

A TEST OF THE WEAK FORM EFFICIENCY OF THE ZIMBABWE STOCK EXCHANGE AFTER CURRENCY REFORM

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ABSTRACT

The Zimbabwean dollar lost its value and purpose as a medium of exchange as a result of the hyper inflation which had its greatest impact on the Zimbabwean economy between 2007 and 2008. The introduction of the multi-currency system, which entails the use of various foreign currencies to transact, resulted in the Zimbabwe Stock Exchange (ZSE) adopting the United States dollar (USD) as its main currency. The researchers investigated the weak form efficiency of the ZSE after introduction of the multi-currency system by testing if it is possible to create an excess return by the use of technical trading rules. According to the efficient market hypothesis (EMH) and the random walk theory, in an efficient market it is not possible to predict the future stock prices by analysing historical stock prices. The profitability of technical analysis and technical trading rules has been researched and debated extensively, but researchers are yet to reach a consensus. This article focuses exclusively on the ZSE. The purpose of this article is to test whether the ZSE exhibits weak form market efficiency. The data used to carry out the empirical study was obtained from the ZSE for the period 19 February 2009 to 28 June 2012. The efficiency of the ZSE is tested using the daily closing prices and indices over the aforementioned period. The data was then subjected to a number of tests namely auto-correlation, the runs test and the Q-statistic test. The results of the study provide evidence that the ZSE is not weak form efficient. This article adds to the existing body of knowledge and offers for the first time an investigation of the weak form efficiency on the ZSE following currency reform.

Keywords: Zimbabwe Stock Exchange, efficiency, multi-currency.

INTRODUCTION

The role of private capital cannot be overemphasized in the context of African economies. Decades after acquiring political independence, most African countries face serious capital constraints against a backdrop of dwindling capital inflows from the developed West, as well as accelerated implementation of economic indigenization policies. African stock markets are therefore left with a daunting task to mobilize and disperse scarce local and foreign savings to support the growth needs of local businesses. The majority of African stock exchanges were established in the late 1980s and early 1990s, largely as vehicles for the privatization of state enterprises (Mlambo and Biekpe, 2001; Moss, 2004 as cited in Mlambo and Biekpe, 2007). Over the past three decades, African stock markets have grown significantly in terms of both local and foreign participation, raising over 10 billion US dollars between 2007 and 2009 and growing market capitalization from 222 billion to over 700 billion US dollars between 2002 and 2008 (African Securities Exchanges Association (ASEA) as cited in Afego, 2011). The size of African stock exchanges relative to their economies has also grown remarkably over the years, with South Africa, Egypt, and Zimbabwe leading the pack. This is not surprising considering that the three markets are the oldest in Africa. This growth has generated increasing interest among financial market researchers, who have gone on to study the efficiency of these markets.

African market efficiency studies conducted from the mid-1990s to date have so far shown that the efficiency of a market depends on the stage of development of the market, implying tentatively that older markets are more likely to be efficient than newer markets. While studies on the South African market largely confirm this view, research on Egyptian and Zimbabwean markets casts a shadow of doubt on this otherwise persuasive conjecture. The two latter markets have been shown to be inefficient in the majority of studies despite having been in existence for more than a century. The newer markets however are not shown to be any better than the older markets in terms of efficiency. This raises pertinent empirical questions regarding the impact of age on stock market efficiency. It would appear that changing economic and political realities affect stock markets at different levels of development in ways that may turn even otherwise mature markets into fresh markets. A case in point is the currency reforms adopted in Zimbabwe in February 2009, which resulted in Zimbabwe adopting the US dollar alongside other regional and international currencies, such as the South African rand, Botswana pula, British pound, and the Euro as legal tender.

