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How Efficiently Can Infant Stock Markets Exhibit the Random Walk? Evidence From Malawi

Joseph Paul Chunga[1] & Yu Ping[1]

[1] School of Economics, Wuhan University of Technology, Wuhan, Hubei, PR China

Correspondence: Joseph Paul Chunga, School of Economics, Wuhan University of Technology, Wuhan, Hubei, 430070, PR China. Tel: 86-186-2710-3275. E-mail: chunga.joseph@yahoo.com

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Abstract

It is no secret that the Malawi Stock Exchange (MSE) is still in its infancy. In 2011, the Malawi government in conjunction with the World Bank launched the Financial Sector Technical Assistance Project (FSTAP). The project targeted an improvement in financial literacy and also the automation of trading on the MSE to an advanced stage so as to improve market efficiency. This paper investigated the weak form and semi-strong efficient market hypotheses on the Malawi Stock Market in the wake of such a project with aid of parametric and non-parametric tests. The weak form efficiency of the market is tested by the application of Lo and MacKinlay's Variance ratio test, the Cumby-Huizinga autocorrelation test and the Phillips-Perron unit root test. An adjustment to the methodology suggested by Borges (2009) is employed to ascertain the presence of market anomalies and by extension test out semi-strong form of efficiency. The paper employed more recent and comprehensive data stretching back to January 2010 through to June, 2022, amounting to 12years and 6months. Results are in support of weak form efficiency. However, the paper found significant evidence against semi-strong efficiency of the MSE. Calendar effects like day-of-the-week effect and turn-of-the-year effect were deemed to be absent from the market but turn-of-the-month effect was existent. Results of applying the Fama and French three-factor model to a time series regression reveal the presence of size and value effects. As such, the paper concludes that the Malawi Stock Market is weak-form efficient but semi-strong inefficient.

Keywords: market efficiency, weak form efficiency, semi-strong form efficiency, market efficiency anomalies

1. Introduction

Within the walls of the financial world reverberates a familiar adage "Nobody beats the market". Such a saying intuits both theoretical and practical connotations that have anchored contemporary work in the field of financial economics. Theoretically, it implies that the market is efficient thus opportunities to outperform market benchmarks and other participants are arbitraged away as new information filters into the market. On the other hand, there have been cases where some market participants have utilized unorthodox strategies to yield abnormal returns on their invested funds. In such scenarios, the adage alludes to how the market averages out such performances. It is the former connotation of Market Efficiency that has been the focal point for most research works.

According to the theory of market efficiency, stock prices accurately reflect all relevant information, making it very difficult to continually outperform the market. It is impossible to predict stock prices, according to the Efficient Market Hypothesis (EMH), which was first put forth by Fama (1965, 1970). It also contends that price aberrations from an asset's genuine investment value would be promptly remedied. Simply put, stock prices move randomly and erratically. Market efficiency can be classified into three groups: poor, strong, and semi-strong. The Weak Form of the EMH first claims that prices only take into account prior asset knowledge. According to this interpretation of the EMH, it is impossible to reliably identify assets that are overpriced and beat the market using technical analysis of prior prices. The semi-strong form's prices take into account all information that is available to the general public. In this line, examples of publicly available information include financial market data and financial statement data. The weak form of market efficiency is thereby incorporated into the semi-strong version. To put it another way, if a market is semi-strong efficient, it must also be weak-form efficient. In a strong-form efficient market, security prices accurately represent both public and private information. By definition, there is also a market that is both strongly and weakly efficient. Insiders would not be able to generate abnormal gains by trading using secret information in a strong-form efficient market.

Being one of the prime indicators of market sentiment and direction, the stock price is of paramount importance to investors and firms. Efficient market prices allow for profit maximization as investors and firms are able to minimize transaction costs such as those associated with market price discovery. In essence, this denotes that resources are being allocated to their best use, a term economists refer to as "Pareto efficient allocation". In other words, investors can purchase these assets at prices that accurately reflect their underlying intrinsic values and can raise money to finance their activities by selling securities at fair prices. Prices, therefore, have a substantial and useful function in resource allocation (Note 1). As such, in the grand scheme of the economy, the spillover effects that accrues to such kind of efficiency cannot be overemphasized. A deviation from such a pretext signifies a departure from the random walk notion and the presence of anomalies which may have profound negative effects on investors, firms and the economy at large.

