November 2017. The results reveal that the full samples of only South Africa and Tunisia re not predictable and therefore deemed consistent with the weak-form efficient market hypothesis. Further tests on the yearly sub-samples suggest that all the markets have exhibited features of predictable markets at some point in line with the varying levels of return predictability. This finding provides evidence in favour of the postulation of the Adaptive Market Hypothesis.

Keywords: Adaptive Market Hypothesis; African Stock Markets; Predictability; Martingale Difference Hypothesis

1. INTRODUTION

In 1990, the African continent had five stock and bond markets (Andrianaivo & Yartey, 2009). Currently, the African continent has 29 stock exchange markets, representing 38 of Africa's 54 countries. Twenty-seven (27) of the 29 stock exchange markets are member exchanges of the African Securities Exchanges Association (ASEA) (African Securities Exchange Association, 2017). When compared to other emerging markets, African stock markets are still small (Andrianaivo & Yartey, 2009). On average, African stock markets are illiquid; this is partly driven by the large gaps between buy and sell orders, in addition, trading is generally around a few stocks which represent the majority of the market capitalisation (Yartey & Adjasi, 2007). Clearing and settlement systems are slow, due to infrastructure challenges (Senbet, 2008). Given all the challenges faced by African stock markets, when compared to other emerging markets, African stock markets, on average, provide higher stock returns (Senbet, 2008).

The largest exchange on the African continent, the Johannesburg Stock Exchange (JSE), was formed in 1887 amidst South Africa's first gold rush. In 1963, the JSE became a member of the World Federation of Exchanges. Currently ranked as the 19th largest stock exchange in the world by market capitalisation, the Johannesburg Stock Exchange offers trading platforms to five financial market segments, such as, equities, bonds, financial, commodity, and interest rate derivatives (Johanneburg Stock Exchange, 2013). The JSE All Share Index (JALSH) comprises 150 listed companies; it is the largest index on the JSE in terms of value and size (Johannesburg Stock Exchange, 2013). The JALSH index is a market capitalisation weighted index, the companies listed under this index make up the top 99% of all listed companies on the JSE in terms of market capitalisation (Trading Economics, 2017). There are over 400 listed companies on the JSE (Courtney Capital, 2017). The JSE is Africa's largest with a market capitalisation of USD 987 billion (Olarinmoye, 2017).

Located in West Africa, and founded in 1960, the Nigerian Stock Exchange (NGSE) services arguably the largest economy in Africa. With a market capitalisation of USD 44 billion, the NSE has 190 listed companies. Formulated in 1984, the Nigerian Stock

Exchange All Share Index (NGSE) comprises and tracks the performance of all listed stocks on the Nigerian Stock Exchange (The Nigerian Stock Exchange, 2017). The Ghana Stock Exchange (GSE) was established in 1989; it has over 42 listed companies. The GSE has a market capitalisation of USD 20 billion. The Ghana Stock Exchange Composite Index (GGSECI) tracks all ordinary shares listed on the GSE, with the exception of dual listed companies. The index is a market capitalisation weighted index (Bloomberg Markets, 2017).

There are three giants in the North of Africa: Egypt, Tunisia, and Morocco. The Egyptian Stock Exchange is made up of two exchanges, Alexandria and Cairo. The Alexandria exchange market was established in 1883 and the Cairo exchange market in 1903. The Egyptian Stock Exchange has 222 listed companies and a market capitalisation of USD 46 billion. The Egyptian Stock Exchange 30 Index (EGX 30) is a free-float weighted average index made up of the top 30 listed companies, in terms of market capitalisation and liquidity (Bloomberg Markets, 2017). The Tunis Stock Exchange was established in 1969; in 2009, it was reported to have a market capitalisation of USD 3.3 billion. The Tunis Stock Exchange (TUSISE) index is a capitalisation weighted index of equities listed on the Tunis Stock Exchange (TSE). The index was established in 1997 and is now a free float weighted index (Bloomberg Markets, 2017). Founded in 1929 and relaunched in 1993, the Morocco Casablanca Stock Exchange (MCSE) has over 75 listed companies and a market capitalisation of USD 57 billion. It is the third largest stock exchange on the African continent. The MCS index tracks the performance of the large and mid-cap companies of the Moroccan market. The index is made up of 11 listed companies. The index is a free float-adjusted index and covers approximately 85% of the free float-adjusted market capitalisation on the Moroccan market. (MSCI, 2017).

Other markets are found in Mauritius and Kenya. The Stock Exchange of Mauritius (SEM) was established in 1989. The SEM has about 43 listed companies and has a market capitalisation of USD 11 billion. The SEMDEX is an all-share index which was launched at the inception of the SEM; the index is designed to capture the price evolution of all the ordinary shares listed on the SEM. It is a free-float index (SEM,

2018). The Nairobi Securities Exchange (NSE) was established in 1954; it has over 64 listed companies. The NSE has a market capitalisation of USD 23 billion. The Nairobi Securities Exchange All Share Index (NSEASI) is a market capitalisation weighted index consisting of all the companies on the NSE (Bloomberg Markets, 2017).

As Yartey and Adjasi (2007) noted, there are some challenges facing African stock markets that make trading in Africa unattractive: information not readily available on African stock markets, infrastructure bottlenecks, disintegrated trading, clearing and settlement systems. According to them, these drawbacks on African stock markets can induce investor and overall market participant inactivity. Even with the said challenges and drawbacks of trading on African stock markets, African stock markets represent unexploited opportunities for investors within the continent and international investors from outside the continent.

This study contributes to the literature of African stock markets by investigating the Adaptive Market Hypothesis (AMH) and stock return predictability on the following African stock markets; Johannesburg Stock Exchange (JSE), Nigerian Stock Exchange (NSE), Namibian Stock Exchange (NSX), Botswana Stock Exchange (BSE), Egyptian Exchange (EGX), and the Casablanca Stock Exchange (CSE). The price index over the period 2011 – 2017 was examined, using linear and non-linear tests to determine the behaviour and predictability of stock returns and establish whether the AMH provides a better description of stock return behaviour than the EMH.

The efficient market hypothesis postulates that stock price movements are random and unpredictable (Fama, 1970). Empirical evidence exists on the existence of seasonality at certain days, months and times of the year, showing abnormal stock price movements and risk-adjusted return changes (see Acharya & Pedersen, 2005; Archana et al., 2014; Banz, 1981; Bhandari, 1988; Borges, 2009; Muller & Ward, 2013; Strugnell et al., 2011; Van Rensburg, 2001). These abnormal movements are known as ‘anomalies’ and are contrary to the hypothesis that stock prices have priced in all available and current information. In practice, the theory of efficient market suggests that stock prices movement is random in nature and not predictable, since the stock price adjusts automatically at the introduction of new information. The existence of

market anomalies has been indubitably documented in a number of markets across the globe. Whilst there is evidence which is contrary to the EMH and suggests that stock price movements are not random in nature, scholars have not been able to agree on an alternative theoretical framework to the EMH. The introduction of the Adaptive Market Hypothesis (AMH) by Lo (2004), presented an alternative to the EMH. Lo (2004) proposed the AMH premised on evolutionary principles and argued that evolution determines market dynamics and as such, the market risk premium changes over time as investor demographics and the investment environment changes.

Ever since this postulation was made, attempts have been advanced to re-examine evidence on whether market efficiency is time-varying or constant. Unfortunately, not much research has been conducted on African stock markets, compared to western stock markets. Very limited research has been conducted on the AMH and African stock markets in general. It has been argued by Arewa et al (2014) that, more research needs to be conducted on African stock markets in order to add to the existing body of literature (Arewa, Nwakenma, & Toriba, 2014). Aside this, most of the empirical research that has been conducted on African stock markets make use of weekly and monthly data (see Appiah-Kusi & Menyah, 2003; Mecagni & Sourial, 1999; Omran, 1997; Smith & Jefferis, 2005). A study by Alagidede (2011) uses daily data to explore the return behaviour of stocks in Africa's emerging equity markets, however the data ends in 2006. Thus, a further study into stock return predictability across a number of African stock markets using daily data is imperative to provide insights into the behaviour of African stock markets. Such understanding would assist market participants with their trading, asset allocation, as well as in their portfolio management strategies and decisions.

Between 1990 and 2005, emerging markets received private capital inflows in excess of $500 billion (World Bank, 2006). Globalisation has made it easier to move financial capital to developing markets. Africa is poised to be the investment destination of choice; the continent of Africa is the most attractive investment destination in the world, second to North America, and foreign direct investment to Africa was at a record $60 billion in 2013 (World Bank, 2015). Alagidede (2009) argues that in spite of the

attractiveness of African stock markets and recent socio-political reforms, external risk perception and institutional underdevelopment continue to inhibit the growth of African stock markets. The continued development of African stock markets is paramount to the continent's growth agenda, as Ojah and Kodongo (2015) aptly pointed out that stock markets provide an incomparable access platform for capital and trade.

The possibility of abnormal profits on the stock market could lead asset managers and other market participants to make investment decisions predominantly on anomaly patterns. This poses regulatory challenges. Scholars have varying views on the continued relevance of the efficient market hypothesis which is the basis for capital asset pricing. This research provides valuable information to investors, traders, securities exchange regulators, researchers and government. This adds to the existing body of knowledge and provides deeper understanding of African stock markets on the subjects of market efficiency and stock return predictability.

The research is limited to the following stock markets and respective indices daily prices, for the period under consideration; Johannesburg Stock Exchange (JALSH), Nigerian Stock Exchange (NGSE), Nairobi Securities Exchange (NSEASI), Stock Exchange of Mauritius (SEMDEX), Egyptian Stock Exchange (EGX30), Morocco Casablanca Stock Exchange (MCSI), Ghana Stock Exchange (GGSECI), and Tunisia Stock Exchange (TUSISE). Although indicative, the research outcomes may not be applicable to other African stock markets. The data analysed is not from the inception of the respective indices, but is limited to the period under consideration (January 2008 – November 2017). Also, the study is premised on the assumption that the sources of the data used and the integrity of the data can be relied upon. The indices of the respective stock markets are an overall representation of the respective stock markets.

The remainder of the paper is organised in the following manner; Section 2 covers a review of existing theoretical and empirical literature on the subject. Section 3 discusses and outlines the methodology and data that is used for the analysis. Section 4 is the presentation, analysis, and discussion of the study results. Finally, Section 5 provides a conclusion of the study and recommendations for future research.

2. LITERATURE REVIEW

The main objective of this study is to investigate the existence of the adaptive market hypothesis and stock return predictability on eight African stock markets. In answering the study's questions, it is necessary to consider and review the following existing theoretical and empirical literature on stock markets and related subjects. The literature review looks at the efficient market hypothesis, stock market anomalies, the adaptive market hypothesis, the behavioural finance view, proponents of the efficient market hypothesis and literature on African stock markets.

