



ORIGINAL RESEARCH PAPER

Management

CONSTRUCTION OF OPTIMAL PORTFOLIO USING TREYNOR'S BLACK MODEL: A STUDY OF SELECTED COMPANIES IN INDIAN TELECOMMUNICATION INDUSTRY
KEY WORDS: Risk free rate, Risk-Return, Variance, Beta.

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ABSTRACT

Portfolio refers to investment on two or more securities which includes stocks, bonds, money market instruments and any other financial assets. Investors considering investment on securities are faced with the problem of choosing from a large number of securities. Their choice depends on the risk-return characteristics of individual securities. They would attempt to choose the most desirable securities and like to allocate the funds over the group of securities. Portfolio management concerns the construction and maintenance of a collection of investment. This study is an attempt to analyze the performance of selected stocks of Indian Telecommunication companies and construct an optimal portfolio using Treynor's Black model. The study reveals that the weight on active portfolio is **0.6037** and the weight on passive portfolio is **0.3961**.

1. Introduction:

The term portfolio refers to investment on two or more securities which includes stocks, bonds, money market instruments and any other financial assets. Portfolios may be held by individual investors and financial institutions. It is generally a time frame and investment objectives.

An investor considering investment on securities is faced with the problem of choosing from a large number of securities. His choice depends upon the risk-return characteristics of individual securities. He would attempt to choose the most desirable securities and like to allocate his funds over his group of securities. Again he is faced with the problem of deciding his securities to hold and how much to invest in each. The investors' faces an infinite number of possible Portfolio or group of securities. The risk and return characteristics of portfolio differ from those of individual securities and the investor tries to choose the optimal portfolio taking into consideration the risk return characteristics of all possible portfolios. An investor invests his funds in a portfolio expecting to get a good return with less risk.

Portfolio management concerns the construction and maintains of a collection of investment. It is the investment of funds on different securities in such a way that the total risk of the portfolio is minimum and the return is maximum. The main objective of a portfolio manager is to safeguard the investment, ensure safety return and appreciation of capital investment.

The steps to be followed in constructing optimal portfolio are as follows.

- Determination of Objectives.
- Selection of securities based on the objectives.
- Chose a suitable approach to construct the portfolio.
- Apply the approach and construct the portfolio.
- Assessment of risk and return.

Treynor's Black Model is an approach to construct the optimal portfolio. Treynor's Black Model tries to define risk and return while constructing the portfolio of assets. The model tries to be constituent with Efficient Market Hypothesis to construct portfolio. Alpha is determining in a subjective manner and helps in deciding whether to buy, hold or sell the security. Alpha gives the projected return of the security over the market. The model tries to find a mix of securities, where their associated Alpha and systematic risk generate the highest possible benefit from the active management.

2. Research objectives:

- To analyze the performance of selected stocks of Indian Telecommunication companies using Treynor's Black model
- To construct the optimal portfolio of the stocks using Treynor's Black model
- To analyze the volatility of stocks in comparison with the market.

3. Scope of the study:

- The present study is mainly intends to construct the optimal portfolio using Treynor's Black model.
- Companies listed in BSE are considered for the study.
- The key factors taken for the analyses are share price movements, index movements, rate of return on government securities and beta values.

4. Data Collection:

- The study is based on secondary data.
- The data from the year 2014 to 2016 have been considered for the analysis of performance of companies.
- The data has been collected through data base of BSE & annual reports of the company.
- Three years data are taken into consideration

5. Sample Size:

For the study, convenient sampling technique has been used. Following three Indian Telecommunication Companies are taken into consideration to construct the portfolio:

- a) MTNL
- b) Tata Communication
- c) Bharti Airtel Ltd

6. Steps to be followed to construct the optimal portfolio using Treynor's Black Model:

Step-1: Calculation of weight of each security based on the ratio of its Alpha to its unsystematic risk (Residual Variance).

Step-2: Calculation of Alpha (α) of Active Portfolio:

$$\alpha_A = W_1 \alpha_1 + W_2 \alpha_2 + W_3 \alpha_3 + W_n \alpha_n$$

Step-3: Calculation of Beta (β) of Active Portfolio:

$$\beta_A = W_1 \beta_1 + W_2 \beta_2 + W_3 \beta_3 + W_n \beta_n$$

Step-4: Calculation of Residual Variance ($\sigma_{e_A}^2$) of Active Portfolio:

$$\sigma_{e_A}^2 = W_1^2 \sigma_{e_1}^2 + W_2^2 \sigma_{e_2}^2 + W_3^2 \sigma_{e_3}^2 + W_n^2 \sigma_{e_n}^2$$

$$\sigma_{e_A} = \sqrt{\text{residual Variance}}$$

Step-5: Calculation of Initial weights of Active Portfolio:

$$W_0 = \frac{\frac{\alpha_A}{\sigma_{e_A}^2}}{\frac{R_m - R_f}{\sigma_m^2}}$$

Step-6: Calculation of Final weights of Active Portfolio:

$$w^* = \frac{W_0}{1 + (1 - \beta_A)W_0}$$

Step-7: Calculation of weight of Passive Portfolio:

$$W_m = 1 - W_A$$

Step-8: Composition of Optimal Risky Portfolio:

