

Homework 4

Numerical Methods for Financial Derivatives

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Purpose: Calculate value of American call option and American put option

Numerical Method: Monte Carlo simulation and Linear Regression 1 method

Output :

Index	delta_t	American_Call	American_Put	
0	0.01	41.3248	36.4076	
1	0.001	42.6408	35.7249	

Analysis:

An American option can be exercised at any time, whereas a European option can only be exercised at the expiration date. This added flexibility of American options increases their value over European options in certain situations. Thus, we can say American Options = European Options + Premium where the Premium is greater than or equal to zero.

Unfortunately, the Black Scholes equation cannot be used to find a closed form solution for this iterative process. Hence, we have used monte carlo simulation and linear regression method 1 to determine the option value.

In our case, we have considered, dividend equal to be zero and value of $\mu = r = 0.03$.

For standard American call options without dividends, there are several reasons why the call should never be exercised before the expiration date. For an American call with dividends it may be beneficial to exercise the option prior to expiration.

We can see that value of call option is greater than the value of put option, which is consistent with the theory.

From, the output we deduce that, as the time step increased, the value of call option increased, while as the value of American option decreased. The reason could be when we have more number of time steps, the probability of getting noisy payoffs increases. The smaller the time step, better will be the accuracy and stability.