

Research Paper

Zimbabwe Stock Exchange and Efficiency in the Multiple Currency Exchange Rate Regime.

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ABSTRACT

In this paper, the Zimbabwe Stock Exchange (ZSE) was tested to see whether it is efficient or not after the country adopted the multiple currency exchange rate regime. To achieve this, the weak form market efficiency was tested. Data on daily and weekly closing stock prices over a period of 19 February 2009 to 31 December 2012 was used. The non-parametric and parametric research methods through the partial autocorrelation function were used. The results of both tests showed that the successive stock price changes were dependent which indicates that the ZSE was not efficient in the weak form when the country used multiple currencies. In addition, the results showed evidence of autocorrelation which implies that during the period under study, the ZSE did not follow random walk hypothesis. In order to make the ZSE efficient we recommend that regulators may consider putting in place measures and regulations that enable large number of well informed investors. The ZSE may insist on timely release of correct and quality information to boost public and investor confidence and provide a platform for informed decision making by the investing public. There may be need for the removal of fees and other costs by the ZSE committee which hinder smooth trading on the stock exchange. Where removal is not feasible, such costs must be kept to the minimal to avoid hindrance on efficiency.

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INTRODUCTION

The Zimbabwe Stock Exchange (ZSE) was established in 1896. The ZSE only became a significant capital market in the 1990s, after the introduction of market reforms in the form of the Economic Structural Adjustment Programme (ESAP), adopted in 1991. Smith and Jefferis (2001) points out that the most important boost of the ZSE came with opening of the stock exchange to foreign investors in May 1993, alongside with a major relaxation of exchange controls. Since then the ZSE has grown immensely to become one of Africa's leading equity exchanges and a leading provider of services that facilitates the raising of capital and trading of shares.

The ZSE is one of Africa's third largest bourses after the JSE Securities Exchange of South Africa and the Casablanca Stock Exchange of Morocco and the second largest stock market in Sub-Saharan Africa behind the South African stock market. It boasts of more than 77 listed companies and provides the platform and means for raising capital for both Zimbabwean and international companies through the issuance of equity, debentures and depository receipts. Sunde and Zivanomoyo (2008) note that between 1989 and 1996 the market capitalization of the ZSE increased by 1542 percent in local currency terms and 240 percent in US dollar terms. They affirmed that between 1994 and 1996 the

market capitalisation was rising at an average annual rate at 36 percent in US dollar terms. In the year 2001, a survey conducted by Standard and Poors (S&P) rated the ZSE as the second best performer in the world's emerging capital markets, both in terms of returns in US dollar and share prices, outshining thirty-three other emerging stock bourses.

In a similar rating conducted by the African Stock Exchange Association (ASEA), the ZSE was rated the best performing bourse in the African continent for 2005. The key industrial index shot to 18,055.72 points at the end of December 2005 from 1,097.46 points during the same period in 2004, realizing a yearly growth of 1545 percent in 2005 alone. This rise was way above the 146 percent growth of the Casablanca Stock Exchange, its closest rival. The bullish behaviour continued in 2006, with the industrial index closing the year at 569,844.00 points, a figure about 2983 percent higher than that of 2005-year end (Zimbabwe Stock Exchange, 2006).

The Zimbabwean dollar lost its power as legal tender in late 2008 at the height of macro-economic instability and hyperinflation which peaked at 231million percent in July 2008, (RBZ, 2008). In 2009, the government introduced a multiple currency exchange rate regime. The system allowed trade to be completed using major trading currencies, for example, the United States Dollar (USD), Pound Sterling, South African Rand, and the Botswana Pula. Settlement in payment systems however took place in the US Dollar (MOF 2009a, RBZ 2009). The use of the multiple currencies and the suspension of the Zimbabwean dollar from the monetary system resulted in immediate and tangible effects on the economy. (Chikoko and Samu 2012). The question is whether there has been efficiency on the ZSE in the multiple currency exchange rate regime? Stock market efficiency is an important concept, in terms of an understanding of the working of capital markets. The term market efficiency is used to explain the relationship between information and share prices. Market efficiency may be put into three categories namely weak form, semi strong form and strong form. The main objective of this paper is to test whether Zimbabwe stock exchange was weak form efficient in a multiple currency regime. The study also intends to come up with prerequisite conditions that are conducive for there to be efficiency on the ZSE.

