

Interest Rate *Floor* with *Knock-In*

1 Introduction

An Interest Rate *Floor* is (generally) an O.T.C. derivative contract based on a series of European interest rate put options. This interest rate sensitive instrument protects the floor buyer from losses resulting from a decrease in interest rates. The floor seller compensates the buyer with a payoff when the reference interest rate falls below the floor strike rate. In detail a knock-in option under a trigger clause is an option contract in which the option holder receives an option conditional on the underlying rate breaching a certain trigger level (also called barrier level).

Interest Rate <i>Floor</i> with <i>Knock-In</i>		
Principal		100 <i>bullet</i>
Trade Date		23/03/2010
Effective Date		25/03/2010
Termination Date		25/03/2015
Payment Frequency		<i>Quarterly</i>
Payoff		
From Effective to Termination date	If <i>EUR Euribor 3M</i> \leq 1.5%	$\max(2\% - \text{EUR Euribor } 3M ; 0\%)$
	If <i>EUR Euribor 3M</i> $>$ 1.5%	–
Conventions		
Reset dates	<i>Advance</i> , 2 days before	
Day Count Fraction	<i>Act/360 (Adjusted)</i>	

Table 1: *Example of an Interest Rate Floor with Knock-In template.*

2 Template implementation

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

Interest Rate <i>Floor</i> with <i>Knock-In</i> on <i>Fairmat</i>		
Principal		N
Trade Date	Trading date (simulation start date)	
Effective Date	Contract initial date	
Termination Date	Pd [end]	
Payment Frequency	matRate -Year (exchange per year)	
Payoff		
From 1 to length(@ Pd)	If matRate -Year Euribor \leq strkin If matRate -Year Euribor $>$ strkin	max(levStk*stk - levRate* matRate -Year Euribor ; 0%) —
Conventions		
Reset dates	Advance , rday days before	

Table 2: *Example of Interest Rate Floor with Knock-In template described through Fairmat objects.*

The variables of Interest Rate *Floor* with *Knock-In* template loaded on “Parameters & Functions” can be classified into three categories:

N	pdu
100.00	25/06/2010
100.00	25/09/2010
100.00	25/12/2010
100.00	25/03/2011
100.00	25/06/2011
100.00	25/09/2011
100.00	25/12/2011
100.00	25/03/2012
100.00	25/06/2012
100.00	25/09/2012
100.00	25/12/2012
100.00	25/03/2013
100.00	25/06/2013
100.00	25/09/2013
100.00	25/12/2013
100.00	25/03/2014
100.00	25/06/2014
100.00	25/09/2014
100.00	25/12/2014
100.00	25/03/2015

Table 3: *Input (Vectors) of Interest Rate Floor with Knock-In 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);

- **matRate**: time horizon of Floating rate expressed into year fraction;
- **levRate**: leverage on Floating rate;
- **levStk**: leverage on strike (**stk**) rate;
- **stk**: strike rate;
- **stkin**: strike from which the *Floor* (or *floorlet*) is active;
- **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.

- **KnockIn1**: analytic function of a *floorlet* payoff with knock-in threshold;
- **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);