

NEPSE Sub- Indices Performance Evaluation: A Risk-Return Analysis with Sharpe, Treynor, Jensen and Modigliani Approaches

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Abstract

Portfolio analysis offers a formal approach to decision making on how to make a proper investment decision at least in relation to the portfolio performance analysis in emerging markets. The primary goal of the research was to assess the performance of chosen sub- indices of the Nepal Stock Exchange in terms of Sharpe, Treynor, Jensen as well as the measures of the M² by Modigliani. The study employed explanatory descriptive research design using latest data of selected subindexes from NEPSE ALPHA. Also, verification was done crosschecking data from Share sansar. Performance assessment of years 2021 to 2025, using 91-day T-bill rate. Average annualized risk-free rate of 5.12% has been used as proxy. Additionally, the Sharpe ratio, Treynor ratio, Jensen's, and M-squared metrics were calculated using the daily closing price. The results showed the hotel index gained the highest annualized return of 17.44% and outperformed across multiple performance measures, with the highest Sharpe ratio of 0.384, Treynor ratio of 23.62%, and Jensen's alpha of 16.7%. At the same time, Mutual funds were less volatile, with a ($\sigma = 0.207$) and a favorable Coefficient of variation of 5.40 ensuring positive return. The most volatile with ($\sigma = 0.412$) with negative returns but the highest in ($M^2 = 4.25$) where market risk was adjusted was the Finance Index. On the same note, the development bank index depicts poor risk-return Coefficient of variance -33.34. The form of data above indicates that the Hotel Index has worked exceptionally well within the measurement period that the Trading offer and the Mutual Fund Index provide diversification to potential investors. While. Meanwhile, the weakening of the Finance and Development Banks makes them less desirable, because of the heavy risks and bad performance. Consequently, the investors can opt to take the diversification strategy so that the risk is reduced and returns can be maintained in the long run. This strategy will give investors a stronger investment strategy in order to improve their yields. Future researchers may apply additional tools, such as the Sortino ratio, stochastic modelling, and the value-at-risk model, to strengthen the performance.

Keywords: NEPSE Index, Risk Assessment, Sharpe Ratio, Treynor Ratio, Jensen's Alpha

Introduction

Portfolio analysis refers to the procedure of risk, returns and strategy evaluation in investment decisions. The portfolio analysis offers a systematic approach to making the right investment choices and changing to more appropriate investment opportunities. Various tools and techniques are employed by organisations, fund managers, investors, and other concerned parties to ensure that they take the greatest returns out of their portfolio investments. Investors are interested in an optimum level of profit as opposed to absolute profit based on the degree of risk. In order to deal with this issue, diverse financial instruments have been implemented in the economic literature. The Sharpe ratio, Treynor ratio, Jensen alpha and Modigliani, along with other measures, are employed as well amongst majority of models.

The ratio, which was created by Sharpe (1965) is known as the reward to variability ratio. It assesses a portfolio's performance based on the standard deviation of its returns or the risk premium relative to the overall risk. Sharpe improved the metric in 1994, and risk-adjusted performance is frequently measured using it. This ratio shows the best Sharpe ratio, which is the best performance. The Sharper ratio is the easiest to compute and can be applied to diversified and non-diversified portfolios, and that is the strength of this ratio as it is easy to compare the performance of a portfolio and the strategy implemented by the institution. However, it has some limitations such as equal penalties for upward and downward volatility. It was assumed that the data were typically distributed. However, in the long run, if there are no stable averages and variances, then there is performance bias. It always misclassifies whether the investment return is negative across different time horizons. (Steinki & Mohammad 2015)

The Treynor ratio was introduced by Jack L. Treynor in 1965, which is used to measure portfolio performance, risk premium, and return over the systematic risk (Beta). This detaches market-related risk, making it particularly useful for evaluating diversified portfolios. The higher the Treynor ratio, the superior the portfolio performance relative to the risk premium. The strength of the Treynor ratio is determined by segregating systematic and unsystematic risks using beta, which provides stability as a risk measure. However, it relies on the CAPM framework, which is sensitive to the choice of the market index and assumes that portfolios are diversified. If the portfolio has low correlation with the benchmark, it produces misleading values. Variations such as the Appraisal ratio, Jensen's alpha, and Generalised Treynor have been developed to address this problem.

