

[Help](#)

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#include <pnl/pnl_mathtools.h>
#include <pnl/pnl_complex.h>
#include "pnl/pnl_specfun.h"
#include "pnl/pnl_integration.h"
#include "cgmy1d_std.h"

#if defined(PremiaCurrentVersion) && PremiaCurrentVersion < (2016+2) //The "#els

static int CHK_OPT(AP_PARFT)(void *Opt, void *Mod)
{
    return NONACTIVE;
}
int CALC(AP_PARFT)(void *Opt, void *Mod, PricingMethod *Met)
{
    return AVAILABLE_IN_FULL_PREMIA;
}
#else

typedef struct params_cgmy {
double C;
double G ;
double M ;
double Y;
double mu;
double T;
long int N ;
double K;
double S;
    double x;
double alp;
double eps;
double om;
double d;
double zet;

} params_cgmy;
```

```

static void Set_params(params_cgmy *p, double r, double divid, double Y, double
{

p->C = C;    //in the paper C=c, Y=nu, G=lambda_+, M=-lambda_-.
p->G = G; //lm=lambda_+
p->M = M; //lp=-lambda_-
p->Y = Y;
p->T = t;
p->N = N;
p->K = k;
p->S = s;
p->mu = r-divid+pnl_sf_gamma(-Y)*C*( exp(Y*log(M))-exp(Y*log(M-1)))+pnl_sf_gamma
    p->x = log(s/k)+(p->mu)*t;
    p->alp=MIN(2.0,1./Y+1.);
p->eps=2*M_PI*eps*exp(r*t)/k;
if (ifCall)//Call
    {
p->om=-0.5*M-0.5;
p->d=0.5*(M-1);
    }
else
{
p->om=0.5*G;
p->d=0.5*G;
    }
p->zet=-M_PI*(p->d)/(1.1*log(p->eps));
//printf("mu= %f\ n",p->mu);
}

static void psiCGMY(params_cgmy *p, dcomplex u, dcomplex *res)//computation for
{
dcomplex aux1, aux2, aux3, aux4;

aux1.r = p->M + u.i;
aux1.i = -u.r;

aux2.r = p->G - u.i;
aux2.i = u.r;

aux3=Cexp(RCmul(p->Y,Clog(aux1)));

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aux4=Cexp(RCmul(p->Y,Clog(aux2)));

res->r = p->C*pn1_sf_gamma(-p->Y)*( exp(p->Y*log(p->M))-aux3.r)+p->C*pn1_sf_gamm
res->i = -p->C*pn1_sf_gamma(-p->Y)*(aux3.i + aux4.i);
}

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static dcomplex chip(double eta, double al, double om, double lp)
{
    dcomplex z, aux1, aux2, res;
    z.i=lp;
    z.r=0;
    aux1.i=eta;
    aux1.r=lp-om;
    aux2=Cexp(RCmul(al,Clog(aux1)));

    aux1.i=-pow(lp,1-al);
    aux1.r=0.;
    aux2=Cmul(aux1,aux2);
    res=Cadd(z,aux2);

    return res;
}

```

```

static dcomplex chim(double eta, double al, double om, double lm)
{
    dcomplex z, aux1, aux2, res;
    z.i=-lm;
    z.r=0;
    aux1.i=-eta;
    aux1.r=lm+om;
    aux2=Cexp(RCmul(al,Clog(aux1)));

    aux1.i=pow(lm-1.,1-al);
    aux1.r=0.;
    aux2=Cmul(aux1,aux2);
    res=Cadd(z,aux2);

    return res;
}

```

```

static double RePutInt(double eta, void *pp) ///Re( exp(ixChi_+(eta+i om)-T psi
{

params_cgmy *p = (params_cgmy*)pp;

dcomplex ix, aux, aux1, aux2, aux3;

ix.i=p->x;
ix.r=0.;
//////////exponent computation//////////
aux=chip(eta,p->alp, p->om, p->G);
psiCGMY(p, aux, &aux1);
aux2=Cmul(aux, ix);
aux1=CRmul(aux1,-p->T);
aux1=Cadd(aux1,aux2);
//////////end//////////
//////////fraction computation//////////
aux2 =Cdiv(Cexp(aux1),aux);
aux.i=aux.i+1.;
aux3 =Cdiv(aux2,aux);
//////////end//////////
//////////chi derivative computation//////////
aux.i=eta/(p->G);
aux.r=1-(p->om)/(p->G);
aux1=Cexp(RCmul(p->alp-1,Clog(aux)));
//////////end//////////
aux2=Cmul(aux3,aux1);
return aux2.r*(p->alp);
}

