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   Help
#include <stdlib.h>
#include  "bs1d_std.h"
#include "error_msg.h"
#define BIG_DOUBLE 1.0e6

int CALC(DynamicHedgingSimulatorTempsdeter1)(void *Opt,voi
    d *Mod,PricingMethod *Met,DynamicTest *Test)
{



  TYPEOPT* ptOpt=(TYPEOPT*)Opt;
  TYPEMOD* ptMod=(TYPEMOD*)Mod;
  int  type_generator,error;
  long path_number,step_number,hedge_number,i,j;
  double step,initial_stock,initial_time,stock,selling_
    price,delta,previous_delta;
  double cash_account,stock_account,cash_rate,stock_rate;
  double pl_sample,mean_pl,var_pl,min_pl,max_pl;
  double exp_trendxh,sigmaxsqrth;
  double r,divid;

  /* Variables needed for Graphic outputs */
  double *stock_array, *pl_array, *hedge_time, *hedge_spot,
     current_mean_pl, median_pl=0.;
  double *delta_array;
  int  k,indicehedge;
  long size, size2;
  double current_date;

  /******** Initialization of the test's parameters *******
    */
  initial_stock=ptMod->S0.Val.V_PDOUBLE;
  initial_time=ptMod->T.Val.V_DATE;

  type_generator=Test->Par[0].Val.V_INT;
  path_number=Test->Par[1].Val.V_LONG;
  step_number=Test->Par[2].Val.V_LONG;
  current_date=ptMod->T.Val.V_DATE;
  hedge_number=Test->Par[3].Val.V_LONG;
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step=(ptOpt->Maturity.Val.V_DATE-ptMod->T.Val.V_DATE)/(
  double)step_number;
//step_hedge=(ptOpt->Maturity.Val.V_DATE-ptMod->T.Val.V_
  DATE)/(double)hedge_number;

r=log(1.+ptMod->R.Val.V_DOUBLE/100.);
divid=log(1.+ptMod->Divid.Val.V_DOUBLE/100.);
cash_rate=exp(r*step);
stock_rate=exp(divid*step)-1.;

sigmaxsqrth=ptMod->Sigma.Val.V_PDOUBLE*sqrt(step);
exp_trendxh=exp(ptMod->Mu.Val.V_DOUBLE*step-0.5*SQR(sigma
  xsqrth));

mean_pl=0.0;
var_pl=0.0;
min_pl=BIG_DOUBLE;
max_pl=-BIG_DOUBLE;

pnl_rand_init (type_generator,1,path_number);

/* Graphic outputs initializations and dynamical memory
  allocutions */
current_mean_pl=0.0;
size=step_number+1;
size2=hedge_number+1;

if ((stock_array= malloc(size*sizeof(double)))==NULL)
  return MEMORY_ALLOCATION_FAILURE;
if ((pl_array= malloc(size*sizeof(double)))==NULL)
  return MEMORY_ALLOCATION_FAILURE;
if ((hedge_time= malloc(size2*sizeof(double)))==NULL)
  return MEMORY_ALLOCATION_FAILURE;
if ((hedge_spot= malloc(size2*sizeof(double)))==NULL)
  return MEMORY_ALLOCATION_FAILURE;
if ((delta_array= malloc(size*sizeof(double)))==NULL)
  return MEMORY_ALLOCATION_FAILURE;

for (k=5;k<=14;k++)
  {
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    pnl_vect_resize (Test->Res[k].Val.V_PNLVECT, size);
  }
for (k=15;k<=20;k++)
  {
    pnl_vect_resize (Test->Res[k].Val.V_PNLVECT, size2);
  }

for (k=0;k<=step_number;k++) /* Time */
  Test->Res[5].Val.V_PNLVECT->array[k]=current_date+k*
  step;




/******** Trajectories of the stock ********/
for (i=0;i<path_number;i++)
  {
    /* computing selling-price and delta */
    ptMod->T.Val.V_DATE=initial_time;
    ptMod->S0.Val.V_PDOUBLE=initial_stock;
    delta=0.;
    hedge_number=Test->Par[3].Val.V_LONG;

    if ((error=(Met->Compute)(Opt,Mod,Met)))
{
  ptMod->T.Val.V_DATE=initial_time;
  ptMod->S0.Val.V_PDOUBLE=initial_stock;
  return error;
};
    selling_price=Met->Res[0].Val.V_DOUBLE;
    delta=Met->Res[1].Val.V_DOUBLE;
    delta_array[0]=delta;


    /* computing cash_account and stock_account */
    cash_account=selling_price-delta*initial_stock;
    stock_account=delta*initial_stock;

    stock=initial_stock;
    stock_array[0]=stock;
    pl_array[0]=0;
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    hedge_time[0]=0.;
    hedge_spot[0]=stock;
    indicehedge=1;



    /******** Dynamic Hedge ********/
    for (j=1;j<step_number;j++)
{
  previous_delta=delta;

