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*Research Article*

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# Weak Form of Market Efficiency in Nepalese Stock Market

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**ABSTRACT**
This study investigates the weak form of market efficiency in the Nepalese stock market, focusing on the overall index and its sub-indices from 2013 to 2022. The weak form of market efficiency hypothesis posits that all historical price and volume information is reflected in current market prices, making it impossible to achieve abnormal returns through past data analysis. This study utilized the Kolmogorov-Smirnov test, run test, and Hurst exponent as an analytical tool. The findings reveal a rejection of the null hypothesis of weak form market efficiency across most sectors with p - value < 0.05. This indicates that the Nepal Stock Exchange (NEPSE) does not exhibit weak-form efficiency, which suggest that technical analysis could be effective for generating abnormal returns. The research contributes to existing literature by providing evidence of return predictability within NEPSE, emphasizing implications for technical analysis and investment strategies in developing markets. Furthermore, it highlights the significance of recognizing predictable patterns in historical returns across NEPSE and its sectoral indices. The application of the Hurst exponent offers a valuable methodological approach for analyzing return predictability in developing markets like Nepal. Ultimately, this study underscores the necessity for investors and policymakers to understand market inefficiencies and leverage them for enhanced investment strategies. The results advocate for further exploration into market dynamics and investor behavior within the context of Nepal's evolving financial arena.

**Keywords:** Weak Form of Efficient Market Hypothesis, Random Walk, Discrete Wavelet, Hurst Exponent, Autocorrelation

## Introduction

The concept of market efficiency refers to the extent to which prices in the market accurately reflect all relevant information. The Efficient Market Hypothesis (EMH), developed by Fama (1970), posits that markets are efficient, and all information is already incorporated into prices, leaving low opportunity for investors to achieve above-average returns through active investing. According to EMH, stock prices always trade at their fair value on exchanges, making it impossible to purchase undervalued stocks or sell stocks at inflated prices [1]. Consequently, outperforming the overall market through stock selection or market timing is improbable, and higher returns can only be achieved by purchasing riskier investments. EMH thus suggests that matching market returns through passive index investing is the optimal strategy [2].

EMH identifies three levels of market efficiency: weak, semi-strong, and strong. The weak form, also known as the random walk theory, asserts that past price movements cannot predict future securities prices. The semi-strong form contends that prices reflect all publicly available information in addition to historical data [3]. The strong form of EMH posits that prices also incorporate private, insider information [4]. In an efficient market, stock prices only fluctuate with new, unpredictable information, leading to random price movements without detectable trends [5]. According to author in, stock price changes are unrelated to prior fluctuations, indicating no historical memory of price variations [6].

The study of EMH has ignited significant debate among financial economists. In the Nepalese stock market, various studies have examined EMH's validity. For instance, author in concluded that the Nepalese market is not efficient, allowing opportunities for above-average returns through diverse strategies [7]. Author in found the market weak-form efficient only after adjusting

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for infrequent trading [8]. Conversely, author in reported inefficiency in the weak form, suggesting predictability of future price movements based on past trends [9]. Despite these studies, no consensus exists regarding Nepalese market efficiency [7-11]. The market has grown in size and volume following the introduction of an online trading system, intensifying discussions on market predictability and efficiency [12].

The weak form of market efficiency remains a contested topic globally, with studies yielding mixed results. While some researchers argue that past prices lack predictive value for future returns, others have identified patterns in historical data that may forecast future performance [13-15]. Nepalese studies largely refute weak-form efficiency, with few exceptions [11]. Furthermore, there is a lack of consensus on the methodologies used to test the weak form of EMH, highlighting the need for a comprehensive and context-specific approach to this topic.

This study aims to assess the weak form of market efficiency in the Nepalese stock market, including sectoral indices and sensitive index, from 2013 to 2022. It employs a healthy methodology tailored to the distinctive characteristics of the Nepalese market. Despite widespread belief in market efficiency, this research seeks to contribute to ongoing debates by addressing the research questions: 1. Are the daily and weekly returns normally distributed? 2. Do the daily and weekly return series follow the random walk proposition? 3. Are the daily and weekly returns independent? 4. Do the Nepal Stock Exchange (NEPSE) and sub-indices return series exhibit identifiable patterns and cycles at multiple scales?

The main objective of this study is to assess the weak form of market efficiency in Nepalese stock exchange. Specifically, the study aims:

1. To examine the normality of distribution of returns of NEPSE and sub - indices.
2. To examine the randomness of returns of NEPSE index and sub-indices.
3. To analyze the independence of returns of NEPSE index and sub-indices.
4. To analyze patterns and cycles at multiple scales of resolution.

Overall, the results of these tests will be helpful to determine the extent to which the Weak form of efficient market hypothesis (WEMH) holds for the Nepalese stock market.

The structure of the study is carried out in the following manner. Section one – introduction: it contains the background, statement of the problem, research objectives. Section two literature review - this section comprised the review of relevant literature nationally and internationally as necessary. Section three is research method which provides the details of the research design, population and sample, nature and sources of data, research hypothesis and analytical tools. Section four is result and discussion; it consists of summary measures and results of testing hypothesis. The final section of this study is summary and conclusion. This section summarizes key points of the study and it also includes conclusion with future implication.

**Empirical Review**

A review of several published literature on the area of EMH in different form such as weak, semi strong and strong shows that EMH were examined in several developed and emerging market with differing results, for instance, authors in found that capital market does not exhibits WEMH which suggest future returns are predictable [16-18]. Nonetheless, author in found that the stock markets of the United States exhibit the WEMH [19]. Under those circumstances, investor cannot outperform the market even if they prefer efficient investing strategy. Likewise, author in showed the result of 17 European countries demonstrating weak form of efficiency i.e. investors cannot beat the market [20]. Equally author in also studied the WEMH of five emerging equity markets in Latin America on which markets from Argentina, Brazil, Chile, and Mexico do not exhibit WEMH [21]. Similarly, a study conducted by author in found that emerging markets in eight countries were not efficient using unit root test and GARCH model [22]. Furthermore, another study on the stock markets of 14 Asia-Pacific nations which were performed by author in, found inefficient markets. There is dissension among authors regarding the WEMH [23].

