The Sharpe Ratio

The Sharpe ratio is the **ratio of reward to volatility**. It's a popular way to look an asset relative to its risk.

$$\text{Sharpe Ratio} = \frac{r_{\text{risky portfolio}} - r_{\text{risk free}}}{\sigma_{\text{excess return}}}$$

The numerator of the Sharpe ratio is called the *excess return*, *differential return* *premium*. It's called "excess return" because this is the return in excess of the ri called the "risk premium", because this represents the premium that investors with for taking on risk.

The denominator is the volatility of the excess return.

How do you calculate this? The *risk premium* (which we'll denote with _D_) equa minus risk free rate over a period of time:

$$D_t = r_{\text{portfolio}, t} - r_{\text{risk free}, t}$$

Then, calculate the mean and standard deviation of D_t over the historical peri

$$D_{average} = \frac{1}{T}\sum_{t=1}^{T} D_t \qquad \sigma_D = \sqrt{\frac{\sum_{t=1}^{T}(D_t - D_{average})^2}{T-1}}$$

$$\text{Sharpe Ratio} = \frac{D_{average}}{\sigma_D}$$

As we saw previously, the Sharpe Ratio is the slope of the *Capital Market Line*.

The Sharpe Ratio allows us to compare stocks of different returns, because the returns by their level of risk.

[Note that if you do not see some fractions displaying as expected, please try tc browser]

Annualized Sharpe Ratio

Please keep in mind that the Sharpe Ratio depends on the time period over wh it's normally annualized. You annualize it in the same way you annualize volatili refresher on annualization, please refer to the video on annualization within th For example,

$$\text{Sharpe Ratio}_{\text{year}} = \sqrt{252}\ \text{Sharpe Ratio}_{\text{day}}$$

Let's see where the square root of 252 trading days comes from by annualizing numerator, and then annualizing the standard deviation in the denominator. T together as the annualized Sharpe Ratio.

To annualize daily risk premium $(r_p - r_f)$, we add the daily return 252 times, c by 252. $D_{year} = 252 \times D_{day}$

To annualize the daily standard deviation, let's first annualize the daily variance variance, we add σ_D^2 252 times, or more simply multiply it by 252. $\sigma^2_{D,year} = 2$!

The standard deviation is the square root of the variance, which is
$\sqrt[2]{252 \times \sigma_D^2}$,
or just $\sqrt[2]{252} \times \sigma_D^2$

In other words:
$\sigma_{D,year} = \sqrt[2]{252} \times \sigma_{D,day}$

If we combine the annualization factors of the numerator and denominator, th
$\frac{252}{\sqrt[2]{252}}$