  /* Capitalization of cash_account and yielding divid
  ends */
  cash_account*=cash_rate;
  cash_account+=stock_rate*stock_account;

  /* computing the new stock's value */
  stock*=exp_trendxh*exp(sigmaxsqrth*pnl_rand_normal(ty
  pe_generator));

  /* computing the new selling-price and the new delta *
  /
  ptMod->T.Val.V_DATE=ptMod->T.Val.V_DATE+step;
  ptMod->S0.Val.V_PDOUBLE=stock;
  if ((error=(Met->Compute)(Opt,Mod,Met)))
    {
      ptMod->T.Val.V_DATE=initial_time;
      ptMod->S0.Val.V_PDOUBLE=initial_stock;
      return error;
    };

  if ((hedge_number!=0)&&(j%(step_number/hedge_number))=
  =0)
    {
      delta=Met->Res[1].Val.V_DOUBLE;
      hedge_time[indicehedge]=ptMod->T.Val.V_DATE;
      hedge_spot[indicehedge]=stock;
      indicehedge++;
    }

  delta_array[j]=delta;
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  /* computing new cash_account and new stock_account */
  cash_account-=(delta-previous_delta)*stock;
  stock_account=delta*stock;

  stock_array[j]=stock;
  pl_array[j]=cash_account-Met->Res[0].Val.V_DOUBLE+delt
  a*stock;

} /*j*/

    /******** Last hedge *******/
    /* Capitalization of cash_account and yielding divid
  ends */
    cash_account*=cash_rate;
    cash_account+=stock_rate*stock_account;

    /* computing the new stock's value */
    stock*=exp_trendxh*exp(sigmaxsqrth*pnl_rand_normal(ty
  pe_generator));


    delta_array[step_number]=delta;
    hedge_time[hedge_number]=ptMod->T.Val.V_DATE;
    hedge_spot[hedge_number]=stock;

    /* Capitalization of cash_account and computing the
  P&L using the PayOff*/
    cash_account=cash_account-((ptOpt->PayOff.Val.V_
  NUMFUNC_1)->Compute)((ptOpt->PayOff.Val.V_NUMFUNC_1)->Par,stock)+
  delta*stock;
    pl_sample=cash_account;

    stock_array[step_number]=stock;
    pl_array[step_number]=pl_sample;

    mean_pl=mean_pl+pl_sample;
    var_pl=var_pl+SQR(pl_sample);
    min_pl=MIN(pl_sample,min_pl);
    max_pl=MAX(pl_sample,max_pl);
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```
    /* Selection of trajectories (Spot and P&L) for graph
  ic outputs */
    if (i==0)
{
  for (k=0; k<=step_number; k++)
    {
      Test->Res[6].Val.V_PNLVECT->array[k]=stock_array[
  k];
      Test->Res[7].Val.V_PNLVECT->array[k]=stock_array[
  k];
      Test->Res[8].Val.V_PNLVECT->array[k]=stock_array[
  k];
      Test->Res[9].Val.V_PNLVECT->array[k]=pl_array[k];
      Test->Res[10].Val.V_PNLVECT->array[k]=pl_array[k];
      Test->Res[11].Val.V_PNLVECT->array[k]=pl_array[k];
      Test->Res[12].Val.V_PNLVECT->array[k]=delta_array[
  k];
      Test->Res[13].Val.V_PNLVECT->array[k]=delta_array[
  k];
      Test->Res[14].Val.V_PNLVECT->array[k]=delta_array[
  k];
    }
  for (k=0; k<size2; k++)
    {
      Test->Res[15].Val.V_PNLVECT->array[k]=hedge_time[
  k];
      Test->Res[16].Val.V_PNLVECT->array[k]=hedge_spot[
  k];
      Test->Res[17].Val.V_PNLVECT->array[k]=hedge_time[
  k];
      Test->Res[18].Val.V_PNLVECT->array[k]=hedge_spot[
  k];
      Test->Res[19].Val.V_PNLVECT->array[k]=hedge_time[
  k];
      Test->Res[20].Val.V_PNLVECT->array[k]=hedge_spot[
  k];
    }
  median_pl=pl_sample;
}
    else
{
```

```
current_mean_pl=mean_pl/i;
if (pl_sample==min_pl)
  {
    for (k=0; k<=step_number; k++)
{
  Test->Res[6].Val.V_PNLVECT->array[k]=stock_array[k]
;
  Test->Res[9].Val.V_PNLVECT->array[k]=pl_array[k];
  Test->Res[12].Val.V_PNLVECT->array[k]=delta_array[
k];
}
    for (k=0; k<size2; k++)
{
  Test->Res[15].Val.V_PNLVECT->array[k]=hedge_time[k]
;
  Test->Res[16].Val.V_PNLVECT->array[k]=hedge_spot[k]
;
}
  }
else if (pl_sample==max_pl)
  {
    for (k=0; k<=step_number; k++)
{
  Test->Res[7].Val.V_PNLVECT->array[k]=stock_array[k]
;
  Test->Res[10].Val.V_PNLVECT->array[k]=pl_array[k];
  Test->Res[13].Val.V_PNLVECT->array[k]=delta_array[
k];
}
    for (k=0; k<size2; k++)
{
  Test->Res[17].Val.V_PNLVECT->array[k]=hedge_time[k]
;
  Test->Res[18].Val.V_PNLVECT->array[k]=hedge_spot[k]
;
}
  }
else if (SQR(pl_sample-current_mean_pl) < SQR(median_
pl-current_mean_pl))
  {
    median_pl=pl_sample;
```