Brief History Of The Zimbabwe Stock Exchange (ZSE)

The first stock market in Zimbabwe (Southern Rhodesia as it was then known) is documented to have been established in June 1894 under the name Salisbury Stock Exchange (Karekwaivenani, 2003). Around the same time, three more exchanges were established in Bulawayo, Gwelo (now Gweru), and Umtali (now Mutare). Alternative accounts of the history of stock markets in Zimbabwe however give 1896 as the year when the first exchange was formed (Mlambo and Biekpe, 2007). We however adopt the former account by Karekwaivenani (2003) on account of the granularity of the detail provided in that account. The early exchanges were primarily driven by speculation around the Rand boom of 1894-95 and the growth of these markets was not underlain by real economic activity (Karekwaivenani, 2003). The primary beneficiaries of these early exchanges were exclusively mining companies involved in gold exploration, among them the British South Africa Company (BSAC) which led the colonization of Southern Rhodesia. Not surprisingly, the speculative bubble burst around 1898, leading to the collapse of all the exchanges by 1902. There was no local stock market activity between 1902 and 1945, and a new stock exchange was only established in January 1946 under the name Rhodesia Stock Exchange (RSE), and it was based in Bulawayo.

The RSE adopted rules and regulations from the Johannesburg Stock Exchange (JSE) in South Africa and it did not take time for the JSE and the London Stock Exchange (LSE) to grant the RSE associate status. Five years after the Bulawayo floor of the RSE was opened, a second floor was opened in Salisbury (now Harare) in 1951 to further facilitate trading. Apart from the administrative convenience afforded by the adoption of ready-made rules and regulations from the JSE, the RSE also benefited immensely from the diversified nature of the local economy, as witnessed by growing significance of the agriculture and manufacturing sectors of the economy. While it took some time for locals to develop confidence in the RSE, the pace of economic prosperity and the establishment and growth of the country's financial system provided much needed impetus to the exchange. An enduring feature of the RSE, however, was that it continued to rely heavily on foreign capital.

The RSE adopted the name Zimbabwe Stock Exchange (ZSE) upon independence in 1980. The ZSE has 76 listings spread across manufacturing, agriculture, retail, mining, and service sectors of the economy. The ZSE is governed by the Securities Act (Chapter 24:25) and is supervised by the Securities Exchange Commission of Zimbabwe (SECZ). Trading on the ZSE is now based in Harare and trades take place on an open outcry basis from Monday to Friday between 10:00 and 12:00. The ZSE has been open to foreign investors since 1993, with limits on foreign ownership of listed companies of 10% and 40% for individuals and companies respectively. The government of Zimbabwe is however currently implementing an indigenization policy that puts a ceiling of 49% on foreign ownership of any listed company operating from Zimbabwe.

The adoption of multiple currencies in Zimbabwe has brought about a number of empirical questions about the ZSE and this paper tackles the question of efficiency following currency reform. After having experienced the biggest stock market bubble ever in its history between 2006 and 2008, which was only burst by the currency reform of 2009, Zimbabwe was faced with a daunting task of reorganizing the ZSE and rebuilding investor confidence in the entire financial system. A number of initiatives have been on the cards since 2009, including plans to establish a central scrip depository, and also introduce electronic trading. The stable monetary regime that has prevailed since 2009 has been seen as a confidence booster for the ZSE and the increase in trading activity since then corroborates this assertion. In light of all these positives, it becomes imperative that the ZSE be given an efficiency check to determine how far it has come in terms of drifting towards efficiency.

Contribution To Empirical Literature

This paper contributes to the developing empirical literature on African Stock Markets (ASMs). In particular, it is, to our knowledge, the first documented empirical test of the weak form efficiency of the ZSE that utilizes data after the 2009 currency reforms. Apart from providing evidence on the efficiency of the ZSE, this work also contributes to the debate on the impact of currency reforms on market efficiency by demonstrating that it takes time for the positive effects of currency reforms, if any, to translate into efficiency on stock markets, largely due to the impact of such reforms on general market liquidity, availability of credit, investor risk aversion, as well as general market confidence. While the paper does not generate detailed evidence on the evolutionary aspects of stock market efficiency on the ZSE, we find that the ZSE is less efficient after the currency reform than it was after the 1997 foreign exchange crisis.

Organization Of The Paper

The rest of the paper is organized as follows; the first part provides a review of the related literature on weak form efficiency, the second part outlines the methodology adopted for this paper, the third part presents the results and the final part concludes the paper and suggests areas of further research.

