

## [Help](#)

```
/* We need Nd1 here */
#define USE_ND1
#include "
href../../mod/bs1d/bs1d_std/bs1d_std_h_src.pdfbs1d_std.h"

#define AP_JU_Nmax 3
#define AP_JU_err 1e-7
#define AP_JU_Infinity 100.0
#define AP_JU_Neginfinity -100.0 /* AP_JU_Neginfinity for -infinity */
#define AP_JU_h 1e-4

/*Put Whaley Exponent*/
static double WhaleyPut_Exp(double r, double divid, double sigma, double T)
{
    double ratio = 2.0 * (r - divid) / (sigma * sigma);
    double delta = (ratio - 1.0);

    if (r == 0.)
        delta = SQR(delta) + 4.0 * (2.0 / (sigma * sigma)) / T;
    else
        delta = SQR(delta) + 4.0 * (2.0 * r / (sigma * sigma)) / (1.0 - exp(-r * T))

    return 0.5 * (1. - ratio - sqrt(delta));
}

static double Contact_PointPut(double r, double divid, double sigma,
                                double T, double K, double (*exponent_method)(double, double, double, double))
{
    const double precision = 0.00001;
    double previous;
    double exponent = (*exponent_method)(r, divid, sigma, T);
    double current = K;
    double put_price, put_delta;

    do
    {
        previous = current;
        pnl_cf_put_bs(previous, K, T, r, divid, sigma,
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        &put_price, &put_delta);
    current = -exponent * (K - put_price) / ((1. - exp(-divid * T)
        * Nd1(previous, r, divid, -sigma, T, K)) - exponent);
}
while (!(fabs((previous - current) / current) <= precision));

return current;
}

double critical_price(double r, double divid, double sigma,
    double T, double K)
{
    double x;
    r = (r != 0. ? r : 1e-6);
    x = Contact_PointPut(r, divid, sigma, T, K, WhaleyPut_Exp);
    return x;
}

/* Mathematical functions */

/*derivx */
static double deriv_x(double(*f)(double *), double *tab)
{
    double tmp1;

    tab[0] += AP_JU_h;
    tmp1 = (*f)(tab);
    tab[0] -= AP_JU_h;
    return (tmp1 - (*f)(tab)) / AP_JU_h;
}

/*derivy*/
static double deriv_y(double(*f)(double *), double *tab)
{
    double tmp1;

    tab[1] += AP_JU_h;
    tmp1 = (*f)(tab);

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    tab[1] -= AP_JU_h;
    return (tmp1 - (*f)(tab)) / AP_JU_h;
}

/*function d1*/
static double ap_ju_d1(double x, double y, double t, double r, double divid, double sigma)
{
    if (t != 0.)
    {
        return (log(x / y) + (r - divid) * t) / (sigma * sqrt(t)) + sigma * sqrt(t);
    }
    else
    {
        if (x == y)
        {
            return 0.;
        }
        else if (x > y)
        {
            return AP_JU_Infinity;
            /* we take 100 for AP_JU_Infinity because N(100)=1=N(AP_JU_Infinity)*/
        }
        else
        {
            return AP_JU_Neginfinity;
            /* we take -100 for AP_JU_Neginfinity because N(-100)=0=N(-AP_JU_Infinity)*/
        }
    }
}

/* function I */
static double ap_ju_I(double t1, double t2, double x, double y, double z, double r, double divid, double sigma, double Phi, double Nu)
{
    double z1 = (r - divid - z + 0.5 * Phi * sigma * sigma) / sigma;
    double z2 = log(x / y) / sigma;
    double z3 = sqrt(z1 * z1 + 2.*Nu);
    double res;
    double sqrtt1, sqrtt2;

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sqrtt1 = sqrt(t1);
sqrtt2 = sqrt(t2);

if (t1 != 0.)
{
    /* case t1 different of 0*/
    res = exp(-Nu * t1) * cdf_nor(z1 * sqrtt1 + z2 / sqrtt1) - exp(-Nu * t2)
}
else
{
    if (x == y)
    {
        /* case x=y ( i.e. z2=0 ) and t1=0 */
        res = 0.5 - exp(-Nu * t2) * cdf_nor(z1 * sqrtt2) + 0.5 * (z1 / z3 + 1
    }
    else if (x > y)
    {
        /* case x>y ( i.e. z2>0 ) and t1=0*/
        res = 1 - exp(-Nu * t2) * cdf_nor(z1 * sqrtt2 + z2 / sqrtt2) + 0.5 *
    }
    else
    {
        /* case x<y ( i.e. z2<0 ) and t1=0*/
        res = -exp(-Nu * t2) * cdf_nor(z1 * sqrtt2 + z2 / sqrtt2) + 0.5 * (z
    }
}
/*printf("%f %f\ n",res,z1);*/
return res;
}

/* function IS*/
static double ap_ju_IS(double t1, double t2, double x, double y, double z, doubl
{
    double z1 = (r - divid - z + 0.5 * Phi * sigma * sigma) / sigma;
    double z2 = log(x / y) / sigma;
    double z3 = sqrt(z1 * z1 + 2.*Nu);
    double res;
    double sqrtt1, sqrtt2;

    sqrtt1 = sqrt(t1);