In addition to this, Asian securities market has also undergone several tests to determine their efficiency such as empirical proof of market inefficiency in the Indian stock markets was presented by authors in [24-29]. Nevertheless, other studies that looked at the Indian stock markets came up with conflicting findings [30]. On the other hand, another asserted that the Indian stock market was efficient in weak form [31]. Authors in performed a study on selected Asian market with mixed result on the evidence of WEMH [32]. Author in conducted a study to test the WEMH in the Amman Stock Exchange (ASE) using autocorrelation (AC) test, runs test, and unit root test and presented ASE as inefficient in weak form [13].

Voluminous studies have examined the efficiency of the Nepalese stock market and have found mixed results like in discovered calendar anomalies and concluded that the Nepalese market is inefficient [33]. Author in presented the finding that did not support the EMH [34]. Author in also attempted to test a WEMH for neutral behavioral factors such as weather and biorhythms on the Nepalese stock market, but the results were mixed [35]. Authors in found that the Nepali stock markets are inefficient, while author in found evidence of efficient market behavior in some equities [36-38]. Another study showed that the Nepalese stock market is inefficient [9]. Which suggests that historical price movements can predict future price changes.

The efficiency of the Nepalese stock markets has been the subject of conflicting studies. For example, authors in discovered unequivocal evidence that the Nepalese stock market is not efficient in weak form [34,36]. When tests were performed by author in observed NEPSE Index data after the adjustment for thin trading, produced inconsistent results [11]. The majority of the research was done using data until 2017 except finding in [9,39]. The Nepalese stock markets have undergone numerous modifications since that time such as the amount of trading has grown dramatically over time, investors are becoming more and more aware of security analyses and information transmission is becoming more effective every day [9,12]. Widespread use of online trading system during the lockdown period is also one of the major modifications felt by the Nepalese Stock Market [39]. This shows the efficiency of NEPSE has been subject to conflicting studies.

A review study conducted by author in found that, despite a vast amount of research on the weak form of market efficiency over more than a half century, there is no harmony in the financial literature on the validity of the efficient market hypothesis [14]. A contribution made by authors in on EMH using wavelet analysis and concluded that market reject the WEMH, methodologically these studies are differing with predecessor [40,41]. On top of that, there is also no agreement on the use of analysis methods followed to test the WEMH.

The literature on the efficiency of the stock market is inconclusive, with some studies finding evidence in favor of the efficient market hypothesis with the finding of and others finding evidence against it are in [9,11,16-19,39]. These conflicting results may be due to the use of different methods and data, as well as differences in the markets and time periods being studied. Additionally, there is a lack of research on the use of wavelet analysis to examine the efficiency of stock markets, particularly in developing countries like Nepal. This is an important area for future research, as wavelet analysis has the potential to provide a deeper understanding of the stock market and to identify patterns and trends that may not be visible using other methods [40].

Thus, this study endeavors to delve into the intricacies of WEMH in the NEPSE, by breaking it down into two distinct levels: the NEPSE index and individual NEPSE indices, using daily and weekly data, akin to [11]. Additionally, this study employs the technique of Discrete Wavelet Transform to uncover patterns that may exist. The examination will span from the year 2013 to 2022.

The literature on the efficiency of stock markets is inconclusive, with the studies finding evidence in favor of the WEMH and others finding evidence against it. Studies have been conducted in several developed and emerging markets, including the United States, Europe, Asia-Pacific, India, and Nepal. In some cases, the results of studies conducted in the same market have been conflicting. Additionally, there is no agreement on the use of analysis methods followed to test the WEMH. Despite a vast amount of research on the weak form of market efficiency, there is no harmony in the financial literature on the validity of the efficient market hypothesis. Recent studies using wavelet analysis have also found evidence against the WEMH. The situation is still a debatable issue and requires further exploration, particularly for emerging economies.

## Research Method

### Introduction

There have been several studies on the predictability of stock market returns in developed markets using traditional and newer statistical models, such as K - S test, run test, unit root test, variance ratio models, cross-sectional regression and wavelet analysis. To become confident on the findings and theories being tested, multiple statistical tools are used in this study.

### Research Design

A descriptive and experimental research design is used with the sample consisting of overall NEPSE index and 13 sectoral indices of Nepal Stock Exchange. Data were collected for a period of ten years to ensure sufficient sample size and to allow for the analysis of long-term trends since this period covers bull and bear both.

### Research Hypothesis

The following are the four research hypotheses for examining WEMH using stock market data.

**Hypothesis 1: Normality.**

**H1:** The returns of NEPSE and its sub-indices do not follow a normal distribution.

**Hypothesis 2: Predictability of past return.**

**H2:** The returns of NEPSE and its sub-indices do not follow a random walk.

**Hypothesis 3: Serial independence**

**H3:** The changes in price of NEPSE and sub-indices are not independent.

**Hypothesis 4: Generalized Hurst Exponent**

**H4:** Hurst exponent of the financial time series data is not equal to 0.5.

### Population and Sample

This study used daily closing prices of NEPSE sub-indices, and NEPSE index itself ranging from Mid - July 2013 to Mid - July 2022. Data will be collected from the publicly available source namely - NEPSE official site. A total of 14 sub-indices and one NEPSE index closing price will be collected for analysis. The total population of the study is represented by sampling the NEPSE index and all NEPSE sub-indices to examine weak form efficiency in Nepal. Returns will be computed by using the natural log same as the computation followed by study [11,40-43].

$$R_t = \ln\left(\frac{p_t}{p_{t-1}}\right) \text{ X } 100 \qquad (1)$$

Where,

$R_t$ = Logarithmic return

Ln = Natural log

$p_t$ = Current closing price

$p_{t-1}$ = Previous closing price

### Data Analysis Methods

This research utilized descriptive and experimental research design. Descriptive statistics provide a profile of the data, while experimental analysis, incorporating the Runs test, Kolmogorov-Smirnov goodness-of-fit test, autocorrelation analysis, and wavelet analysis, examines the weak form of market efficiency.

Kolmogorov – Smirnov goodness of fit test: The Kolmogorov-Smirnov test (Karson, 1968) is used to decide if a sample comes from a population with a specific distribution and is defined by;

$$D = \max| F(x)-G(x)| \qquad (2)$$

Where F(x) is the expected cumulative distribution function of the sample, G(x) is the cumulative distribution function of the population. The value of D is calculated for all values of x in the sample, and the maximum value is taken as the test statistic. The non-parametric Kolmogorov-Smirnov (K-S) test assesses the goodness-of-fit between a dataset and a specified distribution, without distributional assumptions [44]. A p-value below 0.05 (at a 5% significance level) rejects the null hypothesis of distributional fit [45].