static double ReCallInt(double eta, void *pp) ///Re( exp(ixChi_-(eta+i om)-T ps
{

params_cgmy *p = (params_cgmy*)pp;

dcomplex ix, aux, aux1, aux2, aux3;

ix.i=p->x;
ix.r=0.;
//////////exponent computation//////////

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aux=chim(eta,p->alp, p->om, p->M);
psiCGMY(p, aux, &aux1);
aux2=Cmul(aux, ix);
aux1=CRmul(aux1,-p->T);
aux1=Cadd(aux1,aux2);
//////////end//////////
//////////fraction computation//////////
aux2 =Cdiv(Cexp(aux1),aux);
aux.i=aux.i+1.;
aux3 =Cdiv(aux2,aux);
//////////end//////////
//////////chi derivative computation//////////
aux.i=-eta/(p->M-1);
aux.r=(p->M+p->om)/(p->M-1);
aux1=Cexp(RCmul(p->alp-1,Clog(aux)));
//////////end//////////
aux2=Cmul(aux3,aux1);
return aux2.r*(p->alp);
}

```

```

static double ReDPutInt(double eta, void *pp) ///Re( iexp(ixChi_+(eta+i om)-T p
{

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params_cgmy *p = (params_cgmy*)pp;

```

```

dcomplex ix, aux, aux1, aux2, aux3;

```

```

ix.i=p->x;
ix.r=0.;
//////////exponent computation//////////
aux=chip(eta,p->alp, p->om, p->G);
psiCGMY(p, aux, &aux1);
aux2=Cmul(aux, ix);
aux1=CRmul(aux1,-p->T);
aux1=Cadd(aux1,aux2);
//////////end//////////
//////////fraction computation//////////
aux2 =Cexp(aux1);
aux.i=aux.i+1.;
aux3 =Cdiv(aux2,aux);
//////////end//////////

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//////////chi derivative computation//////////
aux.i=eta/(p->G);
aux.r=1-(p->om)/(p->G);
aux1=Cexp(RCmul(p->alp-1,Clog(aux)));
//////////end//////////
aux2=Cmul(aux3,aux1);
return -aux2.i*(p->alp);
}

static double ReDCallInt(double eta, void *pp) ///Re( i exp(ixChi_-(eta+i om)-T
{

params_cgmy *p = (params_cgmy*)pp;

dcomplex ix, aux, aux1, aux2, aux3;

ix.i=p->x;
ix.r=0.;
//////////exponent computation//////////
aux=chim(eta,p->alp, p->om, p->M);
psiCGMY(p, aux, &aux1);
aux2=Cmul(aux, ix);
aux1=CRmul(aux1,-p->T);
aux1=Cadd(aux1,aux2);
//////////end//////////
//////////fraction computation//////////
aux2 =Cexp(aux1);
aux.i=aux.i+1.;
aux3 =Cdiv(aux2,aux);
//////////end//////////
//////////chi derivative computation//////////
aux.i=-eta/(p->M-1);
aux.r=(p->M+p->om)/(p->M-1);
aux1=Cexp(RCmul(p->alp-1,Clog(aux)));
//////////end//////////
aux2=Cmul(aux3,aux1);
return -aux2.i*(p->alp);
}

static int ParFt(double Spot, double Strike, double T, double r, double divid,
double C, double G, double M, double Y, int

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```

                                iscall,long N, double *price,double *delta)
{
params_cgmy p;
double eps;
double UP_PARFT;
PnlFunc Put, Call;

eps = 0.00001;