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LITERATURE REVIEW

Efficiency in the capital markets has been defined in many ways. The most common way is to define it in terms of what sort of information is available to market participants and

how they handle the information. Fama (1965) defined efficient markets as a market where there are large numbers of rational profit maximisers actively competing with each other trying to predict future market values of individual securities, and where important current information is almost freely available to all participants. Fama (1965) also proposed that in an efficient market at any point in time the actual price of a security would be a good estimate of its intrinsic value and that in an efficient market the actions of the many competing participants should cause the actual price of a security to wonder randomly about its intrinsic value. Asset prices fully reflect all available information, to the extent that no economic profits can be made by trading on the information. Fama (1970) added that a market is efficient with respect to information set if the expected future prices conditioned on that information is on average equal to the actual future price. However in practice expected prices are unobservable and the definition is silent with regards to whose expectations are involved.

Efficient capital market is one where prices of financial assets accurately reflect all information and quickly adjusts to new information, this definition is referred to as informational efficiency. Efficient markets are involved in allocating resources to their profitable use and in cost effective ways. This is called allocative efficiency, which pertains to market's ability to provide liquidity, rapid execution and low trading costs (Sharpe et al, 1999; Keasey, 2000; Malkiel, 2003). stated that the efficient markets hypothesis, by itself is not a well defined and empirically reputable hypothesis. To make it operational one must specify additional structures which include investors' preferences, information structure, and business conditions. Nevertheless the definition of efficiency, it is agreed among researchers that stock exchange can be efficient in the weak form, semi-strong form and strong form.

Weak form market efficiency assumes that current stock prices fully reflect all security market information including the historical sequence of prices, rates of return, trading volume data, and other market generated information such as odd lot transactions, block trades and transactions by exchange specialists (Reilly and Brown, 2006). The hypothesis assumes that current market prices already reflect all past returns and any security market information, the hypothesis implies that past rates of return and other historical market data should have no relationship with future rates of return. Therefore this hypothesis contends that one should gain little from using any trading rule that decides whether to buy or sell a security based on past security market data (Keasey 2000; Reilly and Brown, 2006; Khan 2010; Khan et al 2011). A capital market is said to be weakly efficient or satisfy weak form efficiency if it fully incorporates the information in the past stock prices. Weak form efficiency is the weakest type of efficiency that is expected for a financial market to display because historical price information is the easiest type of information to acquire about a stock (Mensah 2003).

The semi-strong form EMH asserts that security prices adjust rapidly to the release of all public information, that is current security prices fully reflect all public information. The semi-strong hypothesis encompasses the weak form hypothesis because all the market information considered by the weak form hypothesis such as stock prices, rates of return and trading volume is public (Smith and Jefferis, 2001). Public information, such as earnings and dividend announcements, price to earnings ratio, dividend yield, stock splits, news about the economy and political news (Reilly and Brown, 2006). This hypothesis implies that investors who base their decision on any important new information after the public should not derive above average risk adjusted profits from their transactions considering the cost of trading because the security price already reflects all such new public information.

The strong-form EMH contends that stock prices fully reflect all information from public and private sources. This means that no group of investors has monopolistic access to information relevant to the formation of prices. Therefore this hypothesis contends that no group of investors should be able to consistently derive above average risk adjusted rates of return. The strong form EMH encompasses both the weak form and the semi-strong form EMH. Further the strong form EMH extends the assumption of efficient market in which prices adjust rapidly to the release of new information, to assume perfect markets in which all information is cost free and available to everyone every time.

A well developed and efficient stock market plays a significant role in the economic growth of an economy. If a market is efficient, it is likely to result in more liquidity, integration with world markets and less volatile. From previous studies, most African stock markets in general are believed not to be efficient in any form, (Smith and Jefferis, 2001; Jain, 2005; Hein and Piesse, 2008 Sunde and Zivanomoyo, 2008 ; Chigozie and Okpara, 2010). According to the resaerchers' knowledge, no work has been done on testing whether the ZSE was efficient after the government adopted the multiple currency system. This study intends to fill the gap.

METHODOLOGY

The population constituted 79 ZSE listed companies. A judgemental sampling method was used. Eight companies were selected based on the industrial index, large enough in size and actively traded (trade in large volumes). The non parametric runs test and a more scientific autocorrelation involving correlograms and the Ljung Box Q statistics for a higher order serial correlation were adopted from the works of Chigozie and Okpara (2010).

