

Interest Rate *Collar*

1 Introduction

An Interest Rate *Collar* is an instrument created to guarantee that the interest rate on the underlying floating rate always lies between a ceiling and a floor. It is a combination of a long position in a cap and a short position in a floor.

| Interest Rate <i>Collar</i> | | | |
|---------------------------------------|---|---|-----------------------|
| Principal | See N on Table 3 | | |
| Trade Date | 30/12/2005 | | |
| Effective Date | 31/12/2005 | | |
| Termination Date | 31/12/2018 | | |
| Payment Frequency | <i>Quarterly</i> | | |
| Payoff | | | |
| From the First to the Third year | | If <i>EUR Euribor 3M</i> \leq (1.2 * 1.30%) | (1.2 * 1.30%) + 0% |
| | If (1.2 * 1.30%) < <i>EUR Euribor 3M</i> \leq (1.5 * 5.00%) | | – |
| | If <i>EUR Euribor 3M</i> > (1.5 * 5.00%) | | (1.5 * 5.00%) + 0.20% |
| From the Fourth to the Eighth year | | If <i>EUR Euribor 3M</i> \leq (1.2 * 1.60%) | (1.2 * 1.60%) + 0% |
| | If (1.2 * 1.60%) < <i>EUR Euribor 3M</i> \leq (1.5 * 5.10%) | | – |
| | If <i>EUR Euribor 3M</i> > (1.5 * 5.10%) | | (1.5 * 5.10%) + 0.20% |
| From the Ninth to the Thirteenth year | | If <i>EUR Euribor 3M</i> \leq (1.2 * 2.20%) | (1.2 * 2.20%) + 0% |
| | If (1.2 * 2.20%) < <i>EUR Euribor 3M</i> \leq (1.5 * 5.70%) | | – |
| | If <i>EUR Euribor 3M</i> > (1.5 * 5.70%) | | (1.5 * 5.70%) + 0.20% |
| Conventions | | | |
| Reset dates | <i>Advance</i> , 2 days before | | |
| Day Count Fraction | <i>Act/360 (Adjusted)</i> | | |

Table 1: *Example of an Interest Rate Collar template.*

2 Template implementation

This section describes the constants, symbols and functions we used for the implementation of the template:

| Interest Rate Collar on Fairmat | |
|---------------------------------|--|
| Principal | N |
| Trade Date | Trading date (simulation start date) |
| Effective Date | Contract initial date |
| Termination Date | $Pd[end]$ |
| Payment Frequency | $matRate \cdot Year$ (exchange per year) |
| Payoff | |
| From 1 to length(@Pd) | $\begin{aligned} & \text{If } matRate \cdot Year \cdot Euribor \leq (levStkfloor * Stklow) && (levStkfloor * Stklow) + sprlow \\ & \text{If } (levStkfloor * Stklow) < matRate \cdot Year \cdot Euribor \leq (levStkcap * Stkhigh) && - \\ & \text{If } matRate \cdot Year \cdot Euribor > (levStkcap * Stkhigh) && (levStkcap * Stkhigh) + sprhigh \end{aligned}$ |
| Conventions | |
| Reset dates | Advance, rdays days before |
| Day Count Fraction | Dur |

Table 2: Example of Interest Rate Collar template described through Fairmat objects.

The variables of Interest Rate *Collar* template loaded on “Parameters & Functions” can be classified into three categories:

