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Risk-Return Analysis of Infosys Co. Ltd

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ABSTRACT

This research paper presents a comprehensive risk-return analysis of Infosys Co. Ltd., an Indian multinational IT corporation, using historical monthly returns from January 2021 to December 2024. Amidst economic volatility and globalization, assessing the company's return profile and embedded risk is crucial for reasoned investment decisions and management. The study employs empirical models including descriptive statistics, Monte Carlo simulation, multivariate regression, Value at Risk (VaR), and Conditional Value at Risk (CVaR) to assess Infosys' investment charisma and volatility. Results reveal that Infosys has consistently generated moderate volatility returns, maintaining favorable risk-adjusted profile. Analysis confirms Infosys as a viable long-term investment within diversified portfolios, while advising caution in extreme market scenarios. It particularly benefits investors seeking exposure to the Indian IT sector with rational perspective on associated risks. Integrating classical and advanced simulation models, visualizations, and comparative forecasts, the study serves as practical guidance for investors, analysts, and researchers in risk-return evaluation and portfolio management.

Keywords: Infosys, Risk-Return, Volatility, Investors, Stock Market.

INTRODUCTION

In the dynamic landscape of financial markets, risk and return are key factors in the investment decision-making process. With the morphing scenario nature of Indian financial markets and shifting investor expectations, it becomes essential to understand the historical return behavior, volatility patterns, and market sensitivity of Infosys Co. Ltd., a leading Indian information technology company.

This paper aims at providing valuable insights into the performance and volatility of Infosys shares, assessing its' investment potential over a four-year period (2021–2024). Maneuvering quantitative approach and employing various statistical and mathematical tools—including descriptive statistics, graphical representations, Monte Carlo simulation, multivariate regression, and VaR—the study offers a holistic overview of Infosys's risk-return profile.

Analysis reveals that Infosys remains a propitious long-term investment for diversified portfolios, although investors should be circumspect during extreme market scenarios. This research presents a pragmatic reference for investors, management, and researchers aiming to understand stock-specific risk-return dynamics in emerging economies. It also paves the way for future comparative studies across sectors, abetting in asset allocation and portfolio design strategies.