Runs test

The runs test was used to test and detect statistical

dependencies. The runs test was preferred to prove the randomness of stock prices because the test ignores the properties distribution and more so it is a strong test for randomness in investigating serial dependence in share price movements. It also compares expected number of runs from actual number of runs given a sequence of observations. Runs test examine whether the value of one observation influences the values taken by later observations. Actual number of runs can be compared to the expected number of runs using the following equation as adopted from Islam et al (2005)

$$\mu = \frac{N(N + 1) - \sum_{i=1}^3 n_i^2}{N} \tag{1}$$

Where N denotes the number of observations, *i* is the sign of pluses, minuses and no change, *n_i²* is the total number of changes of each category signs. For a larger number of observations (N>30) the expected number of runs *m* is approximately normally distributed with standard deviation Islam et al. (2005).

$$\sigma_{\mu} = \left[\frac{\sum_{i=1}^3 [\sum_{i=1}^3 n_i^2 + N(N + 1)] - 2N(\sum_{i=1}^3 n_i^3 - N^3)}{N^2(N - 1)} \right]^{1/2} \tag{2}$$

$$Z\text{-score} = \frac{r - \mu \pm 1/2}{\sigma_{\mu}} \tag{3}$$

Where *r* is the actual runs and ½ denotes the correlation factor for continuity adjustment in which the sign continuity adjustment is positive if *R* << *m* and negative if *R* >> *m* (Barnes et al., 2001). A negative Z value indicates a positive serial correlation, whereas a positive Z value indicates a negative serial correlation. Positive serial correlation implies that there is a positive dependence of stock prices therefore indicating a violation of random walks.

The autocorrelation test

Autocorrelation refers to the relationship not between two or more different variables but between successive values for the same variable. Autocorrelation can be used to measure the persistence or predictability of market prices on the basis of past market prices (Harvey 1999). It is a reliable measure for testing of either dependence or independence of random variables in a series. Autocorrelation tests compute the price changes at different lagged 1;2;3;4;5 time periods. The serial correlation coefficient measures the relationship between the values of a random variable at time *t* and its value in the previous period given by;

$$\rho(k) = \frac{\text{cov}(r_t, r_{t+k})}{\sqrt{\text{var}[r_t] * \text{var}[r_{t+k}]}} = \frac{\text{cov}(r_t, r_{t+k})}{\text{var}[r_t]} \tag{4}$$

Table 1. Summary of runs tests for the ZSE daily data set.

Stock	Observed no. of runs	Expected number of runs	No of observations	Negative \leq mean	Positive $>$ mean	z-statistic
Hwange colliery	13	226.19	470	283	187	(-20.6)
Pearl properties	46	189.09	470	340	130	(-16.5)
Old mutual	10	195.13	470	137	333	(-20.7)
Delta	21	221.19	470	294	176	(-19.3)
OK Zimbabwe	36	233.55	470	211	259	(-18.4)
Edgars	33	209.44	470	314	156	(-18.4)
Africa sun	14	234.77	470	252	218	(-20.5)
Econet	2	205.97	470	151	319	(-21.6)

Where $\rho(k)$ is the autocorrelation coefficient of the time series r_t

k is the number of lags,

$\text{Cov}(r_t, r_{t-k})$ denotes the return on index over time period (t-1; t) and its lagged return t-k periods earlier

$\text{Var}(r_t)$ denotes the variance on the return of a security over time period (t-1; t).

In this study we used the standard error test and the Ljung Box Q test. The standard error tests measures the autocorrelation coefficients for individual lags and identifies the significant one, while the Ljung Box Q test, measures the significant autocorrelation coefficients at the group level, (Okpara, 2010).

The standard error σ_k is defined as:

$$\sqrt{\frac{1 + 2 \sum_{t=1}^{k-1} \theta_t^2}{N}} \quad (5)$$

Where N is the total number of observations and θ_k is the autocorrelation at lag (k).

Box Pierce Q is identified as:

$$Q'_m \equiv T(T+2) \sum_{k=1}^m \frac{\rho^2(k)}{T-k} \quad (6)$$

RESULTS AND DISCUSSION

This section presents the findings of the research. The empirical analysis is based on the results obtained from the use of E-views 7 and Stata 11. To test weak form efficiency of the Zimbabwe Stock Exchange from Feb 2009 to 31 December 2012, the runs test and autocorrelation test were used. The empirical results are classified in accordance to the different statistical techniques used. Stata 11 was used for runs test and E-views 7 was used for autocorrelation tests. The findings of statistical techniques are discussed

below in each sub section.

Runs tests

A run is a repeated occurrence of the same value or category of a variable, it is indexed by two parameters which are the type of run and the length of the run. This test is used to detect statistical dependencies using Statistical technique of testing for randomness. The runs tests is considered more appropriate than the parametric autocorrelation test since all observed series do not follow normal distribution and no parameters are required when conducting the tests. Since the table of values computed in Stata11 did not represent the expected number of runs, we calculated the values following equation (1).

