Example of finance report

Business, Marketing

Security pricing and hedging

Mean Variance Optimization Model vs. Capital Asset Price Model

Q1. Capital Asset Pricing Model (CAPM) as well as Mean Variance Optimization Model are based on certain assumptions that help an investor or a user to apply these models before taking a decision. The underlying assumptions of both the models are:

- Every investor has an aversion to risk and given a choice with the same amount of returns, every investor will choose the less risky investment.

- Risk is taken in proportion to the risk premium but in inverse proportion to the variance of returns and the investor's aversion to risk

- Every investor has a portfolio of investments which contain risk less investments as well as market driven or risky investment. (Black, J, Scholes, M, 1973)

Both the models under discussion seek to calculate with maximum accuracy what the expected rate of return of an investment could be against a risk free investment and how a portfolio consisting of both types of investments can be built to get maximum benefit. Understanding the distribution of risk and the probability of returns is very important when an investor makes such decisions.

As per the probability distribution assumption, estimates of probabilities of returns in future are calculated based on historical data. By using these estimates an investor can predict what the probable returns of an investment can be in a given future period. This gives the investor a choice between various alternatives that can give him the desired return and risk trade off. The resulting portfolio can then be carried forward as a set of

optimal solutions with an optimal level of risk. The assumptions in derivation of CAPM and MVO state that an investor will make a study of all possible options and always invest in those options that will offer the highest return with least risk. (Eisenberg, L, Jarrow, R, 1994)

Q2. The inputs that are used for calculation in the mean variance optimization model for a single period investment are:

- The expected return for each asset, which is the assumption drawn by the investor about the rate of return he expects to get. This is generally based on past experiences and on the probability of getting the same results in future.

- The standard deviation of each asset; this is a measure of risk. The standard deviation represents that there is some uncertainty about the actual result that the investor will get. This uncertainty will have to be borne by the investor when he puts in his money in the investment.

- Correlation matrix; this is the correlation between the assets or investments being considered by the investor. It is a symmetric matrix, where the diagonal is unity and all other elements lie between 1 and -1. A positive correlation is an indication that if one asset gives a higher return the other will also give a higher yield. A negative correlation implies that if one gives a higher return the other will give a negative return or a return that is below expected value. (Black, J, Scholes, M, 1973)

The inputs that an investor needs to use the Capital Asset Pricing Model are:

- `Current risk free rate; this is the rate of return that an investor will earn on investing in a risk free bond or government security.

- The expected rate of return on the market index; this is an assumption made by the investor based on historical data and calculation of probabilities. The number or amount of historical data to be referred depends upon the investor and so accuracy of this assumption is relative and depends upon the data used by the investor.

- Beta of the asset being analyzed; this signifies the amount of risk that a particular investment holds in comparison to the market. The normal value of beta is assumed to be 1, which is the relative risk of the market. (Eisenberg, L, Jarrow, R, 1994)

Q3. Capital Asset Pricing Model:

Pros of CAPM:

- It is simple to calculate and it merges different indicators into one factor.

- It captures the fact that a positive risk for return tradeoff does exist and is possible for an investor.

- It implies that diversification of risk is possible and advisable for an investor

Cons of CAPM:

- Beta is a poor indicator of the expected return from an investment because practically high risk investments can perform very poor while low risk investments might give best results.

- 100% hedging against risk is not possible and this assumption has not been provided for in the CAP model. (Black, J, Scholes, M, 1973)

- There are factors in the market other than premium and risk which govern returns and they have not been captured in CAPM.

Mean Variance Optimization Model:

Pros of MVO:

- It is useful in assembling portfolios and investor can make educated decisions based on the results of this model.

- Mean Variance Portfolio Optimization further simplified portfolio selection by reducing it to a quadratic programming problem which is simple and easy to calculate.

Cons of MVO:

- Investors do not use a quadratic programming model for building portfolios since it does not consider other market factors such as limits on holdings in a company, turnover constraints etc.

- The model does not give a complete description of market returns.

- In real life, investment decisions are very complex and cannot be made on the basis of linear calculations. In the real market there are too many options and building a matrix for comparison for so many options is not physically possible. (Eisenberg, L, Jarrow, R, 1994)

References:

Black, J, Scholes, M, 1973, The Pricing of Options and Corporate Liabilities, J. of Political Economy, 81st pbl, pp. 637-659.

Eisenberg, L, Jarrow, R, 1994, Option Pricing with Random Volatilities in Complete Markets, Review of Quantitative Finance and Accounting 4th edn, pp. 5-17.