NORMALITY TEST OF NEPSE SENSITIVE INDEX

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Abstract

A return from the stock market is assumed to follow the random walk hypothesis. An investor is concerned about the risk and returns of the fund in which he or, she has invested. A risk-averse investor develops a portfolio with a secured return followed with a perfect prediction. Hence, a normality test for the market return is an easier way to diversify and eliminate risk. Thus, this paper tests the normality of the returns from the 'blue-chip' stocks in the context of NEPSE. A NEPSE Sensitive Index is an index calculated based on the trade of stocks for large, capital-based Nepalese listed companies with better earning histories and higher book values. The NEPSE sensitive index and NEPSE sensitive float index are tested for normality. The paper followed the data visualization technique, descriptive statistics, and test statistics to test the normality and find out the parameters of normal distribution. The paper found that the daily return from both indices best fit a normal distribution. Hence, two basic statistical parameters from the returns, i.e., the mean and standard deviation, are sufficient to estimate future trend for 'blue-chip' stock return in Nepal. The governing body should develop a new index that would better represent the market movement in the coming days that would be beneficial to predict the return movement from NEPSE.

Key words: Sensitive index, NEPSE, normality.

Background

Investment management is far more tractable when rates of return can be well approximated by the normal distribution. When securities are normally distributed, the statistical relationships between returns can be summarized with a straightforward correlation coefficient (Bodie et al., 2018). Hence, investors and researchers have an interest in the normality of return from the stock market. At the same time, two basic parameters of statistics, mean and standard deviation values emerges from the fitted normal distribution helps an investor to determine the average return and risk associated with the portfolio.

Since the movement of price is considered to be in random walk, the price changes cannot be predicted from earlier changes in any 'meaningful' manner. In the decade of the 1960s, however, a 'counter-theory', first labelled, 'random walk' and later 'the theory of efficient capital market', was advanced to explain in stock price (Roberts,

1959). Efficient market hypothesis (EMH) postulates the random walk hypothesis for the return from the stock market, which further assumes the normality for risk and return generated from the stock market. Thus, an assumption of normality in return from the stock market has been a concern to academician and investors. Similarly, in real market, expectation of absolute efficient or wholly inefficient could not be expected, but a mixture of both can be said in reality.

The normality of stock market return is stated to be determined by the size of the data covered for analysis, though, in context to Indian stock market, Marisetty and Vedpuriswar (2002) found positively skewed for the returns from BSE-100, BSE-500, SENSEX and BSE-200. Agrawal (2006) revealed that even the small size data could lead to normality while studying on daily return from Nifty and SENSEX. Saini and Dhankar (2011) found non-normality for the BSE SENSEX. Similarly, risk and return were inconsistent in the case of daily and weekly returns. Allen et al. (2011) analyzed the blue-chip companies' stock return and found that the correlation coefficient between return varies from -0.03 to +0.03, thus concluded that today market price of the stock will not be influenced in the tomorrow price. At the same time, Joshi and Tiwari (2012) studied the Weibull distribution in the case of transforming the BSE SENSEX return into a log-return.

Ahmad et al. (2016), while testing normality for the six Asian stock exchanges, including the BSE SENSEX, found non-normality for all the sampled market indices' returns.

Ghosh et al. (2021) found the log-period power-law (LPPL) model suitable to track down the medium and large crashes in the context of the S&P BSE SENSEX. Similarly, Mangukiya and Gondaliya (2021) tested sixteen major indices published by the Bombay Stock Exchange (BSE). The paper concluded that the return from the market was highly volatile. The paper also rejected the presence of random walks and supported the weak form of EMH for the Indian stock market. At the same time Elangovan et al. (2021) in the study on the return from the BSE found non-normality. Hong (2022) in his paper employed Kolmogrov-Smirnov test for the APPL stock and SPX500 index to test the normality from the return, where the paper concluded that an assumption of normality from the stock market is not reliable and also disclosed that increasing the size of the sample might lead to normality.

In context to Nepal, Dangol (2016), while testing weak form of efficient market hypothesis for Nepalese stock market found non-normality with the problem of thin trading. Risal and Koju (2021) found the daily NEPSE return deviated significantly from normality, while Vaidya et al. (2022) found that the daily return from the Nepalese stock market fitted on Gaussian distribution (1821).

In context with the assumption of normality, an investor can predict the market return

trend using two basic statistical parameters of the returns, namely the mean and standard deviation. If the returns are better fitted to a normal distribution, then the prediction process for the investors becomes easier. The majority of investors are risk-averse rather than risk-seekers. Investors who are risk-averse choose more stable investment portfolios, even if they get lower returns. Thus, defensive investors try to find blue-chip and large companies considered to be quite safe and secure investments, though they have a lower return. The earlier papers had only tested the normality for the NEPSE daily return, as the NEPSE Sensitive Index and NEPSE Sensitive Float Index was introduced at NEPSE floor since past one and half decade ago only. As a result, the paper attempts to test the return normality for listed stocks of well-established and better-performing Nepalese companies at the country's sole secondary market.