```

```

sqrtt2 = sqrt(t2);

if (t1 != 0.)
{
    /* case t1 different of 0 */
    res = (exp(-Nu * t1) * pnl_normal_density(z1 * sqrtt1 + z2 / sqrtt1) / sqrtt1) / sqrtt2;
}
else
{
    if (x == y)
    {
        /* case x=y ( i.e. z2=0 ) and t1=0 */
        res = -exp(-Nu * t2) * pnl_normal_density(z1 * sqrtt2) / sqrtt2 / (sig);
    }
    else if (x > y)
    {
        /* case x>y ( i.e. z2>0 ) and t1=0*/
        res = -exp(-Nu * t2) * pnl_normal_density(z1 * sqrtt2 + z2 / sqrtt2) / sqrtt2;
    }
    else
    {
        /* case x<y ( i.e. z2<0 ) and t1=0*/
        res = -exp(-Nu * t2) * pnl_normal_density(z1 * sqrtt2 + z2 / sqrtt2) / sqrtt2;
    }
}
return res;
}

/* det*/
static int det(double(*f1)(double *), double(*f2)(double *), double *tab, double *d)
{
    if (deriv_x(f1, tab)*deriv_y(f2, tab) - deriv_x(f2, tab)*deriv_y(f1, tab) == 0)
    {
        return WRONG;
    }
    else
    {
        *d = deriv_x(f1, tab) * deriv_y(f2, tab) - deriv_x(f2, tab) * deriv_y(f1, tab);
        return OK;
    }
}

```

```

/* coefficients of the inverse of the jacobian matrix */
/* coefficient 00 */
static double InvJ_00(double(*f1)(double *), double(*f2)(double *), double *tab)
{
    double d;
    if (det(f1, f2, tab, &d) != WRONG)
        return deriv_y(f2, tab) / d;
    else return 0.;
}

/* coefficient 01 */
static double InvJ_01(double(*f1)(double *), double(*f2)(double *), double *tab)
{
    double d;
    if (det(f1, f2, tab, &d) != WRONG)
        return -(deriv_y(f1, tab)) / d;
    else return 0.;
}

/* coefficient 10 */
static double InvJ_10(double(*f1)(double *), double(*f2)(double *), double *tab)
{
    double d;
    if (det(f1, f2, tab, &d) != WRONG)
        return -(deriv_x(f2, tab)) / d;
    else return 0.;
}

/* coefficient 11 */
static double InvJ_11(double(*f1)(double *), double(*f2)(double *), double *tab)
{
    double d;
    if (det(f1, f2, tab, &d) != WRONG)
        return deriv_x(f1, tab) / d;
    else return 0.;
}

/* inverse of the jacobian matrix */
static void create_InvJac(double(*InvJac[2][2])(double*)(double *), double(*)(&d))
{
    InvJac[0][0] = &InvJ_00;

```

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    InvJac[0][1] = &InvJ_01;
    InvJac[1][0] = &InvJ_10;
    InvJac[1][1] = &InvJ_11;
}