Research in developed countries has established conflicting findings on the topic. Tegtmeier (2021) found that globally listed private equity (LPE) markets as captured by nine indices exhibit randomness in terms of price behaviour. The study further posits that the efficiency of the sampled indices has not improved in the post-Covid 19 period. Such results are also retorted by Sathyanarayana (2021) in a study on market efficiency during the Covid-19 pandemic with prime focus on stocks listed in Bombay Stock Exchange. However, Shaikh (2016) found evidence that supports weak form efficiency for the Pakistan Stock Exchange. However, the study contends that there is no strong form efficiency.

In Africa, research is scanty owing to the under development of the stock markets which leaves a lot to be desired. The infancy nature of such markets can also be attributed to the low financial literacy prevalent in most African countries. Amadou (2021) used Partial Auto-correlation Function (PACF) to examine eight African financial markets and tested their performance in weak form. The study found that only two markets (Johannesburg and Uganda stock exchanges) were weak-form efficient with the remaining markets being inefficient at the lowest form. Empirical studies conducted remain inconclusive. Kelikume et al. (2020) utilized the wavelet unit root analysis-tool to test out EMH in selected stock markets in Africa vis-à-vis the presence of imperfections in the market. The research discovered that institutional limitations have effects on the efficient market hypothesis and stock market investment in Africa. In Malawi's case, such kind of research is limited with only Tankeh (2020) testing out the validity of the hypothesis. He concluded that the random walk hypothesis does not hold for the Malawi Stock Exchange for time period spanning from January 01, 2016, to December 31, 2019. However, the in-sample return prediction tests employed in these studies limit the consistency of the findings. As such, this current study further employs out of sample return prediction statistical tests to account for such a short fall. In addition, this paper also incorporates the recommendation made by the aforesaid previous research on the need to test for weak-form efficiency on the Malawi Stock Exchange (MSE) using actual stock prices on an extended period of observation.

In August 2011, the Malawi government in conjunction with the World Bank launched the Financial Sector Technical Assistance Project (FSTAP). Among other changes, the project targeted an improvement in financial literacy and also the automation of trading on the MSE to an advanced stage so as to improve market efficiency. With financial literacy gauged at 29% in 2018 (Financial Literacy Report, 2018), there exists a possibility of market inefficiencies stemming from cost advantages. This then begs the question: Has the MSE improved at incorporating all public information other than some historical price and volume information vis-à-vis such changes? This is one of the questions that was circumvented in the aforementioned paper and will be comprehensively investigated in this paper.

The paper studies both weak and semi-strong forms of market efficiency for the Malawi Stock Market. The period of observation is from January 01, 2011 through to June 30, 2022, amounting to 4561 daily data. The data has been collected on the Malawi All Share Index (MASI) since it is the most active index with readily available data for the Malawi Stock Market. To develop size and value portfolios, fundamental information on every company listed on the MSE has been added to the mix. The weak form of market efficiency is assessed using the Cumby-Huizinga autocorrelation test, the Phillips-Perron unit root test, and the Lo and MacKinlay's Variance ratio test. Additionally, the approach has been adjusted to include out-of-sample prediction tests and to evaluate if returns are distributed equally throughout a specific calendar period, a non-parametric Kruskal-Wallis test is utilized. What is more, the time series regression of excess returns on the combined size and value portfolios has adopted the Fama and French three-factor model (1995). This aids in establishing the MSE's semi-strong efficiency idea. The statistical software Stata 16 is used to estimate the results.

The results of the study stand to accrue benefits to investors and policy makers among other stakeholders. On one hand, investors tend to use price signals to judge market sentiment and trends. This then implies that by appraising if the market reflects all the available public information, the risks commensurate with information asymmetry will be alleviated. On the other hand, this paper will provide crucial insights to policy makers on whether the implemented projects are yielding the intended purposes or not.