African stock markets are pivotal to Africa's future development, consequently Levine and Zervos (1998) found that stock market development positively impacts development, productivity, and capital accumulation. Since the introduction of the EMH by Fama (1970), much debate amongst scholars has occurred, most of the debate has been around the postulation of the EMH that investors are rational in nature and markets are relatively efficient (see Latief et al., 2011; De Bondt & Thaler, 1994; Bachelier, 1900; Shleifer, 2002; Banz, 1981; Fama & French, 1992; Lo, 2004; Alagidede, 2008). Premised on the work of Markowitz (1959), the Capital Asset Pricing Model (CAPM) as introduced by Sharpe (1964) six years before the introduction of the EMH, similarly to the EMH makes the assumption that all investors have similar risk expectations. The CAPM is used for estimating the cost of capital and for the evaluation of managed portfolios, and offers prediction on the relationship between risk and expected returns.

In contrast, behavioural finance scholars argue that both the markets and investors are irrational, which could give rise to stocks being under-priced or over-priced (De Bondt & Thaler, 1994). De Bondt and Thaler (1994) are supported by scholars who have found the existence of predictable stock price movement patterns and seasonality, referred to as market anomalies (see Acharya & Pedersen, 2005; Archana *et al*., 2014; Banz, 1981; Bhandari, 1988; Borges, 2009; Muller & Ward, 2013; Strugnell *et al*., 2011; Van Rensburg, 2001). Notably, the majority of research on market efficiency and related subjects has been conducted mainly on developed western stock markets.

The AMH proposed by Lo (2004) takes an evolutionary approach to market efficiency. The theory is not in complete disagreement with the EMH. However, the AMH can be viewed as seeking to reconcile the EMH and behavioural biases in an intellectually satisfying manner. Lo (2004) argues that the counter-examples cited by behavioralists, with regards to economic rationality, overconfidence, loss aversion, overreaction, mental accounting, and other behavioural biases, are in fact evidence of individuals who are adapting to a changing market environment.

The subject of market efficiency was first introduced by Bachelier (1900), in his thesis '*Theory of Speculation*' which also introduced the idea of random or unpredictable price movements. Fama (1965) further refined the concept of market efficiency through his dissertation '*The Behaviour of Stock Market Prices'*. According to Fama (1970), there are three forms of efficiency found in markets around the world. The first form is the weak-form of efficiency, which displays the inability of past prices to predict future prices. This version of the EMH lends itself to the random walk theory. The random walk theory posits that current stock prices are independent of past or future stock prices (Jensen, 1978). The second type of efficiency is the semi-strong efficiency, which shows stock prices to be fully inclusive of historical information and all publicly available information. The third form is the strong-form efficiency, which describes stock prices as completely inclusive of historic, public and all private information. The existence of a strong-form of market efficiency implies a certain level of insider trading, which by itself is a violation of law (Bodie et al, 2011).

One other driver of stock prices movement, in addition to information factors, are investor expectations and requirements. The efficient market hypothesis assumes that market participants are profit maximising agents who also have rational expectations. In reality, this is not necessarily always true. As Naffa (2009) writes, a section of investors will overreact and some will underreact; these reactions will be random and create volatility in stock prices.

Arguably, whilst most research supports the efficient market hypothesis, the proponents of the adaptive markets hypothesis are not fully convinced that the EMH is a complete rigid model of financial markets and stock returns behaviour. Similarly, Mazviona and

Nyangara (2013) agree and cogently argue that rigidness of the EMH can be empirically contested. It follows from the hypothesis that stock prices are random and change with receipt of new information.

Lo (2007) describes financial market anomalies as a pattern in asset returns, that cannot be explained by the efficient market theory. This pattern seems regular, reliable, and is widely recognised. The phenomena of financial market anomalies dates back to Bachelier (1900) and can implicitly be found. The term 'financial market anomalies' was introduced 70 years after Bachelier's work and was first introduced by Kuhn (1970). Research has found the existence of financial market anomalies through empirical tests which rely on a joint null hypothesis. It follows from the EMH that capital markets are efficient in terms of information and stock returns behave according to a pre-specified equilibrium model. Financial market anomalies are cross-sectional, time series patterns and are not predicted by a central theory (Keim, 1983). There are a number of documented financial market anomalies.

The biological perspective of financial markets was initially introduced by authors Farmer and Lo (1999), the authors in essence argue that trading strategies influence the price and ecologically the price influences the trading strategies. Lo (2004) introduced the theory of adaptive market hypothesis as a convergence of the behavioural finance and efficient market hypothesis principles. Contrary to the efficient market hypothesis which assumes investor rationality and random stock price movement due to Fama (1965), the adaptive market hypothesis assumes that investors are irrational. Lo (2005) further argues that investments tend to have cycles of superior and inferior performance. De Bondt and Thaler (1985) documented irrational investor behaviour; which is consistent with Russo and Shoemaker (1989) which concluded that humans are generally more confident than their general knowledge warrants. Another argument advanced by the proponents of the EMH is that behavioural literature is a primary observation with no unifying principles to support the origins of investment behaviour (Rabin, 2002). Ricciardi and Simon (2000), on the contrary, argue that the main objective of behavioural finance is to understand investors thought and reasoning process when making a decision to purchase or sell a given stock. Some authors have

argued that there is a positive correlation between rationality and emotions (see Damasio, 1994; Rolls, 1999). Thus, it could be argued that the EMH cannot infer investor rationality but can exclude the emotional components of the investor.

Sharpe et al. (1995) define an efficient market as a market where it is impossible to make abnormal profits, by using all available information to formulate a selling or buying decision. The evolutionary approach of AMH suggests that the level of market efficiency and stock predictability changes over time. According to the AMH, a change in market efficiency is brought about by changes in market conditions. Consistent with the postulation of the AMH, Grossman and Stiglitz (1980) argue the impossibility of informationally efficient markets. Lo (2004) argues that if markets were perfectly efficient, there will be little incentive to trade on the markets and that this would eventually lead to a collapse of markets. Varying levels of market efficiency as observed by Lim and Brooks (2011) can be viewed as an incentive to trade.

Farmer (1994) argues that profit maximization behaviour slows the progress of market efficiency. The author further argues that trend followers have higher levels of resistance to market efficiency as opposed to value investors. The AMH is premised on biological evolutionary principles of competition, mutation, reproduction, and natural selection. According to Lo (2004), these principles impact market efficiency. This paradigm implies that the EMH is an ideal condition which is not based on real life factors, such as the limits of the market participant's ability to reason, the regulatory environment, and transactional costs.

In terms of the AMH, the equity risk premium varies as the stock market and investor demographics change, assets should be done through exploiting the market's path dependence. The AMH also implies that all investment products usually experience inferior and superior performance cycles, and further claims that institutional and individual risks change, and are not stable over time. The AMH can be viewed as reconciliation between EMH and behavioural finance. It is premised on the following primary components: individual investors act in own self-interest, investors make mistakes, investors learn and adapt, innovation and adaptation is driven by competition,

market ecology is shaped and influenced by natural selection, and market dynamics change at the rate of evolution (Lo, 2005).

Following this, empirical studies have been conducted to verify the validity of the theory. Ito and Sugiyama (2009) conducted a time-varying study on the US market, and time-varying market inefficiency in the US, evidencing the existence of the AMH. In a study on foreign exchange rates in developing countries and the AMH, Charles et al. (2012) found evidence of return predictability and noted that the predictability changed with market conditions. In another study on the US market evolution, Kim et al. (2011) identified market conditions as the driving factors of predictability and further observed that the US market was more efficient after 1980s as compared to previous periods. Urquhart and Hudson (2013), on the other hand, documented mixed results, after conducting an AMH study on three markets; the US, UK, and Japan. The authors concluded that the AMH provides a convincing description of these markets. Gyamfi (2017) examined the predictability of returns on two indices on the Ghana stock market using three tests; the study results showed high levels of predictability which were consistent with the AMH.

On the subject of risk and return, portfolio theorists define risk to be volatility, measured statistically with the standard deviation being the measure of absolute volatility (Keppler, 1990). Beta is a measure of relative volatility which indicates an individual stock price variance in relation to the overall market. According to the traditional capital market theory, the expected returns are constant over the duration of the investment. Contrary to the capital market theory, Poterba and Summers (1987) reported evidence which suggests expected returns vary over time and note a clear business-cycle pattern, consistent with the adaptive market hypothesis theory (Lo, 2004). Furthermore, Poterba and Summers (1987) rejected the hypothesis that stock prices follow a random pattern as suggested by the efficient market hypothesis (Fama, 1970); Poterba and Summers (1987) produced evidence which suggests that returns are negatively correlated. Fama and French (1988) performed variance ratio tests which found significant autocorrelation in long-horizon returns, in disagreement with Poterba and Summers' (1987)

observations. According to the Capital Asset Pricing Model (Sharpe, Capital asset prices: a theory of market equilibrium under conditions of risk, 1964) and the Portfolio Selection Theory (Markowitz, 1959), there is a positive correlation between risk and return. One of the drawbacks of the CAPM is its primary reliance on historical data for future risk and return decisions. Furthermore, both the CAPM and PST define risk as volatility, Keppler (1990) argues that risk is not the same as volatility. Keppler (1990) argues that a risk-adjusted performance measurement is a more accurate measure of risk since it factors in the probability of loss, together with its potential magnitude. Graham (1973) and Jeffrey (1984) view risk in relation to time; Graham (1973) observed that a possible decline in price of a given stock, does not necessarily and ultimately mean that there is an increase in the risk of loss, if the decline in stock price is temporal and where the likelihood of selling the stock during a decline is low. Similarly, Jeffrey (1984) argued that risk refers to future liquidity needs, and the likelihood of not having enough cash to meet necessary cash payments increases risk.

In the main, behavioural finance has of two schools of thoughts, namely the heuristics decision process and prospects theory. Ricciardi and Simon (2005) define the heuristic decision process as a process which deal with the measures people use during the decision making process, while prospects theory refers to an idea that people do not always behave rationally. Moisand (2000) states that an investment professional who is able to systematically recognise and address incorrect uses of heuristics in their financial decision making, is more likely equipped to improve and better deliver to their clients' investment objectives. According to Ricciardi and Simon (2005), the objective of behavioural finance is to understand the thought process and reasoning of investors when they are making decisions about purchasing a stock. To an extent, behavioural finance is in contradiction with the EMH, the EMH assumes investors are always rational. Shefrin and Statman (2011) argue that cognitive psychology enables investor irrationality to have a long-lived influence on stock prices.