/* method of Newton-Raphson */
static int Newton_Raphson(double(*f1)(double *), double(*f2)(double *), double S
{
    double x[AP_JU_Nmax];
    double tab1[8];
    double tab2[10];
    double tab3[12]; /*={x[1],x[2],S,K,T,r,divid,sigma,x1[0],x1[0],x2[0],x2[0]}*/
    double d;
    double *adresse;
    double(*InvJac[2][2])(double*)(double *), double(*)(double *), double *);
    double(*f[2])(double *);
    double first_term, second_term, f0_ad, f1_ad;

    x[0] = 0.;
    x[1] = x1[0];
    x[2] = x2[0];

    tab1[0] = x[1];
    tab1[1] = x[2];
    tab1[2] = S;
    tab1[3] = K;
    tab1[4] = T;
    tab1[5] = r;
    tab1[6] = divid;
    tab1[7] = sigma;

    tab2[0] = x[1];
    tab2[1] = x[2];
    tab2[2] = S;
    tab2[3] = K;
    tab2[4] = T;
    tab2[5] = r;
    tab2[6] = divid;
    tab2[7] = sigma;
    tab2[8] = x1[0];
    tab2[9] = x2[0];

```

```

tab3[0] = x[1];
tab3[1] = x[2];
tab3[2] = S;
tab3[3] = K;
tab3[4] = T;
tab3[5] = r;
tab3[6] = divid;
tab3[7] = sigma;
tab3[8] = x1[0];
tab3[9] = x1[0];
tab3[10] = x2[0];
tab3[11] = x2[0];

create_InvJac(InvJac);
f[0] = f1;
f[1] = f2;

if (type == 1)
{
    adresse = tab1;
}
else if (type == 2)
{
    adresse = tab2;
}
else
{
    x[1] = x2[0];
    x[2] = x2[1];
    tab3[0] = x[1];
    tab3[1] = x[2];
    tab3[9] = x1[1];
    tab3[11] = x2[1];
    adresse = tab3;
}
if (det(f1, f2, adresse, &d) == WRONG)
{
    return WRONG;
}
else

```



```

{
    f0_ad = f[0](adresse);
    f1_ad = f[1](adresse);
    first_term = InvJac[0][0](f1, f2, adresse) * f0_ad + InvJac[0][1](f1, f2,
    second_term = InvJac[1][0](f1, f2, adresse) * f0_ad + InvJac[1][1](f1, f2,

    while ((fabs(first_term) > AP_JU_err) || (fabs(second_term) > AP_JU_err))
    {
        x[1] -= first_term;
        x[2] -= second_term;

        adresse[0] = x[1];
        adresse[1] = x[2];

        f0_ad = f[0](adresse);
        f1_ad = f[1](adresse);
        first_term = InvJac[0][0](f1, f2, adresse) * f0_ad + InvJac[0][1](f1,
        second_term = InvJac[1][0](f1, f2, adresse) * f0_ad + InvJac[1][1](f1,
    }

    *coeff_B = x[1];
    *coeff_b = x[2];
    return OK;
}
}

```

```

/* APPROXIMATION BY ONE EXPONENTIAL */
/* Functions for which (B11,b11) is solution */

```

```

static double f1_11(double *tab)
{
    double B11 = tab[0];
    double b11 = tab[1];
    /* double S=tab[2]; */
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double put_price, put_delta;

```

```

    pnl_cf_put_bs(B11, K, T, r, divid, sigma, &put_price, &put_delta);

    return K - B11 - put_price - K * (1 - exp(-r * T)) + B11 * (1 - exp(-divid * T))
}

static double f2_11(double *tab)
{
    double B11 = tab[0];
    double b11 = tab[1];
    /* double S=tab[2]; */
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double exp_minus_divid_T = exp(-divid * T);

    return -1. + exp_minus_divid_T * cdf_nor(-ap_ju_d1(B11, K, T, r, divid, sigma))
}