LITERATURE REVIEW

The Concept Of Market Efficiency

The volume of empirical research output on efficiency in financial markets has been amazing since the work of Fama (1970). Fama (1970) propounded the famous efficient markets hypothesis (EMH), which asserts that the price discovery mechanism in an 'informationally' efficient market is such that prices instantaneously assimilate new information, implying a very short arbitrage window. The three forms of the EMH (namely the weak form, semi-strong form, and the strong form) define efficiency relative to the information set available to investors in the markets. The weak-form of the EMH, which defines the efficiency of a market relative to the history of asset prices, has earned a reputation for being the most empirically studied form of the EMH (Lim and Brooks, 2006). If a market is efficient, abnormal returns (returns above what is sufficient to reward investors for time

and risk taking) are hypothesized to have a mean of zero conditional on past information. Tests of the weak form EMH have typically involved testing for linear serial dependence between successive prices to establish if the price process follows a random walk. The presence of any discernible trends in the past price process is interpreted as evidence that abnormal returns may be earned consistently based on technical trading rules, thus a violation of the random walk model. Empirical studies on the weak form of the EMH are therefore basically 'tests for return predictability', consistent with the view that the hypothesis that prices fully reflect available information implies only that prices are sub-martingales (Fama, 1991).

The semi-strong form EMH hypothesizes that in a semi-strong efficient market; prices reflect all publicly available information relevant for pricing of a security. In other words, fundamental analysis is a futile exercise, and fundamentalist strategies cannot be relied on to consistently beat a naïve investment strategy (Chiwira and Muyambiri, 2012). The level of investor sophistication or an analyst's analytical prowess does not matter in such a market.

Tests Of Market Efficiency On ASMs

Most empirical work on efficiency has concentrated on stock markets, understandably owing to their significant role in mobilizing and allocating capital across sectors of an economy, hence driving economic growth (Lagoarge-Segot and Lucey, 2008). The few documented studies of weak form efficiency on ASMs suggest that all but one ASMs are weak form inefficient (Jefferis and Smith, 2005; Mlambo and Biekpe, 2007; Sunde and Zvinanomoyo, 2008; Smith, 2008; Chiwira and Muyambiri, 2012). The notable exception is South Africa which is only found to be inefficient in Appiah-Kusi and Menyah (2003) and Smith (2008). The implication of the above evidence is that skillful investors can make abnormal profits from using technical trading rules. Thin trading has been blamed for the inefficiency in ASMs. This is despite numerous efforts by African governments to open their markets since the 1990s. The reversal of capital flows to developing markets due to recurrent global financial crises may be instrumental in the slow pace of development in most young ASMs.

Researchers have shown very little interest in studying the semi-strong form of the EMH on ASMs, ostensibly due to the clear evidence of weak form inefficiency of most ASMs from studies hitherto. There is no documented empirical evidence to date to suggest that a market that is inefficient in the weak form can be efficient in the semi-strong form of the EMH. While it appears theoretically impossible to admit such a possibility, there is no valid reason to deny that such a finding is empirically possible. Financial markets are full of surprises anyway! To the relief of most researchers though, the scanty documented research on the semi-strong form EMH in ASMs presents unanimous evidence of semi-strong inefficiency for South Africa, Ghana, and Nigeria (Bhana, 1991; Osei, 2002; Adelegan, 2009; Afego, 2011).

Tests Of Weak Form Efficiency On The Zimbabwe Stock Exchange (ZSE)

ZSE was ranked among the top five largest stock markets in Africa by market capitalization as at 2010 and is the 3rd oldest stock market in Africa (Afego, 2011). Given the status of the ZSE as one of Africa's largest and oldest stock markets, one would expect some evidence of efficiency, at least in the weak form. However, studies to date provide convincing evidence that the ZSE is weak form inefficient (Magnusson and Wydick, 2002; Simons and Laryea, 2005; Jefferis and Smith, 2005; Smith, 2008; Sunde and Zivanomoyo, 2008). The only studies that conclude that the ZSE is consistent with a random walk are Appiah-Kusi and Menyah (2003) and Mlambo and Biekpe (2007). The general conclusion has been that the ZSE is weak form inefficient, a result that is in line with the rest of Africa. It is noteworthy however that the path to economic development has not been smooth for Zimbabwe; war from the 1960s to 1980, political and economic transition in the 1980s, structural economic adjustment in the early to mid-1990s, currency and politico-economic crises from the late 1990s to 2008, and currency reform in 2009. The recent currency reforms in Zimbabwe have ushered a new economic dispensation, creating a platform for significant market reforms and stability. However, there is no documented research to date that re-tests the weak form efficiency of the ZSE following the currency reforms, a research gap that this paper attempts to fill.