Run Test: The Run test evaluates serial independence in return streams, testing the random walk hypothesis [46]. By analyzing sequences of positive (+) and negative (-) returns relative to the mean, it assesses the frequency of non-consecutive events to determine if returns are randomly distributed [46]. Calculating the mean and variance is done as follows:

$$\mu = \frac{2n_1n_2}{n} = 1 \tag{3}$$

$$\sigma^2 = \frac{2n_1n_2 \, X \, 2n_1n_2 - n}{n^2 \, X \, (n-1)} \tag{4}$$

Standard normal Z value used to conduct the run test followed by.

$$Z = \frac{O-E}{\sqrt{\sigma^2}} \tag{5}$$

Where,
Z = Standard normal z – statistics
O = Observed
E = Expected

When a p-value is found to be less than 5% level of significance, the null hypothesis is rejected, indicating the presence of non-random patterns or runs in the return series [45]. This suggests that the weak form of the efficient market hypothesis does not hold true.

**Ljung - Box Test:** Autocorrelation measures the similarity between a time series and its lagged values, with higher values indicating stronger correlation [23]. In efficient markets under the submartingale condition, weak serial correlation may exist, and the Ljung-Box Q statistic, following a chi-square distribution, tests for autocorrelation [6].

$$Q_m = n(n+2) \sum_{j=1}^{m} \frac{r^2}{n-j} \tag{6}$$

Where,
$r_j$ is the accumulated sample autocorrelations.
m is the time lag

**Wavelet Analysis:** The wavelet analysis is a mathematical tool that can be used to test the weak form of market efficiency, which states that past price movements do not provide any useful information for predicting future price movements [40]. The general equation for wavelet analysis involves decomposing a signal into a series of wavelets, which are oscillating functions that have a localized frequency spectrum. The wavelets are constructed using a mother wavelet, which is a basic oscillating function that is used as a building block for the wavelets [47].

In the context of testing the weak form of market efficiency, wavelet analysis can be used to analyze the time-varying behavior of asset prices and compare them to a random walk model. This can be done by comparing the wavelet coefficients of the asset prices to those of a random walk signal, and testing whether there is any statistically significant difference between the two [48]. Author in [49] elegantly defined a mother wavelet as such: let $\Psi_o(t)$ be an oscillating function, with a finite support of order m, that adheres to the properties of having a null average and being constrained by $L_R$.

$$\int_R \Psi_o(t)dt = 0 \tag{7}$$

This function of t must be following the two conditions

a. Condition of admissibility $C_\Psi = \int_R \Psi\,(f)df < \infty$ and
b. Condition of regularity $\int_R t^k\, \Psi(t)dt \equiv 0 \;\forall k=0,\ldots N-1$

Where, $\Psi(f)$ represents the Fourier transform of $\Psi$. The first condition ensures rapid convergence of $\Psi(f)$ to 0 when $f \rightarrow 0$.

Discrete Wavelet Transform (DWT): The wavelet coefficients, serving as a reflection of the signal's variations across various scales, possess a distinct significance. For instance, the level one coefficient captures the signal's most intricate and high-frequency components, corresponding to variations of the highest resolution [50]. Meanwhile, the other coefficients denote variations of progressively larger scales or lower resolutions. These coefficients may diverge significantly from the genuine fluctuations of the data sets [51]. In the following section deeper understanding of the estimation of Hurst exponents are outlined.

Let $x_t(t = 1, 2, 3, ..., N)$ be a time series of length N. To begin, the "profile" (referred to as $Y_i$) is determined by taking the cumulative sum of the series after subtracting the mean.

$$Y_i = \sum_{t=1}^{i} [x_t - \langle x \rangle],\ i=1...,N \tag{8}$$

Further, after extraction of the statistics of scale dependence by transforming the profile of the time series into the wavelet space, the coefficients of wavelets at various scales are used to determine the fluctuation function [52]. The lower scale wavelet coefficients encapsulate the high-frequency details of the series, while the higher scales capture the low-frequency details. By applying the discrete wavelet transform over the given time series, the wavelet coefficients for various scales are obtained.

$$W_{j,k} = 2^{j/2} \sum_{i=0}^{n} y_i\, \Psi(2^j\, t-k) \tag{9}$$

Here j is the scaling index and k represents the translation variable.

Owing to the adherence of orthogonality condition, the information of the time series at various scales can be obtained with clarity through the use of the discrete wavelet transform. The elimination of any polynomial trends present in the time series is achieved by performing the wavelet transform using the Daubechies basis [53]. For the purpose of DWT, Daubechies-4 wavelets is employed.

The wavelet power is calculated by aggregating the squares of the coefficient values for each level.

$$A(j) = \sum_{k=0}^{\frac{k}{2^j}-1} W_{j,k}^2 \tag{10}$$

To give an understanding of the time series, the fluctuation function F (s) is extracted from the cumulative power spectrum at a specific level s.

$$F(s)= [\sum_{j=1}^{s} A_j]^{1/2} \tag{11}$$

The scaling behavior is then obtained through,

$$F(s) \sim s^H \tag{12}$$

Here, H is the Hurst scaling exponent, which can be obtained from the slope of the log-log plot of F (s) vs scales s. Alternatively, The Hurst exponent[8]**:** value will be computed using the following equation for the purpose of testing the hypothesis.

$$H=\frac{\ln\left(\frac{\text{range}(x)}{\sigma}\right)}{\log(x)} \tag{13}$$

where, $H_s$ is the Hurst exponent, range (x) is the range of the wavelet decomposition coefficients, σ is the standard deviation of the coefficients, and n is the number of coefficients.

The Hurst exponent is a measure of the long-term memory of a time series. If the H > 0.5, the time series is persistent i.e., distribution holds the long-term memory and If the H < 0.5, the time series anti - persistent, hence the distribution of returns tends to be thin tailed. If the H = 0.5 the time series is a random walk and the distribution of returns is approximately normal [54-57].

## Result and Discussion

### Summary Measures of Daily Returns

Summary measures assess the informational accuracy of the stock market (Table 1 and 2). Skewness values across the overall NEPSE index, sensitive index, and twelve sectoral indices (e.g., commercial banks, development banks, finance, microfinance, hydropower) range from 0.263 to 1.072, indicating positively skewed distributions. This suggests that returns are generally higher than the mean, favoring higher returns for investors. Mean returns for all sectors were positive, except for the investment sector in both daily and weekly data. Kurtosis values range from 1.109 to 26.633, with sensitive and microfinance sectors showing high kurtosis (>3), indicating extreme volatility. Other sectors, such as commercial banks and life insurance, are also leptokurtic but less volatile. In contrast, hydropower, investment, and non-life insurance sectors exhibit platykurtic behavior (kurtosis <3), suggesting lower volatility and fewer extreme values. These sectors may appeal to risk-averse investors.