2. Historic Perspective on Market Efficiency

Market Efficiency originated in the early 1900s when Bachelier introduced the idea of random and unpredictable price changes. He noted that stock prices behaved like Brownian motion and described efficient markets in terms of martingale. Kendall's study of 22 UK stocks and commodity price series in 1953 led to the random walk theory. The concept of efficient market hypothesis advanced in the 1960s and 1970s, with Samuelson's work on the randomness of anticipated price changes and Fama's empirical study on the haphazard fluctuations of stock prices. EMH assumes different levels of efficiency, with weak form implying technical analysis is not effective, semi-strong form suggesting private/insider information is necessary, and strong form stating that neither public nor private information yields above-market returns. These forms rely on certain assumptions, including zero transaction costs, costless access to information, and agreement among all participants.

3. Methodology

The study employs an approach as utilized by Yavrumyan (2015) in his investigation of efficient market hypothesis and calendar effects with proof from the Oslo Stock Exchange. A couple of modifications have been made to suit the Malawian setting and furthermore out-of-test forecast strategies have been utilized.

3.1 Random Walk Hypothesis Testing

3.1.1 Cumby-Huizinga Autocorrelation Test

Two null hypotheses are tested under this test:

$$H_0^1: disturbance\ is\ serially\ uncorrelated$$

$$H_0^2: disturbance\ is\ MA(q) process\ up\ to\ order\ q = (lag - 1)$$

The first null hypothesis states that there is no serial correlation in disturbance whereas the second null hypothesis argues that serial correlation occurs but fades away at some finite lag,

Cumby Huizinga's autocorrelation test generalizes Sargan's test for serial independence of regression errors, which in turn generalizes the test suggested by Breusch and Godfrey, as observed by Baum, Schaffer, and Stillman (2007).

3.1.2 Variance Ratio Test

Developed by Lo and MacKinlay in 1988, the test investigates the claim that log price series exhibit random walk behavior with drift.

Consider a logarithmic price random walk model as specified below:

$$ln(P_t) = \alpha + ln(P_{t-1}) + \varepsilon t, \qquad \varepsilon t \sim IID(0, \sigma^2)$$

It is assumed that the variance of its increments, $\ln(P_t) - \ln(P_{t-1})$, is linear if $\ln(P_t)$ follows a random walk. So that the variance of $\ln(P_t) - \ln(P_{t-2})$ is twice variance of $\ln(P_t) - \ln(P_{t-1})$. The assumption that logarithmic returns have a linear relationship between increments' variances is tested using the Variance Ratio test. For every time interval N that was observed, the variance ratio should equal one:

$$\mathrm{VR(N)} = \frac{V(N)}{NV(1)} = 1$$

In this instance, V(1) denotes the variance of returns observed in the initial period, while V(N) denotes the variance of returns observed over N periods.

The formula for the N-period variance ratio is true if RWH is false:

$$VR(N) = 1 + \frac{2}{N} \sum_{\tau=1}^{N-1} (N - \tau)\rho_\tau \qquad (1)$$

where ρ_τ is correlation coefficient.

The variance ratio ought to be the same under the null hypothesis, indicating that returns are uncorrelated. The variance ratio is equal to 1 minus the correlation term if the null hypothesis is rejected.

The heteroskedasticity problem, non-normal increments, and ARCH processes all have no effect on Lo and MacKinlay's Variance Ratio test statistic, but correlated price changes affect it.

3.1.3 Unit Root Test

The hypothesis that the variable follows a random walk process, or alternatively that it has a unit root, is tested using the Phillips-Perron unit root test. Serial correlation was taken into consideration in the Dickey-Fuller statistic by adding additional lags to the model.

Phillips-Perron's test stipulates fitting the following model:

$$y_t = \alpha + \rho y_{t-1} + \delta t + u_t \quad (2)$$

It is possible to rewrite the model in terms of logarithmic stock prices:

$$\ln(P_t) = \alpha + \rho\ln(P_{t-1}) + \sigma t + u_t$$

Two approaches are tested:

1) Including trend and drift term in the model ($\alpha \neq 0$ and $\delta \neq 0$);

2) Including only drift term in the model ($\alpha \neq 0$ and $\delta = 0$).

In both cases hypotheses that are tested are represented by:

$$H_0: \rho = 1 \ against \ H_a: \rho < 1$$

The time series is integrated of order 1 under the null hypothesis, meaning the variable has a unit root. The alternate theory claims that a stationary mechanism produced the variable.

3.2 Calendar Anomalies

By employing ARCH-type models, all methodologies used in this section identify the existence of calendar effects.

