The weak form states that all past information are absorbed by the market which is reflected in stock prices.

The semi-strong form states that not only current stock prices reflect historical information but also newly public information.

The strong form extends the information further to include not only public information, but also private, secret information along with those information that has not been public yet. The best example would be insider information.

Informational Efficiency

Regulators, academicians and other institutions who are working around market have been advocating for efficient market.

Informational efficiency is needed in the market to make investment decision effective. If informational efficiency persist in market, all market participants (investors and others) can value their investments based on the information. This gives investors to "Trust prices" which are prevailing in the market. These prices become real fair value in market.

Thus, it can lead funds flow to those securities whose information are transparent and positive at the same time. And eventually leads to shareholders wealth maximization.

Another practical reason for advocating for efficiency is that participants who do not have the time and tools to do comprehensive research will be willing to invest their savings in the market if they trust that securities are accurately (efficiently) priced. This aids participants to guide investible funds into efficiently priced securities which is translated to effective projects leading to better returns. Finally, if capital markets are efficient, then regulators role in financial markets will be limited. If security prices do not accurately reflect fundamental information, then whole burden for maintaining financial market including capital allocation comes under shoulders of regulators.

Need of Random Walk Test in Microfinance Sector of NEPSE

A gap is found in other studies where only Random walk of NEPSE is tested. Also, it is seen that Random walk of Commercial Banks are tested *(Baral and Shrestha, 2006)*. To go into detail, NEPSE is a weighted index, where market capitalization of every listed stock is taken into consideration for index calculation. In addition to that, NEPSE consists of 27 listed commercial banks, 27 financial companies, and 32 Development banks. The

number of listed Microfinance institutions are 44 and still counting as MFIs stands out as one of the most IPO issuing sector after Hydropower Sector.

Microfinance Sub index is comparatively newer, the said sub index was bifurcated from Development Banks Sub index on November, 2017.

Thus, as Microfinance sector has not been studied exclusively before, also, the index is comparatively newer with increasing number of listed MFI which is making NEPSE index heavier with market capitalization of Microfinance companies, leading microfinance sector to be one of the market drivers tomorrow. Thus, it was deemed obligatory to know how MFI Stocks are traded and on what basis the MFI stocks are invested in.

2. Literature Review

Much of researches were not done about sub-indexes of NEPSE. Most of reviewed literature point out at nonrandom behavior of returns. Much of study has been done on various indexes of emerging markets. It consists of Gulf countries, Syria, Sri Lanka and also Nepal. Most of methodologies chosen by researchers are: Variance Test, Runs Test, Unit Root Test, Autocorrelation Test (Ljung-Box Test).

As stated most of researches on Nepali market were based on NEPSE Index, Baral & Shrestha (2006) is one of the specialized paper which has focused its study on commercial banks. The paper tested Weak Form of efficiency on seven selected commercial banks in Nepal, which was chosen at random in the fiscal year 2005/06. The paper used Runs Test and Test of Serial Correlation as methodology. The study concluded that there is no randomness in price changes in commercial banks of Nepal.

Mishra (2012) tested weak form of efficiency of Nepalese market by employing Autocorrelation test, Runs test, Variance test, and Unit Root Test. The test states there is randomness in monthly returns of NEPSE from 2003 to 2012.

Dangol (2010a) tested a randomness of NEPSE and other indices for 10 years. The test stated presence of stationary in returns and it does not follow a random walk. Multiple tests were applied. Unit roots, Augmented Dickey Fuller Test, and Philips-Perron Test were applied to test randomness.

As stated, before there were not much specialized research paper on MFIs as MFI sub index is new to NEPSE. Still, different families of Sub-Indices on NEPSE were tested in research papers.

Dangol (2010b) tested randomness of NEPSE and all other Sub-Indices. The paper applied Autocorrelation Test and other descriptive statistical tools. The result of the test stated of presence of weak form efficiency in all Sub-Indices when monthly and weekly returns are corrected for thin trading. This paper supported the random-walk and weak form of market efficiency.

As Nepal is as growing market based on increasing number of listed companies, and presence of new investors, papers based on emerging market were also reviewed.

Gupta & Gedam (2014) tested Random Walk Efficiency of some selected companies listed in NSE (India). Runs Test was employed and results showed significant Weak Form of Efficiency in these stock returns.

Hawaldar, *et al.* (2017) tested weak form of efficiency of Bahrain market. Weak form of EMH was tested using the KS Goodness of Fit Test, Run Test and Autocorrelation Test. The test concluded that there is nonrandom walk. But the unanimous conclusion from all test was reckoned unclear because of mixed results.

Abbas (2014) has applied random test on Damascus Securities Exchange. The researcher applied parametric and non-parametric tests as Serial Correlation Test, Variance Ratio Test and Runs Test, BDS Test from 2009 to 2014. It is found that daily returns were following nonrandom walk.

Dahel & Laabas (1998) also studied weak form of efficiency in four GCC markets: Bahrain, Kuwait, Oman and Saudi Arabia. The efficiency was tested in three different ways by Unit Root, Variance Test and Autocorrelation structure of returns. It was concluded that the GCC markets covered in this study have weak form of efficiency.