7. Findings:

Year	Market (BSE)	MTNL	Tata Communication	Bharti Airtel Ltd
2014	0.2989	0.8737	-0.3829	1.0039
2015	-0.0503	-0.1978	0.0774	0.2724
2016	0.0195	-0.0730	-0.6055	-0.1977
Mean Return	0.0894	0.2009	-0.3037	0.3595
Beta	1	3.1599	-0.7134	2.7255
Std. Deviation	0.2865	0.5860	0.3483	0.6055

Construction of optimal risky portfolio using Treynor's Black Model :

Step1: calculation of weight of each security based on the ratio of its alpha to its unsystematic risk

Company	Rj	Risk (σ_{ei})	$\alpha_j = R_j - [R_f + (R_m - R_f)\beta_j]$	α_j	α_j / σ_{ei}	weight
MTNL	0.200951	0.3434	$= 0.200951 - [0.07 + (0.08939 - 0.07)3.15993]$	0.0696	0.2027	0.058
Tata communication	-0.30365	0.1213	$= -0.30365 - [0.07 + (0.08939 - 0.07) - 0.71335]$	0.32031	2.6410	0.757
Bharti Airtel Ltd	0.359508	0.3667	$= 0.359508 - [0.07 + (0.08939 - 0.07)2.725521]$	0.23660	0.6454	0.185
Total					3.4891	1

Step 2: calculation of alpha (α) of active portfolio

$$\begin{aligned} \alpha_j &= W_1 \alpha_1 + W_2 \alpha_2 + W_3 \alpha_3 \\ &= (0.0580 * 0.0696) + (0.757 * 0.32031) + (0.1849 * 0.26660) \\ &= 0.0413 + 0.2425 + 0.0493 \\ &= 0.29584 \end{aligned}$$

Step 3: calculation of beta (β) of active portfolio

$$\begin{aligned} \beta_j &= W_1 \beta_1 + W_2 \beta_2 + W_3 \beta_3 \\ &= (0.0580 * 3.1599) + (0.757 * 0.71335) + (0.189 * 0.5039) \\ &= 0.1833 + 0.5400 + 0.5039 \\ &= 0.14724 \end{aligned}$$

Step 4: calculation of residual variance (σ_{ei}) of active portfolio

$$\begin{aligned} \sigma_{ei} &= \sqrt{W_1^2 \sigma_{ei_1}^2 + W_2^2 \sigma_{ei_2}^2 + W_3^2 \sigma_{ei_3}^2} \\ &= \sqrt{(0.0580 * 0.3434) + (0.757 * 0.12128) + (0.1849 * 0.3667)} \\ &= \sqrt{0.00116 + 0.0695 + 0.01253} \\ &= 0.08319 \\ \sigma_{ei} &= \sqrt{0.08319} \\ &= 0.2884 \end{aligned}$$

Step 5: calculation of initial weights of active portfolio

$$\begin{aligned} W_0 &= \frac{\alpha_{ap} + \sigma_{ei}^2 \alpha_p^2}{E[R_m - R_f] + \sigma_m^2} \\ &= \frac{0.29584 + 0.08319^2}{0.08939 - 0.07 + 0.082093} \\ &= \frac{0.29584 + 0.00692}{0.01939} \\ &= \frac{0.30276}{0.01939} \\ &= 15.6194 \end{aligned}$$

Step 6: calculation of final weights of active portfolio

$$\begin{aligned}
 W_A &= \frac{W_o}{1 + [1 - \beta_a] w_o} \\
 &= \frac{1.2452}{1 + (1 - 0.14724)1.2452} \\
 &= \frac{1.2452}{2.0619} \\
 &= 0.6039
 \end{aligned}$$

Step 7: calculation of weight of passive portfolio

$$\begin{aligned}
 W_m &= 1 - W_A \\
 &= 1 - 0.6039 \\
 &= 0.3961
 \end{aligned}$$

Step 8: composition of optimal risky portfolio

Companies		Proportion of investment
MTNL	0.6039*0.0580	0.0350
Tata communication	0.6039*0.7570	0.4570
Bharti Airtel Ltd	0.6039*0.1849	0.1117
Active portfolio		0.6037
(+) passive portfolio		0.3961
Grand total		1

8. Conclusion:

Under Treynor’s Black Model, the final portion of the optimal risky portfolio made up of active portfolio & passive portfolio. The weight on active portfolio is **0.6037** and the weight on passive portfolio is **0.3961**. The proportion of investment on active portfolio is **0.035** on MTNL, **0.457** on Tata communication and **0.1117** on Bharti Airtel Ltd.

9. References:

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