bs1d_std_testpatry1

In this routine, we simulate the best stopping times when the number of hegde is fixed. We simulate the spot in the Black-Scholes model. We must use the function tr_patry.c.

/* Variables needed for graphic outputs */

stock_array, *pl_array*, *hedge_time*, *hedge_spot* and *delta_array* are arrays of double which contain respectively the values of the stock, the P&L time after time, the values of the dates of hedge, the values of the corresponding spot and the delta.

/****** Initialization of the test's parameters ********/**

path_number: number of the different simulated stock's trajectories.

hedge_number: number of hedge.

step_number: number of possible dates of hedging.

step_hedge: $h = \frac{Maturity - current\_date}{step\_number}$, period of time between two dates of possible trading.

cash_rate=e^{rh}, interest rate yielded by the bank account over the period of time h.

stock_rate=$e^{divid.h} - 1$, dividends rate yielded by owning the stock account.

sigmaxsqrth=$\sigma\sqrt{h}$.

exp_trendxh=$e^{\left(\mu h - \frac{\sigma^2}{2} h\right)}$.

/* Graphic outputs initializations and dynamical memory allocutions */

We allocate dynamically some arrays to keep in the values needed for graphic outputs : stock's and P&L's trajectories, the dates of trading and the corresponding spot, and the delta.

/****** Trajectories of the stock *******/**

In this loop, we simulate path_number different stock's trajectories and for each we calculate the corresponding P&L.

/* Calculating selling_price and delta */
We send informations like the current date and the option's type to the chosen method, and this last gives us the corresponding selling price and delta at initial time. We suppose that the market maker hedges at the initial time.

/* Calculating cash_account and stock_account */
With the selling price and the delta given before, we determine the first cash account : *cash_account=selling_price-delta*stock*. And the stock account equals *delta*stock*, in fact delta is the quantity of stock owned by the Market Maker.

/****** Dynamic Hedge *******/**
This loop calculates the amount of money at current time out of a cash amount *selling_price* and a sequence of buying/selling (hedging) of the underlying asset between time *initial_time* and current time, with no option deals any longer between these two dates. It gives also the dates of trading (hedge_now=0 means it is optimal to hedge).

/* Capitalization of cash_account and yielding dividends */
The cash_account is capitalized at the rate *cash_rate* defined before and dividends are yielded with the rate *stock_rate* defined before.

/* Calculating the new stock's value */
At each step of the loop we simulate the stock's value given by the Black&Scholes model.

1. The first mode is to calculate the new stock's value is to use the expression of the solution of the E.D.S. $dS_t = S_t\left(\mu dt + \sigma dB_t\right)$, it gives us : $S_{t+h} = S_t \times e^{\left(\mu h - \frac{\sigma^2}{2}h + \sigma\sqrt{h}G\right)}$ where $G \hookrightarrow N\left(0,1\right)$.
2. The second consists in the decision to set the spot's value at S_{T1} at time $T1$, using the same formula as before but with a brownian bridge, the new stock's value is also calculated as follow : $S_{t+h} = S_t \times e^{\left(\left(\mu - \frac{\sigma^2}{2}\right)h\right)} \times e^{\sigma\left((B_{T1}-B_t)H + \sqrt{h(1-H)}\times G\right)}$,
   where B_{T1} is the value of the bridge at time $T1$, $H = \frac{h}{T1 - current\_time}$, $h = step\_hedge$ and $G \hookrightarrow N\left(0,1\right)$. For further informations, please consult the document on Dynamic Tests.

/* Calculating the new selling_price and the new delta */
The same as before. If hedge_now=0, it is optimal to hedge.

/* Calculating the new cash_account and the new stock_account */
new_*cash_account*=old_*cash_account*-(new_*delta*-old_*delta*)*stock.

/******** **Last Hedge** ********/
That's the last step in the hedge process. Here, rather than using the selling_price, we simply use the pay-off known since the beginning : so we avoid all numerical problem of the last step of the loop for the reason that we are, at this time, nearby the maturity date and some numerical methods may cause a problem here.

/* **Capitalization of cash_account and yielding dividends */**
The same as before.

/* Calculating the last stock's value */
The same as before.

/* Capitalization of cash_account and calculating the P&L using the PayOff */

/* Selection of trajectories (Spot and P&L) for graphic outputs */
Here we select different noteworthy spot's trajectories : we keep stock's trajectories generating the minimal, the maximal and the average P&L. The aim is to display them to observe the behavior of the used pricing method in extrem situations. We keep also the dates of hedging, the corresponding spot and the delta for these extrem trajectories.