Benartzi (2007) observed that naïve diversification strategy heuristics often cause even the most educated of investors to spread their assets evenly across a given number of available options, without any further analysing the characteristics and permutation of

each option. Olsen (2010) argues that modern finance is based on six core themes: cause and effect can be understood, at least in theory; negative feedback dominates and results in a market equilibrium, over time; the human mind is adept at learning to solve problems in a structured way and can be further trained to make decisions focused on optimisation in a logical manner; complete objectivity is possible, as observers can stand outside and be independent of the system observed; emotions negatively influence decision making process; and humans have a natural inclination to make decisions in their best interest.

On the other hand, Subash (2012) argues in contradiction to Olsen (2010); Subash (2012) argues that people often make financial decisions in strange, seemingly irrational ways. Kahneman and Tversk (1971) find fault with the way people hold statistical results based on random samples to be representative of the population; the authors argue investor reliance on statistical studies carries an inherent bias. Gervais and Odean (2001) argue that irrational decisions which lead to failure assist traders to learn and become better traders.

The value effect anomaly refers to the positive relation between the stock return and the ratio of accounting based measures of cash flow value of the same security. The accounting measures are earnings per share and book value of common equity per share. A number of scholars, such as Ball (1978), De Bondt and Thaler (1987), Hawawini and Keim (2000), have documented and noted a significant positive relation between returns and earnings to price ratio.

The size effect anomaly was first documented by Banz (1981) on the New York Stock Exchange (NYSE). Both Banz (1981) and Reinganum (1981) found that small capitalised companies on the NYSE had higher average yields than what was predicted through the capital asset-pricing model (CAPM), which is based on the efficient market hypothesis. Sharpe (1964) and Linter (1965) contradict Banz (1981), who argues that small companies are more inclined to earn higher yields than larger companies, after adjusting for risk. Sharpe (1964) and Linter (1965) argue that the only measure of risk is beta.

Reinganum (1981) and Keim (1983) noticed abnormal yields occur during the first two weeks in January. Roll (1983) further hypothesised that higher volatility of small capitalised stocks made them incur substantial short-term capital losses, which investors might want for income tax purposes prior to the year ending. This selling pressure results in a decrease in the stock prices in December, resulting in a rebound in the stock price in January.

De Bondt and Thaler (1985) found that stocks with lower yields in the past three to five years have higher average yields compared to stocks that had performed well in the past similar period, whereas Jegadeesh and Titman (1993) found recent performing (winners) stocks on the last year of past returns outperform losers.

The day of the week effect is similar to the weekend effect, although it relates to the inequality in the mean of returns on different days of the week. Evidence of the existence of the day of the week effect was first presented by Broco (1992) who analysed the Indian Stock Exchanges' BSE NATEX daily return; he found that Wednesdays had the lowest mean returns. On the other hand, Sarma (2004) tested three indices of the Indian Stock Exchange and found that all the indices had the highest positive deviations, indicating an opportunity for abnormal returns, by buying on Mondays and selling on Fridays. Gunnlaugsson (2003), in a study of the day of the week effect on the Icelandic stock market from 1993 to 2003, found that average returns were the lowest on Tuesdays and highest on Fridays.

African stock markets vary quite significantly in size, age and performance. The continent's long established stock markets are Egypt, South Africa and Zimbabwe (Ndikumana, 2001).

Some African countries are still without stock markets; these countries include Angola, Burundi, Gambia, Niger, and South Sudan. Over the last three decades, the number of stock markets in Africa has grown significantly; despite the increase in foreign investments into African stock markets and the overall increase in the number of stock markets, there has not been much research on African stock markets (Simons &

Laryea, 2004); this can be partly attributed to the paucity of data on African stock markets.

EMH studies conducted by Olowe (1999) on the Nigerian stock exchange using correlational analysis found the Nigerian stock market to have a weak form of market efficiency. Whilst Osei (2002) investigated asset pricing characteristics and annual earnings announcements on the Ghanaian Stock market, his investigation revealed that the Ghana Stock Market (GSM) is not efficient in terms of annual earnings information releases. Mahlophe (2015) studied the use of different asset-pricing models in testing the effect of market anomalies on different JSE sector returns; her study found that market anomalies differ across the sectors reviewed, restricting the risk-free-rate in the asset pricing models reduces the probability of finding the presence of market anomalies, and found that the consumer services sector was the most efficient sector on the JSE. Chukwuogor-Ndu (2007) investigated the day-of-the-week effect, return volatility and annual returns on five African stock markets; Ghana, Nigeria, Botswana, Egypt and South Africa. Chukwuogor-Ndu (2007) observed negative returns on Tuesdays for Botswana and Egypt whilst South Africa's JSE showed negative returns on Wednesdays, conversely the Botswana, Ghana and Nigerian stock markets showed high returns on Wednesdays. Mbululu and Chipeta (2012) tested the day-of-the-week effect on skewness and kurtosis on the Johannesburg Stock Exchange, using data from nine economic sector indices over the period 1995 to 2011; no day-of-the-week effect was found in all nine sector indices. The authors argued that the JSE has a weak form of efficiency due to the absence of seasonality. Notably, a study of the Johannesburg Stock Exchange by Mangani (2007) found the return distributions to be highly leptokurtic. On the other hand, Chinzara and Slyper (2013) observed day-of-the-week seasonality, after conducting a study of the JSE's All Share Index and four sector indices. The authors found significant positive effect on Mondays for the All Share index and the Industrials index.

Using indices from six African stock markets, CASE 30 (Egypt), NSE 20 (Kenya), FTSE/JSE (South Africa), MASI (Morocco), NSE All Share Index (Nigeria) and Tunisia's TUNINDEX; to study stock return behaviour on African stock markets, Alagidede (2011)

found that Egypt had the highest daily mean return, followed by South Africa, and Kenya had the lowest mean return. Alagidede (2011) also found that time varying returns were predictable; he observed evidence of long memory which indicated that returns are not serially independent.

No evidence of seasonality was found by Claessens et al. (1995) on the Zimbabwean stock market, however they observed significant returns in the months of March and June on the Nigerian stock market. Bundoo (2011) investigated market anomalies and momentum strategies on the Mauritius Stock Exchange; the data showed significant daily returns on Wednesdays and Fridays, surprisingly the coefficient of variation for both days was the lowest. A study conducted by Kalidas, Mbululu and Chipeta (2013) analysed the daily closing prices for five African stock markets, Johannesburg Stock Exchange All Share Index; Nigerian All Share Index; Moroccan MASI Index; Zambian All Share Index and the Botswana All Share, for the period 2004 to 2012. Using a K-S test, the authors observed significant existence of the day-of-the-week effect in four of the markets, with the exception again, of South Africa.

The efficient market hypothesis has been the theoretical premise for most of the studies conducted on financial markets. The efficient market hypothesis postulates that the market is informationally efficient and as such, market efficiency in the context of the EMH implies that investors appropriately and correctly anticipate any time or cross-sectional variances of expected returns. Empirical studies conducted on African stock markets and other emerging markets as well as studies conducted on developed markets, indicate a similar existence of market anomalies. The existence of market anomalies, to an extent, disproves some of the postulation of the efficient market hypothesis. Caution must be exercised when trading purely using anomaly patterns, empirical studies on anomalies indicates that the patterns disappear, which would make trading purely on market anomalies undependable.

Proponents of behavioural finance argue that investors are not necessarily or always rational as the EMH postulates. Furthermore, proponents of behavioural finance argue that there are a number of psychological factors that influence investor decision. The AMH is a relatively new theory added to the stock market body of knowledge; there are

few empirical studies conducted on the theory and even fewer on the theory and African stock markets. The majority of studies on stock return predictability and market hypothesis have been conducted on single markets. The AMH seems to be a reconciliation of behavioural finance and the EMH.

3. DATA AND RESEARCH METHODOLOGY

This section outlines the process of data collection and provides a detailed explanation of the automatic portmanteau Box-Pierce, the wild-bootstrapped automatic variance ratio, unit root and generalised spectral tests that have been used in the study, with the objective of examining the AMH and stock return predictability on eight African stock markets.

3.1 RESEARCH DESIGN

The return returns of the indices are calculated as follow;

$$return = \ln[(Pt - Pt\text{-}1) \times 100] \quad (1)$$

where P_t represents the most current closing price value; and P_{t-1} represents the previous closing price value. The tests chosen for this study are the autocorrelation, variance ratio, and generalised spectral tests. Results of the tests are presented, analysed and there is a discussion of the empirical findings. In terms of design, this research is quantitative and explanatory. The data used for the study is secondary time series data.

3.2 DATA SOURCE AND DESCRIPTION

The data used for the study was obtained from Bloomberg (www.bloomberg.com). The study was undertaken using the historical daily closing prices of the Johannesburg Stock Exchange all share index (JALSH), Nigerian Stock Exchange all share index (NGSE), Nairobi Securities Exchange all share (NSEASI), Stock Exchange of Mauritius index (SEMDEX), Egyptian Exchange Top 30 index (EGX30), Morocco Casablanca Stock Exchange index (MCSI), Ghana Stock Exchange index (GGSECI) and the Tunisia Stock Exchange index (TUSISE) indices for the period 4 January 2011 to 30 November 2017. The period of study was chosen based on the availability of data for the eight indices.

3.3 EMPIRICAL METHODOLOGY

3.3.1 UNIT ROOT TESTS

Unit root tests were conducted on the study data as part of the auto-correlation. The unit root tests have been used to test for stationarity in order to determine the predictability of indices prices and returns. The study applies the Augmented Dickey-Fuller (ADF) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. Enders (2004) found the ADF test to find a unit root even when none exists; to counter this drawback the study also used the KPSS unit root test.

The null hypothesis of the ADF test is that there is a unit root and that data is non-stationary. The alternative hypothesis is that the time series is stationary or integrated of order 1. The ADF (Dickey & Fuller, 1981) test is constructed as:

$$y_t = \phi_1 y_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-\mathrm{i}} + \varepsilon_t \tag{2}$$

The test statistic is calculated using the following equation:

$$\Delta y_t = (\phi_1 - 1)\, y_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \varepsilon_t \ . \tag{3}$$

Kwiatkowski, Phillips, Schmidt, and Shin (1992) posit that a time series is stationary around a deterministic trend and is calculated as the sum of a deterministic trend, random walk, and stationary random error, based on the model:

$$\begin{aligned} y_t &= d_t + r_t + \varepsilon_t, \\ r_t &= r_{t-1} + u_t, \end{aligned} \tag{4}$$

The null hypothesis for KPSS test is that the data is stationary, where statistical properties such as the mean and variance are constant over time. The alternative hypothesis is that the data is non-stationary or integrated.