Methodology

The paper followed an exploratory research design dealing with big data to explain and test the return pattern from the Nepalese stock market. The paper used secondary data published at the official website of Nepal Stock Exchange Limited (NEPSE). The daily returns from the NEPSE Sensitive Index and the NEPSE Sensitive Float Index from the first day of calculation and publication have been used in the paper. The paper used the daily closing indices for the NEPSE Sensitive Index from January 1, 2007 to July 14, 2022 and NEPSE Sensitive Float Index from September 15, 2008 to July 14, 2022.

The NEPSE Sensitive Index was created on January 1, 2007 for listed companies that met the following criteria: a minimum paid-up capital of NPR 20 million, more than 1000 shareholders, a consecutive three-year net profit, a higher book value than a par value, and the publication of an annual report within six months of the fiscal year's end (www.nepalstock.com.np).

Similarly, the NEPSE Sensitive Float Index was introduced on September 15, 2008, which considers the ordinary shares of companies that are eligible for the NEPSE Sensitive Index. The index considers only the ordinary shares of high-performing stocks and helps investors see where the larger listed Nepalese companies are heading (www.nepalstock.com.np).

The paper has used major descriptive statistics and data visualization to check the normality of the returns. The paper used the percent vs. percent (P-P) plot, the quantile vs. quantile (Q-Q) plot, Zipf's plot, and the probability density function (PDF) plot to determine the normality of the returns. At the same time, the Kolmogorov-Smironov (K-S) test and Shapiro-Wilk (W) test were run to determine the statistical validity of the returns' normality.

Data Analysis

This section shows the statistical results and visualization of the return data to test the normality.

The table below shows the descriptive statistics for the two samples indices:

Table 1

Descriptive Statistics Result

Statistics	NEPSE Sensitive Index	NEPSE Sensitive Float Index
Mean	+0.05	+0.06
Standard Error	0.02	0.04
Median	-0.03	-0.04
Sample Variance	2.03	2.05
Standard Deviation	1.42	1.43
Kurtosis	3.65	3.14
Skewness	+0.33	+0.50
Range	14.24	12.81
Number of observation	3604	1595

Figure 1

P-P Plots for NEPSE Sensitive Index (a) and NEPSE Sensitive Float Index (b)

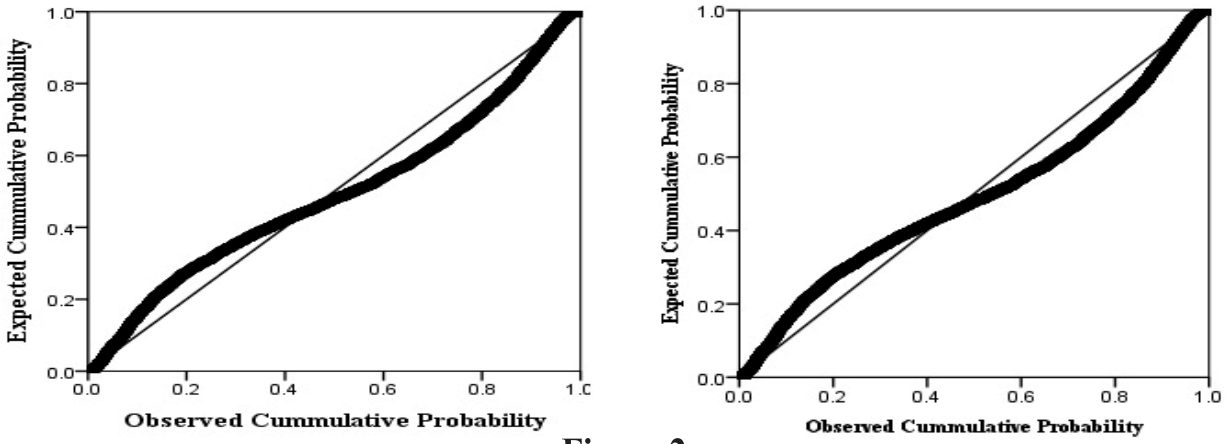
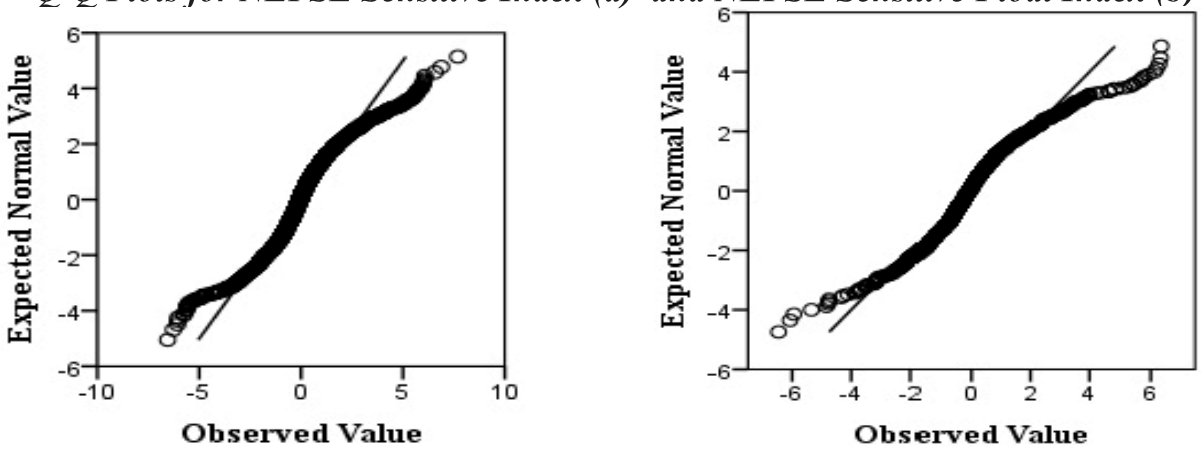


