

## [Help](#)

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#include<stdlib.h>
#include<time.h>
#include"pnl/pnl_specfun.h"
#include "
href../../../../mod/cgmy1d/cgmy1d_pad/cgmy1d_pad_h_src.pdfcgmy1d_pad.h"

#if defined(PremiaCurrentVersion) && PremiaCurrentVersion < (2011+2) //The "#els
static int CHK_OPT(AP_CernyKyriakou_CGMY_FloatingAsian)(void *Opt, void *Mod)
{
    return NONACTIVE;
}
int CALC(AP_CernyKyriakou_CGMY_FloatingAsian)(void *Opt, void *Mod, PricingMetho
{
    return AVAILABLE_IN_FULL_PREMIA;
}
#else
//Laplace transform of CGMY process
static dcomplex CGMY_laplace_transform(dcomplex u, double t, double C, double G,
{
    dcomplex temp;

    if (Y == 1)
    {
        temp = RCmul(C, Cadd(Cmul(RCsub(M, u), Clog(RCsub(1, CRdiv(u, M)))), Cmul(
    }
    else
    {
        temp = RCmul(C * pnl_sf_gamma(-Y), Cadd(RCmul(POW(M, Y), Csub(Cpow_real(RC
                                Csub(Cpow_real(RCadd(1, CRdiv(u, G
    }
    return Cexp(RCmul(t, Cadd(RCmul(drift, u), temp)));
}
//The generalized discrete Fourier transform (DFT) of a from x onto u
static void DFT(dcomplex *a, double *x, int n, double *u, int m, dcomplex *b)
{
    int j, k;

    for (k = 0; k <= m; k++)
    {
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        b[k] = CZERO;
        for (j = 1; j <= n; j++)
            b[k] = Cadd(Cmul(a[j], CIexp(x[j] * u[k])), b[k]);
        b[k] = CRmul(b[k], fabs(x[1] - x[0]));
    }
}

int cgmy_ap_cernykyriakou_asianfloating(NumFunc_2 *P, double S0, double T, double
{
    double *lambda, drift, *L, *L_bar, *u, *U, *U_bar, rho, u_max, *x, *y, x_step,
    double u_step, *u_minus, *h, *a, *b, exp_X, u_em, l_em, coef, temp_db;
    int i, k, i_up, i_down, x_nb, y_nb, u_nb, i_temp, i_x, test;
    dcomplex *q, *p, *P_vect, *phi, *temp;
    k = 0;
    rho = 1e-6;
    time_step = T / n_points;
    u_nb = POW(2, 10);
    x_nb = POW(2, 10);
    y_nb = POW(2, 10);
    i_x = 0;
    coef = 1;
    lambda = malloc((n_points + 1) * sizeof(double));
    a = malloc((n_points + 1) * sizeof(double));
    b = malloc((n_points + 1) * sizeof(double));
    L = malloc((n_points + 1) * sizeof(double));
    U = malloc((n_points + 1) * sizeof(double));
    L_bar = malloc((n_points + 1) * sizeof(double));
    U_bar = malloc((n_points + 1) * sizeof(double));
    x = malloc((x_nb + 1) * sizeof(double));
    y = malloc((y_nb + 1) * sizeof(double));
    h = malloc((y_nb + 1) * sizeof(double));
    p = malloc((y_nb + 1) * sizeof(dcomplex));
    q = malloc((x_nb + 1) * sizeof(dcomplex));

    //Measure change so that the option can be value as a fixed strike asian optio
    M = M - 1;
    G = G + 1;
    temp_db = M;
    M = G;
    G = temp_db;
    drift = -(r - divid) - log(Creal(CGMY_laplace_transform(Complex(1, 0), 1, C, G