Jensen's Alpha was introduced by Michael Jensen in 1968, which measures the risk premium of a portfolio's performance and helps fund managers make forecasts of returns. The capital asset pricing model created by Sharpe and Treynor serves as the foundation for this. Jensen's Alpha measures whether a portfolio's earnings exceed the expected level of systematic risk. Between 1945 and 1964, empirical evidence of mutual funds from 115 U.S. mutual funds shows that an average fund manager was unable to outperform consistently. Market strategy of fund managers: Buying and selling: Most managers cannot cover brokerage expenses. The strength of this approach is that it isolates the manager's skill from market risk, thus providing a reliable assessment of the total performance. However, it also relies on the CAPM framework, and there is a possibility of bias when the portfolio deviates from the diversification assumption or the portfolio returns are highly negative (Jensen 1968).

In 1997, Franco Modigliani and Leah Modigliani introduced risk-adjusted performance (M^2). It uses a benchmark to measure an adjusted portfolio's return at the same level of risk as that of the benchmark market. These metrics help investors and fund managers make relative comparisons across portfolios. Based on contemporary portfolio theory, M^2 is an improvement above previous metrics like Jensen's alpha and the Sharpe ratio. The measure shows whether the portfolio outperforms or underperforms the market once the risk is standardized. Empirical applications explain that portfolio managers adjusting to benchmark risk provide a precise evaluation of fund managers' skills rather than risk-taking. During market strategy management, achieving a higher M^2 adds real value to the portfolio, while those with a lower M^2 underperform the benchmark. However, it needs accurate risk adjustment and assumes that market benchmarks are appropriate for evaluation (Modigliani 1997).

The history of Nepal's security market began with the floating Share of Birtnagar Jute Mill's and Nepal Bank limited to 1937 B37B. S. The first government security bond was issued in 1964, and the Stock Exchange Center (SEC) was founded in 1976 with the goal of encouraging and facilitating the expansion of the capital market a major model of capital market development. Under capital market reform programmer in 1993 SEC converted into Nepal Stock Exchange.

The Nepalese stock market is underdeveloped with more than 300 companies listed and actively trading on the NEPSE platform. Despite an increase in the number of listed securities, challenges, such as weak corporate governance, lack of transparency, limited diversification, and ineffective enforcement of legal provisions, continue to hinder performance. The predominance of financial instruction and inadequate protection of the minority investor has weakened confidence, making it essential to strengthen reform in security, governance, and transparency (Koirala and Bajracharya 2002).

Karki et al. (2023) examined the performance using descriptive and quantitative methods, including modelling, back testing, and bootstrap analysis between September 2012 and August 2022, using technical indicators (simple moving average, moving average convergence/ divergence, relative strength index, stochastic oscillator, and Bollinger Band on NEPSE and its sub-indexes) and discovered that a majority of indications tend to favor the technical analysis in NEPSE. Certain indicators however fail and relativity strength index gives a negative return. This indicates that certain technical indicators do not provide substantial returns in a given index, and argues that further considerations are needed in making sound decisions in Nepalese stock market.

Portfolio performance evaluation gives good information on the performance of the investment strategies as well as aids in making strategic investment choices. Not many studies in Nepal compare the performance of mutual funds using Sharpe, Treynor and Jensen ratios. Nevertheless, this kind of analysis has its own unique insights and specific research gaps which are filled and thus its usage is essential to make a complete analysis of the portfolio.