if (iscall)//Call
{
if (p.x>0)
{
iscall=0;
Set_params(&p, r, divid, Y, M, G, C, T, Strike, Spot, eps, iscall, N);
UP_PARFT = p.N*p.zet;
Put.F = &RePutInt;
Put.params = &p;
*price = pnl_integration (&Put, 0, UP_PARFT, p.N , "trap");
*price =-*price*p.K/M_PI+(exp((r-divid)*T)*p.S - p.K);
Put.F = &ReDPutInt;
Put.params = &p;
*delta = pnl_integration (&Put, 0, UP_PARFT, p.N , "trap");
*delta =exp(r*T)-*delta*p.K/(M_PI*p.S);
}
else {
Set_params(&p, r, divid, Y, M, G, C, T, Strike, Spot, eps, iscall, N);
UP_PARFT = p.N*p.zet;
Call.F = &ReCallInt;
Call.params = &p;
*price = pnl_integration (&Call, 0.0, UP_PARFT, p.N , "trap");
*price =-*price*p.K/M_PI;
Call.F = &ReDCallInt;
Call.params = &p;
*delta = pnl_integration (&Call, 0.0, UP_PARFT, p.N , "trap");
*delta =-*delta*p.K/(M_PI*p.S);
}
}
else // Put
{ if (p.x<0.)
{ iscall=0;

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```

Set_params(&p, r, divid, Y, M, G, C, T, Strike, Spot, eps, iscall, N);
    UP_PARFT = p.N*p.zet;
Call.F = &ReCallInt;
Call.params = &p;
*price = pnl_integration (&Call, 0.0, UP_PARFT, p.N , "trap");
*price = -*price*p.K/M_PI-(exp((r-divid)*T)*p.S - p.K);
Call.F = &ReDCallInt;
Call.params = &p;
*delta = pnl_integration (&Call, 0.0, UP_PARFT, p.N , "trap");
*delta = -exp(r*T)-*delta*p.K/(M_PI*p.S);}
    else
    { Set_params(&p, r, divid, Y, M, G, C, T, Strike, Spot, eps, iscall, N);
      UP_PARFT = p.N*p.zet;
Put.F = &RePutInt;
Put.params = &p;
*price = pnl_integration (&Put, 0, UP_PARFT, p.N , "trap");
*price = -*price*p.K/M_PI;
      Put.F = &ReDPutInt;
Put.params = &p;
*delta = pnl_integration (&Put, 0, UP_PARFT, p.N , "trap");
*delta = -*delta*p.K/(M_PI*p.S);}
}
*price = exp(-r*T)**price;
*delta = exp(-r*T)**delta;

    return OK;
}

static int CALC(AP_PARFT)(void *Opt, void *Mod, PricingMethod *Met)
{
    double r, divid;
    int iscall;
    TYPEOPT *ptOpt = (TYPEOPT *)Opt;
    TYPEMOD *ptMod = (TYPEMOD *)Mod;

    iscall = FALSE;
    if (ptOpt->PayOff.Val.V_NUMFUNC_1->Compute == &Call) iscall = TRUE;

    r = log(1. + ptMod->R.Val.V_DOUBLE / 100.);
    divid = log(1. + ptMod->Divid.Val.V_DOUBLE / 100.);

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    return ParFt(ptMod->S0.Val.V_PDOUBLE,
                 ptOpt->PayOff.Val.V_NUMFUNC_1->Par[0].Val.V_PDOUBLE,
                 ptOpt->Maturity.Val.V_DATE - ptMod->T.Val.V_DATE,
                 r, divid, ptMod->C.Val.V_PDOUBLE,
                 ptMod->G.Val.V_PDOUBLE,
                 ptMod->M.Val.V_PDOUBLE,
                 ptMod->Y.Val.V_PDOUBLE,
                 iscall,
    Met->Par[0].Val.V_PINT,
                 &(Met->Res[0].Val.V_DOUBLE), &(Met->Res[1].Val.V_DOUBLE));
}

static int CHK_OPT(AP_PARFT)(void *Opt, void *Mod)
{
    if ((strcmp(((Option *)Opt)->Name, "CallEuro") == 0) ||
        (strcmp(((Option *)Opt)->Name, "PutEuro") == 0))
        return OK;

    return WRONG;
}

#endif

static int MET(Init)(PricingMethod *Met, Option *Opt)
{
    if (Met->init == 0)
    {
        Met->Par[0].Val.V_PINT = 300;
        Met->init = 1;
        Met->HelpFilenameHint = "ap_parft_cgmy1d_euro";

    }
    return OK;
}

PricingMethod MET(AP_PARFT) =
{
    "AP_PARFT",
    { {"N", LONG, {100}, ALLOW},
      {" ", PREMIA_NULLTYPE, {0}, FORBID}},

```

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