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/////////////////////////////////////////////////////////////////
u_max = 5.;
while (Cabs(CGMY_laplace_transform(Complex(0, u_max), time_step, C, G, M, Y, d
{
    u_max += 5.;
}
u_step = 2 * u_max / u_nb;
if (u_step > 0.125)
{
    u_nb = trunc(16 * u_max);
    u_nb += PNL_IS_ODD(u_nb);
    u_step = 2 * u_max / u_nb;
}
u = malloc((u_nb + 1) * sizeof(double));
u_minus = malloc((u_nb + 1) * sizeof(double));
P_vect = malloc((u_nb + 1) * sizeof(dcomplex));
phi = malloc((u_nb + 1) * sizeof(dcomplex));
temp = malloc((u_nb + 1) * sizeof(dcomplex));
for (i = 0; i <= u_nb; i++)
{
    u[i] = -u_max + i * u_step;
    u_minus[i] = -u[i];
    phi[i] = CGMY_laplace_transform(Complex(0, u[i]), time_step, C, G, M, Y, d
}
/*Put Case*/
lambda[0] = 1. / (n_points + 1) - 1;
for (i = 1; i <= n_points; i++)
    lambda[i] = 1. / (n_points + 1);
do
{
    u_em = 5 * coef;
    l_em = -5 * coef;
/////////////////////////////////////////////////////////////////
    a[n_points] = 1;
    b[n_points] = lambda[0] * (lambda[0] > 0);
    exp_X = Creal(CGMY_laplace_transform(Complex(1, 0), time_step, C, G, M, Y,
    for (i = n_points; i > 0; i--)
    {
        a[i - 1] = a[i] * exp_X;
        b[i - 1] = b[i] + a[i - 1] * lambda[n_points - i + 1];
    }
}

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/////////////////////////////////////////////////////////////////
    L_bar[0] = log(lambda[n_points]);
    U_bar[0] = log(lambda[n_points]);
    for (i = 1; i < n_points; i++)
    {
        L[i] = L_bar[i - 1] + l_em;
        U[i] = U_bar[i - 1] + u_em;
        L_bar[i] = log(exp(L[i]) + lambda[n_points - i]);
        U_bar[i] = log(exp(U[i]) + lambda[n_points - i]);
    }
    L[n_points] = L_bar[n_points - 1] + l_em;
    U[n_points] = U_bar[n_points - 1] + u_em;
    y_step = (U[n_points] - L[n_points]) / y_nb;
    for (i = 0; i <= y_nb; i++)
    {
        y[i] = L[n_points] + i * y_step;
        p[i] = Complex((exp(y[i]) + lambda[0]) * (exp(y[i]) + lambda[0] > 0),
    }
    coef *= 0.95;
}
while (y[y_nb] > 10);
for (k = n_points; k > 1; k--)
{
    x_step = (U_bar[k - 1] - L_bar[k - 1]) / x_nb;
    for (i = 0; i <= x_nb; i++)
    {
        x[i] = L_bar[k - 1] + i * x_step;
    }
    DFT(p, y, y_nb, u, u_nb, P_vect);
    for (i = 0; i <= u_nb; i++)
    {
        temp[i] = Cmul(P_vect[i], Conj(phi[i]));
    }
    DFT(temp, u_minus, u_nb, x, x_nb, q);
    for (i = 0; i <= x_nb; i++)
    {
        q[i] = CRdiv(q[i], 2 * M_PI);
    }
}
/////////////////////////////////////////////////////////////////
    y_step = (U[k - 1] - L[k - 1]) / y_nb;
    for (i = 0; i <= y_nb; i++)