Various experiments have been carried out in the developed markets and have widely been deployed to the risk-adjusted performance assessment. Nevertheless, new market economies like Nepal where capital markets are less developed and investor behaviour varies greatly has weak empirical evidence on Sharpe, Treynor and Jensen ratios to determine portfolio efficiency. This lack of local evidence creates a gap in understanding whether Nepalese indices deliver adequate risk-adjusted returns. Addressing this gap provides support to portfolio managers, investors, and policymakers for guiding and making appropriate financial decisions. In order to add to the body of knowledge on portfolio performance evaluation in emerging markets, the primary goal of this study is to assess the performance of particular indices of the Nepal Stock Exchange using the Sharpe, Treynor, Jensen, and Modigliani's M^2 measures.

Literature Review

Several studies have used Jensen, Treynor, and Sharpe to evaluate the performance of stocks listed in the indices.

Manap et al. (2025) analysed investment companies' financial performance using the Treynor Black method analysis of Risk-Adjusted Returns to validate portfolio optimisation effectiveness. Identifying higher Sharpe and Treynor ratios, along with a positive Jensen's alpha, effectively manages systematic risk through active management (Gobbilla & Keerthi 2025).

Assess the mutual fund Using a quantitative approach to analyze the NAV trends of five years' worth of secondary data using Sharpe, Treynor, and Jensen's Alpha, the performance of ICIC Growth Plan Fund and SBI mutual fund to guide investor decision-making revealed that the majority of schemes' risk-adjusted returns fall short of market expectations. In terms of growth and stability over time, the SBI Scheme often performs better. These variations are contingent upon management strategies, including risk consistency and risk profiles.

(Ruma & Tawe 2023), Analyze the Indonesia Stock Exchange LQ45 index optimal stock portfolio performance between (Feb 2019 & December 2022) using a single index model and evaluate it using Sharpe, Treynor, and Jensen metrics. Of the 30 stocks, eight achieve optimal profits (ADRO, ANTM, BBKA, BRPT, INCO, INDY, ITMG, and MEDC). The analysis shows that the Sharpe ratio (0.1241) outperforms Treynor (0.0112) and Jensen (0.0334), indicating that the Sharpe method is the most effective in assessing portfolio performance.

"Analisis Perbandingan Kinerja Reksadana Saham sebagai Dasar Pengambilan Keputusan untuk Berinvestasi pada Masyarakat Kota Bandung Menggunakan Metode Sharpe, Treynor, Jensen, dan Rasio Informasi" study evaluates the performance of mutual fund portfolio between 2014 to 2020 by using Sharpe, Treynor, Jensen, and information ratio method. It also examines investors' investment decisions before and during the pandemic and conducts positive philosophy-based quantitative research with a randomly selected sample, instrument-based data collection, and statistical analysis used for hypothesis testing. The Kruskal-Wallis test ($\chi^2 = 4.233$, $p = 0.237 > 0.05$) showed no significant differences in portfolio performance across the four methods. However, most participation agreement performance factors influence investor investment decisions which is reflected by questionnaire responses. (Wiliyawan & Nurdin 2022).

(Alim, Rahmawati, & Matsaany 2023) Analyze the performance of stocks listed in Jakarta Islamic Index (JII) for portfolio formation based on performance prioritize utilizing the Jensen, Treynor, and Sharpe indices. The JII index's closing stock price quantitative data from March 2018 to February 2023 was assessed using descriptive and analytical research found that the optimised portfolio consists of 69.17% MDKA, 26.55% HRUM, and 4.28% BRIS shares. In conclusion, using multiple performance indices allows investors to select stocks effectively and construct an optimised portfolio adhering to Sharia principles.

Methodology

This study intends to assess the performance of the Indices of the Nepal Stock Exchange from 16 July 2021 (1 Shrawan 2078) to 15 July 2025. Four year's performance assessment, descriptive and exploratory research analysis was used, and the research analysed 12 indices categorised in NEPSE. Daily closing prices were considered to calculate returns.