3.3.2 AUTO-CORRELATION

The autocorrelation test is used to test the hypothesis that the process generating the observed returns is a series of identical distributions and independent of random variables. Serial linear models have been used to test the random walk theory by Hoque, Kiam and Pyun (2007). The autocorrelation test helps to evaluate whether successive values of a serial correlation are significantly different from zero. Ljung and Box's (1978) portmanteau Q-statistic was used to test the joint hypothesis; that all autocorrelation coefficients (P_k) are simultaneously equal to zero. Autocorrelations occur when the covariance and correlation between different disturbances are not equal to zero. Where a series of financial returns, $\{R_t\}_{t=1}^{T}$ with sample mean $\bar{R}$ and; $\hat{\gamma}_j = \frac{1}{T_{t-j}} \sum_{t=1+j}^{T} (R_t - \bar{R})(R_{t-j} - \bar{R}),\ j = 0,...,T-1$ as the sample auto covariance, the test statistic is given as

$$Q_k = T \sum_{j=1}^{k} \hat{\rho}_j^2 \tag{5}$$

where $\hat{\rho}_j = \hat{\gamma}_j / \hat{\gamma}_0$ is the j order sample autocorrelation. A modified version of this was proposed by Lobato et al. (2001) in order to make it more robust to conditional heteroscedasticity, the modified statistic is written as:

$$Q_k^* = T \sum_{j=1}^{k} \tilde{\rho}_j^2 \tag{6}$$

where $\tilde{\rho}_j^2 = \hat{\gamma}_j^2 / \hat{\tau}_j$, and $\hat{\tau}_j = \frac{1}{T_{t-j}} \sum_{t=1+j}^{T} (R_t - \bar{R})^2 (R_{t-j} - \bar{R})^2$.

A further modification was proposed by Escanciano and Lobato (2009); the authors' revision allows the data to automatically determine the value of *k*, based on the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) as:

$$Q_k^* = T \sum_{j=1}^{\tilde{k}} \tilde{\rho}_j^2 \tag{7}$$

where $\tilde{k} = \min\left\{k : 1 \le k \le d; L_p \ge L_h, h = 1,2,...,d\right\}$, $L_p = Q_k^* - \pi(k,T,q)$, d is a fixed upper bound and π is a penalty term.

3.3.3 VARIANCE RATIO TEST

Lo and MacKinlay (1988) introduced the variance ratio test to research, when testing for linear dependence of market returns. Campbell and Mankiw (1987) introduced variance ratio (VR) testing; the authors developed VR testing premised on the assumption that a martingale series is serially uncorrelated. The VR test introduced by Lo and MacKinlay (1988) has a drawback that the sequential procedure of the test leads to size distortions and the test invariably ignores the joint nature of random walk. Choi (1999) developed the automatic variance ratio (AVR), which overcomes the drawback of the VR test as introduced by Lo and MacKinlay (1988); the test posits that a time series follows a random walk where the VR statistic VR (k) is equal in all horizons of the lag order k. The null hypothesis of automated variance ratio test is that the returns of a series are not serially correlated. The AVR test is defined as;

$$AVR(\hat{k}) = \sqrt{\mathrm{N}/\tilde{k}}\left[V\hat{R}(\tilde{\mathrm{k}}) - 1\right]/\sqrt{2} \tag{8}$$

The VR estimator as

$$V\hat{R}(\tilde{k}) = 1 + 2\sum_{i=1}^{N-1} m(i/\tilde{k})\hat{\rho}(i) \tag{9}$$

where $\hat{\rho}(i) = \frac{\sum_{t=1}^{N-1}(R_t - \hat{\mu})(R_{t+1} - \hat{\mu})}{\sum_{t=1}^{N}(R_t - \hat{\mu})^2}$ is the estimated order autocorrelation coefficient of the returns R_t, $\hat{\mu} = \frac{1}{N}\sum_{t=1}^{N} R_t$ is the estimated mean (6) of R_t and $m(x) = \frac{25}{12\pi^2 x^2}\left[\frac{\sin(6\pi/5)}{6\pi/5} - \cos(6\pi/5)\right]$, is a quadratic spectral kernel for the weighting function $m(.)$.

The study used the wild-bootstrapped automatic variance ratio (WBAVR) test. This is because Kim (2006) observed a drawback with the AVR test, in that stock returns are assumed to be identically and independently distributed, which is based on asymptotic theory and therefore ignores unknown conditional heteroscedasticity in data samples. This can lead to underestimation of uncertainty of data samples.

To overcome this drawback, the study uses the wild-bootstrapped method used by Mammen (1993), which replicates the heteroscedasticities (conditional and unconditional) inherently present in the data. The data is conducted in three steps:

1. A bootstrap sample of the observations (n) is formed from the index return data;
2. Calculation of the AVR statistic, for the bootstrap sample and;
3. Repetition of steps 1 and 2 to form a distribution of the AVR statistics.

3.3.4 GENERALISED SPECTRAL TEST

The generalised spectral (GS) test is used to test for nonlinear independence over time, the test is a non-parametric test designed to detect the presence of linear and non-linear dependencies in a time series. The GS is robust to conditional heteroscedasticity and is consistent against uncorrelated non-martingale sequences.

Escanciano and Velasco (2006) used the following GS distribution function;

$$H(\lambda, x) = \gamma_0(x)\lambda + 2\sum_{j=1}^{\infty} \gamma_j(x)[\sin(j\pi\lambda)/j\pi] \tag{10}$$

The sample estimate of H becomes;

$$\hat{H}(\lambda, x) = \gamma_0(x)\lambda + 2\sum_{j=1}^{n-1} (1 - j/n)^{1/2} \hat{\gamma}_j(x) \frac{\sin(j\pi\lambda)}{j\pi} \tag{11}$$

where the sample finite correction factor is given as

$$(1 - j/n)^{1/2}$$

4 EMPIRICAL RESULTS AND ANALYSIS

The presentation of empirical results, analysis, and discussion are covered in the following section. The data are graphically presented in Figures 1 and 2 and the estimation results are presented in Tables 1 to 12.

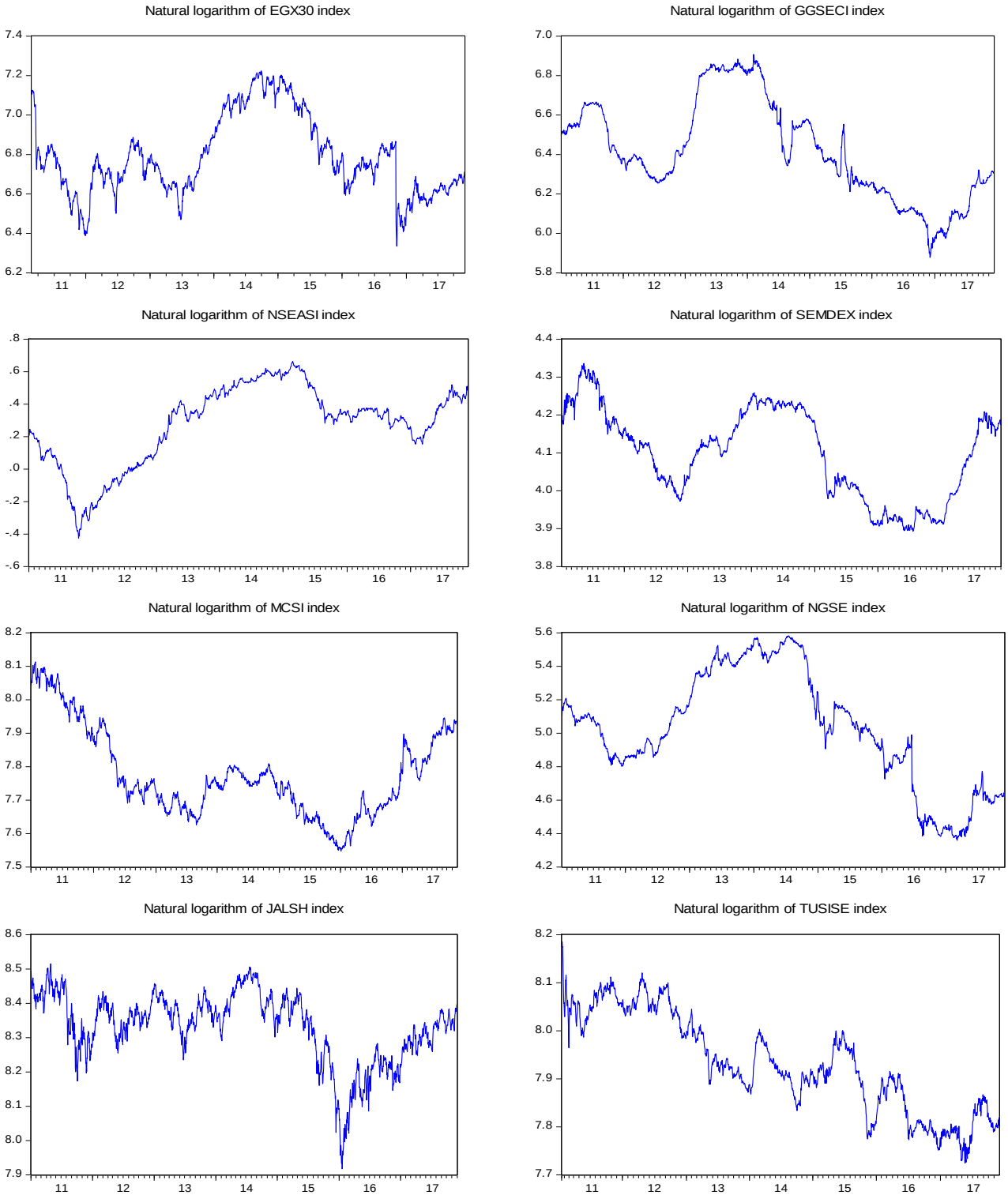
4.1 GRAPHICAL DESCRIPTIONS

The natural logarithm of prices and returns of the EGX30, GGSECI, SEMDEX, MCSI, NSEASI, NGSE, JALSH, and TUSISE indices are reported in Figure 1. The distributions of the index returns observed are not normally distributed. Furthermore, it was observed that the first differences show non-linear return patterns on all eight indices. All eight stock market indices experienced negative returns in the 2012 period. Abnormal returns are observed for the GGSECI, NSEASI, and NGSE for the 2013 period.