3.2.1 Kruskal Wallis Rank Test

The tested data is arranged in rank order from 1 to N, with 1 designating the smallest value and N the largest.

The test statistic is as follows when there are no linked values:

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{m} \frac{R_j^2}{N_j} - 3(n+1)$$

Here, R_j is the sum of the ranks of the j group, m is the number of groups, N_j is the size of the j group and N is the total sample size. The sampling distribution of the test statistics is approximately chi squared with m-1 degrees of freedom, that is, $H \sim X_{m-1}^2$.

3.2.2 Day-of-the-Week Effect Testing

Following Borges (2009), the proceeding models are estimated to test for the day-of-the-week (DOW) effect, which includes returns on the MASI that vary for various weekdays:

OLS regression prediction with the bootstrap method:

$$r_t = const + \beta_i DOW_{i,t} + \varepsilon_t \quad (3)$$

where r_t stands for returns on MASI, $DOW_{i,t}$ is the day-of-the-week dummy, that equals to 1 when returns are observed on i's day of the week. Subscript i takes values of 1, 2, 3, 4, 5, that stands for Monday, Tuesday, Wednesday, Thursday and Friday respectively.

Other calendar effect testing, in particular turn-of-the-month and turn-of-the-year testing, also employs a bootstrap method.

EGARCH(1,1)-t model:

$$r_t = const + \beta_i DOW_{i,t} + \sum_{i=1}^{n} \lambda_{t-i} r_{t-i} + \varepsilon_t \quad (4)$$

Conditional variance equation:

$$lnVAR(\varepsilon_t) = \ln(\sigma_t^2) = \alpha_0 + \gamma_1 z_{t-1} + \varsigma_1(|z_{t-1}| - E|z_{t-1}|) + \gamma_2 ln\sigma_{t-1}^2$$

where $rt-i$ are lags of returns on index. The lags are included in the model based on the autocorrelation test results.

3.2.3 Turn-of-the-Month Effect Testing

The following model is estimated to evaluate whether the turn-of-the-month effect (TOM) exists on MASI:

EGARCH(1,1)-t model, mean equation:

$$r_t = \sum_{i=-7}^{81} \alpha_i TOM_{i,t} + \alpha_0 ROM_t + \sum_{i=1}^{n} \lambda_{t-i} r_{t-i} + \sum_{i=1}^{k} \beta_i DOW_{i,t} + \varepsilon_t \tag{5}$$

Here, $TOM_{i,t}$ is a window of (-7, -6,..., +7, +8) trading days, or turn-of-the-month dummy variables for the seven last trading days of the month and the first eight trading days of the following month. For instance, when returns are observed on the first trading day of the month, $TOM_{+1,t}$ equals 1, and when returns are not, it equals 0. The rest of the month dummy variable ROM_t has a value of 0 for returns within the window (-7, -6,..., +7, +8) and a value of 1 for returns on other days of the month. The day-of-the-week dummy is $DOW_{i,t}$ with index i = 1 ,2, 3, 4, 5 representing Monday, Tuesday, Wednesday, Thursday and Friday respectively.

3.2.4 Turn-of-the-Year Effect Testing

The following mean equation of the EGARCH(1,1)-t model estimates the conventional end-of-year effect:

$$r_t = const + \sum_{i=1}^{k} \beta_i DOW_{i,t} + \alpha_1 TOY_t + \sum_{i=1}^{n} \lambda_{t-i} r_{t-i} + \varepsilon_t \tag{6}$$

where TOY_t is a traditional turn-of-the-year dummy that is symbolized by a window of (-1, +1,…, +5) trading days, that is, the last trading day in December and the first five trading 28 days in January. When cumulative returns are noted on the final trading day of December and the first five trading days of January, TOY_t equals 1 and 0 otherwise.

3.3 Fundamental Anomalies

3.3.1 Size and Value Effects Testing

Fama and French (1995) proposed a three-factor model to study excess returns. This model, as specified below, is better than the Capital Asset Pricing Model (CAPM) as it accounts for size and value effects.

$$E(R_{it}) - R_{ft} = \beta_{iM}(E(R_{Mt}) - R_{ft} + \beta_{is} E(SMB_t) + \beta_{ih} E(HML_t) \tag{7}$$

Where $E(R_{it})$ is the expected return for portfolio i, R_{ft} is the risk-free rate, R_{Mt} is the market rate of return, SMB_t (small minus big) is the difference between returns on portfolios of high and low B/M stocks and HML_t is the difference between returns on small- and large-cap stocks.

