Help

```
#include <stdlib.h>
#include "
href../../../mod/sg1d/sg1d_stdi/sg1d_stdi_h_src.pdfsg1d_stdi.h"
#include "pnl/pnl_vector.h"
#include "
href../../../mod/sg1d/sg1d_stdi/QuadraticModel_h_src.pdfQuadraticModel.h"
#include "
href../../../common/math/InterestRateModelTree/TreeShortRate/TreeShortRate_h_src
#include "
href../../../common/math/read_market_zc/InitialYieldCurve_h_src.pdfmath/read_mar


#if defined(PremiaCurrentVersion) && PremiaCurrentVersion < (2007+2) //The "#els
int CALC(TR_SwaptionSG1D)(void *Opt, void *Mod, PricingMethod *Met)
{
  return AVAILABLE_IN_FULL_PREMIA;
}
static int CHK_OPT(TR_SwaptionSG1D)(void *Opt, void *Mod)
{
  return NONACTIVE;
}
#else

static void Swaption_InitialPayoffSG1D(TreeShortRate *Meth, ModelParameters *Mod
{
  int jminprev, jmaxprev, i, j, NumberOfPayments;

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

  double Ti, ZCPrice_T_Ti, x0, r0, current_rate, x;

  Data data1, data2;
  Omega om;

  initial_short_rate(ZCMarket, &r0, &x0);
  ZCPrice_T_Ti = 0.0;
```

```
a = ModelParam->MeanReversion;
sigma = ModelParam->RateVolatility;

jminprev = pnl_vect_int_get(Meth->Jminimum, Meth->Ngrid);   // jmin(Ngrid)
jmaxprev = pnl_vect_int_get(Meth->Jmaximum, Meth->Ngrid);  // jmax(Ngrid)

pnl_vect_resize(OptionPriceVect2, jmaxprev - jminprev + 1);
pnl_vect_set_double(OptionPriceVect2, 0.0);

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

NumberOfPayments = (int) floor((contract_maturity - option_maturity) / periodi

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

/* coefficients of P(0,T) */
bond_coeffs(ZCMarket, &data1, option_maturity, a, sigma, x0);

for (i = 1; i < NumberOfPayments; i++)
  {
    Ti = option_maturity + i * periodicity;

    /* coefficients of P(0,S) */
    bond_coeffs(ZCMarket, &data2, Ti, a, sigma, x0);
    /* omega distribution of P(T,S) */
    transport(&om, data1, data2, a, sigma, x0);

    for (j = jminprev ; j <= jmaxprev ; j++)
      {
        x = j * delta_x1 + GET(Meth->alpha, Meth->Ngrid);
        current_rate = func_model_sg1d(x); // rate(Ngrid, j )

        ZCPrice_T_Ti = exp(-(om.B * current_rate + om.b * x + om.c)); // P(T,

        LET(OptionPriceVect2, j - jminprev) += periodicity * SwaptionFixedRate
      }
  }

// Last payement date
Ti = contract_maturity;
```

```
  /* coefficients of P(0,S) */
  bond_coeffs(ZCMarket, &data2, Ti, a, sigma, x0);
  /* omega distribution of P(T,S) */
  transport(&om, data1, data2, a, sigma, x0);

  for (j = jminprev ; j < jmaxprev ; j++)
    {
      x = j * delta_x1 + GET(Meth->alpha, Meth->Ngrid);
      current_rate = func_model_sg1d(x); // rate(Ngrid, j )

      ZCPrice_T_Ti = exp(-(om.B * current_rate + om.b * x + om.c));

      LET(OptionPriceVect2, j - jminprev) += (1 + periodicity * SwaptionFixedRat

      LET(OptionPriceVect2, j - jminprev) = ((p->Compute)(p->Par, GET(OptionPric
    }

}


/// Price of a swaption using a trinomial tree
double tr_sg1d_swaption(TreeShortRate *Meth, ModelParameters *ModelParam, ZCMark
{