**Table 1: Summary Measures of Daily Return**

| Indices | N | Mean | SD | Min | Max | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| Overall | 2049 | 0.07 | 1.32 | -6.23 | 5.89 | 0.26 | 3.38 |
| Sensitive | 2041 | 0.06 | 1.42 | -14.84 | 18.32 | 0.73 | 21.08 |
| Commercial Bank | 2049 | 0.05 | 1.43 | -7.72 | 7.52 | 0.67 | 4.80 |
| Development Bank | 2049 | 0.13 | 1.62 | -7.59 | 10.15 | 0.87 | 5.75 |
| Finance | 2049 | 0.09 | 1.55 | -8.96 | 8.93 | 0.68 | 7.12 |
| Micro Finance | 1066 | 0.08 | 1.95 | -19.11 | 22.69 | 1.07 | 26.63 |
| Hydro Power | 2043 | 0.04 | 1.90 | -7.24 | 8.95 | 0.60 | 2.75 |
| Hotels and Tourism | 2021 | 0.07 | 1.97 | -9.09 | 8.96 | 0.71 | 3.04 |
| Investment | 321 | -0.11 | 2.16 | -5.54 | 8.49 | 0.60 | 1.11 |
| Life Insurance | 901 | 0.05 | 1.98 | -9.54 | 9.48 | 0.60 | 4.44 |
| Non-life Insurance | 900 | 0.03 | 1.96 | -7.75 | 7.90 | 0.51 | 2.17 |
| Manufacturing | 1710 | 0.10 | 1.53 | -7.86 | 7.38 | 0.65 | 3.51 |
| Trading | 1262 | 0.18 | 2.43 | -9.94 | 9.52 | 0.83 | 3.80 |
| Others | 2030 | 0.04 | 1.63 | -9.57 | 8.55 | 0.05 | 5.21 |

**Table 2: Summary Measures of Weekly Returns**

| Indices | N | Mean | SD | Min | Max | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| Overall | 405 | 0.35 | 3.19 | -12.83 | 12.91 | 0.20 | 2.01 |
| Sensitive | 403 | 0.29 | 3.17 | -12.21 | 14.60 | 0.31 | 2.33 |
| Commercial Bank | 405 | 0.26 | 3.43 | -14.82 | 18.02 | 0.63 | 4.07 |
| Development Bank | 405 | 0.65 | 3.84 | -11.48 | 16.78 | 0.77 | 2.88 |
| Finance | 405 | 0.45 | 4.09 | -16.71 | 25.69 | 1.48 | 8.75 |
| Micro Finance | 212 | 0.42 | 4.25 | -17.55 | 14.84 | 0.36 | 2.25 |
| Hydro Power | 404 | 0.20 | 4.41 | -17.16 | 15.85 | 0.47 | 1.79 |
| Hotels and Tourism | 400 | 0.35 | 4.63 | -13.03 | 24.96 | 1.54 | 6.30 |
| Investment | 61 | -0.63 | 4.98 | -9.68 | 14.00 | 0.84 | 0.95 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Life Insurance | 180 | 0.28 | 4.84 | -14.97 | 18.40 | 0.75 | 2.04 |
| Non-life Insurance | 180 | 0.18 | 4.61 | -16.43 | 13.68 | 0.23 | 1.29 |
| Manufacturing | 340 | 0.52 | 3.82 | -12.69 | 14.78 | 0.69 | 2.21 |
| Trading | 249 | 0.93 | 6.46 | -16.31 | 39.17 | 2.26 | 9.67 |
| Others | 402 | 0.23 | 3.59 | -10.19 | 17.10 | 1.02 | 4.29 |

**Test Result of Hypothesis 1: Normality of the Distribution**

For testing the weak form of market efficiency, a p-value less than the significance level indicates that returns do not follow a normal distribution, implying a lack of weak-form efficiency[58]. In this study, all daily and weekly return series have p-values < 0.05, confirming that weak form market efficiency is not satisfied (tables 3 and 4). These findings align with prior research [39, 59-61].

**Table 3: One Sample K – S Test of Daily Return**

| Indices | Test Statistic | Asy. Sig. | Indices | Test Statistic | Asy. Sig. |
|---|---|---|---|---|---|
| Overall | 0.08 | .000[c] | Hotels and Tourism | 0.09 | .000[c] |
| Sensitive | 0.10 | .000[c] | Investment | 0.07 | .000[c] |
| Commercial Bank | 0.10 | .000[c] | Life Insurance | 0.11 | .000[c] |
| Development Bank | 0.11 | .000[c] | Non-life Insurance | 0.10 | .000[c] |
| Finance | 0.14 | .000[c] | Manufacturing | 0.12 | .000[c] |
| Micro Finance | 0.11 | .000[c] | Trading | 0.21 | .000[c] |
| Hydro Power | 0.11 | .000[c] | Others | 0.10 | .000[c] |

**Note:** c Lilliefors Significance Correction.

**Table 4: One Sample K – S Test of Weekly Return**

| Indices | Test Statistic | Asy. Sig. | Indices | Test Statistic | Asy. Sig. |
|---|---|---|---|---|---|
| Overall | 0.05 | .011[c] | Hotels and Tourism | 0.13 | .000[c] |
| Sensitive | 0.05 | .027[c] | Investment | 0.11 | .072[c] |
| Commercial Bank | 0.07 | .000[c] | Life Insurance | 0.13 | .000[c] |
| Development Bank | 0.08 | .000[c] | Non-life Insurance | 0.07 | .022[c] |
| Finance | 0.17 | .000[c] | Manufacturing | 0.11 | .000[c] |
| Micro Finance | 0.09 | .000[c] | Trading | 0.19 | .000[c] |
| Hydro Power | 0.09 | .000[c] | Others | 0.12 | .000[c] |

**Note:** c Lilliefors Significance Correction.

**Test Result of Hypothesis 2: Predictability of Past Return**

The run test evaluates whether a sequence of data exhibits non-random patterns, with a p-value < 0.05 indicating the presence of significant runs. Results for daily and weekly return series (Tables 5 and 6) show p-values < 0.05 for all sectors except hotels and tourism, investment, and others, leading to rejection of the null hypothesis and evidence of non-random patterns in returns. This indicates that weak form market efficiency does not hold for the overall NEPSE index, sensitive index, and sectors like commercial banks, development banks, finance, microfinance, hydropower, life insurance, non-life insurance, manufacturing, and trading, suggesting future returns are predictable. These findings align with prior studies [8,23,32,60-62] but contradict the random walk hypothesis of [6].

