Triple Penance Rule

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Abstract

Drawdown based stopouts is a framework for informing the decision of stopping a portfolio manager or investment strategy once it has reached the drawdown or time under water limit associated with a certain confidence limit.

1 Maximum Drawdown

Maximum Drawdown tells us Up to how much could a particular strategy lose with a given confidence level ?. This function calculated Maximum Drawdown for two underlying processes normal and autoregressive. For a normal process Maximum Drawdown is given by the formula

When the distibution is normal

$$MaxDD_\alpha = max\left\{0, \frac{(z_\alpha \sigma)^2}{4\mu}\right\}$$

The time at which the Maximum Drawdown occurs is given by

$$t^* = \left(\frac{Z_\alpha \sigma}{2\mu}\right)^2$$

Here Z_α is the critical value of the Standard Normal Distribution associated with a probability $\alpha.\sigma$ and μ are the Standard Distribution and the mean respectively.

When the distribution is non-normal and time dependent, Autoregressive process.

$$Q_{\alpha,t} = \frac{\phi^{(t+1)} - \phi}{\phi - 1}(\triangle\pi_0 - \mu) + \mu t + Z_\alpha \frac{\sigma}{|\phi - 1|}\left(\frac{\phi^{2(t+1)} - 1}{\phi^2 - 1} - 2\frac{\phi^(t+1) - 1}{\phi - 1} + t + 1\right)^{1/2}$$

ϕ is estimated as

$$\hat{\phi} = Cov_0[\triangle\pi_\tau, \triangle\pi_{\tau-1}](Cov_0[\triangle\pi_{\tau-1}, \triangle\pi_{\tau-1}])^{-1}$$

and the Maximum Drawdown is given by.

$$MaxDD_\alpha = max\left\{0, -MinQ_\alpha\right\}$$

Golden Section Algorithm is used to calculate the Minimum of the function Q.

1.1 Usage of the function

The Return Series ,confidence level and the type of distribution is taken as the input. The Return Series can be an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns.

```
> data(edhec)
> MaxDD(edhec,0.95,type="ar")
```

```
             Convertible Arbitrage CTA Global Distressed Securities
MaxDD(in %)               14.85445   7.177264              7.050179
t*                        29.79704  11.319084             13.832336
             Emerging Markets Equity Market Neutral Event Driven
MaxDD(in %)          23.40602             0.9875744     5.705754
t*                   30.65993             3.2964944    10.552376
             Fixed Income Arbitrage Global Macro Long/Short Equity
MaxDD(in %)                8.678753     2.740074           6.916315
t*                        24.980931     3.890720          10.777582
             Merger Arbitrage Relative Value Short Selling Funds of Funds
MaxDD(in %)          1.537452       3.354683      66.33794       6.935491
t*                   4.273601       8.987624     160.24707      14.086820
```

The t^* in the output is the time at which Maximum Drawdown occurs.

2 Maximum Time Under Water

For a particular sequence $\{\pi_t\}$, the time under water (TuW) is the minimum number of observations, $t > 0$, such that $\pi_{t-1} < 0$ and $\pi_t > 0$.

For a normal distribution Maximum Time Under Water is given by the following expression.

$$MaxTuW_\alpha = \left(\frac{Z_\alpha \sigma}{\mu}\right)^2$$

For a Autoregressive process the Time under water is found using the golden section algorithm.

2.1 Usage

```
> data(edhec)
> TuW(edhec,0.95,type="ar")

                      Convertible Arbitrage CTA Global Distressed Securities
Max Time Under Water               103.2573   44.65415              43.27392
                      Emerging Markets Equity Market Neutral Event Driven
Max Time Under Water          117.1875              9.279164     34.78838
                      Fixed Income Arbitrage Global Macro Long/Short Equity
Max Time Under Water                89.18303     14.79475          38.61956
                      Merger Arbitrage Relative Value Short Selling
Max Time Under Water          12.27602       26.26871      639.0094
                      Funds of Funds
Max Time Under Water        50.64823
```

The Return Series ,confidence level and the type of distribution is taken as the input. The Return Series can be an xts, vector, matrix, data frame, timeSeries or zoo object of asset returns.

The out is given in the same periodicity as the input series.

3 Golden Section Algorithm