LITERATURE REVIEWS

Kanthimathi et al. (2023) and Kolte et al. (2022) acknowledged market unpredictability, while asserting significant potential of ML (Machine Learning) and DL (Deep Learning) techniques for managing risk-return dynamics of stocks like Infosys Ltd[1,2]. Bantwa & Ansari (2019) found Infosys, HCL Technologies, and Tech Mahindra to be extremely fragile to market trends, showing significant systematic risk[3].Zhao et al. (2023) developed methodological rigor exercising advanced risk metrics and AI-powered forecasting for global equity analysis, apropos Indian firms like Infosys[4]. Maiti and PushparajShetty (2020) circumstantiated the efficiency of Long Short-Term Memory (LSTM) and GAN(Generative Adversarial Network) models for Indian NSE stocks, perceiving these models' strength to emulate traders' behavior, key for capturing risk-return perceptivity[5]. Logambal and Kanagasabapathy (2024) emphasized the critical role of technological adaptation and agile investment strategies in maneuvering the dynamic environment of IT sector[6]. Singh (2022) and Jaiswal et al. (2022) strengthened the necessity for resilient prediction models to address intrinsic instability of the Nifty50 Index[7,8]. Fathali, et al. (2022) addressed challenges in stock market prediction on the NSE applying deep learning for time series analysis. Ultimately, informed investment choices remain a strenuous task, as acknowledged by Kokare et al. (2022), making resilient predictive models indispensable in coxing stock market complicacies[9,10]. Jyothilinga and Venkatesha (2022) emphasized investor preference for high-return, low-risk stocks on the NSE[11].You et al. (2023) emphasized LSTM models' merits for risk and return prediction in investment portfolios, particularly in volatile environments[12].Zhang et al. (2024) reviewed transformers and graph neural networks in upgrading prediction authenticity[13]. Ajiga et al. (2024) underlined importance of feature selection in ML models, offering crucial aspect for navigating intricate stock markets[14]. Khan MN (2024) used TVP-VAR(Time-Varying Parameter Vector Auto regression) model to examine volatility integrity in global markets, providing essential prescience for risk management during crises[15].Ch. Naresh et al. (2024) examined volatility models in forecasting future volatility, concluding that demeaning statistics profoundly affect volatility, a takeaway for effective portfolio decisions[16]. Maddodi and Kunte (2024) underscored social media sentiment in forecasting stock market behavior amidst geopolitical tensions. They developed an avant-garde model incorporating sentiment and momentum indicators into stock prediction for better veracity[17]. He et al. (2023) presented the power of ensemble deep learning models in financial forecasting[18]. Fraternali et al. (2022) stressed the need for explainability tools in Deep Neural Networks (DNNs) models implementation[19]. Karuppiah et al.(2021) and Jiang (2020) extensively examined DL architectures like RNN (Recurrent Neural Network) and LSTM for NSE stock market prediction, and appreciated them for flexibility and superior accuracy in temporal prediction[20, 21]. Rajkar et al. (2021) examined stock market predictions employing fundamental and technical indicators, finding slightest variations between predicted and real price volatilities[22].Goel and Singh (2021) achieved strong prediction results integrating macroeconomic and global market factors into Artificial Neural Networks(ANN) model for Indian markets[23]. Dinesh Shoban et al. (2021) offered hybrid ML model to address latency of moving average strategy in stock prediction[24]. Kishori and Divya (2020) dealt with technical analysis for selected companies on the BSE, focusing on predicting share price and identifying trading opportunities, key aspects in analyzing stock-level return and risk behavior[25]. Matsumoto (2022) developed quantitative risk frameworks for multinational technology firms, which include firms like Infosys. Focus on market risk during crises underscores the need for comprehensive models for risk-return

evaluation during volatile periods[26]. Lee et al. (2022) and Aldhyani and Alzahrani (2022) explored BiLSTM and DL models to initiate profitable trading methodologies, and underscored the assurance of the models in stock price movement prediction[27]. Paliwal and Sharma (2022) promoted evolutionary algorithms for model optimization. This approach not only enhances the ability to detect broad market trends but also supports the development of more reliable and refined predictive systems[28]. Atkins et al. (2018) and Cao (2021) acknowledged sentiment analysis and hybrid human-AI[29, 30]. Nenavath (2018) while examining CAPM (Capital Asset Pricing Model) and three-factor models in Indian markets, observed that three-factor model cogently delineated stock return behavior, and beta served as crucial benchmark of risk, with higher beta tied to better yield[31].Faisal et al. (2018) stressed evaluating beta for stock selection and portfolio construction with low beta, supporting risk management[32].

OBJECTIVES OF THE STUDY

The principal objective of this study is to examine and interpret the risk-return characteristics of Infosys Co. Ltd. for 2021–2024 using both traditional and modern financial tools. Specifically, the study seeks to compute and analyze monthly and annualized returns, evaluates risk profile applying standard deviation, coefficient of variation, and beta coefficient, and assesses downside risks through VaR and CVaR at 95% confidence level. It also strives to simulate future price paths using Monte Carlo Simulation and effectuate multivariate regression to explore the relationship between Infosys's returns and the NIFTY50 index. Lastly, the study explores implications on different investor types and recommends investment strategies and future research directions, bridging theory with practical experience from Infosys's stock performance.

INFOSYS–AN INTRODUCTION

Infosys Limited, established in 1981 with an initial investment of US $250, is a globally renowned Indian IT company headquartered in Bengaluru. It provides business consulting and IT services across 45 countries, helping clients boost dexterity and streamline functions. Rated A-by Standard & Poor's, Infosys is famed for cutting-edge delivery, and digital commerce. Forbes India (2020) and Forbes American Business Magazine(2020) portrayed its' stature as an "Asian invasion," and ranked 3rd in Forbes' 2019 list of "The World's Best Regarded Companies for 2019" for it's credibility, employee equity, affability, and service excellence which exemplifies its' magnum opus, and also embellishes trustworthiness of ubiquitous technological facilities[33,34]. Recognized by Ethisphere as one of the World's Most Ethical Companies and certified as a Top Employers' Global, 2021, Infosys keeps driving in sustainability and technological impact.