**Table 5: Result of Run Test for Daily Returns**

| Indices | Test Value | No. of Runs | Z | Asy. Sig. |
|---|---|---|---|---|
| Overall | 0.07 | 817 | -9.05 | 0.000 |
| Sensitive | 0.06 | 817 | -8.63 | 0.000 |
| Commercial Bank | 0.05 | 829 | -8.30 | 0.000 |
| Development Bank | 0.13 | 849 | -7.43 | 0.000 |
| Finance | 0.09 | 883 | -5.81 | 0.000 |
| Micro Finance | 0.08 | 438 | -5.15 | 0.000 |
| Hydro Power | 0.04 | 867 | -6.33 | 0.000 |
| Hotels and Tourism | 0.07 | 1021 | 0.89 | 0.376 |
| Investment | -0.11 | 140 | -2.29 | 0.022 |
| Life Insurance | 0.05 | 412 | -1.97 | 0.049 |
| Non-life Insurance | 0.03 | 405 | -2.73 | 0.006 |
| Manufacturing | 0.10 | 753 | -4.01 | 0.000 |
| Trading | 0.18 | 443 | -6.18 | 0.000 |
| Others | 0.04 | 1013 | 0.08 | 0.935 |

**Table 6: Result of Run Test for Weekly Returns**

| Indices | Test Value | No. of Runs | Z | Asy. Sig. |
|---|---|---|---|---|
| Overall | 0.35 | 163 | -4.01 | 0.000 |
| Sensitive | 0.29 | 167 | -3.50 | 0.000 |
| Commercial Bank | 0.26 | 177 | -2.63 | 0.008 |
| Development Bank | 0.65 | 163 | -3.81 | 0.000 |
| Finance | 0.45 | 172 | -2.53 | 0.011 |
| Micro Finance | 0.42 | 88 | -2.30 | 0.021 |
| Hydro Power | 0.20 | 169 | -2.93 | 0.003 |
| Hotels and Tourism | 0.35 | 208 | 0.93 | 0.351 |
| Investment | -0.63 | 24 | -1.74 | 0.082 |
| Life Insurance | 0.28 | 72 | -2.49 | 0.013 |
| Non-life Insurance | 0.18 | 70 | -2.95 | 0.003 |
| Manufacturing | 0.52 | 152 | -1.73 | 0.084 |
| Trading | 0.93 | 85 | -3.74 | 0.000 |
| Others | 0.23 | 195 | -0.51 | 0.613 |

**Test Result of Hypothesis 3: Autocorrelation Test.**

The correlation and Ljung-Box (LB) statistics for daily and weekly returns at lags 1, 4, 8, 12, and 16 are presented in Tables 7 and 8. For daily returns, the LB test shows p-values < 0.01 for the overall index, commercial bank, development bank, finance, hydropower, life insurance, non-life insurance, manufacturing, trading, and others, indicating significant serial dependence. Sensitive and investment sectors show p-values < 0.05, while microfinance and hotel and tourism exhibit p-values < 0.10, also indicating dependence.

Weekly returns show similar results to daily returns, except for the investment sector, where p-values < 0.05 suggest independent returns, supporting the null hypothesis. This finding contrasts with finding of, which adjusted for thin trading, but aligns with finding in [11,13,16,17,23,25,32].

**Table 7: Resul of Autocorrelation Test for Daily Return**

| Indices | AC(1) | AC(4) | AC(8) | AC(12) | AC(16) |
|---|---|---|---|---|---|
| Overall | 0.16* (55.33) | 0.04* (66.28) | 0.02* (72.73) | 0.01* (89.09) | 0.04* (93.14) |
| Sensitive | 0.07* (10.22) | 0.02* (16.18) | 0.01** (18.48) | 0.01** (24.43) | 0.02** (26.48) |
| Commercial Bank | 0.20* (78.15) | 0.02* (82.10) | 0.01* (83.76) | 0.01* (90.85) | 0.03* (97.71) |
| Development Bank | 0.107* (23.68) | 0.10* (69.82) | -0.02* (81.75) | -0.03* (126.55) | 0.03* (130.57) |
| Finance | 0.17* (62.454) | 0.07* (96.38) | 0.02* (110.08) | -0.03* (163.56) | 0.06* (173.70) |
| Micro Finance | -0.01 (0.15) | 0.02*** (9.28) | 0.02 (11.64) | 0.02 (16.85) | -0.03 (21.64) |
| Hydro Power | 0.14* (37.06) | 0.03* (50.20) | 0.00* (52.740) | -0.04* (84.14) | 0.06* (91.02) |
| Hotels and Tourism | 0.01 (0.08) | 0.01 (1.84) | -0.02 (5.03) | 0.01*** (19.41) | 0.03 (22.58) |
| Investment | 0.11** (3.80) | 0.07* (17.25) | -0.07* (21.10) | 0.01* (26.72) | 0.04** (27.83) |
| Life Insurance | 0.12* (12.48) | 0.06* (23.23) | 0.04* (35.38) | -0.01* (42.60) | -0.01* (46.51) |
| Non-life Insurance | 0.09* (7.94) | 0.11* (33.55) | 0.01* (39.23) | 0.019* (46.33) | 0.021* (48.56) |
| Manufacturing | 0.14* (31.65) | 0.07* (52.98) | 0.02* (61.27) | 0.008* (70.56) | -0.01* (72.18) |
| Trading | 0.19* (46.37) | 0.07* (57.49) | -0.01* (77.30) | 0.04* (81.19) | -0.02* (89.32) |
| Others | 0.017 (0.56) | 0.024* (19.70) | -0.017* (22.34) | 0.037* (32.13) | 0.045* (38.03) |

**Note:** *Significant at 1%, **significant at 5% and ***significant at 10%. Values in the parentheses are Ljung – Box Q statistics.