The results show evidence of volatility, and high levels of volatility are observed for JALSH and MCSI indices. Log returns of the EGX30 index for the period 2011 to 2013 do not show evidence of excessive volatility, despite the fact that there was major civil unrest as a result of the Arab spring uprising during the period 2010 to 2013 in Egypt and other Arab North African countries. Logarithms of indices' prices data are reported in Figure 1, and show the upward movements are not equal to the downward movements. Evidence shows that on average, rolling coefficients during downward movements are much larger when compared to rolling coefficients during upward movements with the exception of the NSE index.

Graphical data reported in Figure 1 and 2 shows cycles of superior and inferior return performance, which is evidenced by the non-linear and multimodal distributed return movements, the variation in coefficients evidences an ever-changing risk premium and a change in return predictability over time.

Figure 1: Logarithms of stock prices, 2011 – 2017



4.2 DESCRIPTIVE STATISTICS

Tables 1 and 2 present the descriptive statistics of the closing prices and returns. The tables display the statistics such as the mean, standard deviation, skewness, kurtosis, and Jarque-Bera (JB) scores. From Table 1, the skewness for the price indices is negative for most of the markets, implying that prices are flatter to the left compared to the normal distribution. South Africa has the highest mean price, followed by Tunisia and Morocco. This implies that these markets have higher prices compared to the other markets reviewed. Nigeria is the riskiest market in terms of price, with a price standard deviation of 0.342051. Tunisia is the least risky of the markets reviewed. Significant JB statistic and significant kurtosis scores suggests that indices prices are not normally distributed.

From Table 2, the mean of the returns for Egypt, Ghana, Morocco, Nigeria, South Africa, and Tunisia are negative for the study period. Morocco had the highest negative returns (-6.52), followed by South African (-5.61). Positive returns are observed for Kenya and Mauritius. Kenya had the highest mean returns of 0.0000183 followed by Mauritius with 0.0000131. Egypt had the greatest return standard deviation (0.019179), followed by South Africa (0.014929) and Nigeria (0.014480); this indicates that Egypt, South Africa, and Nigeria are the riskiest markets in terms of returns. Mauritius had the lowest return standard deviation (0.006412). The return skewness is negative for the majority of the indices, with the exception of Tunisia and Mauritius. The negative skewness implies that the returns are flatter to the left compared to the normal distribution. Positive return skewness is observed for Morocco and Tunisia, implying that for these markets, the returns are flatter to the right as opposed to a normal distribution curve. It also indicates that extreme negative returns have a greater magnitude than the positive, for the negatively skewed markets, whilst for Morocco and Tunisia positive returns have a greater magnitude than negative.

Kurtosis measures whether the data is flat or peaked, relative to a normal distribution curve. Date series with low kurtosis tend to have a flat top near the mean, rather than a sharp peak, whereas as a series, with a high kurtosis, has a distinct peak near the

mean and have heavy tails. The significant kurtosis scores indicate that return distributions have sharp peaks, compared to normal distribution peaks. Moreover, the significant Jarque-Bera (JB) statistic further confirms that the indices returns are not normally distributed. A normal distribution has a kurtosis of 3, but the kurtosis scores for all of the indices returns are greater than 3. In the case of Egypt and Nigeria the figures are considerably higher. The indices return kurtosis scores indicate a leptokurtic distribution, whilst the kurtosis scores of the indices prices suggest normal distribution, with the exception of South Africa. However, this is not a good measure of normality.

The Jarque-Bera test for normality would be used for this test. The null hypothesis for testing for normality using the JB test is rejected if the p-value is less than 0.05. The critical value for the Jarque-Bera test is 5.99. The JB statistics reported in Tables 1 and 2, for indices closing prices and returns respectively have JB scores which are significantly higher than the JB critical value. The null hypothesis of normal distribution is therefore rejected at the 5 percent significance level and the alternative hypothesis of non-normal distribution is accepted. This then implies that the prices and returns of the indices are not normally distributed. These results are in support of the AMH.

Table 1: Descriptive statistics of natural logarithm of closing prices

Country/stat	Mean	Standard dev	Skewness	Kurtosis	JB
Egypt	6.786909	0.198963	0.496299	2.399289	92.60075***
Ghana	6.416314	0.250230	0.226454	2.136465	68.34001***
Kenya	0.272709	0.247121	-0.708650	2.740318	149.5712***
Mauritius	4.098285	0.117713	-0.114856	1.824780	106.7664***
Morocco	7.775730	0.130077	0.699857	2.776619	143.4831***
Nigeria	5.022255	0.342051	-0.166911	2.111699	64.27428***
South Africa	8.330827	0.102315	-0.993655	4.117284	374.2359***
Tunisia	7.931465	0.101585	0.026345	1.954083	78.36969***

Note: *** represents rejection of the null hypothesis at 1 percent significance level

Table 2: Descriptive statistics of index returns

Country/stat	Mean	Standard dev	Skewness	Kurtosis	JB
Egypt	-0.000243	0.019179	-6.029847	126.1718	1053663***
Ghana	-0.000120	0.010406	-0.261255	18.18575	16594.51***
Kenya	0.000183	0.008382	-0.511383	8.026584	1891.218***
Mauritius	0.0000131	0.006412	-0.004535	10.20201	3862.079***
Morocco	-0.0000652	0.007640	0.146184	5.407146	419.9181***
Nigeria	-0.000258	0.014480	-3.979734	73.33123	357577.0***
South Africa	-0.0000561	0.014929	-0.319513	5.036308	327.7633***
Tunisia	-0.000219	0.007369	0.005862	7.546345	1477.000***

Note: *** represents rejection of the null hypothesis at 1 percent significance level

4.3 ARE AFRICAN STOCK RETURNS STATIONARY OR INTEGRATED?

Table 3 presents the results of the ADF unit root test and KPSS stationary test for both the prices and returns of the eight stock indices. For the prices, the ADF test statistics are greater than the critical values. Also, the p-values reported in parenthesis are all greater than 0.05, except South Africa. Thus, the null hypothesis that there is unit root cannot be rejected at the 5 percent significance level for all the price indices except South Africa. In the case of the KPSS test, the null hypothesis of stationarity is rejected since the test statistics for all the series are greater than the 5 percent critical value. On the other hand, the ADF test statistics of all eight markets suggest that the return times series do not possess unit roots, at varying levels of confidence since the test statistics are less than the 5 percent critical values. The null hypothesis of the ADF test can be rejected. Therefore, based on the results, it can be concluded that the time series exhibit stationary relationships. This implies that indices returns are predictable, since the mean, variances, and auto correlations are consistent over the study period. The null hypothesis of stationarity for the KPSS test cannot be rejected since the time

series mean and variance are constant over time. The KPSS test results for indices' prices support a rejection of the null hypothesis, indicating the indices prices are not non-stationary. In conclusion, basis the results it can be said that all the variables are integrated of order 1, suggesting that they become stationary after first difference. If returns of stock indices are stationary, it means they are not consistent with the dictates of the random walk hypothesis and thus, are predictable.

Table 3: Unit root and Stationarity Tests (ADF and KPSS)

Prices			Returns	
Country/stat	ADF	KPSS	ADF	KPSS
Egypt	-2.597	0.742***	-34.129***	0.097
	[0.094]			
Ghana	-1.081	2.373***	-18.956***	0.140
	[0.725]			
Kenya	-0.704	2.486***	-30.911***	0.214
	[0.844]			
Mauritius	-0.988	1.844***	-50.039***	0.277
	[0.760]			
Morocco	-1.916	1.769***	-37.009***	0.555
	[0.325]			
Nigeria	-0.722	2.153***	-36.553***	0.278
	[0.839]			
South Africa	-3.232**	1.666***	-39.625***	0.073
	[0.018]			
Tunisia	-2.277	4.484***	-39.551***	0.054
	[0.197]			

Notes: ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively. Critical value for ADF at 5% is -2.863 and KPSS is 0.463. The null hypothesis of ADF is rejected if the test statistic is more negative than the critical value and the null hypothesis of KPSS is not rejected if the test statistic is less than the critical value

4.4 ARE AFRICAN STOCK MARKETS PREDICTABLE?

Presented in Table 4 are the linear and nonlinear results of the full sample. The results are from the Automatic Portmanteau and Automatic Variance Ratio tests. The null hypothesis of no autocorrelation or predictability is rejected where the p-values are less than 0.05. Evidence of linear dependence is found for Egypt, Ghana, Kenya, Mauritius and Morocco for the AQ tests, the null hypothesis of no autocorrelation is rejected. Therefore, the returns of these countries are predictable. The null hypothesis is also rejected for the AVR test for Egypt, Kenya and Morocco. Nigeria shows evidence of linear dependence in terms of the DL test. Kenya shows significant levels of predictability. No evidence of linear dependence is found for South Africa and Tunisia; evidence suggests that the returns of these countries are not predictable. South Africa and Tunisa can be viewed as efficient markets. Lo (2004) argues that predictability or efficiency of a market is time-varying and time-dependent.

The results of the autocorrelation test suggest that the null hypothesis is rejected at the 5 percent level for Egypt, Ghana, Kenya, Mauritius, and Morocco. On the other hand, the null hypothesis cannot be rejected at the conventional significance level for South Africa and Tunisia. The p-value for Nigeria is greater than 5%, but less than 10%, and thus the null hypothesis for Nigeria is rejected at 10%. The automatic Variance Ratio tests suggest a rejection of the null hypothesis for Ghana, Kenya, Mauritius and Morocco at 5 percent level. For Nigeria, South Africa, and Tunisia the null hypothesis cannot be rejected at 5%. In the case of the Dominguez-Lobato test for martingale difference hypothesis, the null hypothesis is rejected at the 5 percent level for Egypt, Kenya, Mauritius, Morocco, and Nigeria, whereas the null hypothesis cannot be rejected for South Africa and Tunisia. Lastly, from the Generalized Spectral test, the null hypothesis is rejected for Ghana, Kenya, Mauritius, and Nigeria. Since the p-values for Morocco, South Africa, and Tunisia are greater than 0.05, the null hypothesis can therefore not be rejected.

In conclusion, all the four tests suggest that the full samples of South Africa and Tunisia have been efficient, whereas the other markets are not efficient. The implication is that,

apart from South Africa and Tunisia, all the other African stock markets are predictable. It means that the markets have been predictable throughout the period of the study (2011 – 2017). However, it is likely that some markets have switched between predictability (inefficiency) and periods of unpredictability (efficiency). It would be difficult to determine which market has been adaptive. Thus, the study explores the predictability of the yearly sub-samples to determine if the markets are consistent with the adaptive markets hypothesis. A market is described as efficient or inefficient if it has been efficient or inefficient throughout the seven (7) years under study. If a market has switched between periods of efficiency and periods of inefficiency at least once, then it would be described as being an adaptive market. It is also possible to describe some markets as switching from efficiency to inefficiency or vice versa.