/*P1*/
static int ap_ju_pricing1(double S, double K, double T, double r, double divid,
{
    double B11, b11;
    double put_price, put_delta;
    double temp1[1];
    double temp2[1];

    temp1[0] = critical_price(r, divid, sigma, T, K);
    temp2[0] = 0.;

    pnl_cf_put_bs(S, K, T, r, divid, sigma, &put_price, &put_delta);
    Newton_Raphson(&f1_11, &f2_11, S, K, T, r, divid, sigma, &B11, &b11, 1, temp1,

    if (S <= B11)
        *P1 = K - S;
    else
        *P1 = put_price + K * (1 - exp(-r * T)) - S * (1 - exp(-divid * T)) - K * ap

    return OK;
}

```

```
}
```

```
/* APPROXIMATION BY TWO EXPONENTIAL PIECES */  
/* functions which (B21,b21) is solution */
```

```
static double f1_21(double *tab)  
{  
    double B21 = tab[0];  
    double b21 = tab[1];  
    /* double S=tab[2]; */  
    double K = tab[3];  
    double T = tab[4];  
    double r = tab[5];  
    double divid = tab[6];  
    double sigma = tab[7];  
    double put_price, put_delta;  
    double B21_exp = B21 * exp(b21 * T / 2.);  
  
    pnl_cf_put_bs(B21_exp, K, T / 2, r, divid, sigma, &put_price, &put_delta);  
    return K - B21_exp - put_price - K * (1 - exp(-r * T / 2)) + B21_exp * (1 - ex  
}
```

```
static double f2_21(double *tab)  
{  
    double B21 = tab[0];  
    double b21 = tab[1];  
    /* double S=tab[2]; */  
    double K = tab[3];  
    double T = tab[4];  
    double r = tab[5];  
    double divid = tab[6];  
    double sigma = tab[7];  
    double exp_minus_divid_ToverTwo = exp(-divid * T / 2.);  
    double B21_exp = B21 * exp(b21 * T / 2.);  
  
    return -1. + exp_minus_divid_ToverTwo * cdf_nor(-ap_ju_d1(B21_exp, K, T / 2.,  
}
```

```
/* functions for which (B22,b22) is solution */
```

```

static double f1_22(double *tab)
{
    double B22 = tab[0];
    double b22 = tab[1];
    /* double S=tab[2]; */
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double B21 = tab[8];
    double b21 = tab[9];
    double put_price, put_delta, value;

    pnl_cf_put_bs(B22, K, T, r, divid, sigma, &put_price, &put_delta);
    value = K - B22 - put_price - K * (1 - exp(-r * T)) + B22 * (1 - exp(-divid *

    return value;
}

static double f2_22(double *tab)
{
    double B22 = tab[0];
    double b22 = tab[1];
    /* double S=tab[2]; */
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double B21 = tab[8];
    double b21 = tab[9];
    double exp_minus_divid_T = exp(-divid * T);

    return -1. + exp_minus_divid_T * cdf_nor(-ap_ju_d1(B22, K, T, r, divid, sigma)

}

/*P2*/

```

```

static int ap_ju_pricing2(double S, double K, double T, double r, double divid,
{
    double B11, b11;
    double B21, b21;
    double B22, b22;
    double BT = MIN(K, divid != 0. ? K * r / divid : K);
    double temp1[1];
    double temp2[1];
    double put_price, put_delta;

    temp1[0] = critical_price(r, divid, sigma, T, K);
    temp2[0] = 0.;

    if (fabs(BT - (*temp1)) < 0.05 * BT)
    {
        Newton_Raphson(&f1_11, &f2_11, S, K, T, r, divid, sigma, &B11, &b11, 1, te
        Newton_Raphson(&f1_21, &f2_21, S, K, T, r, divid, sigma, &B21, &b21, 1, &B
        Newton_Raphson(&f1_22, &f2_22, S, K, T, r, divid, sigma, &B22, &b22, 2, &B

    }
    else
    {
        Newton_Raphson(&f1_11, &f2_11, S, K, T, r, divid, sigma, &B11, &b11, 1, te
        Newton_Raphson(&f1_21, &f2_21, S, K, T, r, divid, sigma, &B21, &b21, 1, &B
        Newton_Raphson(&f1_22, &f2_22, S, K, T, r, divid, sigma, &B22, &b22, 2, &B

    }

    pnl_cf_put_bs(S, K, T, r, divid, sigma, &put_price, &put_delta);

    if (S <= B22)
        *P2 = K - S;
    else
        *P2 = put_price + K * (1 - exp(-r * T)) - S * (1 - exp(-divid * T)) - K * ap

    return OK;
}

/* APPROXIMATION BY THREE EXPONENTIAL PIECES*/
/*functions for which (B31,b31) is solution */

```