Since the portfolios are appraised independently, the model is applied to time regression as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_{iM}\left(R_{Mt} - R_{ft}\right) + \beta_{is} SMB_t + \beta_{ih} HML_t \varepsilon_t - \varepsilon_{it} \tag{8}$$

3.4 Out-of-Sample Prediction Tests

The Arima (2,0,2) out-of-sample forecasting model is employed to test the consistency of findings. This model is run in two folds: ex-post and ex-ante forecasting. The proxy for returns is deduced as follows:

$$rsp_t = \frac{D.ClosingPrice}{L.ClosingPrice} \tag{9}$$

Where rsp_t is the return, $D.ClosingPrice$ is the difference in closing price and $L.ClosingPrice$ is the lag in closing price

4. Results and Discussion

4.1 Random Walk Hypothesis

4.1.1 Autocorrelation Test

The Cumby Huizinga autocorrelation test for the Malawi All Share Index (MASI) has two null hypotheses: the first is that the disturbance is serially uncorrelated, and the second is that the disturbance is an MA(q) process up to order q= (lag-1). The findings are presented for a 10 lag length and, at the 5% level of significance, they are consistent with the hypothesis of serially uncorrelated residuals of the returns on the MASI. This is shown in table 1.

Table 1. The Cumby-Huizinga autocorrelation test results for returns on MASI

H_0: q=0 (serially uncorrelated) H_a: s.c. present at range specified				H_0: q=specified lag-1 H_a: s.c. present at lag specified			
Lags	chi2	df	p-val	lag	chi2	df	p-val
1 – 1	1.771	1	0.1833	1	1.771	1	0.1833
1 – 2	1.791	2	0.4083	2	0.041	1	0.8391
1 – 3	3.191	3	0.3631	3	1.433	1	0.2313
1 – 4	4.512	4	0.3411	4	1.434	1	0.2311
1 – 5	4.586	5	0.4684	5	0.040	1	0.8421
1 – 6	4.678	6	0.5858	6	0.700	1	0.4029
1 – 7	4.681	7	0.6988	7	0.363	1	0.5469
1 – 8	4.855	8	0.7730	8	0.696	1	0.4043
1 – 9	5.193	9	0.8172	9	0.524	1	0.4693
1 – 10	5.883	10	0.8250	10	1.461	1	0.2268

Note. The test is robust to heteroscedasticity.

4.1.2 Variance Ratio Test

As depicted in Table 2 below, the Variance Ratio, given by the equation (1), of the logarithmic prices on the MASI is below 1 which reveals the presence of insignificant evidence to reject the null hypothesis of log prices following a random walk process. This is further substantiated by the p-value at different periods (q= 2 4 8 16). As such, this implies weak-form efficiency for the Malawi Stock Market.

Table 2. The Overlapping Lo and MacKinlay's Variance Ratio test results

q	N	VR	R_s	p>|z|
2	4545	0.928	-0.4773	0.6332
4	4545	0.639	-1.3109	0.1899
8	4545	0.321	-1.7613	0.0782
16	4545	0.163	-1.8674	0.0618

Note. Test statistics robust to heteroscedasticity.

It is also pertinent to note that the Variance Ratio (VR) becomes smaller as q increases, that is, for q=8 and q=16 the variance ratios are 0.321 and 0.163 respectively.

4.1.3 Unit Root Test

The findings of the unit root test for the log closing prices on the MASI are shown in Table 3 below. The Phillips-Perron (PPerron) test's null hypothesis is that each series contains a unit root, and the method entails fitting the model provided by equation (2). By using the Newey-West serial correlation robust standard errors, the test takes into consideration the heteroskedasticity and serial correlation issues..

Table 3. The unit root tests of the log closing prices on the MASI

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	MacKinnon Approximate P-Value
PPerron (no trend)	-3.523	-3.430	-2.860	-2.570	0.0074
PPerron (with trend)	-19.785	-3.960	-3.410	-3.120	0.0000

The results of the Phillips-Perron test provide significant evidence to reject the null hypothesis of the presence of unit root in the log prices. This then imply that the price series follow a random walk process and are steady since the absence of unit root denotes stationarity.

