

[Help](#)

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#include "bs1d_pad.h"

static int Babbs_95_FloatingCall(int am,double
    s,double s_min,NumFunc_2*p,double t,double r,
    double divid,double sigma,int N,double *ptprice,
    double *ptdelta)
{
    int i,j,eta0,npoints;
    double u,d,h,pu,pd,a1,stock,eta,y_0;
    double *P,*iv,*Q,*Boundary;
    double upperstock,old_price;
    int odd;
    double flat_price, up_price;

    /*Price, intrinsic value arrays*/
    P=(double *)malloc((2*N+1)*sizeof(double));
    if (P==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    Q=(double *)malloc((2*N+1)*sizeof(double));
    if (Q==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    iv=(double *)malloc((2*N+1)*sizeof(double));
    if (iv==NULL)
        return MEMORY_ALLOCATION_FAILURE;
    Boundary=(double *)malloc((N+1)*sizeof(double))
        ;
    if (Boundary==NULL)
        return MEMORY_ALLOCATION_FAILURE;

    /*Up and Down factors*/
    y_0=s_min/s;
    h=t/(double)N;
    a1=exp(h*(r-divid));
    u=exp(sigma*sqrt(h));
    d=1./u;

    /*Critical Index*/
    eta=-log(y_0)/(sigma*sqrt(h));
    eta0=(int)floor(eta);
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if (eta0>N)
eta0=N;

/*Risk-Neutral Probability*/
pu=(a1-d)/(u-d);
pd=1.-pu;
pu*=exp(-r*h)*u;
pd*=exp(-r*h)*d;

if(eta0<N)
{
    /*First Stage:Computation of price value along the line spot=maximum*/

    /*Intrinsic value initialisation*/
    for (i=0;i<=N;i++)
    Boundary[i]=0.;

    stock=1.;
    for (i=0;i<N+eta0;i++)
    {
        iv[i]=(p->Compute)(p->Par,1.,stock);
        P[i]=iv[i];
        Q[i]=P[i];
        stock*=d;
    }

    Boundary[N]=P[0];

    /*Backward Resolution*/
    for (i=1;i<N-eta0;i++)
    {
        old_price=P[0];/*Used for the delta in the case s=s_min*/
        P[0]=pd*Q[0]+pu*Q[1];
        if (am)
            P[0]=MAX(iv[0],P[0]);
        Boundary[N-i]=P[0];

        for (j=1;j<=N-eta0-i;j++)
        {

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        P[j]=pd*Q[j-1]+pu*Q[j+1];
        if (am)
            P[j]=MAX(iv[j],P[j]);
        }

        for (j=0;j<=N-eta0-i;j++)
            Q[j]=P[j];
    }

if (s_min<s)
{
    /*Second Stage:Computation of price value */
    /*Intrinsic value initialization*/
    upperstock=y_0;
    for (i=0;i<N;i++)
        upperstock*=d;
    stock=upperstock;
    for (i=0;i<=N+eta0;i++)
    {
        iv[i]=(p->Compute)(p->Par,1.,stock);
        stock*=u;
    }

    /*Terminal Values*/
    npoints=eta0+(N-eta0)/2;
    for (j=0;j<=npoints;j++)
        P[j]=iv[2*j];

    /*Backward Resolution*/
    if (eta0>0) /*The first mesh does not break the barrier*/
    {

        /*First part-the barrier is active*/
        odd=1;
        for (i=eta0;i<N-1;i++)
            odd=!odd;

        if (!odd) npoints=npoints-1;
    }
}

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for (i=1;i<=N-eta0;i++)
{
    for (j=0;j<npoints;j++)
    {
        P[j]=pu*P[j]+ pd*P[j+1];
        if (am)
            P[j]=MAX(iv[i+2*j],P[j]);
    }
    /*Special handling of the critical node*/
    if (odd)
    {
        P[npoints]=pu*P[npoints]+pd*Boundary[N+1-i];
        if (am)
            P[npoints]=MAX(iv[i+2*npoints],P[npoints]);
    }

    /*For the critical node at the next iteration*/
    if (!odd)
    {
        npoints=npoints-1;
    }
    odd=!odd;
}

/*Second part-the barrier is strictly below the tree*/
npoints=eta0-1;
for (i=N-eta0+1;i<N;i++)
{
    for (j=0;j<=npoints;j++)
    {
        P[j]=pu*P[j]+ pd*P[j+1];
        if (am)
            P[j]=MAX(iv[i+2*j],P[j]);
    }

    npoints=npoints-1;
}

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    }
    /*Delta*/
    *ptdelta=(P[1]-P[0])/(y_0*(u-d));