3. Methodology

As per the proposition of RWH, the successive price changes are independent. Thus, the following hypothesis is designed:

H_0: Successive results are independent of previous returns

H_A: Successive results are dependent of previous returns

Data

The sample is from the daily prices of Microfinance sub index of NESPE. The sample period is from 12/02/2018 to 05/15/2019. Daily returns are taken from the prices leading us have 113 observations (returns). The market returns are calculated as $RET=Ln (P_1/P_{t-1})$, where RET is Logarithmic Return. $P_1$is current price and P_{t-1} represents price before a

unit of period of time. Daily returns have been used. The use of daily returns was deemed necessary because a practicing short term trader in the market would need to make quick daily decisions about buy and sell activities.

The Model

Under the RWH, a market is efficient at the weak form if most current prices fully reflect all information contained in past prices, and the form reveal that past prices cannot be used as a predictive tool for future stock price movements. We employed econometrics methods which are used in the literatures to test the independence of prices data.

The problem is to see whether the stock prices is predictable or not by exploring serial dependence of stock returns, in order to test the random walk hypothesis (RWH) we used parametric and non-parametric methods, through employing two different procedures Ljung Box Test and Runs test.

Ljung-Box Test

Ljung-Box Test is an econometric test which is sometimes called Modified Box Pierce Test which tests for serial correlation up to specified lag. In financial econometrics the test is for finding serial correlation between returns of a financial time series. Being technical in language, **Ljung-Box Test** is applied to prove joint hypothesis that all autocorrelations between returns are equal to zero.

We take Q test for **Ljung-Box Test**.

$$Q = n(n+2)\sum_{k=1}^{m} \frac{\hat{r}_k^2}{n-k}$$

The Ljung-Box test rejects the null hypothesis if:

$$Q > \chi^2_{1-\alpha,\, h}$$

Where, α is level of significance and where χ^2 is the percent point function of the chi-square distribution. With degrees of freedom *h.* P-Value approach can also be used and same has been used in this study.

Runs Test

Runs test is a non-parametric test (non-parametric test does not assumes about the kind of probability distribution from which the observation are drawn). The runs test is a test

whereby the number of sequences of consecutive positive and negative returns is are observed and tabulated against its sampling distribution. Now it can be clear that "Run" is occurrence of one sign negative or positive without break - meaning consecutively. **(*Gujarati and Porter, 2005)***

Thus, stock returns runs can be counted, and Runs could be found out. *And Null Hypothesis (H_0) states these sequential results are independent.*

We can find the mean and standard deviation using formula given below:

$$\text{Mean, } \mu(r) : \frac{2n1n2}{n1 + n2} + 1$$

$$\text{Standard deviation, } \sigma(r) = \sqrt{\frac{2n1n2(2n1n2 - n1 - n2)}{(n1 + n2)^2 (n1 + n2 - 1)}}$$

Level of significance is taken as at 5%., Z=1.96

And similarly lower and upper limit based on Mean and standard deviation is calculated.

Confidence Interval

L.L: {μ-1.96*(σ)}

U.L: {μ+1.96*(σ)}

Decision Rule: Do not reject the null hypothesis of randomness with 95% confidence if Runs (*R)*, the number of runs, lies in the preceding confidence interval; reject the null hypothesis if the estimated Runs (*R)* lies outside these limits***. (Gujarati and Porter, 2005)***

4. Empirical Results

Runs Test

Runs test of the 113 observation of were done based on the method discussed in methodology. The calculation are simple, so it was deemed fit to carried out it in MS EXCEL©. The calculation are as follows:

Table 1: Particulars of Runs Test	
Number of Total Observations	113
Number of Runs	58
N0 (number –ve observations)	58
N1 (number of +ve observations)	55
Expected Return	57.46
Standard Deviation	5.29
Table 2: Limit Calculation	
Upper Limit	67.82
Lower Limit	47.10

As we can see, total number of observed runs fall within the calculated Upper Limit and Lower Limit, we conclude, returns are independent of each other. We infer from the test that present returns have no relation with prior returns and thus Microfinance sector follows Random Walk. (**H_0 accepted**)

Ljung-Box Test

The **Ljung-BoxTest** was also carried out up to different Lags. We must be informed that **Ljung-Box Test** is carried out based on lags jointly. In total, seven test were done. The number of test were determined on the basis of lags chosen. The test were carried out in R Studio©.

Table 3: Q-statistics for Daily Index Returns of MFI Index

S.N.	Lags up to:	P-Value	Q-Stat	Result
1	5	0.295	6.1154	**Accept H_0**
2	10	0.133	14.973	**Accept H_0**
3	15	0.169	20.072	**Accept H_0**
4	20	0.445	20.200	**Accent H_0**
5	30	0.655	26.393	**Accept H_0**
6	40	0.886	29.589	**Accept H_0**
7	50	0.962	33.805	**Accept H_0**

We see P-Value up to all the lags including up to maximum lag length 50 were greater than 5% level of significance. Thus, we accept Null Hypothesis effectively up to each lags that the returns are independent of past prior returns concluding that MFI follows Random Walk (**H_0 accepted**).

5. Conclusion

The test reveals that the microfinance sub index shows random walk. The empirical evidences, though no study was done on microfinance index, states that NEPSE follows nonrandom walk. As per our study it is further asserted that Microfinance index returns cannot be predicted based on past returns and thus, it follows a Random Walk. As it is tested and believed that as daily returns of MFI Index follow a weak form of efficiency investors cannot reap the benefits of forecasting stock prices and information from forecasting would not be useful. Further researches on MFI Sub-Index is proposed.

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