METHODOLOGY

Data Collection

1. Monthly adjusted closing prices of Infosys Ltd. from January, 2021 to December, 2024;
2. Source: Public Stock Exchange Archives;
3. NIFTY50 Index data: Market benchmark for beta and regression analysis.

Tools and Techniques Used

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- **Monthly Return Calculation:** Monthly Return(%)= $\left(\frac{P_t - P_{t-1}}{P_{t-1}}\right) \times 100$;where, P_t =closing price at time t, and P_{t-1}=price in the previous month. i.e. Current Month Close–Previous Month Close)/Previous Month Close)×100
- **Average Monthly Return ($\bar{R}$):** $R^- = \frac{1}{n}\sum_{i=0}^{n} R_i$ i.e. Mean of Monthly Returns
- **Standard Deviation (σ):** $\boldsymbol{\sigma = \sqrt{\frac{1}{n-1}\sum_{i=0}^{n}\{(R_i - R^-)\}^2}}$
- **Annualized Return: R_{annual}**=$(1+R^-)^{12} - 1$
- **Annualized Risk (Volatility**): $\sigma_{annual}=\sigma\times\sqrt{12}$
- **Coefficient of Variation (CV):** CV= $\frac{\sigma}{R}$ (i.e. Annualized Risk/Annualized Return)
- **Value at Risk (VaR):** VaR at 95% = 5th percentile of Historical Returns(i.e. Mean Return−1.645×Standard Deviation)
- **Conditional VaR (CVaR):** CVaR = Mean of Returns ≤ VaR{i.e. Mean of returns worse than VaR (tail loss estimate)}
- **Beta and Correlation:** Beta= $\frac{Cov(R_i, R_m)}{Var(R_m)}$; where R_i=Infosys return, R_m=Market return (NIFTY 50)
- **Sharpe Ratio** = $\frac{R - R_f}{\sigma}$

Monte Carlo Simulation

1. 1,000 simulations generated
2. Monthly return and standard deviation used as input parameters
3. 12-month projection modeled

Software and Analysis Tools

1. MS Excel used for simulation and summary statistics
2. Regression computed using least squares method
3. Graphical outputs generated via Excel/Matplotlib equivalents

RESULTS AND DISCUSSION

This chapter offers a comprehensive risk-return analysis of Infosys Ltd. from January 2021 to December 2024. Integrating historical monthly data, Monte Carlo simulation, comparative analysis, and regression-based risk modeling, this section captures Infosys's risk-return dynamics, market behavior, and potential future performance.

Monthly Return Analysis

Infosys's monthly return data (2021–2024) as summarized in Table 1 offers crucial insights into its' performance and volatility.

Table 1: Monthly Return Statistics (2021–2024)

Metric	Average Monthly Return	Monthly Standard Deviation	Annualized Return	Annualized Risk	Coefficient of Variation (CV)
Value	~1.02%	~6.38%	~12.96%	~22.12%	~1.71

(Monthly returns plotted showing cyclical volatility and growth)