Table 4: Linear/Non-Linear Tests for the full sample (2008 – 2017)

Country/Test	AQ	AVR	DL	GSS
Egypt	0.000***	0.002***	0.000***	0.000***
Ghana	0.000***	0.680	0.368	0.012**
Kenya	0.000***	0.000***	0.000***	0.000***
Mauritius	0.001***	0.026**	0.022**	0.020**
Morocco	0.001***	0.000***	0.014**	0.103
Nigeria	0.067*	0.152	0.000***	0.010**
South Africa	0.100	0.198	0.152	0.345
Tunisia	0.304	0.146	0.418	0.210

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

4.5 ARE AFRICAN MARKETS ADAPTIVE?

Egypt

From Table 5, the results for Egypt shows mixed evidence. For the 2011 period, the null hypothesis of no return predictability or auto-correlation cannot be rejected, since all four tests have p-values which are greater than 0.05. For the 2012 period, the null hypothesis is rejected for the AQ, DL, and GSS test as the p-values are less than 0.05, the null hypothesis cannot be rejected for the AVR test. For the 2013 period, the null hypothesis is rejected for the AVR and DL tests and cannot be rejected for the AQ and GSS tests. For the 2014 period, the null hypothesis is rejected for the AQ, AVR and DL tests, the null hypothesis cannot be rejected for the GSS test. For the period 2015 to 2017, the null hypothesis is rejected on all four tests. These findings suggest that for the period between 2012 and 2014 returns were predictable, whereas for the period 2011 and period between 2015 and 2017 returns were not predictable. Thus, for the period 2012 to 2014, returns were not independent of past price behaviour. Notably during the same period, Egypt experienced civil unrest and protests which was part of the Arab Spring unrest. The results further suggest that for 2011 and the period between 2015 and 2017, the market was efficient. The results are consistent with the AMH.

Table 5: Test Results for Egypt (EGX30)

Year	AQ	AVR	DL	GSS
2011	0.089*	0.050*	0.110	0.220
2012	0.037**	0.088*	0.030**	0.018**
2013	0.113	0.042**	0.026**	0.278
2014	0.001***	0.006***	0.000***	0.132
2015	0.055*	0.112	0.106	0.400
2016	0.105	0.090*	0.540	0.330
2017	0.267	0.336	0.400	0.746

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

Ghana

The results for Ghana are presented in Table 6. The null hypothesis for periods 2012, 2014, and 2017 cannot be rejected on all four tests. For the 2011 period, the null hypothesis is rejected for the AVR and GSS tests; for the period 2013, the null hypothesis is rejected for the AQ and GSS test. The null hypothesis is rejected for the entire study period 2011 to 2017 for the DL test. The null hypothesis is rejected for the period 2015 for the AQ and AVR test. The null hypothesis is also rejected for the 2016 period for the AQ test. As in the case of Egypt, the test results suggest that Ghana experienced periods of independence and dependence. This implies that the market went through periods of efficiency and inefficiency; an evidence in support of the AMH.

Table 6 : Test Results for Ghana (GGSECI)

Year	AQ	AVR	DL	GSS
2011	0.124	0.030**	0.216	0.022**
2012	0.527	0.448	0.628	0.076*
2013	0.007***	0.466	0.422	0.000***
2014	0.189	0.180	0.498	0.320
2015	0.003***	0.020**	0.116	0.264
2016	0.019**	0.074	0.068*	0.856
2017	0.432	0.178	0.864	0.792

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

Kenya

Test results for Kenya are presented in Table 7, and suggest that for the most part stock returns for Kenya were predictable. The null hypothesis is rejected for periods 2011, 2013, 2014, 2015, 2016 and 2017. For the period 2013, the p-values of all four tests is 0.000. The test results for Kenya are consistent with the AMH. The significant levels of predictability of Kenya present an opportunity of abnormal profits. Kenya exhibits significant levels of linear dependency.

Table 7: Test Results for Kenya (NSEASI)

Year	AQ	AVR	DL	GSS
2011	0.002***	0.002***	0.000***	0.352
2012	0.321	0.576	0.532	0.390
2013	0.000***	0.000***	0.000***	0.038**
2014	0.207	0.090*	0.002***	0.384
2015	0.000***	0.000***	0.000***	0.050*
2016	0.018**	0.016**	0.000***	0.288
2017	0.002***	0.006***	0.000***	0.080*

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

Mauritius

The test results for Mauritius are presented in Table 8. The null hypothesis cannot be rejected for periods 2013 and 2016 since the p-values of all four tests are greater than 0.05. For the periods 2011, 2012, 2014, and 2016 the p-values are less than 0.05 and thus the null hypothesis is rejected at the 5 percent significance level. The results suggest that stock returns went through periods of predictability and unpredictability. The result for Mauritius is consistent with the AMH.

Table 8: Test Results for Mauritius (SEMDEX)

Year	AQ	AVR	DL	GSS
2011	0.018**	0.026**	0.018**	0.324
2012	0.006***	0.000***	0.000***	0.654
2013	0.288	0.372	0.048**	0.334
2014	0.040**	0.024**	0.084*	0.774
2015	0.051*	0.004***	0.134	0.008***
2016	0.312	0.408	0.148	0.698
2017	0.024**	0.090*	0.022**	0.224

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

Morocco

The test results for Morocco are presented in Table 9. The results suggest that for the most part, stock returns were independent, the null hypothesis cannot be rejected for the 2011, 2013, 2014 and 2015. AVR and AQ p-values suggest that for periods 2012 and 2017 market returns were predictable, the null hypothesis is rejected for these periods. Similarly, the null hypothesis for the period 2016 is rejected for the DL test. The test results show evidence that suggests that the market was efficient for the most part, with some period of inefficiency for the periods 2012, 2016 and 2017. The results are consistent with the postulations of the AMH.

Table 9: Test Results for Morocco (MCSI)

Year	AQ	AVR	DL	GSS
2011	0.099	0.130	0.470	0.538
2012	0.014**	0.012**	0.184	0.442
2013	0.672	0.596	0.928	0.288
2014	0.180	0.232	0.542	0.472
2015	0.849	0.958	0.444	0.312
2016	0.139	0.184	0.042**	0.692
2017	0.043**	0.024**	0.126	0.232

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

Nigeria

Results for Nigeria are presented in Table 10, and show that for the period 2011, 2013, 2016 and 2017 the null hypothesis cannot be rejected, whilst for periods 2012, 2014 and 2015 the null hypothesis is rejected. The test results suggest stock returns went through periods of dependence and independence. The results are consistent with the postulations of the AMH.

Table 10: Test Results for Nigeria (NGSE)

Year	AQ	AVR	DL	GSS
2011	0.456	0.260	0.356	0.102
2012	0.092*	0.002***	0.026**	0.442
2013	0.783	0.648	0.962	0.070*
2014	0.013**	0.004***	0.024**	0.178
2015	0.009***	0.008***	0.030**	0.042**
2016	0.600	0.632	0.420	0.096
2017	0.816	0.952	0.884	0.400

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

South Africa

Test results for South Africa are presented in Table 11. The null hypothesis cannot be rejected for all the periods except 2016; the null hypothesis is rejected for the period 2016 for the AQ and DL tests. Evidence suggests that the South African market is efficient, although there is evidence of linear dependence, which implies return predictability for the 2016 period. The results are consistent with the AMH. The linear independence and weaker presence of nonlinear dependence implies that the South African market is efficient.

Table 11: Test Results for South Africa (JALSH)

Year	AQ	AVR	DL	GSS
2011	0.576	0.606	0.960	0.518
2012	0.814	0.756	0.922	0.486
2013	0.340	0.282	0.778	0.456
2014	0.663	0.590	0.964	0.278
2015	0.760	0.726	0.362	0.442
2016	0.029**	0.192	0.018**	0.242
2017	0.874	0.874	0.884	0.422

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

Tunisia

Test results for Tunisia are presented in Table 12. The null hypothesis is rejected at 5 percent significance level for 2011, 2013, 2014, and 2017. The null hypothesis cannot be rejected at 5 percent for 2012, 2015, and 2016. This finding suggests that stock returns went through periods of predictability and unpredictability. Thus, the results are consistent with the postulations of the AMH.

Table 12*: Test Results for Tunisia (TUSISE)*

Year	AQ	AVR	DL	GSS
2011	0.023**	0.014**	0.026**	0.088*
2012	0.911	0.950	0.512	0.498
2013	0.007***	0.004***	0.000***	0.440
2014	0.030**	0.004**	0.006***	0.006***
2015	0.767	0.820	0.932	0.202
2016	0.214	0.094	0.386	0.014**
2017	0.000***	0.000***	0.000***	0.546

Note: The values reported are p-values of the tests. ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance level respectively.

5. CONCLUSION

5.1 SUMMARY OF FINDINGS

This study has examined the AMH and stock return predictability on eight African stock markets, using index data. Results of the autocorrelation tests, namely, the wild-bootstrap automatic variance ratio test, generalised spectral test and the automatic portmanteau Box-Pierce test are shown. The test results suggest non-standard distribution of stock prices and returns. The study results further indicate that stock prices and returns do not follow linear movements. The skewness and kurtosis result of the data shows that for each market, returns do not conform to normality.

The study result from four tests, namely; AQ, AVR, DL, and GSS suggest varying levels of stock returns predictability in all eight markets. There are periods in each market where the null hypothesis could not be rejected, signifying periods of unpredictability of stock returns. The results suggest that Kenya was the most predictable market and South Africa the least predictable, in terms of stock market returns. The findings indicate that the returns are not entirely predictable, all the markets examined in the study exhibited periods of no return predictability.

As argued by Lo (2004), these patterns of predictability and unpredictability are governed by different market conditions of the eco-system from an evolutionary perspective. Lo (2004) is not clear or descriptive of what these market conditions are. Kim *et al*. (2011) mentions certain political crises, economic bubbles and stock market crashes as market conditions that drive the patterns of predictability and unpredictability. On the other hand, Urquhart and McGoarty (2016) have a wider perspective of such market conditions, the authors argue that the market conditions are driven by bull and bear market periods as well as normal market upswings and market declines. In the case of the findings of this study, it is observed that during period of civil unrest or political instability, markets become more predictable, as in the case of Egypt, Tunisia, and Kenya.

The findings are consistent with the AMH, which postulates that markets go through periods of efficiency and inefficiency. There is also strong evidence of time-varying predictability. The significant levels of predictability, as in the case of Kenya and Mauritius, requires appropriate policy measures to further understand what underpins the high levels of linear dependency. In the case of Kenya, it can be argued, based on the study results, that the market is still evolving as the market shows evidence of efficiency in one period of the of seven period reviewed in the study.