**Table 8: Result of Autocorrelation Test for Weekly Return**

| Indices\Lag | AC(1) | AC(4) | AC(8) | AC(12) | AC(16) |
|---|---|---|---|---|---|
| Overall | 0.15* (9.35) | -0.03* (18.32) | 0.05* (23.36) | -0.05** (24.81) | 0.00*** (25.16) |
| Sensitive | 0.11** (4.66) | -0.03** (9.76) | 0.01*** (14.85) | -0.06 (18.22) | -0.01 (19.56) |
| Commercial Banking | 0.10** (3.86) | 0.02 (6.07) | -0.01 (9.42) | -0.10 (17.48) | -0.03 (18.59) |
| Development Bank | 0.20* (15.97) | -0.07* (24.65) | 0.07* (31.10) | -0.05* (41.84) | -0.04* (46.22) |
| Finance | 0.14* (7.76) | -0.00* (13.88) | 0.08** (19.62) | -0.01* (33.14) | -0.02* (35.10) |
| Microfinance | 0.18* (6.67) | -0.09* (15.14) | 0.05** (19.20) | 0.02*** (19.73) | 0.03 (22.66) |
| Hydro Power | 0.07 (2.21) | -0.035** (10.99) | 0.05*** (14.23) | 0.02*** (19.39) | 0.01 (19.75) |
| Hotels and Tourism | -0.01 (0.01) | -0.08** (12.33) | 0.08** (17.51) | -0.04*** (19.52) | 0.06*** (23.63) |
| Investment | 0.103 (0.679) | 0.103 (0.679) | -0.003 (1.800) | 0.045 (7.101) | -0.164 (15.050) |
| Life Insurance | 0.20* (7.16) | -0.04** (9.94) | 0.12*** (13.53) | -0.01 (14.58) | 0.03 (15.38) |
| Non – life Insurance | 0.26* (12.05) | -0.17* (19.13) | 0.15* (23.88) | -0.08* (31.68) | 0.08* (33.73) |
| Manufacturing | 0.25* (20.68) | -0.07* (26.97) | 0.05* (30.32) | -0.07* (33.18) | 0.01* (34.86) |
| Trading | 0.13** (3.98) | -0.07* (14.31) | 0.32* (46.76) | -0.05* (58.03) | 0.08* (61.82) |
| Others | -0.01 (0.02) | -0.09* (14.32) | 0.04* (23.22) | 0.04* (27.43) | -0.04** (30.05) |

**Note:** *Significant at 1%, **significant at 5% and ***significant at 10%. Values in the parentheses are Ljung – Box Q statistics.

Test Result of Hypothesis 4: DWT with Hurst Exponent

The wavelet coefficient trajectory at different decompositions for the NEPSE index, commercial bank, and hydropower daily return series, as shown in Annex 1, highlights periods of significant instability. The generalized Hurst exponent, H(2), is applied to test the WEMH with the null hypothesis H0:H(2)=0.5, indicating no memory. Rejection of the null suggests the presence of either persistence (H(2)>0.5 or anti-persistence (H(2)<0.5. Persistent processes indicate long memory with slowly decaying autocorrelation, while anti-persistent processes indicate short-term memory with negative correlation and a clustering phenomenon, making future return trends predictable [63,64].

The study's results, presented in Tables 9 and 10, show that H0:H (2)=0.5 was rejected for all daily and weekly return series, indicating predictability in future returns for the NEPSE and sectoral indices. Except for the investment and other sectors in daily returns, most sectors exhibit anti-persistence (H(2)<0.5, suggesting short-term memory and negative correlations. Mandelbrot and Taqqu (1979) characterize this as anti-persistence of long-term dependence, where processes offset large variations with opposing variations. Prior studies have reported varied findings on market efficiency, with persistence observed in stock prices [40,65,66] and both positive and negative persistence [67]. The results of this study align with, confirming anti-persistence in stock prices [64].

**Table 9: Generalized Hurst Exponent of Daily Return**

| Method | DWT | Method | DWT |
|---|---|---|---|
| Overall | 0.19* | Hotels and Tourism | 0.20* |
| Sensitive | 0.36* | Investment | 0.57* |
| Commercial Bank | 0.03* | Life Insurance | 0.24* |
| Development Bank | 0.24* | Non-life Insurance | 0.19* |
| Finance | 0.25* | Manufacturing | 0.21* |
| Micro Finance | 0.28* | Trading | 0.20* |
| Hydro Power | 0.18* | Others | 0.56* |

**Note:** *Significant at 1% level.

**Table 10: Generalized Hurst Exponent Weekly Return**

| Method | DWT | Method | DWT |
|---|---|---|---|
| Overall | 0.26* | Hotels and Tourism | 0.26* |
| Sensitive | 0.28* | Investment | NaN** |
| Commercial Bank | 0.32* | Life Insurance | 0.25* |
| Development Bank | 0.23* | Non-life Insurance | 0.25* |
| Finance | 0.31* | Manufacturing | 0.25* |
| Micro Finance | 0.31* | Trading | 0.32* |
| Hydro Power | 0.21* | Others | 0.22* |

**Note:** *Significant at 1% level**The wavelet calculation process did not support the data less than 100 observation.

**Major Findings**

The major finding of this study is that the Nepalese stock market, including its sectoral indices, is not efficient in the weak form. The results of all four tests provide evidence of market inefficiencies. Which means future returns are predictable in Nepalese stock market. Furthermore, the Wavelet analysis revealed an anti-persistent nature of the market, indicating that the market tends to react strongly to external shocks, leading to significant price movements. These findings suggest that investors in the Nepalese stock market may be able to earn abnormal profits by utilizing trading strategies that take advantage of these inefficiencies. Additionally, this study's results are important for policymakers in Nepal, who may need to create policies that can make the stock market perform better in the future.

**Discussion**

The results of this study indicate that the Nepalese stock market is not efficient in the weak form, which is consistent with several previous studies, including studies [39,59-61], based on the Kolmogorov-Smirnov and Run tests. However, the finding is not identical to the result of random walk test hypothesis [6]. Similarly, the results of the autocorrelation test show that the market is not efficient in the weak form, which is similar to the study result of [13,16,23,25,32] but not consistent with [11].

Regarding the wavelet analysis, the study found an anti-persistent nature of the Nepalese stock market, which is consistent with study [64]. Previous studies on the Hurst exponent in market efficiency have produced inconsistent findings, with some indicating persistence in stock prices, such as [40,65,66], while showed both persistent and anti – persistent nature of the stock market [67]. The findings of this study suggest that Nepalese stock market exhibits an anti-persistence nature indeed external shocks and news events have a significant impact on the market. This characteristic can make it challenging for investors to make informed investment decisions. Therefore, policymakers should consider implementing measures to improve market efficiency. Additionally, market participants may benefit from improving their risk management strategies and considering a long-term investment approach.

