Distance to default package

Benjamin Christoffersen

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This package is provides fast functions to work with the Merton's distance to default model. We will denote the observed market values by S_t and unobserved asset values by V_t. We assume that V_t follows a geometric Brownian motion

$$dV_t = \mu V_t \, \mathrm{d}t + \sigma V_t \, \mathrm{d}W_t$$

We assume that we observe the assets over increaments of dt in time. Thus, we will let V_k and V_{k+1} be the value at $t_0 + k \cdot dt$. Thus,

$$V_{k+1} = V_k \exp\left(\left(\mu - \frac{1}{2}\sigma^2\right) dt + \sigma W_t\right)$$

We further let r denote the risk free rate, D_t denote debt due at time $t + T$. Then

$$\begin{aligned} C(V_t, D_t, T, \sigma, r) &= V_t N(d_1) - D_t \exp\left(-rT\right) N(d_1 - \sigma\sqrt{T}) \\ d_1 &= \frac{\log(V_t) - \log D_t + \left(r + \frac{1}{2}\sigma^2\right) T}{\sigma\sqrt{T}} \\ S_t &= C(V_t, D_t, T, \sigma, r) \end{aligned} \tag{1}$$

where C is a European call option. Equation (1) can be computed with the `BS_call` function. Further, the `get_underlying` can be used to invert the equation (1)

```
library(DtD)
(S <- BS_call(100, 90, 1, .1, .3))

## [1] 22.51008

get_underlying(S, 90, 1, .1, .3)

## [1] 100
```