  int index_last, index_first;
  double OptionPrice;

  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);


  ///****************** Computation of the vector of payoff at the maturity of t
  Swaption_InitialPayoffSG1D(Meth, ModelParam, ZCMarket, OptionPriceVect2, p, pe

  ///****************** Backward computation of the option price until initial t
  index_last = Meth->Ngrid;
  index_first = 0;

  BackwardIteration(Meth, ModelParam, OptionPriceVect1, OptionPriceVect2, index_
```

```
  OptionPrice = GET(OptionPriceVect1, 0);

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

  return OptionPrice;

}

static int tr_swaption1d(int flat_flag, double r0, char *curve, double a, 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 (contract_maturity > GET(ZCMarket.tm, ZCMarket.Nvalue - 1))
        {
          printf("\ nError : time bigger than the last time value entered in ini
          exit(EXIT_FAILURE);
        }
    }

  ModelParams.MeanReversion  = a;
  ModelParams.RateVolatility = sigma;

  SetTimeGrid(&Tr, N_steps, first_reset_date);
```

```
  SetTreeShortRate(&Tr, &ModelParams, &ZCMarket, &func_model_sg1d, &func_model_d

  *price =  Nominal * tr_sg1d_swaption(&Tr, &ModelParams, &ZCMarket, N_steps, p,

  DeleteTreeShortRate(&Tr);
  DeleteZCMarketData(&ZCMarket);

  return OK;
}



///********************************************** PREMIA FUNCTIONS ***********

int CALC(TR_SwaptionSG1D)(void *Opt, void *Mod, PricingMethod *Met)
{
  TYPEOPT *ptOpt = (TYPEOPT *)Opt;
  TYPEMOD *ptMod = (TYPEMOD *)Mod;

  return  tr_swaption1d(ptMod->flat_flag.Val.V_INT,
                        MOD(GetYield)(ptMod),
                        MOD(GetCurve)(ptMod),
                        ptMod->a.Val.V_DOUBLE,
                        ptMod->Sigma.Val.V_PDOUBLE,
                        ptOpt->BMaturity.Val.V_DATE - ptMod->T.Val.V_DATE,
                        ptOpt->OMaturity.Val.V_DATE - ptMod->T.Val.V_DATE,
                        ptOpt->ResetPeriod.Val.V_DATE,
                        ptOpt->Nominal.Val.V_PDOUBLE,
                        ptOpt->FixedRate.Val.V_PDOUBLE,
                        ptOpt->PayOff.Val.V_NUMFUNC_1,
                        Met->Par[0].Val.V_LONG,
                        &(Met->Res[0].Val.V_DOUBLE));
}
static int CHK_OPT(TR_SwaptionSG1D)(void *Opt, void *Mod)
{
  if ((strcmp(((Option *)Opt)->Name, "PayerSwaption") == 0) || (strcmp(((Option
    return OK;
  else
    return WRONG;
}
```

```
#endif //PremiaCurrentVersion


static int MET(Init)(PricingMethod *Met, Option *Opt)
{
  if (Met->init == 0)
    {
      Met->init = 1;
      Met->HelpFilenameHint = "tr_quadratic1d_swaption";
      Met->Par[0].Val.V_LONG = 500;
    }

  return OK;
}

PricingMethod MET(TR_SwaptionSG1D) =
{
  "TR_SquareGaussian1d_Swaption",
  { {"TimeStepNumber", LONG, {100}, ALLOW},
    {" ", PREMIA_NULLTYPE, {0}, FORBID}
  },
  CALC(TR_SwaptionSG1D),
  {{"Price", DOUBLE, {100}, FORBID} , {" ", PREMIA_NULLTYPE, {0}, FORBID}},
  CHK_OPT(TR_SwaptionSG1D),
  CHK_ok,
  MET(Init)
} ;
```