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Binomial Tree, geometric Brownian motion: Jarrow, Rudd

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$$u = e^{(Y - \frac{1}{2}\sigma^2)t + \sigma\sqrt{t}}$$

$$d = e^{(Y - \frac{1}{2}\sigma^2)t - \sigma\sqrt{t}}$$

$$S_u = S.u$$

$$S_d = S.d$$

$$p_u = p_d = \frac{1}{2}$$

This is the Jarrow and Rudd version of the Binomial tree. The Binomial tree is a discretized description of geometric Brownian motion which is often used to describe asset behavior. The structure is a recombining tree where the asset S can move either up or down.

Symbol list:

u Up-factor

d Down-factor

σ Volatility

Y Yield of the underlying, for stocks $Y=r$ (interest rate), futures $Y=0$, currencies $Y=(\text{domestic interest rate} - \text{foreign interest rate})$

t Timestep

S Present value of the asset

S_u Value of the asset after a up movement

S_d Value of the asset after a down movement

$p_u = P(S_{t+\Delta t} > S_t)$ Probability of an up movement

$p_d = P(S_{t+\Delta t} < S_t)$ Probability of a down movement