The empirical results of this study suggest the AMH is a more appropriate model for describing the behaviour of stock returns over time for all eight African markets. In conclusion, the study finds strong evidence of the AMH on the Egypt, Ghana, Kenya, Mauritius, Morocco, Nigeria, South Africa, and Tunisia. The magnitude of return predictability varies from market to market.

5.2 IMPLICATIONS AND RECOMMENDATIONS

The insights provided by this study highlight the AMH and stock return predictability on Africa markets. The findings of the study are of interest to investors and other relevant stakeholders. Overall, the patterns of predictability give rise to profit opportunities.

In summary, the findings of the study have the following implications;

1. Stock markets are dynamic, the risk premium varies over time according to changes in the market and the demographics of market participants
2. Time-varying predictability presents arbitrage opportunities to market participants.
3. Markets change over time, there is a need for investment strategies to be dynamic, in keeping with the changing market.
4. The implications of the study findings will further assist regulators, in understanding African stock markets better and in improving information flow amongst market participants.

5.3 AREAS OF FURTHER RESEARCH

The study has established evidence of the AMH and return predictability of African markets. The study did not examine the underlying qualitative or non-quantitative factors which trigger stock return behaviour. Non-quantitative factors which influence stock return behaviour should be examined in the future. An examination of these qualitative factors will further increase the understanding of the AMH on African stock markets.

REFERENCES

Acharya, V., & Pedersen, L. (2005). Asset pricing with liquidity risk. *Journal of Financial Economics, 77*(1), 375-410.

African Securities Exchange Association. (2017, October 1). *http://www.african-exchanges.org*. Retrieved December 15, 2017, from http://www.african-exchanges.org/en/about-asea#contentCarousel/learn-more-about-asea

Alagidede, P. (2008). Day of the week seasonality in African stock markets. *Applied Financial Economics Letters, 4*(2), 115-120.

Alagidede, P. (2009). Randomness and Non-linear Dependence in African Equity Markets. *African Review of Economics and Finance, 4*(1), 1-17.

Alagidede, P. (2011). Return behaviour in Africa's emerging equity markets. *The Quarterly Review of Economics and Finance, 52*(2), 133-140.

Andrianaivo, M., & Yartey, C. (2009, August). Understanding the Growth of African Financial Markets. *IMF Working Paper 09(WP/09/182)*, 09-182. International Monetary Fund.

Appiah-Kusi, J., & Menyah, K. (2003). Return predictability in African stock markets. *Review of Financial Economics, 1*(2), 247–270.

Archana, S., Safeer, M., & Kevin, S. (2014). A study on market anomalies in Indian stock market. *International Journal of Business and Administration Research Review, 1*(3), 128-137.

Arewa, A., Nwakenma, P., & Toriba, L. (2014). Detecting Market Anomalies: Do Evidences hold in Nigeria. *International Review of Management and Business Research, 3*(2), 1128-1138.

Bachelier, L. (1900). Théorie de la spéculation. Retrieved December 2017, 1, from http://physics.princeton.edu/~mcdonald/examples/statistics/bachelier_asens_17_21_00_english.pdf

Banz, R. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics, 9*(1), 3-18.

Benartzi, S. (2007). Heuristics and biases in retirement savings behavior. *Journal of Economic Perspectives, 21:3, 21*(3), 81-104.

Bhandari, L. (1988). Debt/equity ratio and expected common stock returns: empirical evidence. *Journal of finance, 43*(2), 507-528.

Bloomberg Markets. (2017, September 11). *www.bloomberg.com*. Retrieved November 1, 2017, from https://www.bloomberg.com/quote/NGSEINDX:IND

Bodie, Z., Kane, A., & Marcus, A. (2011). *Investment 9th Edition.* New York: Investment 9th Edition.

Broco, D. (1992). Day of the Week Patterns of the Indian Stock Market. *Decision, 19*(2), 57-64.

Bundoo, S. (2011). An Analysis of Stock Market Anomalies and Momentum Strategies on the Stock Exchange of Mauritius. *African Economic Research Consortium, 227*(1), 1-36.

Campbell, J., & Mankiw, N. (1987). Permanent and transitory components in macro-economic fluctuations. *American Economic Review, 77*(2), 111–117.

Campbell, J., Lo, A., & MacKinlay, A. (1997). *The Econometrics of Financial Markets.* Princeton: Princeton University Press.

Charles, A., Darne, O., & Kim, H. (2012). Exchange-rate predictability and adaptive market hypothesis evidence from major exchange rates. *Journal of International Money Finance, 31*(1), 1607-1626.

Chegea, T., Othienoa, F., & Kodongo, O. (2016). Return Volatility and Equity Pricing: A Frontier Market Perspective. Retrieved January 18, 2018, from https://www.researchgate.net/profile/Odongo_Kodongo/publication/267869541_Return_Volatility_and_Equity_Pricing_A_Frontier_Market_Perspective/links/545c5e790cf249070a7a9e58

Chinzara, Z., & Slyper, S. (2013). Volatility and anomalies in the Johannesburg Securities Exchange daily returns. *Financial Markets Journal, 17*(1), 25-41.

Choi, I. (1999). Testing the random walk hypothesis for real exchange rates. *Journal of Applied Econometrics*, 293-308.

Chukwuogor-Ndu, C. (2007). Econometric analysis of African stock markets : Annual returns analysis. *African Journal of Accounting*, 26-43.

Claessens, S., Dasgupta, S., & Glen, P. (1995). Return Behaviour in emerging stock markets. *World Bank Economic Review*, 131-151.

Courtney Capital. (2017). *courtneycapital.co.za*. Retrieved from http://www.courtneycapital.co.za/jse-top-40-shares/

Damasio, A. (1994). *Descartes' Error: Emotion, Reason, and the Human Brain.* New York: Avon Books.

Daragahi, B. (2014, November 12). *www.ft.com*. Retrieved from Financial Times: https://www.ft.com/content/9600cbce-a6db-35c0-87ae-bbffe26febf8

De Bondt, W., & Thaler, R. (1994). Financial decision-making in markets and firms : A behavioural perspective. *National Bureau of economic research, 4777, 1*. Cambridge, Massachusetts.

Dickey, D., & Fuller, W. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica, 49*(1), 1057-1072.

Enders, W. (2004). *Applied econometric time series.* New York: Willey.

Escanciano, J., & Lobato, I. (2009). An automatic portmanteau test for serial correlation. *Journal of Econometrics, 151*(2), 140-149.

Escanciano, J., & Velasco, C. (2006). Generalized spectral tests for the martingale difference hypothesis. *Journal of Econometrics, 134*(1), 151-185.

Fama, E. (1965). The Behaviour of Stock Market Prices. *Journal of Business, 64*(1), 34-105.

Fama, E. (1970). Effecient Capital Markets : A review of theory and empirical work. *Journal of Finance*, 383-417.

Fama, E., & French, K. (1989). Business conditions and expected returns on stocks and bonds. *Journal of Financial Economics,, 25*(1), 23-49.

Fama, E., & French, K. (1992). The cross-section of expected stock returns. *Journal of Finance, 47*(2), 427-465.

Fama, E., & French, K. (1998). Value versus growth: the international evidence. *Journal of Finance, 53*(6), 1975-1999.

Farmer, D. (1994). Market force, ecology, and evolution. *Journal of Economic Behavior and Organization, 4*(1), 1-66.

Farmer, D., & Lo, A. (1999). Frontiers of finance: Evolution and efficient markets. *Proceedings of the National Academy of Sciences of the United States of America, 96*(18), 9991-9992.

Gervais, S., & Odean, T. (2001). Learning to be overconfident. *Review of Financial studies, 14*(1), 1-27.

Graham, B. (1973). *The Intelligent Investor.* New York: Harper.

Grossman, S., & Stiglitz, J. (1980). On the Impossibility of Informationally Efficient Markets. *American Economic Review, 70*(3), 393-408.

Gunnlaugsson, S. (2003). Er samband a milli daga, manaoa, hatioa og avoxtunar a islenskum hlutabrefamarkaoi. *Timarit um voiskipti og Efnahagsmal, 1*(1), 73-88.

Gyamfi, E. (2017). Adaptive Market Hypothesis: Evidence from the Ghanaian Stock Market. *Journal of African Business, 19*(2), 195-209.

Gyamfi, E., & Kyei, K. (2016). Modeling Stock Market Returns under Self-exciting Threshold Autoregressive Model: Evidence from West Africa. *International Journal of Economics and Financial Issues, 6*(3), 1194-1199.

Hiremath, S., & Kumari, J. (2014). Stock returns predictability and the adaptive market hypothesis in emerging markets: evidence from India. *Munich Personal RePEc Archive, 428*(3), 1-14.

Hoque, H., Kim, J., & Pyun, C. (2007). A comparison of variance ratio tests of random walk: A case of Asian emerging stock markets. *International Review of Economics & Finance, 16(4)*, 488-502.

Ito, M., & Sugiyama, S. (2009). Measuring the degree of time varying market inefficiency. *Economic Letters, 103*(1), 62-64.

Jeffrey, R. (1984). A New Paradigm for Portfolio Risk. *Journal of Portfolio Management, 11*(1), 33-40.

Jegadeesh, N. &. (1993). Returns to buying winners and selling losers : Implications for stock market efficiency. *Journal of Finance, 48*(1), 65-91.

Jensen, M. (1978). Some Anomalous Evidence Regarding Market Efficiency. *Journal of Financial Economics, 6*(2), 95-101.

Johanneburg Stock Exchange. (2013). *jse.co.za*. Retrieved September 23, 2017, from https://www.jse.co.za/about/history-overview

Johannesburg Stock Exchange. (2013). *jse.co.za*. Retrieved August 19, 2017, from https://www.jse.co.za/grow-my-wealth/what-is-the-jse-all-share-index

Kahneman, D., & Tversky, A. (1971). Belief in the law of small numbers. *Psychological Bulletin, 76*(2), 105-110.

Kalidas, S., Mbululu, D., & Chipeta, C. (2013). Changing patterns in the day-of-the-week effects in African stock markets. *International Business and Economics Research Journal, 12*(10), 1157-1173.

Keim, D. (1983). Size-related anomalies and stock return seasonality: Further emperical evidence. *Journal of Financial Economics, 12*(1), 12-32.

Keppler, M. (1990). Risk is Not The Same as Volatility. *Die Bank : Journal for the Banking Industry, 11*(1), 610 - 614.