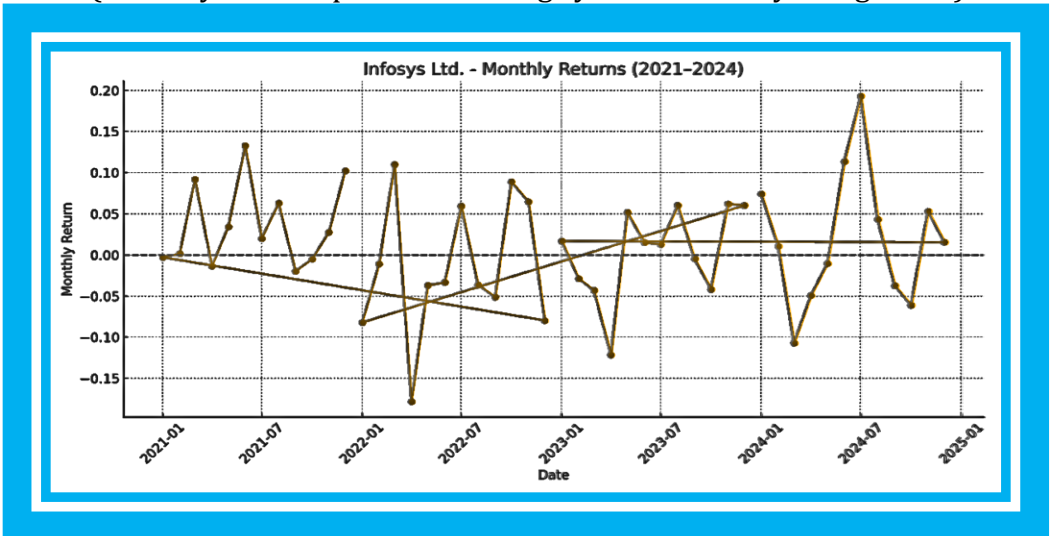

Figure 1: Monthly Return Trend of Infosys Ltd. (2021–2024)

Interpretation: Infosys's consistent positive monthly returns (approx.1.02%) with moderate volatility (6.38%) reflected by CV(1.71), yielding 12.96% annualized return at 22.12% risk level, place it a top Nifty IT performer(Table1). Cyclical patterns reveal stable risk-return during bullish phases (2021, mid-2023) but losses during market corrections like early 2024(Figure1). Seasonal Q2 dips are typically followed by sharp gains post-earnings and dividend announcements. Intense examples include +19.3% returns in July 2024 and -17.83% losses in April 2022. Despite fluctuations, Infosys remains suitable for diversified, growth-focused portfolios, attracting investors seeking blue-chip growth.

Monte Carlo Simulation

The Monte Carlo simulation forecasts Infosys's potential future price trajectory over one-year outlook using 1000 simulated paths based on historical volatility and returns (starting at ₹1500, with daily returns and 252 trading days).

Table 2: Simulation Results:

Metric	Average Ending Price (Mean)	Standard Deviation (1 Year)	5th Percentile (VaR)	25th Percentile (Q1)	Median (50th Percentile)	75th Percentile (Q3)	95th Percentile
Simulated Value (₹)	19,574.33	24,951.68	2,276.26	5,786.66	11,867.76	23,751.95	64,249.60

