

## Help

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#include <stdlib.h>
#include "hullwhite1d_std.h"
#include "math/InterestRateModelTree/TreeShortRate/TreeShortRate.h"
#include "pnl/pnl_vector.h"
#include "hullwhite1d_includes.h"

//The "#else" part of the code will be freely available after the (year of creat
#if defined(PremiaCurrentVersion) && PremiaCurrentVersion < (2007+2)
static int CHK_OPT(TR_BermudianSwaptionHW1D)(void *Opt, void *Mod)
{
    return NONACTIVE;
}
int CALC(TR_BermudianSwaptionHW1D)(void *Opt, void *Mod, PricingMethod *Met)
{
    return AVAILABLE_IN_FULL_PREMIA;
}
#else

/// TreeShortRate      : structure that contains components of the tree (see Tree
/// ModelParameters    : structure that contains the parameters of the Hull&Whi
/// ZCMarketData : structure that contains the Zero Coupon Bond prices of the ma

/// Computation of the payoff at the final time of the tree (ie the option matur
void BermudianSwaption_InitialPayoffHW1D(int swaption_start, TreeShortRate *Meth
{
    double a , sigma;

    int jminprev, jmaxprev; // jmin[i], jmax [i]
    int i, j;

    double delta_x1; // delta_x1 = space step of the process x at time i
    double delta_t1; // time step

    double ZCPrice, SumZC;
    double current_rate;

    int NumberOfPayments;
    double Ti;
```

```

ZCPrice = 0.; /* to avoid warning */
///<*****Parameters of the process r *****/
a = ModelParam->MeanReversion;
sigma = ModelParam->RateVolatility;

///<** Calcul du vecteur des payoffs a l'instant de maturite de l'option
jminprev = pnl_vect_int_get(Meth->Jminimum, swaption_start); // jmin(swaption_start)
jmaxprev = pnl_vect_int_get(Meth->Jmaximum, swaption_start); // jmax(swaption_start)

pnl_vect_resize(OptionPriceVect2, jmaxprev - jminprev + 1);

delta_t1 = GET(Meth->t, swaption_start) - GET(Meth->t, swaption_start - 1); //
delta_x1 = SpaceStep(delta_t1, a, sigma); // SpaceStep(swaption_start)

NumberOfPayments = pnl_iround((contract_maturity - GET(Meth->t, swaption_start)));

p->Par[0].Val.V_DOUBLE = 1.0;

for (j = jminprev ; j <= jmaxprev ; j++)
{
    current_rate = func_model_hw1d(j * delta_x1 + GET(Meth->alpha, swaption_start));

    SumZC = 0;
    for (i = 1; i <= NumberOfPayments; i++)
    {
        Ti = GET(Meth->t, swaption_start) + i * periodicity;
        ZCPrice = cf_hw1d_zcb(ZCMarket, a, sigma, GET(Meth->t, swaption_start), Ti);

        SumZC += ZCPrice;
    }

    //SwapRate = (1-ZCPrice) / (periodicity*SumZC);

    LET(OptionPriceVect2, j - jminprev) = ((p->Compute)(p->Par, periodicity * (j - jminprev)));

    //LET(OptionPriceVect2, j-jminprev) = SumZC* periodicity*(p->Compute)(p->Par, j-jminprev);
}
}

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/// Price of a bermudianswaption using a trinomial tree
double tr_hw1d_bermudianswaption(TreeShortRate *Meth, ModelParameters *ModelPara
{
    double Ti2, Ti1, OptionPrice;
    int i, j, i_Ti2, i_Ti1;
    int NumberOfPayments;

    PnlVect *PayoffVect;
    PnlVect *OptionPriceVect1; // Vector of prices of the option at i
    PnlVect *OptionPriceVect2; // Vector of prices of the option at i+1
    OptionPriceVect1 = pnl_vect_create(1);
    OptionPriceVect2 = pnl_vect_create(1);
    PayoffVect = pnl_vect_create(1);

    ///***** Computation of the vector of payoff at the maturity of t
    Ti1 = contract_maturity - periodicity;
    i_Ti1 = IndexTime(Meth, Ti1);
    BermudianSwaption_InitialPayoffHW1D(i_Ti1, Meth, ModelParam, ZCMarket, OptionP

    ///***** Backward computation of the option price until initial t

    NumberOfPayments = pnl_iround((contract_maturity - option_maturity) / periodic

    for (i = NumberOfPayments - 2 ; i >= 0 ; i--)
    {
        Ti1 = option_maturity + i * periodicity;
        Ti2 = Ti1 + periodicity;
        i_Ti2 = IndexTime(Meth, Ti2);
        i_Ti1 = IndexTime(Meth, Ti1);

        BackwardIteration(Meth, ModelParam, OptionPriceVect1, OptionPriceVect2, i_

        BermudianSwaption_InitialPayoffHW1D(i_Ti1, Meth, ModelParam, ZCMarket, Pay

        for (j = 0; j < PayoffVect->size; j++)
        {
            if (GET(PayoffVect, j) > GET(OptionPriceVect2, j))
            {
                LET(OptionPriceVect2, j) = GET(PayoffVect, j);
            }
        }
    }
}

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    }

    ///***** Backward computation of the option price from first_res
    i_Ti2 = IndexTime(Meth, option_maturity);
    i_Ti1 = 0;
    BackwardIteration(Meth, ModelParam, OptionPriceVect1, OptionPriceVect2, i_Ti2,

    OptionPrice = GET(OptionPriceVect1, 0);

    pnl_vect_free(& OptionPriceVect1);
    pnl_vect_free(& OptionPriceVect2);
    pnl_vect_free(& PayoffVect);

    return OptionPrice;
}

static int tr_bermudianswaption1d(int flat_flag, double r0, char *curve, double
{
    TreeShortRate Tr;
    ModelParameters ModelParams;
    ZCMarketData ZCMarket;

    /* Flag to decide to read or not ZC bond datas in "initialyields.dat" */
    /* If P(0,T) not read then P(0,T)=exp(-r0*T) */
    if (flat_flag == 0)
    {
        ZCMarket.FlatOrMarket = 0;
        ZCMarket.Rate = r0;
    }

    else
    {
        ZCMarket.FlatOrMarket = 1;
        ZCMarket.filename = curve;
        ReadMarketData(&ZCMarket);

        if (option_maturity > GET(ZCMarket.tm, ZCMarket.Nvalue - 1))
        {

```

[illegible]

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Met->Par[0].Val.V_LONG,
&(Met->Res[0].Val.V_DOUBLE));
}
static int CHK_OPT(TR_BermudianSwaptionHW1D)(void *Opt, void *Mod)
{
    if ((strcmp(((Option *)Opt)->Name, "PayerBermudanSwaption") == 0) || (strcmp((
        return OK;
    else
        return WRONG;
}
#endif //PremiaCurrentVersion

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

        Met->Par[0].Val.V_INT = 50;
    }
    return OK;
}

PricingMethod MET(TR_BermudianSwaptionHW1D) =
{
    "TR_HullWhite1d_BermudianSwaption",
    { {"TimeStepNumber per Period", INT, {100}, ALLOW},
      {" ", PREMIA_NULLTYPE, {0}, FORBID}
    },
    CALC(TR_BermudianSwaptionHW1D),
    {"Price", DOUBLE, {100}, FORBID}/*,{"Delta",DOUBLE,{100},FORBID}*/ , {" ", PR
    CHK_OPT(TR_BermudianSwaptionHW1D),
    CHK_ok,
    MET(Init)
} ;

```