☰   The Capital Assets Pricing Model

Capital Asset Pricing Model

In addition to the Capital Market Line, we will further introduce another import
Asset Pricing Model which is also called CAPM and pronounced "cap M".

The CAPM is a model that describes the relationship between systematic risk ar
assets. The CAPM assumes that the excess return of a stock is determined by th
the stock's relationship with the market's movement. It is the foundation of the
factor models used by portfolio managers for portfolio construction.

Ok, let's quickly recap: the systematic risk, or market risk, is undiversifiable risk
entire market. In contrast, the idiosyncratic risk is the asset-specific risk.

Ok, let's take a look at CAPM. For a stock, the return of stock i equals the returr
plus β times the difference between the market return and the risk free return
covariance of stock i and the market divided by the variance of the market.

$$r_i - r_f = \beta \times (r_m - r_f)$$

r_i = stock return
r_f = risk free rate
r_m = market return
$\beta_i = \frac{cov(r_i, r_m)}{\sigma_m^2}$

β describes which direction and by how much a stock or portfolio moves relativ
example, if a stock has a β of 1, this indicates that if the market's excess return
return would also be 5%. If a stock has a β of 1.1, this indicates that if the mark
the stock's excess return would be 1.1 $\times$ 5%, or 5.5%.

Compensating Investors for Risk

Generally speaking, investors need to be compensated in two ways: time value
time value of money is represented by the risk free return. This is the compens
putting down investments over a period of time. β times $r_m - r_f$ represents th
market. It is the additional excess return the investor would require for taking c
exposure, β. $r_m - r_f$ is the risk premium, and β reflects the exposure of an as
market risk.

When the β_i for stock i equals 1, stock i moves up and down with the same ma
When β_i is greater than 1, stock i moves up and down more than the market. I
less than 1, stock i moves up and down less than the market.

Let's look at a simple example. If the risk free return is 2%, β_i of stock i equals
return is 10%. The return of stock i equals 2% + 1.2 $\times$ (10% - 2%) = 11.6.

r_f = 2%
β_i = 1.2
r_m = 10%
r_i = 2% + 1.2$\times$ (10% - 2%) = 11.6%

Security Market Line

The Security Market Line is the graphical representation of CAPM and it represe
between the risk and return of stocks. Please note that it is different from the c
y-axis is expected returns but the x-axis is beta. (You may recall that for the cap
learned earlier, the x-axis was standard deviation of a portfolio.) As beta increa
increases. Hence, the investors demand higher returns to compensate risk.

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