4.1.4 Summary

The RWH's test findings were presented in this section. As evidenced by the logarithmic closing prices on the MASI, which showed increasing market efficiency, the findings support the random walk hypothesis. The results posit significant evidence to substantiate the claim that markets are efficient. The results of the variance ratio test for log closing prices on the MASI point to a failure to reject the hypothesis that stock prices follow a random walk. This contradicts findings by Tankeh (2019). The findings of the Phillips-Perron unit root test, which takes into account serial correlation in series, are in favor of the theory that log stock prices do not have a unit root and instead follow a stationary process.

4.2 Calendar Effects

4.2.1 Day-of-the-Week Effect

The results from the application of equation (3) and (4) are presented in Table 4 below. It is evident that the day-of-the-week effect is absent in the returns on the MASI with the Friday effect being non-existent. This is further verified by the bootstrap procedure as the effect still appears insignificant for all the days included the Friday effect which appears. Kruskal-Wallis test results confirm equal distribution of returns on the MASI for the tested periods.

Table 4. The estimated results for the day-of-the-week anomaly

Weekday	EGARCH (1,1)-t	Regression (bootstrap.)
1	0.0976	0.7229
	(0.578)	(0.329)
2	0.1502	0.1571
	(0.124)	(0.326)
3	-0.1194	-0.0008
	(0.979)	(0.597)
4	-0.1158	0.0003
	(0.999)	(0.264)
5	-	0.1627
		(0.303)

Kruskal-Wallis Test: chi-squared = 3.869 with 6 d.f.
probability = 0.6944
chi-squared =4.344 with 6 d.f.
probability = 0.6303

4.2.2 Turn-of-the-Month Effect

The results for TOM effect, as shown in Table 5, are obtained from the estimation of the equation (5). From the results, it is evident that the TOM effect is absent. This is substantiated by the results of the bootstrap regression procedure which is not reported here to avoid burdensome tables.

Table 5. Turn-of-the-month effect in the returns on the MASI

	Coef.	OPG Std. Err.	Z	p>|z|	[95% conf. Interval]	
Return						
-7	-0.1230166	0.0000415	-2962.89	0.000	-0.123098	-0.1229352
-6	-0.1223026	0.0000334	-3659.62	0.000	-0.1223681	-0.1222371
-5	-0.1267074	0.0000315	-4028.32	0.000	-0.126769	-0.1266458
-4	0.1091821	2.09e-06	5.2e+04	0.000	0.109178	0.1091862
-3	-0.1225226	0.0000367	-3340.03	0.000	-0.1225945	-0.1224507
-2	-0.121845	0.0000259	-4710.44	0.000	-0.1218957	-0.1217943
-1	-0.11984	0.0000476	-2519.36	0.000	-0.1199332	-0.1197467
+1	-0.1228411	0.0000891	-1378.01	0.000	-0.1230158	-0.1226663
+2	-0.1237312	0.0000769	-1608.99	0.000	-0.1242371	-0.1221128
+3	-0.121003	0.0000418	-2895.23	0.000	-0.1210849	-0.120921
+4	0.1927286	1.94e-06	9.9e+04	0.000	0.1927248	0.1927324
+5	-0.1224216	0.0000374	-3271.16	0.000	-0.1224949	-0.1223482
+6	0.1619426	1.94e-06	8.4e+04	0.000	0.1619388	0.1619464
+7	-0.1229309	0.0000506	-2430.90	0.000	-0.12303	-0.1228318
+8	-0.1213198	0.0000309	-3929.75	0.000	-0.1213803	-0.1212593
ROM	-0.1230868	2.85e-06	-4.3e+04	0.000	-0.1230924	-0.1230812

4.2.3 Turn-of-the-Year Effect

Table 6 depicts the results for the turn-of-the-year effect in the MASI, obtained by applying equation (6). It is clear, from the results, that the turn-of-year effect is insignificant for the existent days within the cohort and non-existent for the 2nd and 3rd day of the new year. Needless to say that the TOY effect is absent in the returns on the MASI.