To evaluate the performance index, we used purpose sampling techniques, which calculate the Sharpe ratio, Treynor ratio, Jensen's, and M-squared metrics using the closing price. The NEPSE Index has been considered as the benchmark index for market return. Daily Closing prices were collected from Nepse Alpha, Share Sansar, and the Nepal Stock Exchange Web portal.

Risk Free Rate:

To determine the risk-free rate, 91-day Treasury bill yields were collected from the Nepal Rastra Bank and Public Debt Management Service website. We converted each monthly 91 T-bill rate into the daily risk-free rate as follows:

$$r_d = (1 + r_{\text{monthly}})^{\left(\frac{1}{365}\right)} - 1$$

From the available daily series of risk-free rates, 0.0195 %. Consider as a constant over the period and annualized it to calculate the proxy risk-free rate.

annualized risk-free rate is calculated as follows:

$$r_{f(a)} = (1 + r_{\text{daily}})^{(252)} - 1$$

Where,

$$r_{f(a)} = \text{Risk free rate annualized}$$

Where the annualized risk-free rate of 5.12% is used as a proxy for calculating the Sharpe ratio, Treynor ratio, Jensen's alpha, and M².

Return:

The daily returns of index were calculated using the following formula:

$$R_t = \frac{P_t - P_{(t-1)}}{P_{(t-1)}}$$

Where,

R_t = Return of Index In 't' period

P_t = Market price of of Index In 't' period

P_{t-1} = Market price of of Index In (t – 1) period or previous day.

To analyses performance, the daily risk-free rate and four years (excess return and annual standard deviation) were annualized as follows:

$$R_{\text{annualized}} = \left(\frac{P_1}{P_0}\right)^{\left(\frac{1}{n}\right)} - 1$$

Where,

P_1 = Ending closign price last dated

P_0 = Begining price of Index

n = Time duration

The annual standard deviation is calculated as follows:

$$\sigma_p = \sigma_{\text{daily}} * \sqrt{252}$$

σ_p = annualized standard deviation of protfolio risk

σ_{daily} = daily satandard deviation

252 = approximate trading day

Risk

The study used the standard deviation (σ_i), coefficient of variation (CV), and beta (β) to measure risk. (σ_i) is used for measuring 'Total risk'. It represents the dispersion of observations from the mean; the greater the (σ_i), the greater the deviation, and the higher the risk.

Standard deviation

$$\sigma_i = \sqrt{\frac{1}{N} (R_i - \bar{R}_i)^2}$$

CV was used to measure the relative risk. This represents the risk per unit return. The lower the CV value, the lower the relative risk of the fund.

$$C.V = \frac{\sigma_p}{\bar{x}_p}$$

Where,

σ_p = Annualized Standard deviation of the population

$\bar{x}_p$ = Annualized Average return of the population

Beta was used to evaluate market risk or systematic risk. The following formula was used to determine the beta value:

$$\beta_i = \frac{\text{Covariance } (R_m, R_i)}{(\sigma_m)^2}$$

β_i = Beta of Portfolio

R_i = Return of individual index

R_m = Return of Market Index

σ_m = Standard Deviation of market

Risk-Adjusted Performance

The Sharpe Ratio, Treynor performance measure, Jensen's Alpha, M-squared measure, and information ratio are used to evaluate each index's performance.

The risk premium earned per unit of total risk is represented by the Sharpe ratio. It can be stated as:

$$S_r = \frac{R_i - R_f}{\sigma_i}$$

The Sharpe ratio evaluates performance by taking into account both the overall risk or variability and the rate of return. A fund performs better when its Sharpe ratio is higher. The Sharpe ratio of a single fund, however, is uninformative. To compare the funds, each fund's Sharpe ratio needs to be calculated. Inaccurate ranking is produced by the Sharpe ratio with a negative numerator. Another drawback of Sharpe's ratio is this.