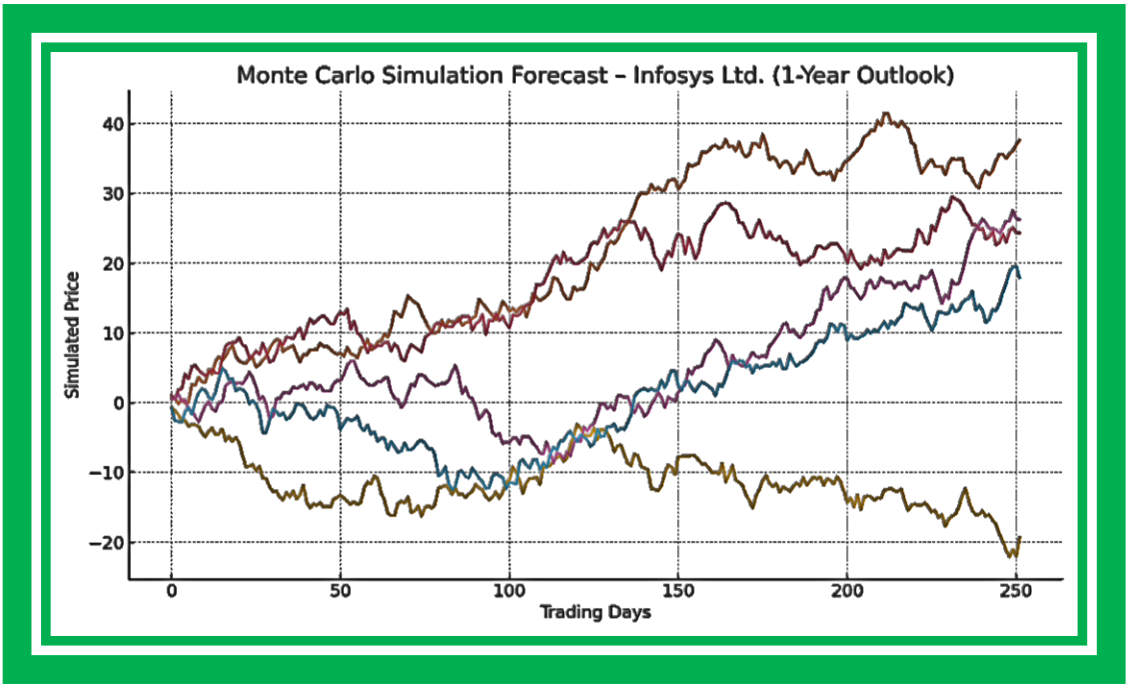

Figure 2: Monte Carlo Simulation-Infosys 12-Month Stock Price Forecast

Interpretation: The Monte Carlo Simulation chart (Figure 2) expressively represents Infosys's potential future price paths with a fan-shaped spread, epitomizing gradual appreciation alongside broadening volatility and uncertainty. This underlines the urgency for diversification and strategic planning. The simulation, based on Table 2 and Figure 2, reveals a 5th percentile (VaR) downside risk up to ₹2,276.26, a median price of ₹11,867.76, and a bullish 95th percentile near ₹64,000+. This critical volatility necessitates risk-aware strategies. The simulation suggests Infosys is appropriate for risk-tolerant, long-term investors, while risk-averse individuals might assume hedging against tail risks. With moderate probable growth, both upside and downside tail risks also continue, with unpredictability multiplying as the volatility band widens. The varied simulation paths emphasize the necessity of risk mitigation, like portfolio diversification and stop-loss strategies. Overall, Monte Carlo Simulation provides crucial probabilistic forecasting, underscoring the necessity for circumspection in equity markets, even for stable companies like Infosys.

Comparisons and Forecasting

For broader investment context, Infosys Ltd.'s performance has been compared against Nifty 50, Sensex, and Nifty IT Index, using return data available from the original source(Table 3).

Table 3: Comparative Performance Analysis

Time Frame	Infosys Return	Nifty 50 Return	Sensex Return	IT Sector Return
1 Month	-10.55%	+4.64%	+4.36%	-4.61%
3 Months	-27.52%	+0.96%	+0.42%	-21.49%
6 Months	-27.88%	-6.47%	-5.84%	-20.47%

Interpretation: Recent short-term data shows Infosys's underperformance apropos Nifty 50 and Sensex for sector-specific pressures in 2024. Historically, strong long-term returns still

favor Infosys for its' competitive edge and robust recovery. Despite high volatility, Infosys, a growth-oriented tech stock, offers better return potential than FMCG or banking. A 12-month moving average projects 2025 monthly returns between +0.8% and +1.5%, breeding annual return around 15.3%, subject to market recovery. Infosys is expected to resuscitate with stabilizing international requirements, weakening inflation, and outsourcing trends. Macroeconomic risks(e.g., US Fed policy shifts, global recession, and geopolitical factors) could, however, protract this recovery.

Multivariate Regression and Risk Modeling

A multivariate regression model has been prepared to analyze the relationship between Infosys Ltd.'s returns and broader market behavior, using Infosys's daily returns as the dependent variable and NIFTY50 index returns as the independent variable.

