STATISTICS

## Introduction

A Sharpe Ratio of 1.2 in one statistic could be 0.5 in another statistic, depending on the methodology. Therefore it is vital to know what parameters are used and how they are calculated when comparing different statistics. All our statistics are calculated using the same methodology.

## Methdology

The following provides a brief description of each statistic used in our analysis and the mathematical formula to calculate the statistic. Our annualized statistics are based on monthly data.

### Cummulative (total) return

The total return over the lifetime of an investment.

$R_i$ = Return for period i

**Cummulative Return** $(R_1,\ldots,R_n) = (\prod_{i=1}^{n}(1+R_i))-1$

### VAMI

Value Added Monthly Index – reflects the growth of a hypothetical 1,000 € in an investment over time.

Vami 0=1000
$R_i$ =Return for period i

**Vami**$_n$ = $(1+R_i)\times \mathrm{Vami}_{n-1}$

### Average (Mean) Return

Arithmetic average (mean) return or simple average return.

n = Number of periods
$R_i$ = Return for period i

**Average Return** = $(\sum_{i=1}^{n} R_i)\div n$

**Annualized Average ROR** = $(\sum_{i=1}^{n} R_i)\div(n\div 12)$

### Average Gain / Average Loss

Arithmetic average return of all periods with a gain / loss. Same calculation as above but only using returns $\geq 0$ (Gain) or returns $< 0$ (Loss).

### Compound Average Growth Rate (CAGR)

Geometric average (mean) return. CAGR is the hypothetical steady percentage return at which an investment would have grown every period in order to arrive at the cummulative (total) return.

n = Number of periods
Vami 0 = 1000

**Compound Monthly Return** = $(\mathrm{Vami}_n \div \mathrm{Vami}_0)^{1/n} - 1$

**Compound Annualized Return** = $(1 + \mathrm{CompoundMonthly})^{12} - 1$

**Standard Deviation (Volatility)**
A measure of the dispersion of a set of data from its mean. The more spread apart the data, the higher the deviation. Standard deviation is calculated as the square root of variance.

$R_i$ = Return for period i
$M_r$ = Average (mean) return
n = Number of Periods

**Standard Deviation** = $\sqrt{(\sum_{i=1}^{n}(R_i - M_r)^2 \div (n-1))}$

**Downside Deviation**
Downside deviation measures only the dispersion of a set of returns that are below 0. This measure is useful, because standard deviation measures both positive and negative deviation from the mean.
Example: Fund A: Jan. +10% Feb. +20%
Fund B: Jan. +5% Feb. –5%

The standard deviation for both funds would be exactly the same. Downside deviation in this case helps to make a more accurate comparison since it shows a higher (unwanted) negative volatility for Fund B.

$R_i$ = Return for period i
n = Number of Periods
$R_{rf}$ = Risk free return for period
$L_i = R_i - R_{rf}$ ( IF $R_i - R_{rf} < 0$ )or 0 ( IF $R_i - R_{rf} \geq 0$ )

**Downside Deviation** = $\sqrt{((\sum_{i=1}^{n}(L_i)^2) \div n)}$

**Sharpe Ratio**
Sharpe ratio measures the excess returns per unit of risk. Excess return is defined as return above a defined risk free rate. Risk is defined as the volatility of the returns. A higher Sharpe Ratio means a better risk/reward ratio.

$R_i$ = Return for period i
$M_r$ = Average (mean) return
SD = Standard Deviation for period
n = Number of Periods
$R_{rf}$ = Risk free return for period

**Sharpe Ratio** = $(M_r - R_{rf}) \div \mathrm{SD}$

**Annualized Sharpe** = Monthly Sharpe $\times \sqrt{12}$

**Sortino Ratio**
Another risk/reward ratio. While Sharpe defines every volatitility as risk, Sortino considers only negative volatility in the calculation of the ratio.

$R_i$ = Return for period i
$CR_n$ = Compound return for period
$DD_n$ = Downside Deviation for period
n = Number of Periods
$R_{rf}$ = Risk free return for period

**Sortino Ratio** = $(CR_n - R_{rf}) \div DD_n$

**Annualized Sortino** = Monthly Sortino $\times\sqrt{12}$

**Calmar Ratio**
Risk/reward ratio that puts the compound annualized return in perspective to the absolute maximum drawdown of an investment in a given period.

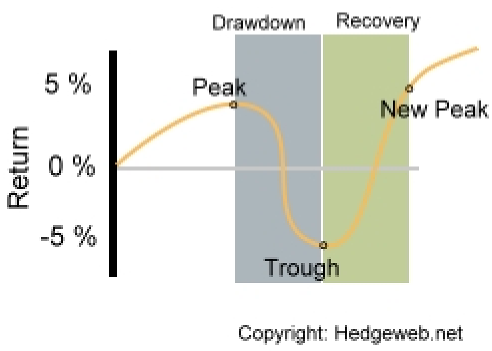
$CR_{na}$ = Compound annualized return for period
MaxDD = Maximum Drawdown (absolute value)

**Calmar Ratio** = $CR_{na} \div MaxDD$

**Drawdown**
The peak-to-trough decline during a specific record period of an investment.

A drawdown is quoted as the percentage between the peak and the trough. A drawdown is measured from the time a retrenchment begins to when a new high is reached. This method is used because a valley can't be measured until a new high occurs. Once the new high is reached, the percentage change from the old high to the lowest trough is recorded.

The maximum drawdown is simply the biggest peak-to-trough decline over the lifetime of an investment record.




**Beta**
A measure of the sensitivity of an investment to broad market movements. The market can be an index or a benchmark. The Beta of the market is per definition 1 ( A Beta of 1 means perfect correlation). Beta is calculated using regression analysis.

$R_i$ = The return of the independent variable for period i *(Benchmark)*
$RD_i$ = The return of the dependent variable for period i *(Investment)*
$M_r$ = Average (mean) return of the independent variable
n = Number of periods

**Beta** = $(\sum_{i=1}^{n}(RD_i \times R_i) - ((\sum_{i=1}^{n} RD_i \times \sum_{i=1}^{n} R_i) \div n)) \div (\sum_{i=1}^{n}(R_i - M_r)^2)$

**Alpha**
A measure of performance on a risk-adjusted basis. The excess return of the investment relative to the return of the benchmark is an investment's alpha. A positive alpha means that the investment has outperformed its benchmark index.

$M_r$ = Average (mean) return of the independent variable
$M_{rd}$ = Average (mean) return of the dependent variable

**Alpha** = $M_{rd} - (\text{Beta} \times M_r)$
**Annualized Alpha** = $\text{Alpha} \times 12$

**R-squared ( $R^2$ )**
R-squared is the coefficient in a statistical analysis and measures the strength of the relationship between an investment and its benchmark index. A R-squared of 0.35 means, that only 35 percent of moves in the investment are explained by moves in its benchmark index. The higher the R-squared the more significant becomes the beta of an investment.

$\sigma R_i$ = Standard deviation of the independent variable
$\sigma RD_i$ = Standard deviation of the dependent varibale
$Cov_{ij}$ = Covariance between i (Benchmark) and j (Investment)
$R_i$ = The return of the independent variable for period i *(Benchmark)*
$RD_i$ = The return of the dependent variable for period i *(Investment)*

**Cov** $_{ij}$ = $(\sum_{i=1}^{n}(RD_i \times R_i) - ((\sum_{i=1}^{n} RD_i \times \sum_{i=1}^{n} R_i) \div n)) \div (n-1)$

**R-squared** = $(Cov_{ij} \div (\sigma RD_i \times \sigma R_i))^2$