Both systematic and market risk are taken into account by the Treynor performance metric. This strategy is predicated on the idea that the portfolio should be fully diversified. Therefore, the market risk which cannot be diversified should be the relevant risk for obtaining higher return compensation. The following is an expression for the Treynor performance measure:

$$T_r = \frac{R_i - R_f}{\beta_i}$$

This is the return on the risk premium per unit of systematic risk. Investors desire a higher Treynor measure value. Negative numerators are incompatible with the Treynor ratio. For meaningful ranking, a positive beta is also necessary.

The Treynor and Sharpe ratios don't reveal whether the mutual fund fared better than the market portfolio. They don't tell us how much a higher index ratio is better than a lower index ratio.

Market risk is the foundation of Jensen's Alpha. The gap between each index's actual mean return and predicted return is represented by Jensen's Alpha. It can be stated as:

$$\alpha = R_{p \text{ or } i} - [R_f + \beta_i(R_m - R_f)]$$

When Jensen's alpha is positive, it means that the index did better than the market. Conversely, underperformance relative to the market is indicated by a negative number. This study employs alternative metrics for ranking because the Sharpe and Treynor ratios have some drawbacks. The Jensen Measure is used to rank the index performance based on market risk, while the M Squared (M^2) measure is used to account for overall risk.

$$M^2 = (R_i - R_f) \times \left(\frac{\sigma_m}{\sigma_i} \right) - (R_m - R_f)$$

An alternate technique for ranking the index's performance is the M Squared (M^2) metric. It can be stated as follows: If the value is zero, the index's performance is equal to the market's; if it is positive, the mutual fund outperforms the market on a risk-adjusted basis.

Major Finding

An analysis based on the index's closing price and annualized returns based on the market prices of twelve indices, together with their total risk, relative risk, systematic risk, and risk-adjusted performance metrics, are shown in Table 1.

Return (Based on Market Price)

The hotel sector generated the highest average annualized return (17.44%) based on market pricing over a four-year period (16 July 2021–17 July 2025). Index, with a higher return, while the Mutual Fund and Trading Index and Manufacturing Index earned 3.83%, 2.04%, and 0.12%, respectively, whereas the other indices perform negatively. When the Benchmark market Index loses by -3.33% (NEPSE index) based on annualized returns.

Between (16 July 2021 and 17 July 2025), nine indices provided a negative return. Most indices showed negative annualized returns. However, indices with positive adjusted returns (e.g. hotels, mutual funds, trading, and manufacturing indices) become viable investment options for portfolio diversification.

Risk

From all 12 indices, "Mutual Index" is found to be less volatile with a 0.207 standard deviation and a better CV of 5.40 with a positive return. While the Banking Index gained a less volatile standard deviation with 0.212 standard deviation, a (-2.65) CV, and Benchmark Index NEPSE showed a low standard deviation (0.22) with a (of-6.81) CV, with a negative return.

Conversely, the Finance Index was found to be the most volatile with a standard deviation of 0.412 and a (of-9.51) CV, with high instability and negative returns. Similarly, the Development Bank index occurs with 0.337 standard deviation with unfavourable CV -33.34, and the Manufacturing Index with 0.263 standard deviation and 210.75 CV shows excessive relative risk, which makes them unattractive investment options.

Performance

The greatest Sharpe measure (0.384) was obtained by the Hotel Sector Index. For every unit of total risk, investing in the hotel index yields 0.384 units of extra gains. The Hotel Index also had the highest Treynor measure (23.62%), indicating strong and positive performance relative to systematic risk. More than that, Hotel Index recorded the highest Jensen's Alpha with (16.73%), which indicates that hotels achieve superior risk-adjusted return in contrast to the CAPM expectation

The Finance Index found the highest M Square (4.25%), which suggests that if the market risk level is adjusted, the market generates a better risk-adjusted return under this matrix. A higher volatility with a negative Sharpe ratio is a weakness of the Finance Index, which may deter investors. Of the 12 indices, seven indices had positive M-square means, indicating that they outperformed the market. The Hotel Index had the highest Alpha Value (16.73%); a positive alpha suggests that the index represents performance, while a negative alpha indicates underperformance by the index.