**Summary and Conclusion**

**Summary**

The Weak Form Market Efficiency Hypothesis (WEMH) asserts that all past price and volume data are fully reflected in current market prices, making it impossible to generate abnormal returns based on this data. This study tests the WEMH by analyzing the NEPSE index and its sub-indices from 2013 to 2022, comparing the findings to WEMH predictions. The descriptive statistics for daily and weekly returns show positive mean returns across most sectors, except for the investment sector. Skewness analysis reveals a bias toward higher returns, and kurtosis values suggest varying volatility across sectors. Kolmogorov-Smirnov test results indicate that returns deviate from normality, rejecting the WEMH as the p-values are less than 0.05.

The run test further supports the rejection of WEMH, revealing non-random patterns in most sector returns, with the exception of hotel and tourism, investment, and others. This suggests that historical returns for many sectors are predictable. Correlation and Ljung-Box tests show serial dependence in returns for most sectors, with significant p-values indicating patterns in returns. Microfinance and hotel and tourism sectors exhibit weaker serial dependence.

Hurst Exponent analysis also rejects the WEMH for all sectors, indicating that future returns for the NEPSE and its sector indices are predictable. Most sectors, except for investment and others, exhibit an anti-persistent nature, suggesting short-term memory and negative correlation, where phases of increase are followed by decrease. This points to the potential for using anti-persistent processes to predict future return trends.

**Conclusion and Future Implication**

This study examined the weak form of market efficiency hypothesis for the NEPSE index and its sub-indices from 2013 to 2022. The Kolmogorov-Smirnov test, run test, and Hurst Exponent analysis consistently rejected the null hypothesis of weak-form efficiency across most sectors. These findings indicate that the NEPSE and its sectoral indices exhibit predictable patterns in historical returns, suggesting potential for technical analysis to generate abnormal returns.

The results have important implications for future research and policy. Researchers are encouraged to replicate this study in other developing markets and extend the analysis to cover longer periods and additional forms of market efficiency, such as semi-strong and strong forms, to enhance understanding. Policymakers should consider the presence of predictable patterns in returns when designing market surveillance mechanisms. Investor education on tools like the Hurst Exponent and market efficiency analyses could further support informed investment decisions in developing markets like Nepal.

**References**


1. Yalçın KC. Market rationality: Efficient market hypothesis versus market anomalies. European Journal of Economic and Political Studies. 2010. 3: 23-38.
2. Ball R. The global financial crisis and the efficient market hypothesis: what have we learned?. Journal of Applied Corporate Finance. 2009. 21: 8-16.
3. Naseer M, Tariq YB. The efficient market hypothesis: A critical review of the literature. The IUP Journal of Financial Risk Management. 2015. 12: 48-63.
4. Mackey AM, Bacon FW. Signaling with stock issues and repurchases: A test of semi-strong form market efficiency. Journal of Business and Behavioral Sciences. 2017. 29: 34.
5. Sharpe WF. Alexander Gordon J, Bailey Jeff V. Investments. 6th ed. (International edition). Landon: Prentice Hall International Inc.. 1999.
6. Fama EF. Efficient capital markets: A review of theory and empirical work. The journal of Finance. 1970. 25: 383-417.
7. Bam N. Thagurathi RK, Shrestha B. Stock price behavior of Nepalese commercial banks: random walk hypothesis. Journal of Business and Management. 2018. 5: 42-52.
8. Dangol J. Stock market efficiency in Nepal. Zenith International Journal of Multidisciplinary Research. 2012. 2: 40-48.
9. Risal HG, Koju P. Testing the weak form of efficiency in Nepalese stock markets. SEBON Journal. 2021. 8: 20-32.
10. Dangol J. Efficient market hypothesis and adjustment of stock prices in Nepal. 2018.
11. Dangol J. Testing weak form of market efficiency in Nepal. International Research Journal of Management Science. 2016. 1.
12. Rijal A. The Nepal Stock Exchange - Background and trends.
13. Ananzeh IEN. Testing the weak form of efficient market hypothesis: Empirical evidence from Jordan. International Business and Management. 2014. 9: 119-123.
14. Leković M. Evidence for and against the validity of efficient market hypothesis. Economic themes. 2018. 56: 369-387.
15. Shiller RJ. From efficient markets theory to behavioral finance. Journal of economic perspectives. 2003. 17: 83-104.
16. Fama EF, French KR. Permanent and temporary components of stock prices. Journal of political Economy. 1988. 96: 246-273.
17. Jegadeesh N, Titman S. Returns to buying winners and selling losers: Implications for stock market efficiency. The Journal of finance. 1993. 48: 65-91.
18. Lo AW, Mac Kinlay AC. Stock market prices do not follow random walks: Evidence from a simple specification test. The review of financial studies. 1988. 1: 41-66.
19. Jarrett JE, Kyper E. Daily variation. capital market efficiency and predicting stock market returns. Management Research News. 2005.
20. Narayan PK, Narayan S. Mean reversion in stock prices: new evidence from panel unit root tests. Studies in Economics and Finance. 2007.
21. Charles A, Darné O. Variance-ratio tests of random walk: an overview. Journal of Economic Surveys. 2009. 23: 503-527.
22. Mishra S. Empirical testing of capital market efficiency: Evidence from Indian Markets. 2017.
23. Hamid K, Suleman MT, Ali Shah SZ, Imdad Akash RS. Testing the weak form of efficient market hypothesis: Empirical evidence from Asia-Pacific markets. 2017.
24. Hawaldar IT, Mallikarjunappa T. Efficiency of stock market: A study of stock price responses to earnings announcements. Iqbal. TH and Mallikarjunappa. 2011.
25. Jagannathan UK. Testing for the weak form of market efficiency in Bombay Stock Exchange. SASTech-Technical Journal of RUAS. 2014. 13: 104-108.
26. Khan A, Ikram S. Testing strong form market efficiency of Indian capital market: Performance appraisal of mutual funds. International Journal of Business and Information Technology. 2011. 1.
27. Pant B, Bishnoi T. Testing random walk hypothesis for Indian stock market indices. in Research Paper Presented in UTI Capital Market Conference Proceedings. Citeseer. 2001. 1-15.
28. Rahmanizadeh F, Mahesh R. Investigation of market efficiency: an event study of insider trading in the stock exchange of India. Asian Journal of Research in Banking and Finance. 2015. 5: 22-34.
29. Thomas AE, Kumar M. Empirical evidence on weak form efficiency of Indian stock market. Thomas Asha E and MC Dileep. Empirical Evidence on Weak Form Efficiency of Indian Stock Market. ASBM Journal of Management. 2009, 2010. 3: 89-100.
30. Bapusaheb SU. A Study of Weak Form of Market Efficiency in India. 2012.
31. Mahajan S, Luthra M. Testing weak form efficiency of BSE Bankex. International Journal of Commerce. Business and Management. 2013. 2: 2319-2328.
32. Patel NR, Radadia N, Dhawan J. An empirical study on weak-form of market efficiency of selected Asian stock markets. Journal of Applied Finance and Banking. 2012. 2: 99.
33. Joshi NK, Kc FB. The Nepalese stock market: Efficiency and calendar anomalies. Economic Review. 2005. 17: 17.
34. Pradhan P, Shyam R, Upadhyay BD. The efficient market hypothesis and the behaviour of share prices in Nepal. Shyam R and Pradhan. Shyam R and Basu DU. The Efficient Market Hypothesis and the Behaviour of Share Prices in Nepal. 2006.
35. Joshi NK, Bhattarai RC. Stock returns and economically neutral behavioural variables: Evidence from the Nepalese stock market. Economic Review Occasional Paper. 2010. 43-58.
36. Bhatta GP. Does Nepalese stock market follow random walk. Sebon Journal. 2010. 4: 18-58.
37. Gaire HN. Forecasting NEPSE index: An ARIMA and GARCH approach. NRB Economic Review. 2017. 29: 53-66.
38. Pradhan RS, Saraswari K. Efficient market hypothesis and behaviour of share prices: the Nepalese evidence. SEBON Journal. 2010. 4: 104-117.
39. Vaidya R. Opinions of Investors on Nepal Stock Exchange Limited (NEPSE) Online Trading System. Prithvi Academic Journal. 2021. 4: 56-65.
40. Diallo OK. Mendy P, Burlea-Schiopoiu A. A method to test weak-form market efficiency from sectoral indices of the WAEMU stock exchange: A wavelet analysis. Heliyon. 2021. 7: e05858.

