

[Help](#)

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#include "bs1d_lim.h"

static int Cryer_UpIn(int am,double s,NumFunc_1
    *p,double l,double rebate,double t,double r,
    double divid,double sigma,int N,int M,double *ptprice,
    double *ptdelta)
{
    int      Index,PriceIndex,TimeIndex,ssl,dummy;
    double   k,vv,loc,h,z,alpha,beta,gamma,y,up,upw
        ind_alphacoef,price1;
    double   *Obst,*A,*B,*C,*P,*S,*Z,*Q,pricen,pr
        icep2h,priceph;

    /*Memory Allocation*/
    Obst=(double *)malloc((N+1)*sizeof(double));
    if (Obst==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    A=(double *)malloc((N+1)*sizeof(double));
    if (A==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    B=(double *)malloc((N+1)*sizeof(double));
    if (B==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    C=(double *)malloc((N+1)*sizeof(double));
    if (C==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    P=(double *)malloc((N+1)*sizeof(double));
    if (P==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    S=(double *)malloc((N+1)*sizeof(double));
    if (S==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    Z=(double *)malloc((N+1)*sizeof(double));
    if (Z==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    Q=(double *)malloc((N+1)*sizeof(double));
    if (Q==NULL)
        return MEMORY_ALLOCATION_FAILURE;
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/*Time Step*/
k=t/(double)M;

/*Space Localisation*/
vv=0.5*sigma*sigma;
z=(r-divid)-vv;
loc=sigma*sqrt(t)*sqrt(log(1.0/PRECISION))+fa
    bs(z*t);

/*Space Step*/
y=log(s);
up=log(1);
h=(up-(y-loc))/(double)(N);

/*Peclet Condition-Coefficient of diffusion augmented */
if ((h*fabs(z))<=vv)
    upwind_alphacoef=0.5;
else {
    if (z>0.) upwind_alphacoef=0.0;
    else if (z<=0.) upwind_alphacoef=1.0;
}
vv-=z*h*(upwind_alphacoef-0.5);

/*Lhs Factor of theta-schema*/
alpha=k*(-vv/(h*h)+z/(2.0*h));
beta=1.0+k*(r+2.*vv/(h*h));
gamma=k*(-vv/(h*h)-z/(2.0*h));

for(PriceIndex=0;PriceIndex<=N-2;PriceIndex++)
{
    A[PriceIndex]=alpha;
    B[PriceIndex]=beta;
    C[PriceIndex]=gamma;
}

/*Terminal Values*/
y=log(s);
for (PriceIndex = 1; PriceIndex < N; PriceIndex++)
    Obst[PriceIndex - 1]=(p->Compute)(p->Par,
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    exp(y-loc+PriceIndex* h));

for (PriceIndex = 2; PriceIndex <= N - 2; PriceIndex++)
{
    P[PriceIndex - 1] = alpha * Obst[PriceIndex - 2] +
        beta * Obst[PriceIndex - 1] + gamma * Obst[PriceIndex];
}

P[0] = beta*Obst[0]+gamma*Obst[1];
P[N-2] = alpha*Obst[N-3] + beta * Obst[N-2];

for (PriceIndex = 0; PriceIndex <= N - 2; PriceIndex++)
{
    S[PriceIndex] = 0.0;
    Z[PriceIndex] = 0.0;
}
ssl = false;

/*Finite Difference Cycle*/
for (TimeIndex= 1; TimeIndex<= M; TimeIndex++)
{
    if (TimeIndex==1)
        for (PriceIndex = 0; PriceIndex <= N- 2; PriceIndex++)
            Z[PriceIndex] =rebate;
    else
        for (PriceIndex = 0; PriceIndex <= N- 2; PriceIndex++)
            Z[PriceIndex] =Z[PriceIndex]+Obst[PriceIndex];

    for (PriceIndex = 0; PriceIndex <= N - 2; PriceIndex++)
        Q[PriceIndex]=P[PriceIndex]-Z[PriceIndex];

    price1=Boundary(1,p,(double)TimeIndex*k,r,

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    divid,sigma);
    Q[0] += alpha*(p->Compute)(p->Par,exp(y-loc
    ));
    Q[N-2]+=gamma*price1;

    dummy=AlgCrayer(N,Z,ssl,A,B,C,Q,S);

    for (PriceIndex = 0; PriceIndex <=N-2; PriceIndex++)
        S[PriceIndex] = Z[PriceIndex];

    ssl = true;
}

for (PriceIndex = 0; PriceIndex <= N - 2; PriceIndex++)
    P[PriceIndex]=Z[PriceIndex]+Obst[PriceIndex];

