Short Report: Portfolio Analysis using Indian Stock Market Data

1. What effect did diversification have?

Diversification significantly reduced portfolio risk without proportionally reducing expected return. As seen in the efficient frontier plot, the minimum variance portfolio (blue cross) lies to the left of the individual assets in terms of risk, indicating lower volatility. This is achieved by combining ICICIBANK.NS, INFY.NS, and RELIANCE.NS in such proportions that the portfolio benefits from the imperfect correlations among them (as shown in the covariance matrix). The result is a portfolio with lower standard deviation (0.0604) than any single stock's standard deviation (each over 0.079).

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2. How did changes in weights affect risk and return?

Changing the asset weights moves the portfolio along the efficient frontier:

- The minimum variance portfolio has a more balanced weight distribution across assets (ICICIBANK: 27.68%, INFY: 36.79%, RELIANCE: 35.53%) and results in lowest risk (0.0604) and a decent return (0.0173).

- The tangency portfolio, optimized for the highest Sharpe Ratio, puts a heavier weight on RELIANCE (53.97%) and reduces ICICIBANK's share significantly (12.79%). This reallocation increases the expected return to 0.0181 while maintaining a moderate increase in risk (0.0623).

These shifts demonstrate the risk-return tradeoff: increasing allocation to higher-return assets (RELIANCE) boosts expected return at the cost of slightly increased volatility, but improves overall risk-adjusted return (Sharpe Ratio increases from 0.204 to 0.211).

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3. Which portfolio would you recommend and why?

I would recommend the Tangency Portfolio because:

- It maximizes the Sharpe Ratio (0.211), indicating the best possible return per unit of risk.

- It lies on the Capital Market Line, meaning it's the optimal portfolio when a risk-free asset is available.

- The incremental increase in risk compared to the minimum variance portfolio is small (only ~0.002 in standard deviation), but the gain in return and efficiency is meaningful.