Methodological Issues In Tests For Weak Form Efficiency

Most of the studies on ASMs have utilized conventional parametric and non-parametric tests of weak form efficiency such as auto-correlations, variance ratio tests, runs tests, and unit root tests. A striking feature of the dominant methodologies is that they test for linear dependency in successive stock returns. Tests for linear dependency have been criticized for not being able to discern non-linear dependencies which may be exploited by traders at a profit. Thus, absence of linear dependency does not necessarily mean lack of predictability (Saadi, Gandhi, and Elmawazini, 2006). In addition, the 'all or none' perspective of conventional tests, that regards markets as either efficient or not at all, tends to ignore the tendency for markets to cyclically move between efficiency and inefficiency in response to institutional, regulatory and technological factors (Chordia, Roll, and Subrahmanyam, 2005). Research on the EMH has produced some evidence of this cyclicity, refuting earlier claims that markets progressively move towards greater efficiency over time (Lo, 2004; Lim, Brooks, and Hinich, 2006). The concepts of relative efficiency and adaptive efficiency (Lo, 2004, 2005, 2011; Lim and Brooks, 2006) have since become increasingly popular in recent times, particularly within the context of emerging markets in Asia and Africa.

Description Of Data

To test the weak form efficiency after currency reform of ZSE, we used daily closing prices data for the period 19 February 2009 to 28 June 2012. The data was obtained from the ZSE for counters with complete data over the period. We analysed 73 counters of which 69 are classified as industrial and 4 are from mining. In addition, we also analysed the daily closing values for the

industrial index and mining index provided by the ZSE over the same period of study. Each counter price series data has a total of 794 observations over the period of study.

Hypothesis

The objective of this article is to examine the weak form efficiency of the ZSE after the currency reform. The hypothesis can be formulated as follows:

- H₀: The ZSE follows a random walk (weak form efficient).
H₁: The ZSE follows a random walk (weak form inefficient).

RESEARCH METHODOLOGY

The daily closing prices and indices were assumed to follow a log-normal distribution. The market returns were computed from the daily closing prices and indices as follows (see Patel et al, 2012):

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

- P_t = Market price at time t
 P_{t-1} = Market price at time $t - 1$

STATISTICAL TESTS FOR WEAK FORM EFFICIENCY

In order to test the hypothesis, we employed some statistical tests namely the runs test, auto-correlation and Q-statistics tests.

Runs Test

According to Al-Jafari (2011), the runs test is a non parametric test used to test for randomness or independence of a sequence of observations. A sequence of the same sign contributes to a run for example ++ or -- count as one run. A positive sign (+) occurs when the market return > 0 and a negative sign occurs when the market return < 0 . In order for price changes or market returns to confirm to randomness, the actual runs must equal or near the expected runs. For large sample sizes, the runs test statistic is calculated as follows (see Hamid et al, 2010):

$$Z = \frac{\omega - \mu_\omega}{\sigma_\omega} \approx N(0,1)$$

where

$$\mu_\omega = \frac{2m_+m_-}{m} + 1 \quad \text{and} \quad \sigma_\omega = \sqrt{\frac{2m_+m_-(2m_+m_- - m)}{m^2(m-1)}}$$

- ω = Actual runs
 m_+ = Number of positive runs
 m_- = Number of negative runs
 $m = m_+ + m_-$, which is the number of observations
 μ_ω = Expected runs
 σ_ω = Standard deviation of runs

