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```

#if defined(PremiaCurrentVersion) && PremiaCurrentVersion < (2007+2) //The "#els
#else

#ifndef QUADRATICMODEL_H
#define QUADRATICMODEL_H

#include "math/read_market_zc/InitialYieldCurve.h"

/**
The instantaneous sport interest rate  $r_t$  is described by  $r_t = 0.5x_t^2$ , with

 $dx_t = (\alpha_t - \beta * x_t) * dt + \sigma * dW_t$ 
 $x_0 = \sqrt{2*r_0}$ 
**/

// Strucure which contains information on the the T-maturity zc bond at time t=0
//  $P(0, T) = \exp(- ( B*r + b * \sqrt{2*r} ) + c)$ 
typedef struct
{
    double T;
    double P; // Price of the T-maturity bond at time t=0
    double f0_T; // T-maturity forward rate at time t=0
    double B; // Coefficients of the T-maturity bond at time t=0 :  $P(0,T)=\exp(-(.5$ 
    double b;
    double c;
    double dB; // Derivatives of B and b with respect to T
    double db;
    double V; // Variance of x under the T-forward probability
} Data;

// Coefficents of the omega distribution :  $.5*B*x^2+bx+c$  where x is normally dis
typedef struct
{
    double B;
    double b;
    double c;
    double mu;
    double V;

```

```
} Omega;
```

```
// coefficients of the  $\chi^2$  distribution :  $\alpha + \beta X$  where  $X$  is non centrally  
typedef struct
```

```
{
    double nu;
    double lambda;
    double beta;
    double alpha;
} Chn;
```

```
// Computes the structure data at time T
```

```
void bond_coeffs(ZCMarketData *ZCMarket, Data *data, double T, double beta, double
```

```
// Gives the omega distribution of the zero-coupon bond  $P(T, S)$  data1 contains t
```

```
void transport(Omega *om, Data data1, Data data2, double beta, double sigma, double
```

```
// Transforms Omega distribution to a  $\chi^2$  distribution
```

```
void om2chn(Omega om, Chn *chn);
```

```
// Compute the initial rate  $r_0$  and corresponding value  $x_0$ 
```

```
void initial_short_rate(ZCMarketData *ZCMarket, double *r0, double *x0);
```

```
/* Price of a european option on zero coupon bond*/
```

```
double zb_call_quad1d(ZCMarketData *ZCMarket, double beta, double sigma, double T,
```

```
double zb_put_quad1d(ZCMarketData *ZCMarket, double beta, double sigma, double T,
```

```
#endif
```

```
#endif //PremiaCurrentVersion
```