| pdu | N | Stklow | Stkhigh | sprlow | sprhigh |
|------------|--------------|---------------|----------------|---------------|----------------|
| 30/06/2006 | 4,806,894.22 | 1.30% | 5.00% | 0.00% | 0.20% |
| 31/12/2006 | 4,719,924.28 | 1.30% | 5.00% | 0.00% | 0.20% |
| 30/06/2007 | 4,630,805.97 | 1.30% | 5.00% | 0.00% | 0.20% |
| 31/12/2007 | 4,539,483.99 | 1.30% | 5.00% | 0.00% | 0.20% |
| 30/06/2008 | 4,445,901.53 | 1.30% | 5.00% | 0.00% | 0.20% |
| 31/12/2008 | 4,350,000.26 | 1.30% | 5.00% | 0.00% | 0.20% |
| 30/06/2009 | 4,251,720.31 | 1.60% | 5.10% | 0.00% | 0.20% |
| 31/12/2009 | 4,151,204.92 | 1.60% | 5.10% | 0.00% | 0.20% |
| 30/06/2010 | 4,048,191.31 | 1.60% | 5.10% | 0.00% | 0.20% |
| 31/12/2010 | 3,942,614.76 | 1.60% | 5.10% | 0.00% | 0.20% |
| 30/06/2011 | 3,834,408.80 | 1.60% | 5.10% | 0.00% | 0.20% |
| 31/12/2011 | 3,723,505.17 | 1.60% | 5.10% | 0.00% | 0.20% |
| 30/06/2012 | 3,609,833.77 | 1.60% | 5.10% | 0.00% | 0.20% |
| 31/12/2012 | 3,494,732.66 | 1.60% | 5.10% | 0.00% | 0.20% |
| 30/06/2013 | 3,376,763.66 | 1.60% | 5.10% | 0.00% | 0.20% |
| 31/12/2013 | 3,255,852.30 | 1.60% | 5.10% | 0.00% | 0.20% |
| 30/06/2014 | 3,131,922.12 | 2.20% | 5.70% | 0.00% | 0.20% |
| 31/12/2014 | 3,004,894.57 | 2.20% | 5.70% | 0.00% | 0.20% |
| 30/06/2015 | 2,874,689.01 | 2.20% | 5.70% | 0.00% | 0.20% |
| 31/12/2015 | 2,743,447.33 | 2.20% | 5.70% | 0.00% | 0.20% |
| 30/06/2016 | 2,608,932.00 | 2.20% | 5.70% | 0.00% | 0.20% |
| 31/12/2016 | 2,484,819.15 | 2.20% | 5.70% | 0.00% | 0.20% |
| 30/06/2017 | 2,357,707.51 | 2.20% | 5.70% | 0.00% | 0.20% |
| 31/12/2017 | 2,230,433.28 | 2.20% | 5.70% | 0.00% | 0.20% |
| 30/06/2018 | 2,100,102.56 | 2.20% | 5.70% | 0.00% | 0.20% |
| 31/12/2018 | 1,986,609.28 | 2.20% | 5.70% | 0.00% | 0.20% |

Table 3: *Input (Vectors) of Interest Rate Collar template loaded on “Parameters & Functions” Fairmat environment.*

1. *Contract specific* parameters:

- **N**: principal, bullet or amortizing (see Table 3);
- **pdu**: payment date (unadjusted), used for auxiliary item **Pd** (see Table 3);
- **Stklow**: strike rate on floor (see Table 3);
- **Stkhigh**: strike rate on cap (see Table 3);
- **sprlow**: spread added to floor strike rate (see Table 3);
- **sprhigh**: spread added to cap strike rate (see Table 3);
- **matRate**: time horizon of Floating rate expressed into year fraction;
- **levStkfloor**: leverage on strike (**Stklow**) rate;
- **levStkcap**: leverage on strike (**Stkhigh**) rate;
- **rday**: number of days before *Initial (Advance) / Ending (Arrears)* period;

2. *Market data*:

- **zr**: zero rate (derived from *spot* rate);

3. *Auxiliary* and *Instrumental* variables: the following elements are other objects and functions that aren't input – they are derived from or depend on *Contract specific* data or *Market* data inputs – but they are useful for use within “*Option Map*” environment.

- **Collar**: analytic function of a *+caplet - floorlet* payoff;
- **Caplet**: analytic function of a *caplet* payoff;
- **Floorlet**: analytic function of a *floorlet* payoff;
- **Pd**: date's vector transformation from **pdu** vector (see Table 3);
- **Rd**: date's vector transformation from **pdu** vector (see Table 3) using **rday** constant;
- **Dur**: date's vector difference transformation from **pdu** vector (see Table 3);