Assignment Report on Modern Portfolio Theory

FIRST SEMESTER 2025-26

ECON F412 & FIN F313:

SECURITY ANALYSIS & PORTFOLIO MANAGEMENT

UNDER THE GUIDANCE OF

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DATE: 08/11/2025

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COMPARISON BETWEEN TANGENTIAL PORTFOLIO AND MINIMUM VARIANCE PORTFOLIO

- SunPharma's stable 9.87% return with low 20% volatility and low correlation make it the portfolio's reliable security.
- SBI's modest 8% return but much higher volatility (28.75%) and strong Sensex correlation means it's treated cautiously or even pushed to negative weight when better international securities exist.
- By contrast Eternal has a high return of 19.8%, but it's very risky (42%). As the risk-return trade off is quite high it is optimal to give a lower weight to manage the risk.
- Infosys- a middle ground at 11.7% return and 23.8% volatility with low correlation — is used as a middle ground between securities like eternal (high risk) and SunPharma (low risk).
- Hindunilvr's (Hindustan Unilever) has a meager 1.9% return (20% volatility) and is significant only for its very low correlation and thus appears in min-variance allocations but can be driven negative in tangency portfolios.
- Apple, with very high returns and almost zero correlation to the domestic names, becomes the go-to for increasing Sharpe ratio while still appearing in variance-focused portfolios despite its high variance hence it's inclusion gives an overall boost to the return of the portfolio.

So the decision to select the weights is a trade-off between: a pair of low-return, low-correlation securities (Hindunilvr, SunPharma) with high-return, uncorrelated securities (Apple, Eternal) and keep highly correlated, high-volatility domestics (SBI) with lesser weights. Even when short-selling is allowed the minimum variance portfolio doesn't have any negative weights as there is very less covariance to exploit amongst the securities hence there are no negative weights in both cases (only domestic and with Apple).

The maximum covariance between any 2 stocks we got was 0.23, which aligns with the Modern Portfolio Theory's assumption about low covariance between stocks.

Important parameters and Weights of the Securities in Portfolio

Security	SunPharma	SBI	Eternal	Infosys	Hinduilvr	Apple	Expected Return	Volatility
Minimum Variance Portfolio (Domestic + International)	26.38	10.16	1.03	12.77	27.81	21.85	12.22%	11.7%
Minimum Variance Portfolio (Domestic)	30.81	16.44	2.17	15.45	35.13	-	6.95%	12.98%
Tangential Portfolio (Domestic + International)	31.89	-25.3	11.45	23.65	-24.63	83.01	31.18%	23.01%
Tangential Portfolio (Domestic)	46.66	0	42.55	60.79	-50	-	17.92%	29.74%

Constraints of short selling:

1. Max short selling for one stock is 100% of the portfolio's value.
2. The summation of absolute values of all stocks (including shorted values) is less than 200%

Justification for the constraints:

- SEBI limited how much of a single stock one category of participant can hold in the securities market (e.g., MFs capped at 30% of MWPL, proprietary brokers at 20%), basically to avoid one player building a disproportionately large position and distorting the market.
- Our first constraint—maximum short in any one stock capped at 100% of portfolio value—follows the same logic of preventing single-name concentration, just scaled down to the portfolio instead of MWPL.
- Under Basel III, a non-risk-based leverage ratio was introduced to serve as a backstop to risk-weighted capital requirements, limiting the total size of exposures relative to capital.
- By analogy, capping the sum of absolute long and short positions at 200% of portfolio value is essentially a leverage cap: it limits total exposure relative to capital, reflecting Basel III's aim of restricting excessive leverage.