Table 6. Turn-of-the-year effect on the MASI's returns

	Coef.	OPG Std. Err.	Z	p>|z|	[95% conf. Interval]	
Return						
-1	-0.0883367	595.7998	-0.00	1.000	-1167.835	1167.658
+1	-0.1228411	0.0000891	-1378.01	0.000	-0.1230158	-0.1226663
+2	-	-	-	-	-	-
+3	-	-	-	-	-	-
+4	0.097438	1412.82	-0.00	1.000	-2769.169	2768.983
+5	-0.0920791	31429.76	-0.00	1.000	-61601.3	61601.11

4.3 Fundamental Effects

4.3.1 Size and Value Effects

Table 7 below portrays the results from the application of equation (8) in assessing the size and value effects on the 4 portfolios.

Table 7. Size and value effect results for companies on MSE

	α_i	β_{iM}	β_{iSMB}	β_{iHML}	R^2
Big Cap. Portfolio	-2.36744	0.8782374	-0.0736752	-0.0005225	0.8679
	(-5.29)	(28.33)	(-1.56)	(-1.53)	
Small Cap. Portfolio	-2.847635	0.898317	0.8260963	-0.0011036	0.9456
	(-7.55)	(34.41)	(20.74)	(-3.84)	
High B/M Portfolio	69.17493	-0.8972798	-1.325703	0.8333972	0.7265
	(1.04)	(-0.19)	(-0.19)	(16.41)	
Low B/M Portfolio	30.79144	2.480602	-0.5517868	-0.001019	0.1150
	(3.48)	(4.05)	(-0.59)	(-0.15)	

As can be seen from the table, there is significant evidence for the three risk factors in the small cap portfolio while as with the big cap portfolio only the risk premium is statistically significant at 0.05. Pertinent to that, the size effect is positive with the former as compared to the latter portfolio. This then implies that small cap stocks tend to outperform big cap stocks on the MSE which confirms the presence of the size anomaly. A superior R-squared of 0.9456 for the small cap portfolio further cements the relevance of these risk factors in explaining excess returns in such stocks.

On the other hand, a high Book-to-Market (B/M) ratio is commensurate with a low Price-to-Earnings (P/E) or Market-to-Book (M/B) ratios. According to the results, the value effect is positive and statistically significant in high B/M portfolio as compared to the low B/M portfolio where it is negative and insignificant. This then means that, ceteris paribus, high B/M or low M/B stocks tend to outperform low B/M stocks. Only the risk premium is statistically significant for the low B/M portfolio. A superior R-squared of 0.7265 shows that the risk factors largely contribute to the excess returns with the high B/M stocks.

4.3.2 Summary

The results from the testing of calendar and fundamental anomalies reveal the absence of most of the former set of anomalies such as day-of-the-week and turn-of-the-year anomalies. However, it has been established that the turn-of-the-month effect and fundamental anomalies like the size effect are present on the Malawi Stock Market. Testing on the size and value effects confirm the presence of such anomalies on the MSE as per the results from the time series regression of the Fama and French model.

4.3.3 Out-of-Sample Prediction Results

Results from the estimation of the ARIMA (2,0,2) model with time restriction for the ex-post model in Table 8 below show that all four lags are significant at 1% level of significance thus making it a reliable model for forecasting.

Table 8. ARIMA Ex-Post Prediction Model

	rsp	Coef.	OPG Std. Err.	z	p>|z|	[95% conf. Interval]	
rsp							
	_cons	0.002479	0.0003639	0.68	0.496	-0.0004652	0.0009611
ARMA							
	ar						
	L1.	1.013182	0.402267	25.19	0.000	0.9343387	1.092025
	L2.	-0.3777428	0.0422616	-8.94	0.000	-0.460574	-0.2949117
	ma						
	L1.	-1.117399	0.0413256	-27.04	0.000	-1.198396	-1.036402
	L2.	0.2531087	0.0491868	5.15	0.000	0.1567044	0.349513
	/sigma	0.016574	0.000022	752.37	0.000	0.0165308	0.0166172

Note. The test of the variance against zero is one sided, and the two-sided confidence interval is truncated at zero.

An ex-post out-of-sample prediction of the ARIMA model of returns shows divergence between the real returns on the MSE and the predicted values as seen in Figure 1 below. This then substantiate the random walk findings by the variance ratio test in section 4.1 implying that investors would not be able to outperform the market by aid of historical information on price and volume to predict how the market will perform.

