

Modern Portfolio Theory

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History

Harry Markowitz came up with MPT and won the Nobel Prize for Economic Sciences in 1990 for it.



Definition

It is an investment theory based on the idea that risk-averse investors can construct portfolios to optimize or maximize expected return based on a given level of market risk, emphasizing that risk is an inherent part of higher reward. It is one of the most important and influential economic theories dealing with finance and investment.

How it works?

MPT assumes that investors are risk averse, meaning that given two portfolios that offer the same expected return, investors will prefer the less risky one. Thus, an investor will take on increased risk only if compensated by higher expected returns. Conversely, an investor who wants higher expected returns must accept more risk. The exact trade-off will be the same for all investors, but different investors will evaluate the trade-off differently based on individual risk aversion characteristics.

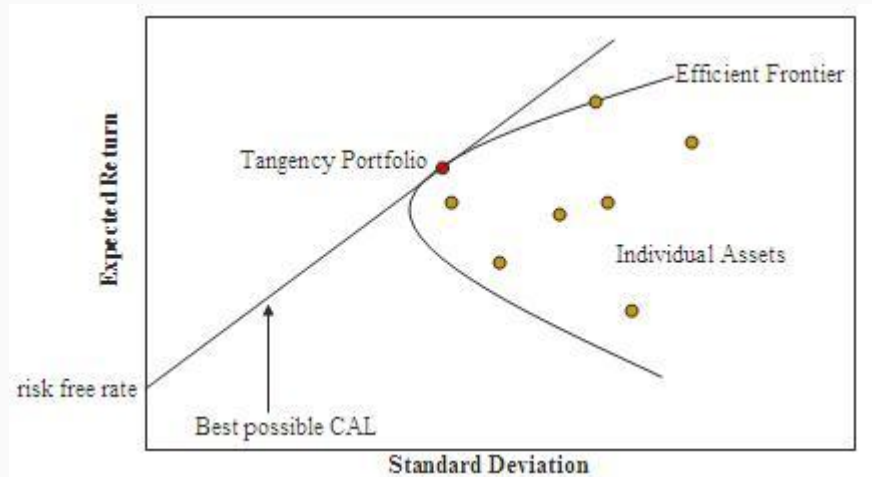
Diversification

An investor can reduce portfolio risk simply by holding combinations of instruments that are not perfectly positively correlated.

If all the asset pairs have correlations of 0—they are perfectly uncorrelated—the portfolio's return variance is the sum over all assets of the square of the fraction held in the asset times the asset's return variance (and the portfolio standard deviation is the square root of this sum).

Efficient Frontier

This graph shows expected return (vertical) versus standard deviation. This is called the 'risk-expected return space.' Every possible combination of risky assets, can be plotted in this risk-expected return space, and the collection of all such possible portfolios defines a region in this space.



Two Mutual Fund Theorem

One key result of the above analysis is the two mutual fund theorem. This theorem states that any portfolio on the efficient frontier can be generated by holding a combination of any two given portfolios on the frontier; the latter two given portfolios are the "mutual funds" in the theorem's name. So in the absence of a risk-free asset, an investor can achieve any desired efficient portfolio even if all that is accessible is a pair of efficient mutual funds. If the location of the desired portfolio on the frontier is between the locations of the two mutual funds, both mutual funds will be held in positive quantities. If the desired portfolio is outside the range spanned by the two mutual funds, then one of the mutual funds must be sold short (held in negative quantity) while the size of the investment in the other mutual fund must be greater than the amount available for investment (the excess being funded by the borrowing from the other fund).

Criticisms

Despite its theoretical importance, critics of MPT question whether it is an ideal investment tool, because its model of financial markets does not match the real world in many ways.

The risk, return, and correlation measures used by MPT are based on expected values, which means that they are mathematical statements about the future (the expected value of returns is explicit in the above equations, and implicit in the definitions of variance and covariance). In practice, investors must substitute predictions based on historical measurements of asset return and volatility for these values in the equations. Very often such expected values fail to take account of new circumstances that did not exist when the historical data were generated