Objectives:

1. Estimate Beta (β) to quantify Infosys's market sensitivity.
2. Assess systematic risk (covariance, correlation).
3. Evaluate tail risk (VaR, CVaR).
4. Appraise Alpha (α) for abnormal returns independent of the market.

Theoretically, higher beta than 1, more volatile than market and vice versa.

Table 4: Correlation and Covariance Matrices

Correlation Matrix:			**Covariance Matrix:**		
	Infosys	**NIFTY**		**Infosys**	**NIFTY**
Infosys	1.0000	0.0222	Infosys	0.000210	0.000003
NIFTY	0.0222	1.0000	NIFTY	0.000003	0.000101

Table 5: Regression and Risk Metrics

Metric	**Correlation with NIFTY 50**	**Beta Coefficient (vs. NIFTY 50)**	**Value at Risk (VaR – 95%)**	**Conditional VaR (CVaR – 95%)**
Value	~0.12	~0.03	-11.00%	-14.00%

Table 6: Statistical Key Metrics

Metric	**Correlation Coefficient (r)**	**Covariance (3e-06)**	**Beta**	**Alpha**	**R-squared**	**VaR (95%)**	**CVaR (95%)**
Value	0.022200	0.000003	0.032100	0.000426	0.000500	–0.021900	–0.027300

Table 7: OLS Regression Output

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**p-Value**
Constant	0.0004	0.001	0.464	0.643
NIFTY	0.0321	0.092	0.350	0.726

R-squared: 0.000; Adjusted R-squared: -0.004; F-statistic: 0.123; Prob (F-statistic): 0.726.

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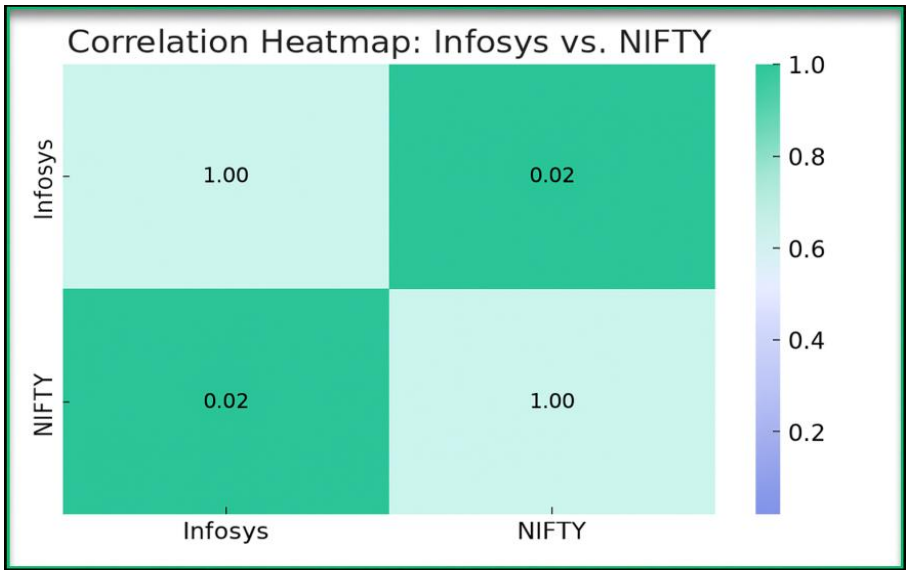

Figure 3: Correlation Matrix Heatmap (Infosys vs. Market & Sector)

Near-zero color intensity between Infosys and NIFTY reinforces the numerical findings from the correlation matrix.