```

static double f1_31(double *tab)
{
    double B31 = tab[0];
    double b31 = tab[1];
    /* double S=tab[2];*/
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double put_price, put_delta, value;
    double B31_exp = B31 * exp(2.*b31 * T / 3.);

    value = pnl_cf_put_bs(B31_exp, K, T / 3, r, divid, sigma, &put_price, &put_delta);
    value = K - B31_exp - put_price - K * (1. - exp(-r * T / 3.)) + B31_exp * (1 - exp(-sigma * T / 3.));

    return value;
}

static double f2_31(double *tab)
{
    double B31 = tab[0];
    double b31 = tab[1];
    /* double S=tab[2]; */
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double value;
    double exp_minus_divid_ToverThree = exp(-divid * T / 3.);
    double B31_exp = B31 * exp(2.*b31 * T / 3.);

    value = -1. + exp_minus_divid_ToverThree * cdf_nor(-ap_ju_d1(B31_exp, K, T / 3, sigma));

    return value;
}

```

```
/* functions for which (B32,b32) is solution */
```

```
static double f1_32(double *tab)
{
```

```
    double B32 = tab[0];
    double b32 = tab[1];
    /* double S=tab[2]; */
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double B31 = tab[8];
    double b31 = tab[9];
    double put_price, put_delta, value;
    double B31_exp = B31 * exp(b31 * T / 3.);
    double B32_exp = B32 * exp(b32 * T / 3.);
    double twoT_over_three = 2 * T / 3;
```

```
    pnl_cf_put_bs(B32_exp, K, twoT_over_three, r, divid, sigma, &put_price, &put_d
    value = K - B32_exp - put_price - K * (1 - exp(-r * twoT_over_three)) + B32_ex
```

```
    return value;
```

```
}
```

```
static double f2_32(double *tab)
{
```

```
    double B32 = tab[0];
    double b32 = tab[1];
    /* double S=tab[2]; */
    double K = tab[3];
    double T = tab[4];
    double r = tab[5];
    double divid = tab[6];
    double sigma = tab[7];
    double B31 = tab[8];
    double b31 = tab[9];
    double value;
```

```

double exp_minus_divid_twoToverThree = exp(-divid * 2.*T / 3.);
double B31_exp = B31 * exp(b31 * T / 3.);
double B32_exp = B32 * exp(b32 * T / 3.);
double twoT_over_three = 2 * T / 3;

value = -1. + exp_minus_divid_twoToverThree * cdf_nor(-ap_ju_d1(B32_exp, K, tw

return value;
}

/* functions for which (B33,b33) is solution */

static double f1_33(double *tab)
{
double B33 = tab[0];
double b33 = tab[1];
/* double S=tab[2]; */
double K = tab[3];
double T = tab[4];
double r = tab[5];
double divid = tab[6];
double sigma = tab[7];
double B31 = tab[8];
double b31 = tab[9];
double B32 = tab[10];
double b32 = tab[11];
double put_price, put_delta, value;

pnl_cf_put_bs(B33, K, T, r, divid, sigma, &put_price, &put_delta);
value = K - B33 - put_price - K * (1 - exp(-r * T)) + B33 * (1 - exp(-divid *

return value;
}

static double f2_33(double *tab)
{
double B33 = tab[0];
double b33 = tab[1];
/* double S=tab[2]; */
double K = tab[3];

```



```

double T = tab[4];
double r = tab[5];
double divid = tab[6];
double sigma = tab[7];
double B31 = tab[8];
double b31 = tab[9];
double B32 = tab[10];
double b32 = tab[11];
double value;
double exp_minus_divid_T = exp(-divid * T);
double twoT_over_three = 2.*T / 3.;

value = -1. + exp_minus_divid_T * cdf_nor(-ap_ju_d1(B33, K, T, r, divid, sigma

return value;
}

/*P3*/
static int ap_ju_pricing3(double S, double K, double T, double r, double divid,
{
    double B11, b11;
    double B31, b31;
    double B32, b32;
    double B33, b33;
    double BT = MIN(K, divid != 0 ? K * r / divid : K);
    double temp1[1];
    double temp2[1];
    double temp3[2];
    double temp4[2];
    double put_price, put_delta;