Auto-Correlation Test And The Q-Statistic

Auto-correlation test has been widely used in the financial literature to test the serial dependence of a series of data at different lags or periods. The lag or period can be daily, weekly or monthly. The series exhibit randomness if the auto-correlation coefficient at the lag in question is zero and if the coefficient differs from zero then there is evidence that the current value is dependent on the previous value and therefore the random walk will not hold. Q-statistic is used to test for the joint hypothesis of no auto-correlation up to a specified number of lags. If the Q-statistic is greater than the critical value from the Chi-square distribution then the null hypothesis of no auto-correlation is rejected. The Q-statistic is calculated as follows (see Patel et al, 2012):

$$Q\text{-statistic} = n(n+2) \sum_{t=1}^k \frac{\psi(t)}{n-t}$$

where

n = number of observations

k = number of lags

ψ = auto-correlation coefficient

EMPIRICAL FINDINGS

Descriptive Statistics

From Table 1, the Jarque-Bera test rejects the normality assumption regarding the distribution of log returns on the ZSE at both 1% and 5% levels of significance. We noted that the distribution of log returns for all counters on the ZSE is leptokurtic, confirming that stock returns conform to non-normal (fat-tailed) stable distributions (Mandelbrot, 1966). In addition, about 82% of individual counters exhibit negative skewness and generally industrial counters are less risky than mining counters as evidenced by a lower standard deviation of returns for the industrial index.

Table 1: Summary of Descriptive Statistics

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	p-value
Individual counters:						
Min	0.007837	0.02417	-16.9130	11.4229	2344.48	0
Max	0.003496	0.29370	11.4109	405.206	5384378	0
Industrial Index	0.000336	0.02095	0.09036	31.9836	27757.7	0
Mining Index	0.000322	0.03990	1.25025	25.2706	16594.6	0

Runs Test

The runs test was based on the null hypothesis that stock returns follow a random walk. The test was conducted at 5% level of significance and the results indicate that more than 50% of the counters reject the random walk model (see Table 2). Therefore based on the runs test, we find that the ZSE is weak form inefficient, providing scope for skilful investment managers to earn abnormal returns using past information on stock prices.

Table 2: Runs test results for individual counters

	Runs Test Significant	Runs Test Not Significant	Total counters of ZSE
Number of counters	40	33	73
Percentage of counters	55%	45%	100%

Auto-Correlation Test And Q-Statistic

Auto-correlation test were conducted based on the null hypothesis that successive stock returns have a zero serial auto-correlation coefficient, implying that the stock returns conform to a random walk. The results presented in Table 3 provide evidence that the percentage of significant auto-correlation function (ACF) coefficient increases with increases in the number of lags. This indicates that, contrary to expectation, past information becomes increasingly useful to the analyst over time for purposes of predicting future returns. The overall joint test based on the Q-statistic provides overwhelming evidence against the random walk model, with 80% of the counters rejecting the random walk model. This is in line with the results of the runs test presented in Table 2 above.

Table 3: Percentage of significant ACF across lags and the overall percentage of significant Q-statistics

	ACF(lags 1-5)					Proportion of significant Q-stat*
	1	2	3	4	5	
Individual counters	67%	77%	77%	81%	84%	80%

*Number of counters with significant Q-statistics as a percentage of the total number of counters in the sample.

CONCLUSION

This article provides consistent evidence rejecting the random walk model for the ZSE after currency reform. The runs test, autocorrelation test and the Q-statistic rejected the weak form efficiency of the ZSE. Comparing studies carried out by Appiah-Kusi and Menyah (2003), Mlambo and Biekpe (2007) and Sunde and Zivanomoyo (2008), we find that the ZSE has moved towards inefficiency particularly in the ten years from 2002 to 2012. We also make the interesting observation that the ZSE is less efficient after currency reform than it was after the currency crisis of 1997.

The foregoing evidence raises pertinent empirical questions regarding the impact of currency reforms on the efficiency of the stock market. It is not clear whether currency reforms worsen the efficiency of the stock market or they enhance efficiency with a significant time lag. With the arrival of more data, we recommend further research into the statistical properties of stock returns before and after currency reforms and also evolutionary aspects of efficiency in emerging stock markets.

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