

[Help](#)

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#include "stein1d_std.h"

#ifdef PremiaCurrentVersion && PremiaCurrentVersion < (2010+2) //The "#els
static int CHK_OPT(AP_Alos_Stein)(void *Opt, void *Mod)
{
    return NONACTIVE;
}
int CALC(AP_Alos_Stein)(void *Opt, void *Mod, PricingMethod *Met)
{
    return AVAILABLE_IN_FULL_PREMIA;
}
#else

static double d1(double x, double t, double s, double K, double r, double T)
{
    double d = (log(x / K) + (r + s * s / 2) * (T - t)) / (s * sqrt(T - t));
    return d;
}
static double H(double t, double x, double v, double K, double r, double T)
{
    double a, d, HH;
    a = d1(x, t, v, K, r, T) * d1(x, t, v, K, r, T);
    d = v * sqrt((T - t) * 2 * M_PI);
    HH = exp(-a / 2) / d * x * (1 - d1(x, t, v, K, r, T) / v / sqrt(T));
    return HH;
}

static double diffH(double v, double T, double S, double K, double r)
{
    return (-0.5 / pow(v, 3) * pow(2, 0.5) / pow(M_PI, 0.5) / pow(T, 0.5) * (log(S
}

int ApAlosStein(double S, NumFunc_1 *p, double T, double r, double divid, doubl
{
    int flag_call;
    double K, prix, delta, price_bs, delta_bs;
    double I1, I2, I, Ivol, vol, d, lambda;
    double sigma0;

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sigma0 = sqrt(v0);
sigma0 = v0;
K = p->Par[0].Val.V_PDOUBLE;

if ((p->Compute) == &Call)
    flag_call = 1;
else
    flag_call = 0;;

// Quantity introduce in the paper to simplify the calculation
lambda = sigma / sqrt(kappa);
I2 = 1. / 4 * (-9 * exp(2 * T * kappa) * pow(theta, 2) - 2 * pow(theta, 2) * T *
    -2 * T * kappa);
//Calculation of the quantity denote by I1 in the paper
I1 = lambda * lambda / 2 * (-1. / 4 * (2 * T * exp(-2 * T * kappa) * kappa + e
I = I1 + I2;
//Calculation of the quantity denote by sigma0* in the paper
Ivol = 1. / 4 * pow(lambda, 2) * (2 * T * kappa + exp(-2 * T * kappa) - 1) / k
vol = sqrt(1 / T * Ivol);
d = diffH(vol, T, S, K, r);

if (flag_call == 1)
{
    pnl_cf_call_bs(S, K, T, r, divid, vol, &price_bs, &delta_bs);
    prix = price_bs + lambda * sqrt(kappa) * rho * H(0, S, vol, K, r, T) * I;
    delta = delta_bs + lambda * sqrt(kappa) * rho * I * d;
}
else
{
    pnl_cf_put_bs(S, K, T, r, divid, vol, &price_bs, &delta_bs);
    prix = price_bs + lambda * sqrt(kappa) * rho * H(0, S, vol, K, r, T) * I;
    delta = delta_bs + lambda * sqrt(kappa) * rho * I * d;
}

/* Price*/
*ptprice = prix;

/* Delta */
*ptdelta = delta;

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    return OK;
}

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

    if (ptMod->Sigma.Val.V_PDOUBLE == 0.0)
    {
        Fprintf(TOSCREEN, "BLACK-SHOLES MODEL\ n\ n\ n");
        return WRONG;
    }
    else
    {
        r = log(1. + ptMod->R.Val.V_DOUBLE / 100.);
        divid = log(1. + ptMod->Divid.Val.V_DOUBLE / 100.);

        return ApAlosStein(ptMod->S0.Val.V_PDOUBLE,
                           ptOpt->PayOff.Val.V_NUMFUNC_1,
                           ptOpt->Maturity.Val.V_DATE - ptMod->T.Val.V_DATE,
                           r,
                           divid, ptMod->Sigma0.Val.V_PDOUBLE
                           , ptMod->MeanReversion.Val.V_PDOUBLE,
                           ptMod->LongRunVariance.Val.V_PDOUBLE,
                           ptMod->Sigma.Val.V_PDOUBLE,
                           ptMod->Rho.Val.V_PDOUBLE,
                           &(Met->Res[0].Val.V_DOUBLE),
                           &(Met->Res[1].Val.V_DOUBLE)
                           );
    }
}

static int CHK_OPT(AP_Alos_Stein)(void *Opt, void *Mod)
{
    if ((strcmp(((Option *)Opt)->Name, "CallEuro") == 0)
        || (strcmp(((Option *)Opt)->Name, "PutEuro") == 0))

        return OK;
}

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    return WRONG;
}

#endif //PremiaCurrentVersion
static int MET(Init)(PricingMethod *Met, Option *Opt)
{
    if (Met->init == 0)
    {
        Met->init = 1;
    }

    return OK;
}

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