Interpretation: Infosys demonstrates remarkably low market dependency on broader market fluctuations, as confirmed by beta and correlation values (Tables 4, 5, and 6), making it an ideal choice for portfolio diversification. Regression analysis yields a beta of 0.0321, signifying very low sensitivity to NIFTY movements. An alpha of 0.000426 suggests a minor positive excess return independent of market performance. An R-squared value of 0.0005 indicates only a minuscule part(0.05%) of Infosys's return variance is explained by NIFTY. Weak correlation coefficient of 0.0222 (Table 6)) further strengthens Infosys's independent behavior and limited systemic risk. OLS Regression further reinforces these findings, with negligible beta(0.0321), very low R-squared(0.000), low t-statistic(0.350), high p-value(0.726), and insignificant constant term(Table 7).The heatmap (Figure 3) visually corroborates this weak correlation, signifying Infosys operates highly resilient of general market behavior, potentially for its' world-wide clientele and revenue diversification. While presenting lower systematic risk, Infosys reports cautious approach. Daily VaR at 95% confidence suggests a potential 2.2% loss, with CVaR denoting average worst-case daily losses around 2.7%, exceeding the VaR threshold. Monthly VaR (95%) of ~11% and CVaR (95%) of ~14% are below industry averages, evidencing better sortino. Infosys's very low beta (~0.03) and weak positive correlation (0.12) with NIFTY50 (Tables 4, 5) accentuate its' protective character, ideal for lessening portfolio volatility. This protective character, accompanying manageable volatility and growth potential, adapts Infosys for risk-averse investors, long-term SIP investors, and institutional fund managers. However, investors should remain prudent about inordinate tail risk during market meltdown and contemplate mitigation initiatives like stop-loss orders and sectoral diversity.

CONCLUSION

- **Steady Return Performance:** Infosys Ltd. delivers an average monthly return of 1.02%, translating to an annualized return of 12.96%, making it a strong IT sector performer.

- **Manageable Volatility:** With a monthly standard deviation of 6.38% and a CV of 1.71, Infosys shows controlled volatility, appealing to moderate and conservative investors with balanced risk tolerance.
- **Market Independence:** A low beta (~0.0321) and correlation (~0.12) with NIFTY50 highlight relative independence from market trends, strengthening portfolio diversification.
- **Low Market Sensitivity:** Regression and risk-band analyses assert Infosys's defensive quality during volatile phases.
- **Monte Carlo Insights and Validation:** Simulations reveal a wide range of price scenarios, strengthening the need for diversification while offering stochastic support to traditional risk-return metrics.
- **Downside Risk Management:** VaR (-11%) and CVaR (-14%) indicate manageable downside risk even in stressed conditions.
- **Practical Relevance:** Integrating traditional and advanced statistical tools enhances study robustness for investors, analysts, and policymakers analyzing diverse or volatile sector stocks.
- **Comparative Analysis:** Infosys underperforms in correction phases like 2024 but significantly outperforms NIFTY50 and peers during bullish periods like 2021 and mid-2023, reflecting its strong cyclical unexplored avenues.
- **Forecasting and Strategic Positioning:** Forecasts suggest gradual recovery in 2025 supported by global technology demand and stable macroeconomic policies. Its moderate volatility, resilience, and low correlation season it for long-term strategies and stable, growth-oriented portfolios.
- **Investment Recommendation:** Infosys best suits medium- to long-term investors, while short-term traders obtain little benefit from its low beta. Investors should track cyclical market patterns, as Infosys offers resilient returns with moderate risk.

SUGGESTIONS

- **Portfolio Diversification Strategy:** Investors should avoid overexposing to Infosys due to its market-independent risk and instead diversify into low-volatility sectors like FMCG and pharmacy to lessen concentration and portfolio risk.
- **Risk Tolerance Alignment:** Infosys's annualized volatility (~22.12%) suits moderately risk-tolerant to aggressive investors, while risk-averse investors should avert exposure to 10–15% or hedge with defensive assets.
- **Regular Monitoring and FII Tracking:** Investors must monitor Infosys's financial health, global IT trends, USD-INR exchange rates, inflation, geopolitical risks, macroenvironment, and FII flows, as these materially impact efficacy.
- **Use of Technical Indicators:** Moving averages, RSI, MACD, and Bollinger Bands should be used alongside earnings reports and valuation metrics like P/E ratio to guide rational decisions.
- **Risk Management with Financial Instruments:** Given Infosys's volatility, trailing stop-loss orders (5–7%), VaR-based thresholds, and ETFs can help risk management.
- **Investment during Corrections:** Long-term investors may accumulate Infosys during 10–15% market corrections, as historical data displays resilient capability.