Overall, the Hotel Index performs best relative to the other indices across multiple measures (Sharpe, Treynor, and Alpha). At the same time, the finance lead on M-squared is aware of relative risk.

Conclusion.

This study assessed the performance of the NEPSE index's closing market point. The Closing point is used as the basis for calculating the index's market performance. This study calculates the Sharpe ratio, Treynor ratio, Jensen's α , and M^2 metrics based on a 4-year daily price annualized return. Even though the market and most sectors saw negative returns, the Hotel Sector Index had the highest average annualized returns (based on market price) over a four-year period, at 17.44%, while the Mutual Fund and Trading Sector Index had positive returns of 3.83% and 2.04%, respectively.

Mutual Funds were less volatile (as compared to finance which is the most volatile) according to risk assessment. The performance appraisal establishes that hotel sector index is very promising within the Sharpe, Treynor, and Alpha performance measures whereas the finance results in M-Square that has greater volatility. The data above demonstrate that Hotel Index recorded excellent results during the period of measurement when the Mutual Fund Index and Trading provide diversification to prospective investors. While. Simultaneously, such alternatives as Finance and Development Banks turn unfavorable because of the over-risk and under-performance.

Implication:

This study was based on historical data from 16 July 2021 to 16 July 2025. In the Future, owing to exogenous factors and changes in the market scenario, the performance of the index may differ. Therefore, investors can adopt a diversification strategy across positively performing indices to minimize risk and sustain returns over time. This approach provides investors with a more resilient investment strategy for enhancing their yields.

Future Recommendation

Future Researchers may apply additional tools, such as the Sortino ratio, stochastic modelling, and the value-at-risk model, to strengthen the performance of the index, utilize updated available data accounting for expanding population growth, and incorporate exogenous variable factors such as macroeconomic variables.

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APPENDIX 1

Variance	Annua l Return	Annual Standard	Sharpe Ratio	Beta	Treyon	Jenson Alpha	M square measure	CV
NEPSE	- 3.33%	0.226	-0.373	1	-8.45%	0.00%	0.00%	-6.806
DEV BANK	- 1.01%	0.337	-0.182	1.325	-4.63%	5.06%	2.01%	-33.345
BANK	- 8.00%	0.212	-0.619	0.925	-14.18%	-5.31%	-0.90%	-2.649
FIN	- 4.33%	0.412	-0.229	0.45	-20.98%	-5.65%	4.25%	-9.511
HOTEL	17.44 %	0.321	0.384	0.522	23.62%	16.73%	-3.64%	1.842
HYDRO	- 1.42%	0.333	-0.196	0.609	-10.75%	-1.40%	2.10%	-23.421
INVESTM ENT	- 1.84%	0.287	-0.243	0.714	-9.75%	-0.93%	1.46%	-15.591
LIFE INSURAN CE	- 6.95%	0.265	-0.455	0.75	-16.10%	-5.74%	1.77%	-3.817

MANUFACTURING	0.12%	0.263	-0.19	0.682	-7.33%	0.76%	0.69%	210.755
MICROFINANCE	-3.66%	0.256	-0.342	0.738	-11.90%	-2.55%	1.03%	-7.001
MUTUAL FUND	3.83%	0.207	-0.063	0.405	-3.19%	2.13%	-0.12%	5.401
NON LIFE	-3.20%	0.258	-0.322	0.767	-10.84%	-1.83%	1.02%	-8.078
TRADING	2.04%	0.346	-0.089	0.452	-6.83%	0.73%	1.06%	16.985