```
        for (k=0; k<=step_number; k++)
    {
      Test->Res[8].Val.V_PNLVECT->array[k]=stock_array[k]
    ;
      Test->Res[11].Val.V_PNLVECT->array[k]=pl_array[k];
      Test->Res[14].Val.V_PNLVECT->array[k]=delta_array[
    k];
    }
        for (k=0; k<size2; k++)
    {
      Test->Res[19].Val.V_PNLVECT->array[k]=hedge_time[k]
    ;
      Test->Res[20].Val.V_PNLVECT->array[k]=hedge_spot[k]
    ;
    }
      }
  }
    } /*i*/

  free(stock_array);
  free(pl_array);
  free(hedge_time);
  free(hedge_spot);
  free(delta_array);

  mean_pl=mean_pl/(double)path_number;
  var_pl=var_pl/(double)path_number-SQR(mean_pl);

  Test->Res[0].Val.V_DOUBLE=mean_pl;
  Test->Res[1].Val.V_DOUBLE=var_pl;
  Test->Res[2].Val.V_DOUBLE=min_pl;
  Test->Res[3].Val.V_DOUBLE=max_pl;
  Test->Res[4].Val.V_DOUBLE=median_pl;

  ptMod->T.Val.V_DATE=initial_time;
  ptMod->S0.Val.V_PDOUBLE=initial_stock;

  return OK;
}
```

```
static int TEST(Init)(DynamicTest *Test,Option *Opt)
{
  static int first=1;
  int i;
  if (first)
    {
      Test->Par[0].Val.V_INT=0;            /* Random     Generator */
      Test->Par[1].Val.V_LONG=10;        /* PathNumber */
      Test->Par[2].Val.V_LONG=200;     /* StepNumber */
      Test->Par[3].Val.V_LONG=20;       /*hedgenumber*/
      Test->Par[4].Vtype=PREMIA_NULLTYPE;

      for ( i=5 ; i<=20 ; i++ )
        {
          Test->Res[i].Val.V_PNLVECT = pnl_vect_create (0);
        }

      Test->Res[21].Vtype=PREMIA_NULLTYPE;

      first=0;
    }

  return OK;
}
int CHK_TEST(test3)(void *Opt, void *Mod, PricingMethod *
    Met)
{
  if ( (strcmp( Met->Name,"TR_PatryMartini")==0) || (strcmp
    ( Met->Name,"TR_PatryMartini1")==0))
    return WRONG;
  else
    return OK;
}

DynamicTest MOD_OPT(test3)=
{
  "bs1d_std_test3",

  {{"RandomGenerator",INT,{100},ALLOW},
   {"PathNumber",LONG,{1000},ALLOW},
   {"StepNumber",LONG,{200},ALLOW},
```

```
   {"HedgeNumber",LONG,{20},ALLOW},
   {" ",PREMIA_NULLTYPE,{0},FORBID}},

  CALC(DynamicHedgingSimulatorTempsdeter1),

  {{"Mean_P&l",DOUBLE,{100},FORBID},
   {"Var_P&l",DOUBLE,{100},FORBID},
   {"Min_P&l",DOUBLE,{100},FORBID},
   {"Max_P&l",DOUBLE,{100},FORBID},
   {"Median_P&l",DOUBLE,{100},FORBID},

   {"Time",PNLVECT,{100},FORBID},
   {"Stockmin",PNLVECT,{0},FORBID},
   {"Stockmax",PNLVECT,{0},FORBID},
   {"Stockmean",PNLVECT,{0},FORBID},
   {"PLmin",PNLVECT,{0},FORBID},
   {"PLmax",PNLVECT,{0},FORBID},
   {"PLmean",PNLVECT,{0},FORBID},
   {"deltamin",PNLVECT,{0},FORBID},
   {"deltamax",PNLVECT,{0},FORBID},
   {"deltamean",PNLVECT,{0},FORBID},
   {"HedgeTimemin",PNLVECT,{0},FORBID},
   {"HedgeSpotmin",PNLVECT,{0},FORBID},
   {"HedgeTimemax",PNLVECT,{0},FORBID},
   {"HedgeSpotmax",PNLVECT,{0},FORBID},
   {"HedgeTimemean",PNLVECT,{0},FORBID},
   {"HedgeSpotmean",PNLVECT,{0},FORBID},
   {" ",PREMIA_NULLTYPE,{0},FORBID}},
  CHK_TEST(test3),
  CHK_ok,
  TEST(Init)
};
```

References