The runs test converts the total number of runs into a z-statistic. For larger samples the z- values gives the probability of the difference between actual and expected number of runs. If the z-values are greater than or equal to ± 1.96 , reject the null hypothesis at five percent level of significance, (Islam et al; 2005). The runs test is based on the argument that if price changes are random then actual number of runs must be nearer to the expected number of runs. As can be seen from Table 1 a remarkable aspect of all the stocks is that the z-scores of all the eight companies did not fall between the ranges of ± 1.96 . This shows that the successive price changes are dependent and thereby not supporting the assertion that the ZSE follows a random walk process. Furthermore the z-statistic is negative at all times which is a clear indication that the observed number of runs is fewer than the expected number of runs as illustrated in Table 1.

In addition the test values are not significant and we conclude that, the null hypothesis is rejected and that there is evidence of autocorrelation. This shows that ZSE capital market is exhibiting inefficiency especially the stock market which can be attributed to inadequate market and legal infrastructure. Therefore the results of the runs tests indicate that ZSE is not efficient in the weak form. This shows that all past information is not fully incorporated in stock price changes.

Table 2. Summary of run tests for the ZSE weekly dataset.

Stock	Observed no. of runs	Expected number of runs	Number of observations	Negative ≤mean	Positive >mean	Test value
Econet	14	49.79	97	48	49	(-7.2)
Hwange colliery	13	47.23	97	59	38	(-7.3)
Pearl properties	24	49.37	97	51	46	(-5.2)
Africa sun	03	49.25	97	52	45	(-9.5)
Delta	18	48.34	97	41	56	(-6.3)
OK Zimbabwe	18	49.25	97	45	52	(-6.4)
Old mutual	6	40.84	97	28	69	(-8.7)
Edgars	21	43.89	97	65	32	(-5.3)

Weekly runs test were conducted by extracting every Wednesday stock from the ZSE compiled daily stock prices, for the period under study to test if daily runs test confirm with the weekly runs test. The results are summarized in Table 2.

A run test using weekly data produces a different result to daily result in the degree of autocorrelation. This is caused by the difference in the number of data being tested. However from the table the researcher observed that the observed number of runs is less than the expected number of runs. In addition the test values of all the companies are significant and we can conclude that for the weekly runs test the null hypothesis is rejected and there is evidence of positive autocorrelation hence ZSE is inefficient in the weak form.

The results are similar to Islam et al (2005) who concluded that actual number of runs is significantly lower than expected number of runs for daily stock prices in the Thailand stock market. The overall results of the run tests analysis on the ZSE indicate that the daily and weekly stock prices are not random as the probabilities associated with the expected number of runs were all greater than the observed number of runs in all the eight stocks tested at all times.

Parametric test

The study investigated the parametric tests to confirm the findings of runs test. To further analyze the randomness of the return series, serial correlation, autocorrelation and Ljung Box-Statistics were used in parametric tests. The extent of dependency is also measured with these parameters estimated under different lags using autocorrelation test.

Autocorrelation test

The serial correlation coefficient measures the relationship between the values of a random variable at time t and its value in the previous period. If p values < 0.05 of the Q

statistics and the null hypothesis of the entire autocorrelation coefficient together equal to zero may be rejected at five percent level of significance. Therefore it is inferred that the historical prices can be used to predict future prices and this element indicates that the weak form of market efficiency does not hold.

Table 3 shows the autocorrelation coefficients computed through correlogram. All lags from 1-36 of all the eight companies exhibited positive autocorrelations except for Edgars that have negative autocorrelation at lags 20,24,28 and 36. The positive sign of autocorrelation coefficients indicates that consecutive daily market prices tend to have the same sign followed by an increase (decrease).

From the summary of the results above, all the autocorrelations and partial autocorrelations lags have their Q -statistics significant $\rho > 0.005$. The probability is significantly different from zero and therefore reject the existence of weak form efficient market hypothesis on the ZSE. The presence of non-zero autocorrelation coefficients in the results suggests that there is a serial dependence between the stock prices. In addition we find that the autocorrelation coefficients are particularly high at lags in the beginning and low at the end of the market price index. The suggestion is that the historical information embedded in longer period lags would be as influential in determining the future price so also are information embedded in shorter period lags.

The stock prices on the Zimbabwe Stock Exchange do not follow the random walk process. The results imply that the opportunity to make excess returns does exist in the ZSE. The research irrespective of its difference in time, scope, volume of data, or population coverage and analytical approach, and the result is in conformation to the work of Okpara (2010).