    /*First time step*/
    P[0]=pu*P[0]+pd*P[1];
    if (am)
    P[0]=MAX(iv[N],P[0]);
    /*Price*/
    *ptprice=P[0];
}
else /*eta0=0, the first mesh breaches the
barrier*/
{
    /*The barrier is always active*/
    odd=1;
    for (i=eta0;i<N-1;i++)
    odd=!odd;

    if (!odd) npoints=npoints-1;

    for (i=1;i<=N-eta0-1;i++) /*We go backward
until the next date*/
    {
        flat_price=P[1]; /*Only for the delta*
/

        for (j=0;j<npoinst;j++)
        {
            P[j]=pu*P[j]+ pd*P[j+1];
            if (am)
            P[j]=MAX(iv[i+2*j],P[j]);
        }
        /*Special handling of the critical node*/
        if (odd)
        {
            P[npoinst]=pu*P[npoinst]+pd*Boundary[N+1-i];
            if (am)
            P[npoinst]=MAX(iv[i+2*npoinst],P[

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    npoints]);;
    }

    if (!odd)
    {
        npoints=npoints-1;
    }
    odd=!odd;

}
up_price=P[0]; /*For the delta*/

/*First time step*/
P[0]=pu*P[0]+pd*P[1];

/*Special handling of the critical node*/
P[0]=pu*P[0]+pd*Boundary[1];
if (am)
P[0]=MAX(iv[N],P[0]);

/*Delta*/
/*Corresponds to setting a third point at
level s between u*s and d*s*/
/*One computes the finite difference app
roximation between s and us*/
*ptdelta=(up_price-(exp(-r*h)*flat_price+
exp(r*h)*P[0])*0.5)/(y_0*(d-1.));
} /*eta0=0*/
}

else /*s=s_min*/
*ptdelta=(P[1]-P[0])/(d-1.);

/*Price*/
*ptprice=s*P[0];

/*Delta*/
*ptdelta=(*ptdelta)*(-y_0)+P[0];

/*Memory Desallocation*/

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    free(P);
    free(Q);
    free(iv);
    free(Boundary);

    return OK;

}

int CALC(TR\_Babbs\_Call)(void *Opt,void *Mod,PricingMethod *Met)
{
    TYPEOPT* ptOpt=( TYPEOPT*)Opt;
    TYPEMOD* ptMod=( TYPEMOD*)Mod;
    double r,divid;

    r=log(1.+ptMod->R.Val.V_DOUBLE/100.);
    divid=log(1.+ptMod->Divid.Val.V_DOUBLE/100.);

    return Babbs_95_FloatingCall(ptOpt->EuOrAm.Val
        .V_BOOL,ptMod->S0.Val.V_PDOUBLE,(ptOpt->PathDep.
        Val.V_NUMFUNC_2)->Par[4].Val.V_PDOUBLE,ptOpt->Pay
        Off.Val.V_NUMFUNC_2,ptOpt->Maturity.Val.V_DATE-pt
        Mod->T.Val.V_DATE,r,divid,ptMod->Sigma.Val.V_PDOU
        BLE,Met->Par[0].Val.V_INT2,&(Met->Res[0].Val.V_
        DOUBLE),&(Met->Res[1].Val.V_DOUBLE));
}

int CHK_OPT(TR\_Babbs\_Call)(void *Opt, void *Mod)
{
    if ((strcmp(((Option*)Opt)->Name,"
        LookBackCallFloatingEuro")==0) || (strcmp( ((Option*)Opt)->Name,"
        LookBackCallFloatingAmer")==0) )
        return OK;
    return WRONG;
}

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

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    if (first)
    {
        Met->Par[0].Val.V_INT2=1000;
        first=0;
    }

    return OK;
}

PricingMethod MET(TR\_Babbs\_Call)=
{
    "TR\_Babbs\_Call",
    {{ "StepNumber", INT2, 100, ALLOW }, { " ", END, 0, FORB
        ID } },
    CALC(TR\_Babbs\_Call),
    {{ "Price", DOUBLE, 100, FORBID }, { "Delta", DOUBLE, 10
        0, FORBID } , { " ", END, 0, FORBID } },
    CHK_OPT(TR\_Babbs\_Call),
    CHK_tree,
    MET(Init)
};
```

References