RISK AND RETURN

Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) describes the relationship between expected return and systematic risk when investing in an asset, especially in stocks. Therefore, the expected return on a security equals the risk-free return plus a risk premium, which is driven by the beta of that security.

The core question in making an investment decision is eventually how much one should ask for prior to assuming the risk associated with the investment proposal. - Or: Which conditions seem fair and appropriate so that an investor may consider adding another asset to an already existing well-diversified portfolio. The answer to this can be found in the CAPM.

Developed – among others – by Sharpe, Markowitz and Miller, all Nobel Prize laureates, the CAPM describes the relationship between the systematic risk and the expected return for assets, foremost stocks. Therefore, the CAPM can be applied to determine the appropriate price of an asset on the basis of an expected return and a given risk:

To start with, an investor will demand a fair compensation not lower than the risk free rate over the anticipated holding period of an asset. Second, for assuming additional risk – such as if investing in a stock which is anything but risk free, like a government bond – an additional compensation will have to be offered: Now, if the asset to be added has the same risk profile – alas: the same volatility or standard deviation - as the overall market, then the additional compensation required is exactly the market risk premium. This premium is defined as the difference between the return of the market- usually a market index - and the risk free rate. To determine the market risk premium, in practice a historical average over a long period of time - ideally over several decades – is being considered. Should, however, the risk profile of the asset be higher (lower) than that of the market, then a multiplier – called beta – will be applied on the market risk premium. This ensures that the additional compensation in form of the risk premium is adequately increased (lowered).

Therefore, the beta indicates whether and by how much an asset is more (less) risky than the overall market. Mathematically, beta is a function of the volatility of an asset vis-à-vis the market, an indication of the correlation between them. An asset with a relatively higher risk vis-à-vis the market – alas: higher volatility - has a beta of more than 1, such with a relatively lower risk of less than 1.
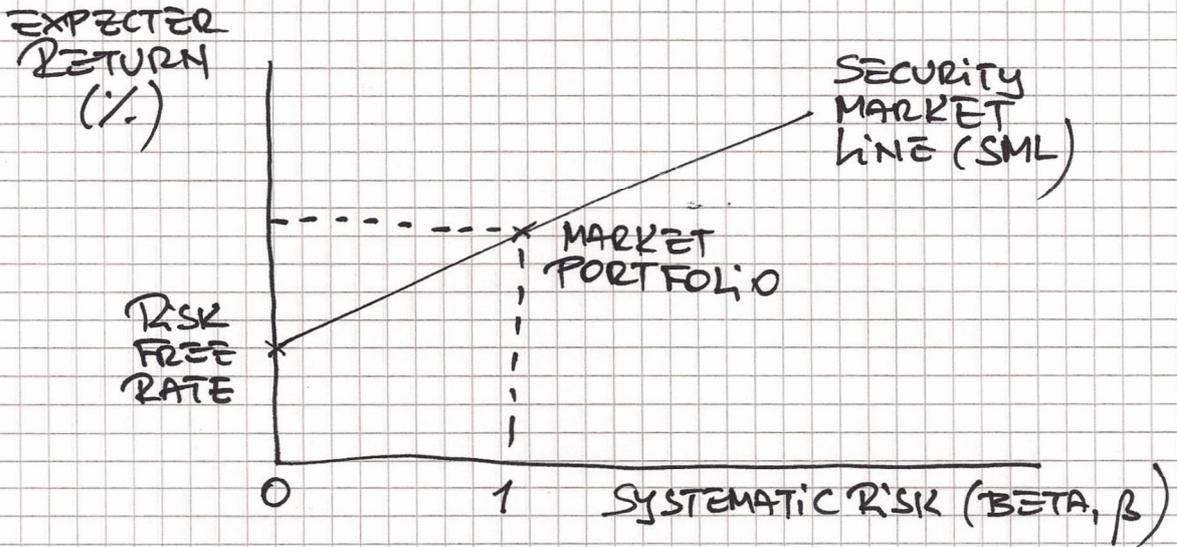
Applying this concept is actually straight-forward: All it says is that an investor in a risky asset has to be compensated over the anticipated holding period with the risk free rate plus the market risk premium multiplied by the beta factor for the asset (or comparably risky assets). - With this approach an investor can now decide fairly quickly whether a proposition seems attractive or not.

Technically, the CAPM´s beta is a measure of an asset´s sensitivity to the non-diversifiable or systematic risk, which is the risk assumed when investing in any asset.

The concept of the Security Market Line (SML) is a by-product of the CAPM: It illustrates the relationship between the expected return and the systematic risk, the beta. The difference between the capital market line and the SML is that the former illustrates the general relationship between return and risk (the standard deviation, therefore including both, systematic and unsystematic risk), whilst latter focuses on the relationship between return and systematic risk only (assuming the unsystematic risk already having been diversified away). – Should a specific investment yield a return above the SML, then this excess return is referred to as alpha. A positive alpha may point towards an investment opportunity being undervalued based on its underlying risk profile. Active investors therefore pursue strategies seeking for opportunities which can "create alpha".

Finally, the CAPM can also be applied for calculating and optimizing the cost of capital for any project or a firm´s balance sheet. – Even though the CAPM has failed numerous empirical tests, it is still broadly applied, foremost for its simplicity.

CAPITAL ASSET PRICING MODEL

EXPECTED
RETURN
(%)

SECURITY
MARKET
LINE (SML)

MARKET
PORTFOLIO

RISK
FREE
RATE

0   1   SYSTEMATIC RISK (BETA, β)

$$R = RFR + \beta \times \underbrace{(R(M) - RFR)}_{MRP}$$

EXPECTED
RETURN

RISK FREE RATE

BETA

MARKET RISK PREMIUM