CONCLUSIONS

The research tested the efficiency of the ZSE in its weak form after the country adopted a multiple currency exchange rate regime. The research employed the runs test and autocorrelation test. The results confirmed with each

Table 3. Summary of autocorrelation tests.

Stock		Lags									
		1	4	8	12	16	20	24	28	32	36
Africa sun	AC	0.976	0.916	0.888	0.88	0.842	0.810	0.787	0.762	0.724	0.697
	Q-stat	450	1685	3221	4737	6161	7484.4	8738	9933	1103	1203
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Delta	AC	0.985	0.920	0.830	0.79	0.657	0.550	0.455	0.378	0.306	0.241
	Q-stat	459	1726	3150	4324	5260	5944.1	6421	6752	6976	7119
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Edgars	Ac	0.946	0.785	0.525	0.26	0.058	-0.013	0.103	0.120	0.125	0.102
	Q-stat	422.3	1423.	2187	2431	2458	2460	2474	2500	2532	2557
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Econet	Ac	0.993	0.967	0.93	0.89	0.847	0.803	0.759	0.717	0.673	0.627
	Q-stat	466.4	1824	3531	5111	6562	7883	9077	1011	1111	1197
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hwange Colliery	Ac	0.985	0.934	0.857	0.78	0.666	0.556	0.448	0.346	0.241	0.163
	Q-stat	459	1751	3250	4494	5461	6166	6641	6938	7099	7172
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OKZIM	Ac	0.983	0.933	0.884	0.82	0.768	0.708	0.665	0.628	0.577	0.520
	Q-stat	457	1741	3305	4684	5901	6943	7861	8685	9405	1001
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Old mutual	Ac	0.988	0.954	0.905	0.82	0.802	0.749	0.698	0.655	0.613	0.570
	Q-stat	462	1788	3420	4888	6202	7365	8383	9284	1002	1074
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pearl properties	Ac	0.783	0.261	0.203	0.06	0.026	0.023	0.052	0.040	0.056	0.068
	Q-stat	290	508	606	618	619.1	621.5	624.3	630.8	634.4	644.6
	ρ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

other than the ZSE was inefficient in the weak form. The two tests conducted showed that there was autocorrelation on ZSE stock prices. The conclusion is that the inefficiency of the ZSE follows from the violation of conditions necessary for an efficient market and also implies financial and institutional imperfections.

The implication of weak form inefficiency is that the benefits of a well functioning stock market are not being realised in the economy during multiple currency exchange rate regime. Based on these results, it can be concluded that financial policies, regulation such as the indigenisation bill and those concerning liberalisation, market deregulation and privatisation have generated a perceived inconsistency and a tendency to provide instability. Indeed the weak form inefficiency of the market demonstrated herein is most likely caused by a combination of lack of development and the implication of policy choices by those in authority.

The results also evidence that all information conveyed in past patterns of the stocks are not being impounded into the current price of the stock. If the price of stocks rises in the past two or four days, it will give useful information as to what today's or tomorrow's price will be.

When a market is weak form inefficient it can be taken advantage of, however in some cases the resultant transaction costs and commissions as well as the illiquidity of the stock market can reduce or eliminate such advantages. The evidence has been a shrink in the performance of stock broking firms during the multiple currency regime.

The perception that prices on the ZSE do not fully reflect some information can lead to investors adopting strategies designed to reap abnormal profits by exploiting the informational inefficiencies. On the other hand the investors may be unwilling to trade in securities if it is felt that the information is possessed by others. Investors might leave the ZSE to invest elsewhere or may reduce the total amount invested.

RECOMMENDATIONS

In order to make the ZSE efficient it is recommended that measures and regulations be put in place to enable large number of well informed investors.

- The ZSE may insist on timely release of correct and

quality information to boost public and investor confidence and provide a platform for informed decision making by the investing public.

- Policy makers may consider paying more attention to issues concerning attraction of foreign investments and improvements in real investments. In addition there is need to improve liquidity through formulating policies to enhance market efficiency.
- There is need for the removal of fees and other costs by the ZSE committee which hinder smooth trading on the ZSE. Where removal is not feasible such costs must be kept to the minimal to avoid hindrance on efficiency.
- In addition opening of the ZSE to foreign investors can also improve market efficiency by introducing competition from foreign and more sophisticated financial institutions and investors, this will result in greater efficiency in allocating capital.
- Policy makers may consider encouraging the free flow of capital across borders through the required integration of ZSE to other regional and international markets.

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