

[Help](#)

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#include "bs1d_pad.h"

int Fixed_PutLookback_ConzeWiswanathan(double s, double s_
    min, double k, double t,
        double r, double divid, double sigma,
        double *ptprice, double *ptdelta)
{
    double b,sigmasqrt,a1,a2,esp,disc;

    if (s_min > s)
    {
        *ptprice=0.;
        *ptdelta=0.;
    }
    else
    {
        b=r-divid;
        sigmasqrt=sigma*sqrt(t);
        esp=2.*b/SQR(sigma);
        disc=exp(-r*t);

        if (k<s_min)
        {
            a1=(log(s/k)+ (b+SQR(sigma)/2.)*t)/sigmasqrt;
            a2=a1-sigmasqrt;
            if (b ==0)
            {
                *ptprice = k*disc*cdf_nor(-a2) - s*disc*cdf_nor(-
                a1) +
                s*disc*sigmasqrt*pnl_normal_density(a1) - s*disc*cdf_
                nor(-a1)*(SQR(sigma)*t/2.+log(s/k));

                *ptdelta = -(k/s)*disc*pnl_normal_density(a2)/si
                gmasqrt + pnl_normal_density(a1)*disc*(sigmasqrt+1./sigmasq
                rt)
                -disc*cdf_nor(-a1)*(2.+SQR(sigma)*t/2.+log(s/k));
            }
            else
            {
                *ptprice=k*exp(-r*t)*cdf_nor(-a2)-s*exp(-divid*t)*
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cdf_nor(-a1)+
s*exp(-r*t)*(SQR(sigma)/(2.*b))*
(pow(s/k,-esp)*cdf_nor(-a1+(2.*b/sigma)*sqrt(t))-exp(
b*t)*cdf_nor(-a1));

    *ptdelta=exp(-divid*t)*cdf_nor(a1)*(1.+SQR(sigma)/
(2.*b))+
exp(-divid*t)*pnl_normal_density(a1)/(sigma*sqrt(t))-
exp(-r*t)*(k/s)*pnl_normal_density(a2)/sigmasqrt+
exp(-r*t)*pow(s/k,-esp)*cdf_nor(-a1+2.*(b/sigma)*sq
rt(t))*(SQR(sigma)/(2*b)-1.)-
exp(-divid*t)*(SQR(sigma)/(2*b)+1.);
    }
}

else
{
a1=(log(s/s_min) + (b+SQR(sigma)/2.)*t)/sigmasqrt;
a2=a1-sigmasqrt;
if (b == 0)
{
    *ptprice = disc*(k-s_min) - s*disc*cdf_nor(-a1) +
s_min*disc*cdf_nor(-a2) +
s*disc*sigmasqrt*pnl_normal_density(a1) - s*disc*cdf_
nor(-a1)*(SQR(sigma)*t/2.+log(s/s_min));

    *ptdelta = -(s_min/s)*disc*pnl_normal_density(a2)/
sigmasqrt + pnl_normal_density(a1)*disc*(sigmasqrt+1./sigma
sqrt)
-disc*cdf_nor(-a1)*(2.+SQR(sigma)*t/2.+log(s/s_min));
    }
else
{
    *ptprice=exp(-r*t)*(k-s_min)-s*exp(-divid*t)*cdf_
nor(-a1)+s_min*exp(-r*t)*cdf_nor(-a2)+
s*exp(-r*t)*(SQR(sigma)/(2.*b))*
(pow(s/s_min,-esp)*cdf_nor(-a1+(2.*b/sigma)*sqrt(t))-
exp(b*t)*cdf_nor(-a1));

    *ptdelta=exp(-divid*t)*(1.+SQR(sigma)/(2.*b))*(cdf
_nor(a1)-1.)+
exp(-divid*t)*pnl_normal_density(a1)/(sigma*sqrt(t))

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        -exp(-r*t)*(s_min/s)*pnl_normal_density(a2)/sigmasq
        rt+
        exp(-r*t)*pow(s/s_min,-esp)*cdf_nor(-a1+2.*(b/sigma)*
        sqrt(t))*(SQR(sigma)/(2*b)-1.);
    }
}

return OK;
}

int CALC(CF_Fixed_PutLookBack)(void*Opt,void *Mod,Pricing
    Method *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 Fixed_PutLookback_ConzeWiswanathan(ptMod->S0.Val.
        V_PDOUBLE,(ptOpt->PathDep.Val.V_NUMFUNC_2)->Par[4].Val.V_
        PDOUBLE,
        (ptOpt->PayOff.Val.V_NUMFUNC_2)->Par[0].
        Val.V_PDOUBLE,
        ptOpt->Maturity.Val.V_DATE-ptMod->T.Val.
        V_DATE,
        r,divid,ptMod->Sigma.Val.V_PDOUBLE,&(
        Met->Res[0].Val.V_DOUBLE),&(Met->Res[1].Val.V_DOUBLE));
}

static int CHK_OPT(CF_Fixed_PutLookBack)(void *Opt, void *
    Mod)
{
    return strcmp( ((Option*)Opt)->Name,"    LookBackPutFixedEuro");
}

static int MET(Init)(PricingMethod *Met,Option *Opt)
{

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    if ( Met->init == 0)
    {
        Met->init=1;
    }

    return OK;
}

PricingMethod MET(CF_Fixed_PutLookBack)=
{
    "CF_Fixed_PutLookBack",
    {{ " ",PREMIA_NULLTYPE,{0},FORBID}},
    CALC(CF_Fixed_PutLookBack),
    {{ "Price",DOUBLE,{100},FORBID},{ "Delta",DOUBLE,{100},FORB
        ID} ,{{ " ",PREMIA_NULLTYPE,{0},FORBID}},
    CHK_OPT(CF_Fixed_PutLookBack),
    CHK_ok,
    MET(Init)
};
```

References