Kim, J. (2006). Wild bootstrapping variance ratio tests. *Economics Letters, 92(1)*, 38-43.

Kim, J., Shamsuddin, A., & Lim, K. (2011). Stock returns predictability and the adaptive markets hypothesis: Evidence from century long U.S. data. *Journal of Finance and Economics, 58*(1), 121-133.

Kwiatkowski, D., Phillips, P., Schmidt, P., & Shin, Y. (1992). Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root. *Journal of Econometrics, 54*(1-3), 159-178.

Latif, M., Arshad, S., Fatima, M., & Farooq, S. (2012). Market efficiency, market anomalies,causes, evidences, and some behavioral aspects of market anomalies. *Research Journal of Finance and Accounting, 2*(9-10), 1-13.

Levine, R., & Zervos, S. (1998). Capital Control Liberalization and Stock Market Development. *World Development, 26, 7*, 1169-1183.

Lim, K., & Brooks, R. (2011). The Evolution of Stock Market Efficiency Over-time : A Survery of the Empirical Literature. *Journal of Economic Surveys, 25*(1), 69-108.

Linter, J. (1965). The valuation of risky assets and the selection of risky investments in stock portfolios and capital budget. *Review of Economics and Statistics, 47*(1), 13-37.

Ljung, G., & Box, G. (1978). On a measure of lack of fit in time series models. *Biom, 65*(1), 297-303.

Lo, A. (2004). The Adaptive Markets Hypothesis : Market efficiency from an evolutionary perspective. *Journal of Portfolio Management, 30*(5), 15-29.

Lo, A. (2005). Reconciling Efficient Markets with Behavioral Finance: The Adaptive Markets Hypothesis. *MIT Sloan School of Management : Investment Management Consultants Association, 22, 1*, 313-324. Cambridge: MIT Sloan School of Management.

Lo, A., & MacKinlay, A. (1988). Stock market prices do not follow random walks: evidence from a simple specification test. *Review of Financial Studies 1, 1*(1), 41-66.

Lo, A., & MacKinlay, A. (2002). *A Non-Random Walk Down Wall Street.* Princeton, New Jersey: Princeton University Press.

Lobato, I., Nankervis, J., & Savin, N. (2001). Testing for autocorrelation using a modified Box–Pierce Q test. *International Economic Review, 42*(1), 187-205.

Mahlophe, M. (2015). *Effect of market anomalies on expected returns on the JSE: A cross-sector analysis.* NORTH-WEST UNIVERSITY. Retrieved October 13, 2017, from https://www.researchgate.net/publication/321397892_TESTING_FOR_MARKET_ANOMALIES_IN_DIFFERENT_SECTORS_OF_THE_JOHANNESBURG_STOCK_EXCHANGE

Mammen, E. (1993). Bootstrap and wild bootstrap for high dimensional linear models. *The Annals of Statistics, 21*(1), 255-285.

Mangani, R. (2007). Distributional properties of JSE prices and returns. *Investment Analysts Journal, 66(1)*, 57-72.

Markowitz, H. (1959). Portfolio Selection: Efficient Diversification of Investments. *Cowles Foundation Monograph No. 16.* New York: John Wiley & Sons, Inc.

Mazviona, B., & Nyangara, D. (2013). test of the weak-form efficiency of the Zimbabwe Stock Exchange after currency reform. *International Journal of Business, Economics and Law, 3*(1), 43-48.

Mbululu, D., & Chipeta, C. (2012). Day-of-the-week effect: Evidence from the nine economic sectors of the JSE. *Investment Analysts Journal, 75*(1), 55-65.

Mecagni, M., & Sourial, S. (1999). The Egyptian stock market: Efficiency tests and volatility effects. *IMF Working Paper, 48*.

Moisand, D. (2000). Effective financial planning in the presence of judgmental heuristics. *Journal of Financial Planning, 13*(4), 130-134.

MSCI. (2017, December 29). *www.MSCI.com.* Retrieved January 5, 2018, from https://www.msci.com/documents/10199/273351c9-0fa8-492c-a05a-eb5b0c11e163

Muller, C., & Ward, M. (2013). Style effects on the Johannesburg Stock Exchange : a graphical time-series approach. *Investment Analysts Journal, 77*(1), 1-16.

Naar, I. (2013, December 17). *Aljazeera : A detailed review of major events looking back at three years of Arab Uprisings across the region.* Retrieved February 1, 2018, from www.aljazeera.com: http://www.aljazeera.com/indepth/interactive/2013/12/timeline-arab-spring-20131217114018534352.html

Naffa, H. (2009). Multifactor Approach in Understanding Asset Pricing Anomalies : An Empirical Study of the Factor Model in the Budapest Stock Market. Retrieved January 11, 2018, from http://phd.lib.uni-corvinus.hu/841/13/Naffa_Helena_ten.pdf

Ndikumana, L. (2001). Financial Markets and Economic Development in Africa. *Political Economy Research Institute, 17(1)*. University of Massachusetts Amherst. Retrieved November 3, 2017, from https://pdfs.semanticscholar.org/d078/2c1dd3affc03eefcea45b1c0a805581b07b7.pdf

Ojah, K., & Kodongo, O. (2015). Financial markets development in Africa : Reflections and Way forward. *The Oxford Handbook of Africa and Economics, 2*(1), 401-423.

Olarinmoye, S. (2017, July 23). *https://nairametrics.com*. Retrieved August 14, 2017, from https://nairametrics.com/the-top-5-stock-exchanges-in-africa/

Olowe, R. (1999). Weak Form Efficiency of the Nigerian Stock Market. *African Development Review, 11*(1), 54-68.

Olsen, R. (2010). Toward a theory of behavioral finance: implications from the natural sciences. *Qualitative Research in Financial Markets, 2(2)*, 100-128.

Omran, M. (2007). An analysis of the capital asset pricing model in the Egyptian. *The Quarterly Review of Economics and Finance, 46*(1), 801-812.

Osei, K. (2002). Asset Pricing and Information Efficiency of the Ghanaian Stock Market. *AERC Research Paper, 115*(1), 1-39.

Poterba, J., & Summers, L. (1987). The Persistence of Volatility and Stock Market Fluctuations. *NBER Working Paper No. 1462, 76*(1), 1142-1151.

Rabin, M. (2002). A Perspective on Psychology and Economics. *European Economic Review, 46*(4-5), 657 - 685.

Reinganum, M. (1981). Misspecification of capital asset pricing: Emperical anomalies based on earnings' yield and market values. *Journal of Financial Economics, 9*(1), 19-46.

Ricciardi, V., & Simon, H. (2000). What is behavioral finance? *Business, Education & Technology Journal, 1*(1), 1-9.

Roll, R. (1983). Vas ist das? The turn-of-the-year effect and the return premia of small firms. *Journal of Portfolio Management, 9*(1), 18-28.

Rolls, E. (1999). *The Brain and Emotion.* Oxford, UK: Oxford University Press.

Russo, J., & Shoemaker, P. (1989). *Decision Traps: Ten Barriers to Billiant Decision Making and How to Overcome Them.* New York: Simon & Schuster.

Sarma, S. (2004). Stock Market Seasonality in an Emerging Market. *Vilalpa, 29, 3*, 35-41.

SEM. (2018, January 30). *http://www.stockexchangeofmauritius.com*. Retrieved February 1, 2018, from Stocke Exchange of Mauritius: http://www.stockexchangeofmauritius.com/sem-at-a-glance

Senbet, L. (2008, March 4-5). African stock markets In African finance for the 21st Century. *High–level seminar organized by the IMF Institute in collaboration with the Joint Africa Institute, 13(3)*. Tunis, Tunisia: International Monetary Fund.

Sharpe, W. (1964). Capital asset prices: a theory of market equilibrium under conditions of risk. *Journal of Finance, 19*(3), 425-442.

Sharpe, W., Alexander, G., & Bailey, J. (1995). *Investments.* New York: Prentice Hall.

Shefrin, H., & Statman, M. (2011). Behavioral finance in the financial crisis: market efficiency, Minsky and Keynes. Retrieved January 25, 2018, from http://www.russellsage.org/sites/all/files/Rethinking-Finance/Shefrin%20Statman%2001272012.pdf Date of access: 21.May.2015.

Shleifer, A. (2002). *Inefficient markets: an itroduction to behavioural finance.* New York: Oxford University Press.

Simons, D., & Laryea, S. (2004). Testing the Efficiency of Selected African Stock Markets. Retrieved February 3, 2018, from https://economics.ca//2004/papers/0056.pdf

Smith, G., & Jefferis, K. (2005). The changing efficiency of African stock markets. *South African Journal of Economics, 11*(9), 54-67.

Strugnell, D., Gilbert, E., & Kruger, R. (2011). Beta, size and value effects on the JSE. *Investment Analysts Journal, 40*(74), 1-17.

Subash, R. (2012). Role of Behavioral Finance in Portfolio Investment Decisions: Evidence from India. Retrieved January 31, 2018, from ies.fsv.cuni.cz/default/file/download/id/20803

Sustainable Stock Exchanges Initiative. (2017, May). *http://www.sseinitiative.org*. Retrieved September 7, 2017, from http://www.sseinitiative.org/fact-sheet/botswana-stock-exchange/

The Nigerian Stock Exchange. (2017). *http://www.nse.com.ng/*. Retrieved October 21, 2017, from http://www.nse.com.ng/

Trading Economics. (2017). *tradingeconomics.com*. Retrieved December 1, 2017, from https://tradingeconomics.com/south-africa/stock-market

Urquhart, A., & Hudson, R. (2013). Efficient or adaptive markets? Evidence from major stock markets using very long historical data. *International Review of Financial Analysis, 28*(1), 130-142.

Urquhart, A., & McGoarty, F. (2016). Efficient or adaptive markets? Evidence of the adaptive market hypothesis. *International Review of Financial Analysis, 47*(1), 39-49.

Van Rensburg, P. (2001). A decomposition of style based risk on the JSE. *Investment Analysts Journal, 30*(54), 45-60.

World Bank. (2000). World Bank Development Indicators. *World Bank Development Indicators 2000*. Retrieved October 6, 2017, from http://documents.worldbank.org/curated/en/462341468766204683/World-development-indicators-2000

World Bank. (2006). *Global development finance : finance: The development potential of surging capital flows*. Retrieved January 12, 2018, from http://econ.worldbank.org

Yartey, C., & Adjasi, C. (2007). Stock Market Development in Sub-Saharan Africa Critical Issues and Challenges. *IMF Working Paper, 07(209)*. Washington: International Monetary Fund. Retrieved August 2, 2017, from https://www.imf.org/external/pubs/ft/wp/2007/wp07209.pdf