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#include "vasicek1d_std.h"

static int nb_payment;
static double A, B;

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

/*Put Option on Zero Coupon Bond*/
static double zbp_vasicek1d(double t, double T, double S, double r, double k, double sigma, double new_K)
{
    double PtS, PtT;
    double d1, d2, sigma_p;
    double new_K;

    new_K = 1. / (1. + K * periodicity);

    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. - exp(-k * (T - t)));
    d1 = 1. / (sigma_p) * log(PtS / (PtT * new_K)) + 0.5 * sigma_p;
    d2 = d1 - sigma_p;

    return new_K * PtT * cdf_nor(-d2) - PtS * cdf_nor(-d1);
}

/*Cap*/
static int cap_vasicek1d(double r, double k, double date, double sigma, double t, double T)
{
    double sum, tim, tip;
    int i;
}
```

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    nb_payerment = (int)((contract_maturity - first_payerment) / periodicity);

    /*Cap=Portfolio of zero-bond Put options*/
    sum = 0.;
    for (i = 0; i < nb_payerment; i++)
    {
        tim = first_payerment + (double)i * periodicity;
        tip = tim + periodicity;
        sum += (1. + K * periodicity) * zbp_vasicek1d(date, tim, tip, r, k, theta,
    }

    /*Price*/
    *price = Nominal * sum;

    return OK;
}

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

    return cap_vasicek1d(ptMod->r0.Val.V_PDDOUBLE, ptMod->k.Val.V_DOUBLE, ptMod->T.
}

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

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

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    return OK;
}

PricingMethod MET(CF_Cap) =
{
    "CF_Vasicek1d_Cap",
    {{" ", PREMIA_NULLTYPE, {0}, FORBID}},
    CALC(CF_Cap),
    {{"Price", DOUBLE, {100}, FORBID}, {" ", PREMIA_NULLTYPE, {0}, FORBID}},
    CHK_OPT(CF_Cap),
    CHK_ok,
    MET(Init)
} ;
```