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#include "vasicek1d_std.h"

static double A, B;

/*Zero Coupon Bond*/
static double zcb_vasicek1d(double theta, double r, double k, double sigma, double t)
{
    /*A,B coefficient*/
    B = (1. / k) * (1. - exp(-k * (Ti - ti)));
    A = exp((theta - SQR(sigma) / (2.*SQR(k))) * (B - Ti + ti) - (SQR(sigma) / (4. * k) * B * B));

    return A * exp(-B * r);
}

/*Call Option*/
static int zbc_vasicek1d(double r, double k, double t, double sigma, double theta)
{
    double PtS, PtT;
    double d1, d2, sigma_p, K;

    K = p->Par[0].Val.V_DOUBLE;
    PtT = zcb_vasicek1d(theta, r, k, sigma, t, T);
    PtS = zcb_vasicek1d(theta, r, k, sigma, t, S);
    sigma_p = sigma * sqrt((1. - exp(-2.*k * (T - t))) / (2 * k)) * (1. / k) * (1. / k);
    d1 = 1. / (sigma_p) * log(PtS / (PtT * K)) + 0.5 * sigma_p;
    d2 = d1 - sigma_p;

    /*Price*/
    *price = PtS * cdf_nor(d1) - K * PtT * cdf_nor(d2);

    /*Delta*/
    *delta = cdf_nor(d1);

    return OK;
}

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

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    TYPEMOD *ptMod = (TYPEMOD *)Mod;

    return zbc_vasicek1d(ptMod->r0.Val.V_PDOUBLE, ptMod->k.Val.V_DOUBLE, ptMod->T.
        ptMod->theta.Val.V_PDOUBLE, ptOpt->BMaturity.Val.V_DATE,
        &(Met->Res[0].Val.V_DOUBLE), &(Met->Res[1].Val.V_DOUBLE))
}

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

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

    return OK;
}

PricingMethod MET(CF_ZCCallBondEuro) =
{
    "CF_Vasicek1d_ZBCallEuro",
    {{ " ", PREMIA_NULLTYPE, {0}, FORBID }},
    CALC(CF_ZCCallBondEuro),
    {{ "Price", DOUBLE, {100}, FORBID }, { "Delta", DOUBLE, {100}, FORBID } , { " ", PR
    CHK_OPT(CF_ZCCallBondEuro),
    CHK_ok,
    MET(Init)
} ;

```