Pricing of the Callable Range Accruals using Longstaff Schwartz algorithm

Houda Sebti[1] Said Guida[2]

[1] Ecole des Ponts ParisTech, Champs-sur-Marne, France
[2] Efficiency Management Consulting, Paris, France

sebti.houda14@gmail.com

***Abstract*—The Callable Range Accrual is one of the most widely used derivatives. The aim of this paper is to model this product under the Libor Market Model.**

The first step of the work is the mathematical modeling of the Callable Range Accrual. To do this, we used the method of Longstaff Schwartz method (Longstaff-Schwartz) to determine the sequence of optimal stopping times.

The second step of the work consists of calibrating the LMM model to the market data and then implementing the C ++ program allowing the pricing of the model. To do so, we used the financial open source library Quantlib.

In the last step of this work, we will adress the application of a corrective measure to the model in order to reduce the gap between the market price and the model price and to correct the relative pricing error due to the calibration.

I. INTRODUCTION

blablabla

A. libor rate

blablabla

B. Libor Market Model

blablaba

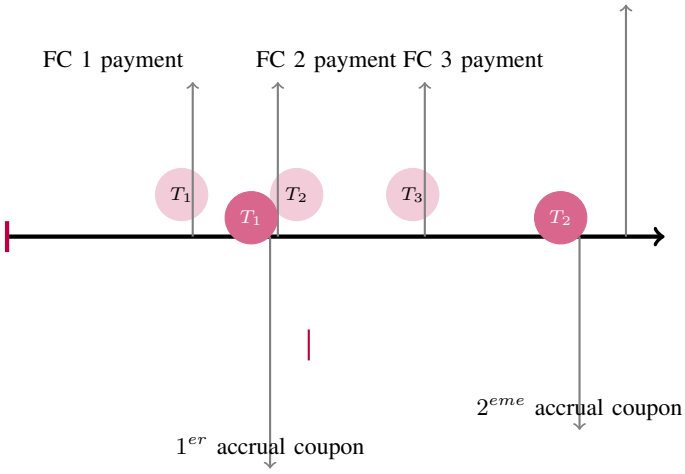
C. Callable Range Accruals

- **Range accruals:**
  A range accrual, or range accrual note, is a type of financial derivative product where one party pays a fixed coupon[1] to a second party and receives a variable coupon from it.
  The variable coupon depends on the value of an index. This index could be an interest rate, currency exchange rate, the price of a commodity, or stock index. If the index value falls within a specified range, the coupon accrues or is credited interest. If the index value falls outside the specified range, the coupon rate does not accumulate.

[1]rate of interest that a bondholder receives

- **The callable aspect:**
  A callable (or cancellable) instrument gives the exotic interest rate payer (variable leg payer) the option to terminate the contract prior to its maturity, and on predetermined dates.
- **Cash flows of a callable range accrual:**

Figure 1. cash flows



The cash flows Z_i of a callable range accrual can be modeled as follows:

$$Z_i = \frac{\delta_{T_i}.C_i - \delta'_{T_i}.F_i}{B(T_i)} \tag{1}$$

Where:

- C_i:
  est le coupon du callable range accrual (accrual coupon).
- On considre ici que le taux de rfrence du callable range accrual est le taux London Interbank Offered Rate (Libor) 6 mois.

O $R_{j,max}$ et $R_{j,min}$ sont les bornes du corridor du callable range accrual.

Le coupon C_i est pay en les dates T_i de la tenor structure, les C_i s'expriment comme suit:

$$C_j = \sum_{i \in [T_j, T_{j+1}]} \mu_i$$

O les μ_i doivent łtre calculs chaque jour $t_i \in [T_j, T_{j+1}]$ avec:

$$\mu_{i,j} = \frac{\alpha_j . R_{fix}}{M_j} . (F_{dig}(t_i, t_i, R_{j,max}) - F_{dig}(t_i, t_i, R_{j,min})) \tag{2}$$

O:

- α_j tant le payout sur la priode $[T_j, T_{j+1}]$.
- R_{fix} est un taux de revient dtermin ds le dbut du contrat (Gnralement gal 5%).
- M_j est le nombre de jours sur la priode $[T_j, T_{j+1}]$.
- Et $F_{dig}(t_i, t_i, R_{max})$ tant la valeur d'un floorlet digital pric en t_i et ayant pour maturit le młme jour t_i. i.e:

$$F_{dig}(t_i, t_i, K) = \begin{cases} 1 & \text{si } L(t_i) \leq K \\ 0 & \text{sinon} \end{cases} \tag{3}$$

II. CALLABLE RANGE ACCRUAL PRICING

A. State of the art

blabla

B. Longstaff Schwartz algorithm

blabla

C. computing the conditional expectancy

blabla

III. EXPERIMENTS

A. Data

blablabla

B. Results

] blabla

IV. CONCLUSIONS

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

Appendixes should appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word acknowledgment in America is without an e after the g. Avoid the stilted expression, One of us (R. B. G.) thanks . . . Instead, try R. B. G. thanks. Put sponsor acknowledgments in the unnumbered footnote on the first page.

References are important to the reader; therefore, each citation must be complete and correct. If at all possible, references should be commonly available publications.

REFERENCES

[1] G. O. Young, Synthetic structure of industrial plastics (Book style with paper title and editor), in Plastics, 2nd ed. vol. 3, J.