Index=(int)floor(loc/h)-1;

*ptprice=P[Index]+(P[Index+1]-P[Index])*(exp(y)
-exp(y-loc+h+Index*h))/(exp(y-loc+h+(Index+1)*h)
-exp(y-loc+h+Index*h));

/*Delta*/
priceph=P[Index-1]+(P[Index]-P[Index-1])*(exp
(y-h)-exp(y-loc+h+(Index-1)*h))/(exp(y-loc+h+(
Index)*h)-exp(y-loc+h+(Index-1)*h));
if (y!=up) {
    pricen=P[Index+1]+(P[Index+2]-P[Index+1])*(
exp(y+h)-exp(y-loc+h+(Index+1)*h))/(exp(y-loc+h+(
Index+2)*h)-exp(y-loc+h+(Index+1)*h));
    *ptdelta=(pricen-priceph)/(2*s*h);
} else {
    pricep2h=P[Index-2]+(P[Index-3]-P[Index-2])*
(exp(y-2*h)-exp(y-loc+h+(Index-2)*h))/(exp(y-loc
+h+(Index-3)*h)-exp(y-loc+h+(Index-2)*h));
    *ptdelta=(-4*priceph+pricep2h+3*(ptprice))/
(2*s*h);
}

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/*Memory Desallocation*/
free(Obst);
free(A);
free(B);
free(C);
free(P);
free(S);
free(Z);
free(Q);

return OK;
}

int CALC(FD_Cryer_UpIn)(void *Opt,void *Mod,PricingMethod *Met)
{
    TYPEOPT* ptOpt=(TYPEOPT*)Opt;
    TYPEMOD* ptMod=(TYPEMOD*)Mod;
    double r,divid,limit,rebate;

    r=log(1.+ptMod->R.Val.V_DOUBLE/100.);
    divid=log(1.+ptMod->Divid.Val.V_DOUBLE/100.);
    limit=((ptOpt->Limit.Val.V_NUMFUNC_1)->Compute)((ptOpt->Limit.Val.V_NUMFUNC_1)->Par,ptMod->T.Val.V_DATE);
    rebate=((ptOpt->Rebate.Val.V_NUMFUNC_1)->Compute)((ptOpt->Rebate.Val.V_NUMFUNC_1)->Par,ptMod->T.Val.V_DATE);

    return Cryer_UpIn(ptOpt->EuOrAm.Val.V_BOOL,ptMod->S0.Val.V_PDOUBLE,ptOpt->PayOff.Val.V_NUMFUNC_1,limit,rebate, ptOpt->Maturity.Val.V_DATE-ptMod->T.Val.V_DATE,r,divid,ptMod->Sigma.Val.V_PDOUBLE,Met->Par[0].Val.V_INT2,Met->Par[1].Val.V_INT2,&(Met->Res[0].Val.V_DOUBLE),&(Met->Res[1].Val.V_DOUBLE));
}

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}

int CHK_OPT(FD_Cryer_UpIn)(void *Opt, void *Mod)
{
    Option* ptOpt=(Option*)Opt;
    TYPEOPT* opt=(TYPEOPT*)(ptOpt->TypeOpt);

    if ((opt->Parisian).Val.V_BOOL==WRONG)
    if ( (strcmp( ((Option*)Opt)->Name,"
        CallUpInAmer")==0) || (strcmp( ((Option*)Opt)->Name,"
        PutUpInAmer")==0) )
        return OK;

    return WRONG;
}

static int MET(Init)(PricingMethod *Met)
{
    static int first=1;

    if (first)
    {
        Met->Par[0].Val.V_INT2=100;
        Met->Par[1].Val.V_INT2=100;

        first=0;
    }

    return OK;
}

PricingMethod MET(FD_Cryer_UpIn)=
{
    "FD_Cryer",
    {{ "SpaceStepNumber", INT2, 100, ALLOW    }, {"TimeStepNumber", INT2, 100, ALLOW},
    { " ", END, 0, FORBID }},
    CALC(FD_Cryer_UpIn),
    {{ "Price", DOUBLE, 100, FORBID }, {"Delta", DOUBLE, 10
        0, FORBID } , { " ", END, 0, FORBID }},
    CHK_OPT(FD_Cryer_UpIn),

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    CHK_split,  
    MET(Init)  
};
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References