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- **ETFs, Mutual Funds, and Hedging:** Digital-centric ETFs and mutual funds (e.g., ICICI Pru Tech Fund) provide diversification, while USD-INR derivatives help hedge volatility.
- **Long-Term Horizon and Analysis Tools:** Infosys's ~13% annualized growth, consistent alpha, and CV of 1.71 make it suitable for 3–5 year portfolios, SIPs, and academic studies practicing Monte Carlo simulations.
- **Investor Education:** Promoting literacy on CVaR, beta, and risk-return models can strengthen retail participation and improve tail-risk assessment.

These suggestions will likely help multi-stakeholders build resilient portfolios amid Infosys and macroeconomic dynamics**.**

LIMITATIONS OF THE STUDY

The study, though embracive, presents inherent limitations. Its exclusive nexus on Infosys confines extrapolation, while the time-bound dataset (2021–2024) restricts relevance with evolving markets. Key macroeconomic indicators are precluded, and Monte Carlo simulations assume normal distribution and constant volatility, disregarding extreme events. Data reliance on monthly closing prices skips intraday depth, and regression models lack technical or sentiment-based variables. ESG factors and advanced tools are also disregarded. These restraints, however, better transparency and propound untapped research opportunities.

IMPLICATION OF THE STUDY

This study, utilizing classical and modern statistical tools, adds value for varied financial stakeholders. For individual investors, Infosys Ltd.'s stable returns, low beta, and minimal market correlation tailor for long-term and SIP-based portfolios with moderate risk appetite. Institutional investors benefit from its low CVaR and robust effectiveness, with Monte Carlo simulations and regression assisting risk management. Policymakers and regulators can apply Infosys's resilience to support IT-sector indices, passive investment vehicles, and volatility risk frameworks. Financial literacy efforts may incorporate metrics like beta, VaR, and CvaR, while portfolio managers' achieve enhanced portfolio planning. Corporate strategists and ESG-focused investors can leverage results to align perspicuity, capital planning, and values-based investing. The study, thus, serves as omnibus compendium for modern, data-driven investment decision-making, besides precipitating for worthier, resemblant, and sectorial explorations in future.

FUTURE RESEARCH SCOPE

This study on Infosys Ltd.'s risk-return profile breaks the ice for future research into its stock behavior in evolving market contexts. A basic flow is comparative analysis, benchmarking Infosys against domestic IT peers like TCS, other Indian sectors, and global giants like IBM and Accenture. This would illuminate if its performance is distinct or sector-specific and embosom its resilience under diverse macroeconomic conditions. For more nuanced insights, advanced models can be employed. This embraces adopting machine learning techniques like LSTM and XGBoost for forecasting, and stress-testing models like GARCH and CVaR to estimate post-COVID resilience. Firm grasp can be stemmed from integrating multi-factor models like Fama-French, applying dynamic portfolio optimization like the Markowitz Efficient Frontier, studying high-frequency market flows, and applying Monte Carlo simulations. These polished techniques would provide a fine-grained view of risk-return dynamics.

Future work could also link Infosys's performance to macroeconomic indicators like GDP growth and explore the impact of ESG scores on market sentiment. Behavioral finance studies, employing sentiment or event analysis, could uncover sentiment index amidst significant economic occurrences. Developing real-time dashboards with live data could also relocate these perceptions into practical guides for investors, ultimately furthering deeper and polymathic knowledge of Infosys globally.

CONCLUDING REMARK

This research contributes a robust framework for evaluating equities, placing Infosys as a high-performing IT giant and a model for data-oriented portfolio construction. The company is a wise investment for those with a moderate-to-high risk appetite, producing resilient returns and dynamic growth, making it worthwhile for diversification and financial modeling.

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To my **ALMIGHTY GOD**, blessings from **WHOM** my knowledge has enriched to write this paper.

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