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% FRE 6251 Numerical and Simulation Techniques in Finance

% Assignment #2

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Brief Reports of Assignment #2:

(1). This simulation has two matlab files, one is a function called “ SpreadOption(S1,S2, K, r, sigma1, sigma2, rho, T, cORp, n) ”, and other one is matlab script file called “SpreadOptionMCS.m”.

The function SpreadOption() uses Monte Carlo Simulation method to calculate Spread Option Price and estimated error of the payoff values of n simulations.

I used example of two assets S1, and S2 with following parameters and values:

S1 = Initial price of asset 1

S2 = Initial price of asset 2

K = Strike price of the spread option

r = Risk free rate

sigma1 = standard deviation of asset 1

sigma2 = standard deviation of asset 2

rho = correlation coefficient

T = Maturity time

cORp = option type, 1 for call and -1 for put option

n = Number of simulation paths

For example,

S1 = 110;

S2 = 105;

K = 2;

r = 0.05;

sigma1 = 0.15;

sigma2 = 0.20;

rho = 0.25;

T = 1;

cORp = 1;

n = 10;

This assets example is used in SpreadOptionMCS.m file using SpreadOption.m function. This is executed initially for n = 10 simulations and then for up to 1,000,000 in multiple of 10.

The results of option price and error estimation is shown for each group of simulation in the attached print-out. For a review, a graph of two asset prices of 10 simulations is also printed.

In the function SpreadOption(..), I used the formula

Si(t) = Si(0) \* exp{[(r – 0.5 σi2) \* dt + σi \* dt0.5  \* zi]}

z1 = randn(1, n)

z2 = ρ \* z1 + randn(1, n) \* , from Levy representation of GBM

and

payoff = exp{-r \* T} \* [ cORp \* (S1-S2-K), 0)]+

option price = mean(payoffs), using matlab mean function.

error = 1.96 \* std(payoffs)/n0.5

Please review the script matlab file and the function for detail.