

[Help](#)

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#include "
href../../mod/bs1d/bs1d_std/bs1d_std_h_src.pdfbs1d_std.h"

/*Critical Price*/
static double PutCriticalPrice(double r, double divid, double sigma, double T, d
{
    const double precision = 0.0001;
    double previous;
    double current = K;
    double put_price, put_delta;
    do
    {
        previous = current;
        pnl_cf_put_bs(previous, K, T, r, divid, sigma, &put_price, &put_delta);
        current = K - put_price;
    }
    while (!(fabs((previous - current) / current) <= precision));
    return current;
}

static double CallCriticalPrice(double r, double divid, double sigma, double T,
{
    const double precision = 0.0001;
    double previous;
    double current = K;
    double call_price, call_delta;
    do
    {
        previous = current;
        pnl_cf_call_bs(previous, K, T, r, divid, sigma, &call_price, &call_delta);
        current = K + call_price;
    }
    while (!(fabs((previous - current) / current) <= precision));
    return current;
}

/* 2-points Ho-Stapleton-Subrahmanyam AP*/
static int HoStapletonSubrahmanyam_94(double s, NumFunc_1 *p, double t, double r
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{
    double p1, p2, crit12, k, price, delta, val, w1, w2, d1, d2, d1c, d2c;

    k = p->Par[0].Val.V_PDOUBLE;

    if ((p->Compute) == &Call)
    {
        val = -1.;
        pnl_cf_call_bs(s, k, t, r, divid, sigma, &price, &delta);
        p1 = price;
        crit12 = CallCriticalPrice(r, divid, sigma, t / 2., k);
    }
    else
    {
        val = 1.;
        pnl_cf_put_bs(s, k, t, r, divid, sigma, &price, &delta);
        p1 = price;
        crit12 = PutCriticalPrice(r, divid, sigma, t / 2., k);
    }
    d1c = (log(s / crit12) + (r - divid + 0.5 * SQR(sigma)) * t / 2.) / (sigma * s);
    d2c = d1c - sigma * sqrt(t / 2.);
    d1 = (log(s / k) + (r - divid + 0.5 * SQR(sigma)) * t) / (sigma * sqrt(t));
    d2 = d1 - sigma * sqrt(t);
    w1 = exp(-divid * t / 2.) * cdf_nor(-val * d1c) + exp(-divid * t) * pnl_cdf2no;
    w2 = exp(-r * t / 2.) * cdf_nor(-val * d2c) + exp(-r * t) * pnl_cdf2nor(val *
    p2 = val * (k * w2 - s * w1);

    /*Price*/
    *ptprice = SQR(p2) / p1;

    /*Delta*/
    *ptdelta = (*ptprice) * (-2.*val * w1 / p2 - delta / p1);

    return OK;
}

```

```

int CALC(AP_HoStapletonSubrahmanyam)(void *Opt, void *Mod, PricingMethod *Met)
{
    TYPEOPT *ptOpt = (TYPEOPT *)Opt;
    TYPEMOD *ptMod = (TYPEMOD *)Mod;

```

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double r, divid;

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

return HoStapletonSubrahmanyam_94(ptMod->S0.Val.V_PDOUBLE,
                                   ptOpt->PayOff.Val.V_NUMFUNC_1,
                                   ptOpt->Maturity.Val.V_DATE - ptMod->T.Val.V_
                                   ptMod->Sigma.Val.V_PDOUBLE,
                                   &(Met->Res[0].Val.V_DOUBLE), &(Met->Res[1].V
}

static int CHK_OPT(AP_HoStapletonSubrahmanyam)(void *Opt, void *Mod)
{
    if ((strcmp(((Option *)Opt)->Name, "CallAmer") == 0) || (strcmp(((Option *)Opt
        return OK;

    return WRONG;
}

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

    return OK;
}

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

```