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{
  y[i] = L[k - 1] + i * y_step;
  h[i] = log(exp(y[i]) + lambda[n_points - (k - 1)]);
  test = 0;
  if (h[i] <= x[0])
  {
    i_x = 0;
    test = 1;
    p[i] = Cadd(q[i_x], CRmul(CRdiv(Csub(q[i_x + 1], q[i_x]), x[i_x +
  }
  if (h[i] >= x[x_nb])
  {
    i_x = x_nb;
    test = 1;
    p[i] = Cadd(q[i_x - 1], CRmul(CRdiv(Csub(q[i_x], q[i_x - 1]), x[i_
  }
  if ((h[i] > x[0]) && (h[i] < x[x_nb]))
  {
    i_down = x_nb / 2;
    i_up = x_nb;
    if (x[i_down] > h[i])
    {
      i_down = 0;
      i_up = x_nb / 2;
    }
    while (test == 0)
    {
      if (x[i_down + 1] > h[i])
      {
        i_x = i_down;
        test = 1;
      }
      else
      {
        i_temp = (i_up - i_down - 1) / 2 + i_down;
        if (x[i_temp] > h[i])
        {
          i_up = i_temp;
          i_down = i_down + 1;
        }
        else

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        {
            i_down = i_temp * (i_temp > i_down) + (i_down + 1) * (
        }
    }
}
p[i] = Cadd(q[i_x], CRmul(CRdiv(Csub(q[i_x + 1], q[i_x]), x[i_x +
}
}
}
////////////////////////////////////
}
x_step = (U_bar[0] - L_bar[0]) / x_nb;
for (i = 0; i <= x_nb; i++)
{
    x[i] = L_bar[0] + i * x_step;
}
DFT(p, y, y_nb, u, u_nb, P_vect);
for (i = 0; i <= u_nb; i++)
{
    temp[i] = Cmul(P_vect[i], Conj(phi[i]));
}
DFT(temp, u_minus, u_nb, x, x_nb, q);
for (i = 0; i <= x_nb; i++)
{
    q[i] = CRdiv(q[i], 2 * M_PI);
}
/*Call case*/
if ((P->Compute) == &Call_StrikeSpot2)
{
    if (r != divid)
        *ptprice = S0 * exp(-divid * T) * Creal(q[0]) + S0 * exp(-divid * T) - S
    else
        *ptprice = S0 * exp(-divid * T) * Creal(q[0]) + S0 * (exp(-divid * T) -
}
/*Put Case*/
if ((P->Compute) == &Put_StrikeSpot2)
{
    *ptprice = S0 * exp(-divid * T) * Creal(q[0]);
}
free(lambda);
free(L);
free(U);

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    free(L_bar);
    free(U_bar);
    free(u);
    free(u_minus);
    free(x);
    free(y);
    free(h);
    free(p);
    free(P_vect);
    free(phi);
    free(temp);
    free(q);
    free(a);
    free(b);

    return OK;
}

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

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

    return cgmy_ap_cernykyriakou_asianfloating(ptOpt->PayOff.Val.V_NUMFUNC_2, ptMod, r, divid, Met);
}

static int CHK_OPT(AP_CernyKyriakou_CGMY_FloatingAsian)(void *Opt, void *Mod)
{
    if ((strcmp(((Option *)Opt)->Name, "AsianCallFloatingEuro") == 0) || (strcmp(((Option *)Mod)->Name, "AsianCallFloatingEuro") == 0))
        return OK;
    return WRONG;
}

#endif //PremiaCurrentVersion

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

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        Met->init = 1;
        Met->HelpFilenameHint = "ap_cernykyriakou_cgmy_asianfloating";
        Met->Par[0].Val.V_PINT = 10;
    }
    return OK;
}

PricingMethod MET(AP_CernyKyriakou_CGMY_FloatingAsian) =
{
    "AP_CernyKyriakou_CGMY_FloatingAsian",
    {"Number of discretization steps", LONG, {100}, ALLOW}, {" ", PREMIA_NULLTYPE,
    CALC(AP_CernyKyriakou_CGMY_FloatingAsian),
    {"Price", DOUBLE, {100}, FORBID}, {" ", PREMIA_NULLTYPE, {0}, FORBID}},
    CHK_OPT(AP_CernyKyriakou_CGMY_FloatingAsian),
    CHK_ok,
    MET(Init)
} ;

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