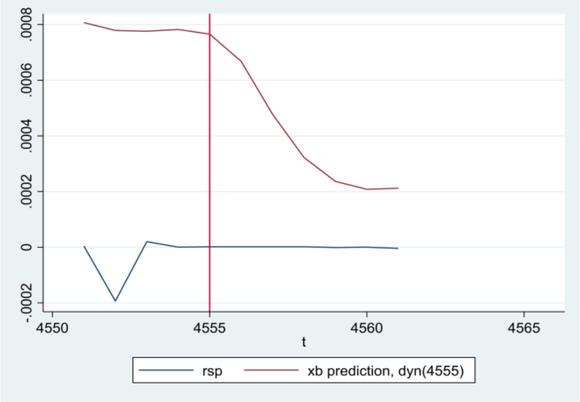

Figure 1. Ex-Post Prediction

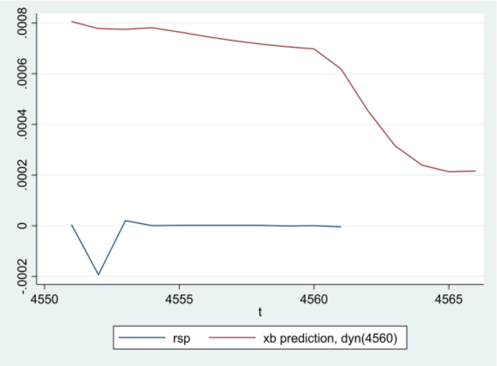

Figure 2. Ex-ante Prediction

An ex-ante prediction of the model yields roughly similar results to the ex-post forecasting as all the lags are significant at 1% level of significance as well. The ex-ante forecasting appraises the power of prediction beyond the size of the sample. It is evident from Figure 2 that the predicted returns continue to be divergent from the trend trajectory of real returns.

5. Conclusions and Future Prospects

In this paper, weak-form and semi-strong efficiencies of the Malawi Stock Market were investigated. The Malawi Stock Market is described by the Malawi All Share Index (MASI) as it is the most active of all the three indices on the market. The fact that the MASI characterizes the whole market means that it provided a comprehensive proxy to ascertain the objectives of the study. The tested period ranges from January 2010 through to June 2022, amounting to 12years and 6months.

First, the variance ratio, unit root, and autocorrelation tests were used to evaluate the weak version of market efficiency. The findings of the variance ratio test and unit root test, which were used to test the random walk hypothesis, show that the market is weakly form efficient for closing prices on the MASI. This suggests that using technical analysis of historical prices is not a reliable way to consistently outperform the market.

An investigation of the calendar and fundamental anomalies also revealed nuances crucial to assess the weak form and semi-strong efficiencies of the market. The study finds that calendar effects as captured by the day-of-the-week effect and turn-of-the-year effect are insignificant but finds significant evidence for turn-of-the-month effect on the Malawi Stock Market giving a strong inclination towards weak form efficiency. An appraisal of the fundamental anomalies found that both the size and value effects exist on the Malawi Stock Market. The presence of such anomalies contradicts the semi-strong form of market efficiency.

As such, the study finds the Malawi Stock Market to be weak-form efficient but semi-strong inefficient. It then follows that technical-oriented investment strategies that are premised on historic volume and price data will not yield above average yields in Malawi. Hence, investors need to increasingly make use of publicly available financial information to harness superb returns. Furthermore, by virtue of being weak-form efficient means that the FSTAP has not had profound impact as the stock market as it still falls short of the semi-strong form which is virtually the main target of the project. This is notwithstanding the strides the project has mustered so far. Compared with previous research, this paper employs an improved approach with out-of-sample prediction techniques, utilization of actual stock prices on an extended window of observation to comprehensively ascertain the consistency in findings. Additionally, the paper also employs the Fama and French three-factor model to appraise the impact of risk factors on excess returns for stocks on the MSE. Nevertheless, lack of proper and concise source of news with which semi-strong efficiency is adequately assessed presented a major limitation for the study. This then presents a grey area that can be explored in further research on market efficiency with regards to the Malawi stock market.

Declaration of Competing Interest

We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

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Notes

Note 1. Economies 2019, 7, 7; doi:10.3390/economies7010007

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