CAPM ANALYSIS

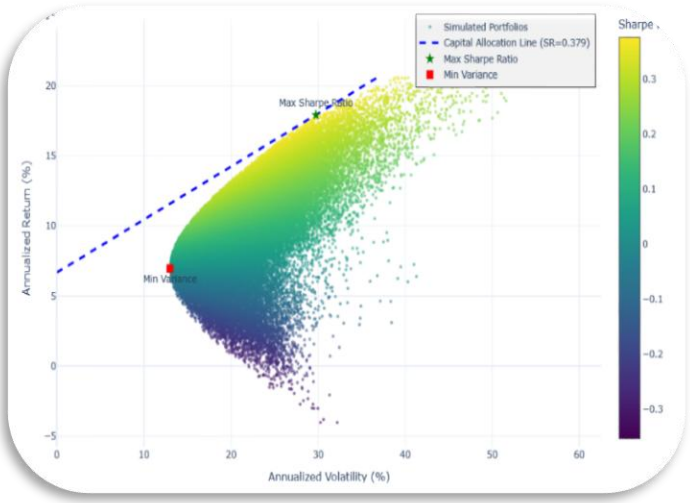
The CAPM-based required returns were compared with the actual annualized returns derived from historical performance. Securities with annualized returns exceeding their required rates, such as SunPharma, SBI, Eternal, and Infosys, indicate undervaluation and thus present buying opportunities. Conversely, Hindunilvr's return falls short of its required rate, suggesting overvaluation and a sell recommendation.

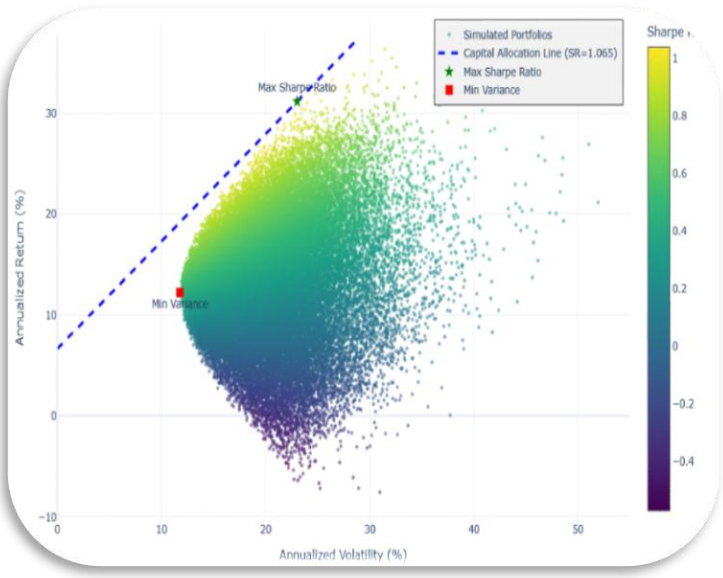
Security	SunPharma	SBI	Eternal	Infosys	Hinduilvr
Annualized Return	9.87%	8.04%	19.83%	11.7%	1.9%
Required Rate of Return	6.21%	5.46%	5.86%	5.98%	6.4%
Stock Advice	BUY (Undervalued)	BUY (Undervalued)	BUY (Undervalued)	BUY (Undervalued)	SELL (Overvalued)

MPT ANALYSIS

DOMESTIC PORTFOLIO:

When comparing the domestic and international portfolios, the international portfolios vastly outperform the domestic ones, with just the addition of one international stock. The international tangency portfolio achieves a much higher risk adjusted return (31.18% vs 17.92%) with much lower volatility (23% vs 29.8%), resulting in a much higher sharpe ratio. This is mostly due to the reduction in domestic correlated risks, which highlights the benefits of global diversification. This is depicted in the graph as the minimum variance portfolio at the international level also provides a much higher expected return, while still having a marginally smaller standard deviation.





DOMESTIC PORTFOLIO WITH APPLE:

This shift of risk-return tradeoff curve outward reflects the core principle of Modern Portfolio Theory (MPT): diversification reduces unsystematic risk more effectively. International portfolio reflects a far steeper Capital Allocation Line (CAL), demonstrating superior Sharpe efficiency. The slope increase means that the investor is rewarded with a significantly higher excess return per unit of risk after including global assets. The shape difference also implies that the marginal utility of risk is higher in the international setup: investors can take on additional risk and be compensated more generously in terms of return.

REFERENCES: 1) GOOGLE COLLAB LINK
2) YAHOO FINANCE
3) SEBI
4) BASEL-III NORMS