41. Mattera R, Di Sciorio F, Trinidad-Segovia JE. A Composite Index for Measuring Stock Market Inefficiency. Complexity. 2022. 2022.
42. Alwagdani O. Dynamic Return-Volume Relations in the Saudi Stock Market: Evidence from Quantiles Regressions. International Journal of Economics and Finance. 2015. 7: 11.
43. Arratia A. Statistics of Financial Time Series. in Computational Finance: Springer. 2014. 37-70.
44. Damodaran A. Investment philosophies: successful strategies and the investors who made them work. John Wiley & Sons. 2012.
45. Gujarati DN, Porter DC. Basic econometrics. 5th ed. New York: McGraw-Hill Education. 2008. 944.
46. Shiblu KA, Ahmed N. Determining the Efficiency of Dhaka Stock Exchange (DSE): A Study based on Weak Form Efficient Market Hypothesis. The Comilla University Journal of Business Studies. 2015. 2: 67-86.
47. Nason GP, Silverman BW. The stationary wavelet transform and some statistical applications. in Wavelets and statistics: Springer. 1995. 281-299.
48. He Yu KL, Lai KK. Crude oil price analysis and forecasting using wavelet decomposed ensemble model. Energy. 2012. 46: 564-574.
49. Daubechies I. Ten lectures on wavelets. SIAM. 1992.
50. Lau KM, Weng H. Climate signal detection using wavelet transform: How to make a time series sing. Bulletin of the American meteorological society. 1995. 76: 2391-2402.
51. Jammazi R. Cross dynamics of oil-stock interactions: A redundant wavelet analysis. Energy. 2012. 44: 750-777.
52. Ranta M. Wavelet multiresolution analysis of financial time series. Vaasan yliopisto. 2010.
53. Grabocka J. Invariant Features For Time-Series Classification. Universität Hildesheim. 2016.
54. Barunik J, Kristoufek L. On Hurst exponent estimation under heavy-tailed distributions. Physica A: Statistical Mechanics and its Applications. 2010. 389: 3844-3855.
55. Kristoufek L, Vosvrda M. Measuring capital market efficiency: Global and local correlations structure. Physica A: statistical mechanics and its applications. 2013. 392: 184-193.
56. Kyaw NA, Los CA, Zong S. Persistence characteristics of Latin American financial markets. Journal of Multinational Financial Management. 2006. 16: 269-290.
57. Tzouras S, Anagnostopoulos C, McCoy E. Financial time series modeling using the Hurst exponent. Physica A: Statistical Mechanics and its Applications. 2015. 425: 50-68.
58. Ahmed F. Assessment of capital market efficiency in COVID-19. European Journal of Business and Management Research. 2021. 6: 42-46.
59. Suthar AB, Patel HR, Parikh SM. A comparative study on financial stock market prediction models. The International Journal of Engineering And Science (IJES). 2012. 1: 188-191.
60. Sarkar R. Testing Weak Form Of Efficient Market Hypothesis (EMH): Empirical Evidence From Leading Stock Exchanges In India. International Journal on Recent Trends in Business and Tourism (IJRTBT). 2019. 3: 64-69.
61. Siddiqui S, Gupta P. Weak form of market efficiency-evidences from selected NSE indices. 2009. 1355103.
62. Patel A, Rajpal R, Modi A. Testing weak form of market efficiency: a study on Indian stock market. International Journal of Management & Business Studies. 2018. 8: 9-11.
63. Lim KP, Brooks R. The evolution of stock market efficiency over time: A survey of the empirical literature. Journal of Economic Surveys. 2011. 25: 69-108.
64. Razdan A. Scaling in the Bombay stock exchange index. Pramana. 2002. 58: 537-544.
65. Cajueiro DO, GogasP, Tabak BM. Does financial market liberalization increase the degree of market efficiency? The case of the Athens stock exchange. International Review of Financial Analysis. 2009. 18: 50-57.
66. Rejichi IZ, Aloui C. Hurst exponent behavior and assessment of the MENA stock markets efficiency. Research in International Business and Finance. 2012. 26: 353-370.
67. Alvarez-Ramirez J, Alvarez J, Rodriguez E, Fernandez-Anaya G. Time-varying Hurst exponent for US stock markets. Physica A: statistical mechanics and its applications. 2008. 387: 6159-6169.