Interest Rate Swap Compounding Formulae

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July 2021

In this short paper, we outline geometric and arithmetic compound formulae for interest rate swaps. We also present ISDA protocol when compounding with a floating spread.

Geometric compounded rates are calculated as,

Geometric Compounded Rate,
$$r_G = \left(\prod_{i=1}^n (1+r_i \, au_i\,) - 1\right) / au_C$$
 (1a)

, where r_i denotes a rate fixing or reset, τ_i the fixing year fraction and τ_c the coupon year fraction

If we assume discount factors (DF) have simple compounding this reduces to,

Geometric Compounded Rate,
$$r_G = \left(\left(\frac{1}{DF_n}\right) - 1\right)/\tau_C$$
 (1b)

Arithmetic compounded rates are calculated as,

Arithmetic Compounded Rate,
$$r_A = \left(\sum_{i=1}^n r_i \tau_i\right) / \tau_C$$
 (2)

Next we briefly outline how to compound floating rates that have a spread, which is often the case for swap transactions. ISDA² define three compounding approaches for floating interest rates with a spread as follows,

¹ Computationally Efficient Zero Coupon Swap Formulae. Available at: https://ssrn.com/abstract=3881983

² Alternative compounding methods for over-the-counter derivative transactions. Available at: https://www.isda.org/a/2KiDE/isda-compounding-memo.pdf

Method 1: Compounding (Include Spread)

Floating rates compound with the spread.

$$C_{1} = N (r_{1} + s) \tau_{1}$$

$$C_{2} = (N + C_{1}) (r_{2} + s) \tau_{2}$$

$$C_{3} = (N + C_{2}) (r_{3} + s) \tau_{3}$$

$$FA = C_{1} + C_{2} + C_{3}$$

(3)

, where C denotes the compound amount and FA the total float amount.

Method 2: Flat Compounding (Exclude Spread)

Floating rates compound without the spread.

$$C_{1} = N (r_{1} + s) \tau_{1}$$

$$C_{2} = N (r_{2} + s) \tau_{2} + C_{1} r_{2} \tau_{2}$$

$$C_{3} = N (r_{3} + s) \tau_{3} + C_{2} r_{3} \tau_{3}$$

$$FA = C_{1} + C_{2} + C_{3}$$
(4

(4)

, where C denotes the compound amount and FA the total float amount.

Method 3: None (Simple Interest)

The spread is excluded from compounding and accrues simple interest.

$$C_{1} = N r_{1} \tau_{1}$$

$$C_{2} = (N + C_{1}) r_{2} \tau_{2}$$

$$C_{3} = (N + C_{1} + C_{2}) r_{3} \tau_{3}$$

$$SA = N s (\tau_{1} + \tau_{2} + \tau_{3})$$

$$FA = C_{1} + C_{2} + C_{3} + SA$$

(5)

, where C denotes the compound amount, SA the spread amount and FA the total float amount.