Help

```
#include  "bs1d_lim.h"

static int Psor_UpOut(double s,NumFunc_1  *p,
    double l,double rebate,double t,double r,double divid,
    double sigma,int N,int M,double theta,double omega,
    double epsilon,double *ptprice,double *ptdelta)
{
  int      Index,PriceIndex,TimeIndex;
  int      j,loops;
  double   k,vv,loc,h,z,alpha,beta,gamma,y,alpha1
    ,beta1,gamma1,up,upwind_alphacoef;
  double   error,norm,x;
  double   *P,*Obst,*Rhs;

  /*Memory Allocation*/
  P=(double *)malloc((N+2)*sizeof(double));
  if (P==NULL)
    return MEMORY_ALLOCATION_FAILURE;
  Obst=(double *)malloc((N+2)*sizeof(double));
  if (Obst==NULL)
    return MEMORY_ALLOCATION_FAILURE;
  Rhs=(double *)malloc((N+2)*sizeof(double));
  if (Rhs==NULL)
    return MEMORY_ALLOCATION_FAILURE;

  /*Time Step*/
  k=t/(double)M;

  /*Space Localisation*/
  vv=0.5*sigma*sigma;
  z=(r-divid)-vv;
  loc=sigma*sqrt(t)*sqrt(log(1.0/PRECISION))+fa
    bs(z)*t;

  /*Space Step*/
  x=log(s);
  up=log(l);
  h=(up-(x-loc))/(double)(N+1);

  /*Coefficient of diffusion augmented*/
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if ((h*fabs(z))<=vv)
  upwind_alphacoef=0.5;
else {
  if (z>0.) upwind_alphacoef=0.0;
  else if (z<=0.) upwind_alphacoef=1.0;
}
vv-=z*h*(upwind_alphacoef-0.5);

/*Lhs factor of theta-schema*/
alpha=theta*k*(-vv/(h*h)+z/(2.0*h));
beta=1.0+k*theta*(r+2.*vv/(h*h));
gamma=k*theta*(-vv/(h*h)-z/(2.0*h));

/*Rhs factor of theta-schema*/
alpha1=k*(1.0-theta)*(vv/(h*h)-z/(2.0*h));
beta1=1.0-k*(1.0-theta)*(r+2.*vv/(h*h));
gamma1=k*(1.0-theta)*(vv/(h*h)+z/(2.0*h));


/*Terminal Values*/
for(PriceIndex=0;PriceIndex<=N;PriceIndex++) {
  Obst[PriceIndex]=(p->Compute)(p->Par,exp(x-
  loc+(double)PriceIndex*h));
  P[PriceIndex]= Obst[PriceIndex];
}
P[N+1]=rebate;

/*Finite Difference Cycle*/
for(TimeIndex=1;TimeIndex<=M;TimeIndex++)
  {
    /*Init Rhs*/
    for(j=1;j<=N;j++)
      Rhs[j]=P[j]*beta1+alpha1*P[j-1]+gamma1*P[
  j+1];

    /*Psor Cycle*/
    loops=0;
    do
      {
        error=0.;
        norm=0.;
```

```
          for(j=1;j<=N;j++)
            {
              y=(Rhs[j]-alpha*P[j-1]-gamma*P[j+1]
    )/beta;
              y=MAX(Obst[j],P[j]+omega*(y-P[j]));

              error+=(double)(j+1)*fabs(y-P[j]);
              norm+=fabs(y);
              P[j]=y;
            }

          if (norm<1.0) norm=1.0;
          error=error/norm;

          loops++;
        }
      while ((error>epsilon) && (loops<MAXLOOPS))
    ;
    }
  Index=(int)floor(loc/h);

  *ptprice=P[Index]+(P[Index+1]-P[Index])*(exp(x)
    -exp(x-loc+Index*h))/(exp(x-loc+(Index+1)*h)-exp
    (x-loc+Index*h));

    /*Delta*/
    if(x==up)
      *ptdelta=(P[Index]-P[Index-1])/(s*h);
    else
    *ptdelta=(P[Index+1]-P[Index-1])/(2*s*h);

  /*Memory Desallocation*/
  free(P);
  free(Obst);
  free(Rhs);

  return OK;
}

int CALC(FD_Psor_UpOut)(void *Opt,void *Mod,Pric
```

```
    ingMethod *Met)
{
  TYPEOPT* ptOpt=(TYPEOPT*)Opt;
  TYPEMOD* ptMod=(TYPEMOD*)Mod;
  double r,divid,limit,rebate;

    r=log(1.+ptMod->R.Val.V_DOUBLE/100.);
    divid=log(1.+ptMod->Divid.Val.V_DOUBLE/100.);
    limit=((ptOpt->Limit.Val.V_NUMFUNC_1)->Compu
    te)((ptOpt->Limit.Val.V_NUMFUNC_1)->Par,ptMod->T.
    Val.V_DATE);
    rebate=((ptOpt->Rebate.Val.V_NUMFUNC_1)->
    Compute)((ptOpt->Rebate.Val.V_NUMFUNC_1)->Par,ptMod-
    >T.Val.V_DATE);

  return Psor_UpOut(ptMod->S0.Val.V_PDOUBLE,pt
    Opt->PayOff.Val.V_NUMFUNC_1,limit,rebate,
                      ptOpt->Maturity.Val.V_DATE-
    ptMod->T.Val.V_DATE,r,divid,ptMod->Sigma.Val.V_PD
    OUBLE,
                      Met->Par[0].Val.V_INT,Met->
    Par[1].Val.V_INT, Met->Par[2].Val.V_RGDOUBLE051,
                      Met->Par[3].Val.V_RGDOUBLE1
    2,Met->Par[4].Val.V_RGDOUBLE,
                      &(Met->Res[0].Val.V_DOUBLE)
    ,&(Met->Res[1].Val.V_DOUBLE));
}

int CHK_OPT(FD_Psor_UpOut)(void *Opt, void *Mod)
{
  Option* ptOpt=(Option*)Opt;
  TYPEOPT* opt=(TYPEOPT*)(ptOpt->TypeOpt);

  if ((opt->Parisian).Val.V_BOOL==WRONG)
  if ( (strcmp( ((Option*)Opt)->Name,"
    CallUpOutAmer")==0) || (strcmp( ((Option*)Opt)->Name,"
    PutUpOutAmer")==0) )
        return OK;
  return WRONG;
}
```

```
static int MET(Init)(PricingMethod *Met)
{
  static int first=1;

  if (first)
    {
      Met->Par[0].Val.V_INT2=100;
      Met->Par[1].Val.V_INT2=100;
      Met->Par[2].Val.V_RGDOUBLE=0.5;
      Met->Par[3].Val.V_RGDOUBLE=1.5;
      Met->Par[4].Val.V_RGDOUBLE=1.0e-7;

      first=0;
    }

  return OK;
}

PricingMethod MET(FD_Psor_UpOut)=
{
  "FD_Psor",
  {{"SpaceStepNumber",INT2,100,ALLOW    },{"TimeS
    tepNumber",INT2,100,ALLOW},
   {"Theta",RGDOUBLE051,100,ALLOW},{"Omega",RG
    DOUBLE12,100,ALLOW}, {"Epsilon",RGDOUBLE,100,ALLOW},{"
     ",END,0,FORBID}},
  CALC(FD_Psor_UpOut),
  {{"Price",DOUBLE,100,FORBID},{"Delta",DOUBLE,10
    0,FORBID} ,{" ",END,0,FORBID}},
  CHK_OPT(FD_Psor_UpOut),
  CHK_psor,
  MET(Init)
};
```

# References