```
   Help
#include <stdlib.h>
#include "hullwhite1d_stdi.h"
#include "hullwhite1d_includes.h"


#if defined(PremiaCurrentVersion) && PremiaCurrentVersion <
     (2007+2) //The "#else" part of the code will be freely av
    ailable after the (year of creation of this file + 2)
int CALC(CF_ZCPutBondEuroHW1D)(void *Opt,void *Mod,Pricing
    Method *Met)
{
return AVAILABLE_IN_FULL_PREMIA;
}
static int CHK_OPT(CF_ZCPutBondEuroHW1D)(void *Opt, void *
    Mod)
{
  return NONACTIVE;
}
#else

double cf_hw1d_zbput(ZCMarketData* ZCMarket, double a,
    double sigma, double S, double T, double K)
{
    double POT, POS, price;
    double d1, d2, sigma_p;

    //Price of an option on a ZC

    /*Computation pure discount bond*/
    POT=BondPrice(T, ZCMarket);
    POS=BondPrice(S, ZCMarket);

    sigma_p = sigma*sqrt((1.-exp(-2.*a*T))/(2.*a))*(1./a)*(
    1.-exp(-a*(S-T)));
    d1 = 1./(sigma_p)*log(POS/(POT*K))+0.5*sigma_p;
    d2 = d1-sigma_p;

    /*Price*/
    price = POS * (cdf_nor(d1)-1) - K * POT * (cdf_nor(d2)-
    1);
```

```
    return price;
}

/*Put Option*/
static int cf_zbp1d(double flat_flag, double a,double sigma
    , double r_t, double S, double T,NumFunc_1 *p,double *
    price)
{
    double K;

    ZCMarketData ZCMarket;

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

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

        if(S > GET(ZCMarket.tm,ZCMarket.Nvalue-1))
        {
            printf("{nError : time bigger than the last
    time value entered in initialyield.dat{n");
            exit(EXIT_FAILURE);
        }
    }

    K = p->Par[0].Val.V_DOUBLE;
    /*Price*/
    *price = cf_hw1d_zbput(&ZCMarket, a, sigma, S, T, K);

    DeleteZCMarketData(&ZCMarket);
```

```
    return OK;
}

int CALC(CF_ZCPutBondEuroHW1D)(void *Opt,void *Mod,Pricing
    Method *Met)
{
    TYPEOPT* ptOpt=(TYPEOPT*)Opt;
    TYPEMOD* ptMod=(TYPEMOD*)Mod;

    return cf_zbp1d(ptMod->flat_flag.Val.V_INT,
                    ptMod->a.Val.V_DOUBLE,
                    ptMod->Sigma.Val.V_PDOUBLE,
                    MOD(GetYield)(ptMod),
                    ptOpt->BMaturity.Val.V_DATE-ptMod->T.
    Val.V_DATE,
                    ptOpt->OMaturity.Val.V_DATE-ptMod->T.
    Val.V_DATE,
                    ptOpt->PayOff.Val.V_NUMFUNC_1,
                    &(Met->Res[0].Val.V_DOUBLE));
}

static int CHK_OPT(CF_ZCPutBondEuroHW1D)(void *Opt, void *
    Mod)
{
  return strcmp( ((Option*)Opt)->Name,"ZeroCouponPutBondEu
    ro");
}
#endif //PremiaCurrentVersion


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

  return OK;
}

PricingMethod MET(CF_ZCPutBondEuroHW1D)=
```

```
{
  "CF_HullWhite1d_ZBPutEuro",
  {{" ",PREMIA_NULLTYPE,{0},FORBID}},
  CALC(CF_ZCPutBondEuroHW1D),
  {{"Price",DOUBLE,{100},FORBID},{" ",PREMIA_NULLTYPE,{0},
    FORBID}},
  CHK_OPT(CF_ZCPutBondEuroHW1D),
  CHK_ok,
  MET(Init)
} ;
```

References