Figure 2

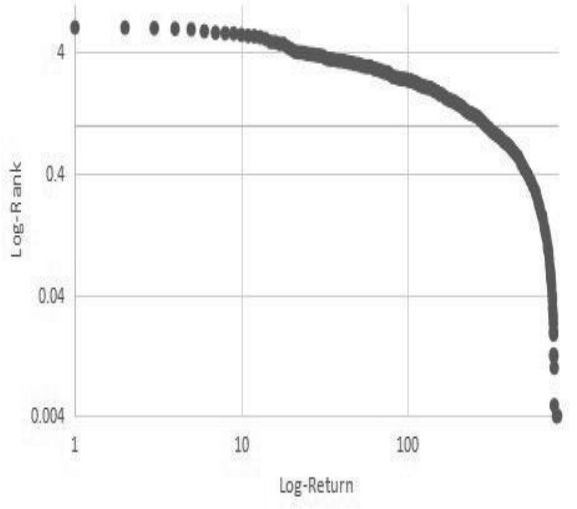
Q-Q Plots for NEPSE Sensitive Index (a) and NEPSE Sensitive Float Index (b)



The average return for both the NEPSE Sensitive Index and NEPSE Sensitive Float Index are at very minimal and the values of median are negative. The value of kurtosis is higher than three (3) and skewness is closer to zero, reflecting double exponential or closer to Laplace distribution(1812) having a stronger peak, more rapid decay and with a heavier tail.

Normality Test

The normality of the return have been tested using statistical tools and data visualization. The tables below show the statistical results for the normality test of the sampled indices.



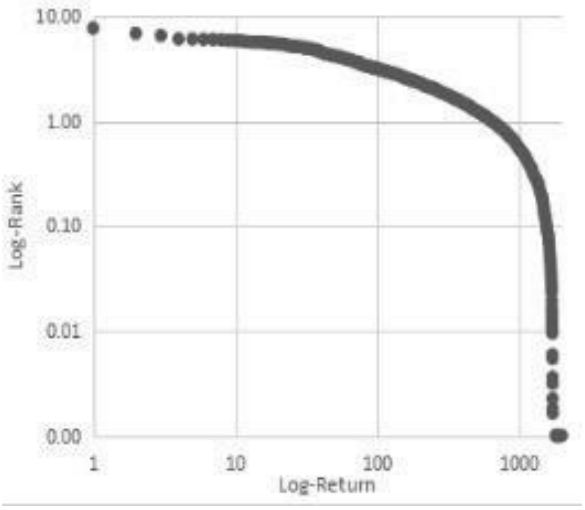


Table 2

Statistical Results for Normality Test

Test Statistics	NEPSE Sensitive Index	NEPSE Sensitive Float Index
Kolmogorov-Smironov (K-S)[a]	0.086 (0.000)	0.085 (0.000)
Shapiro-Wilk (W)	0.938 (0.000)	0.947 (0.000)

[a]*Lilliefors Significant Correction*

Note: The value in parentheses shows the p-value.

Source: Based on authors' calculation and NEPSE 2022.

The K-S test and Shapiro-Wilk (W) test for both the returns from the sampled indices shows normality with the test value having statistically significant.