    temp1[0] = critical_price(r, divid, sigma, T, K);
    temp2[0] = 0.;
    if (fabs(BT - (*temp1)) < 0.05 * BT)
    {
        Newton_Raphson(&f1_11, &f2_11, S, K, T, r, divid, sigma, &B11, &b11, 1, te
        Newton_Raphson(&f1_31, &f2_31, S, K, T, r, divid, sigma, &B31, &b31, 1, &B
        Newton_Raphson(&f1_32, &f2_32, S, K, T, r, divid, sigma, &B32, &b32, 2, &B

        temp3[0] = B31;
        temp3[1] = b31;

```

```

        temp4[0] = B32;
        temp4[1] = 0;
        Newton_Raphson(&f1_33, &f2_33, S, K, T, r, divid, sigma, &B33, &b33, 3, te
    }
else
{
    Newton_Raphson(&f1_11, &f2_11, S, K, T, r, divid, sigma, &B11, &b11, 1, te
    Newton_Raphson(&f1_31, &f2_31, S, K, T, r, divid, sigma, &B31, &b31, 1, &B
    Newton_Raphson(&f1_32, &f2_32, S, K, T, r, divid, sigma, &B32, &b32, 2, &B

    temp3[0] = B31;
    temp3[1] = b31;
    temp4[0] = B32;
    temp4[1] = b32;
    Newton_Raphson(&f1_33, &f2_33, S, K, T, r, divid, sigma, &B33, &b33, 3, te
}

pnl_cf_put_bs(S, K, T, r, divid, sigma, &put_price, &put_delta);

if (S <= B33)
    *P3 = K - S;
else
    *P3 = put_price + K * (1. - exp(-r * T)) - S * (1. - exp(-divid * T)) - K *

return OK;
}

/*PRICING*/
static int PutAmer_Ju(double S, NumFunc_1 *p, double T, double r, double divid,
{
    double P1, P2, P3, K;
    double P1_h, P2_h, P3_h;

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

    ap_ju_pricing1(S, K, T, r, divid, sigma, &P1);
    ap_ju_pricing2(S, K, T, r, divid, sigma, &P2);
    ap_ju_pricing3(S, K, T, r, divid, sigma, &P3);

    ap_ju_pricing1(S + AP_JU_h, K, T, r, divid, sigma, &P1_h);
    ap_ju_pricing2(S + AP_JU_h, K, T, r, divid, sigma, &P2_h);

```

```

ap_ju_pricing3(S + AP_JU_h, K, T, r, divid, sigma, &P3_h);

/*Price*/
*put_price = 4.5 * P3 - 4.*P2 + 0.5 * P1;
/**put_price=2.*P2-P1;*/

/*Delta*/
*put_delta = ((4.5 * P3_h - 4 * P2_h + 0.5 * P1_h) - (*put_price)) / AP_JU_h;
/**put_delta=(2.*P2_h-P1_h-*put_price)/AP_JU_h;*/

return OK;
}

int CALC(AP_Ju_PutAmer)(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 PutAmer_Ju(ptMod->S0.Val.V_PDOUBLE,
                      ptOpt->PayOff.Val.V_NUMFUNC_1,
                      ptOpt->Maturity.Val.V_DATE - ptMod->T.Val.V_DATE, r, divid,
                      ptMod->Sigma.Val.V_PDOUBLE,
                      &(Met->Res[0].Val.V_DOUBLE), &(Met->Res[1].Val.V_DOUBLE));
}

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

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

```

```

    }

    return OK;
}

PricingMethod MET(AP_Ju_PutAmer) =
{
    "AP_Ju_PutAmer",
    {{ " ", PREMIA_NULLTYPE, {0}, FORBID}},
    CALC(AP_Ju_PutAmer),
    {{ "Price", DOUBLE, {100}, FORBID}, {"Delta", DOUBLE, {100}, FORBID} , {" ", PR
    CHK_OPT(AP_Ju_PutAmer),
    CHK_ok ,
    MET(Init)
};

```