Table 3

Fitted Distribution and Parameters

Results	NEPSE Sensitive Index	NEPSE Sensitive Float Index
Distribution	Normal	Normal
Parameters	μ= 0.05, σ = 1.42	μ= 0.06, σ = 1.43

The best fitted distribution for both the indices are normal distribution, i.e. Gaussian distribution. The parameters for the fitted distribution are similar to the result from the descriptive statistics.

The above Figure 1 and Figure 2 clearly shows the scattered values are tightly patterned in an 'S-shaped' around the 45-degree straight line. Hence, visually the returns from both NEPSE Sensitive Index and NEPSE Sensitive Float Index returns follow a normal distribution with heavy tails.

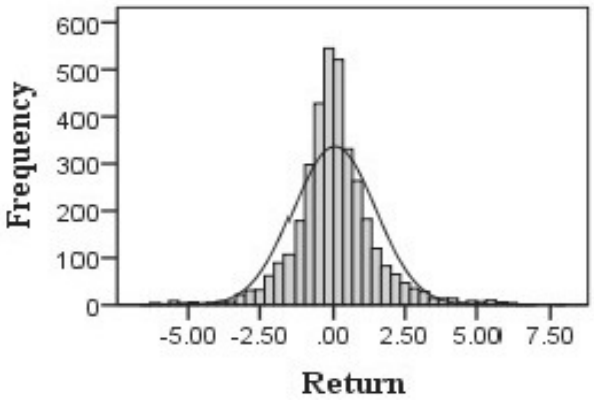
Figure 3

Zipf's Plots for NEPSE Sensitive Index (a) and NEPSE Sensitive Float Index (b)

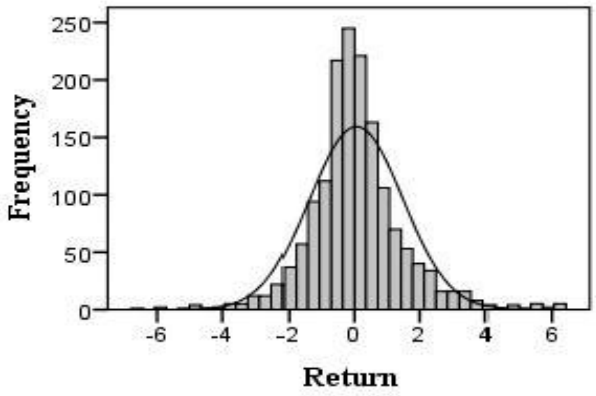
The curvature of the plotted graph for the scattered values is turning towards the rank axis, reflecting normality for returns from both NEPSE Sensitive Index and NEPSE Sensitive Float Index returns follow a normal distribution with heavy tails.

Figure 4

PDF Plots for NEPSE Sensitive Index (a) and NEPSE Sensitive Float Index (b)



a



b

The above figure depicting PDF plots for return from NEPSE Sensitive Index and NEPSE Sensitive Float Index returns follow a normal distribution with heavy tails. A perfect bell-shaped graph have been generated for the returns from both the indices. The return is perfectly fitted on a Gaussian distribution reflecting almost all of its values are within ±3 standard deviations from its mean value.

Conclusion and Implications

The return on investment and the associated risk are two major concerns for stock market investors. Nepal's stock market is primarily comprised of equity. The majority of the securities traded at NEPSE are covered by equity shares. Among the listed and traded equities, too, investors are more interested in and concerned about the trading of the 'blue chip' stocks. The Nepalese investor who wants to make a secure investment seeks to develop a portfolio from stocks calculated under the NEPSE Sensitive Index.

As a result, of the total daily trading of stocks, stocks listed with consistent profit-generating companies are more popular among investors. Therefore, the paper attempted to determine the normality pattern for the return on blue-chip stocks traded on NEPSE.

The paper demonstrated that the daily returns for 'blue chip' stocks in the Nepalese stock market could be determined using two parameters: mean and standard deviation. The statistical calculation result, visualization of the return and fitting of the return for the NEPSE Sensitive Index and NEPSE Sensitive Float Index perfectly fitted on normal distribution. Similarly, the NEPSE Sensitive Float Index is regarded as extremely useful by Nepalese investors in predicting and estimating market trends, as its return is also best-fitted on a normal distribution. Nevertheless, the pattern reflected form the daily closing return for last one and half decade's data could not be generalized and made as a benchmark for future prediction.

As the daily return from the NEPSE Sensitive Index and NEPSE Sensitive Float Index revealed a specific pattern of the return from a particular nature of stock capitalized at the NEPSE floor, the governing bodies could develop new indices that would help investors to predict the market trend in a dynamic way.

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