Variable Cashflow Specification

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May 11, 2017

Version 8.0.8095

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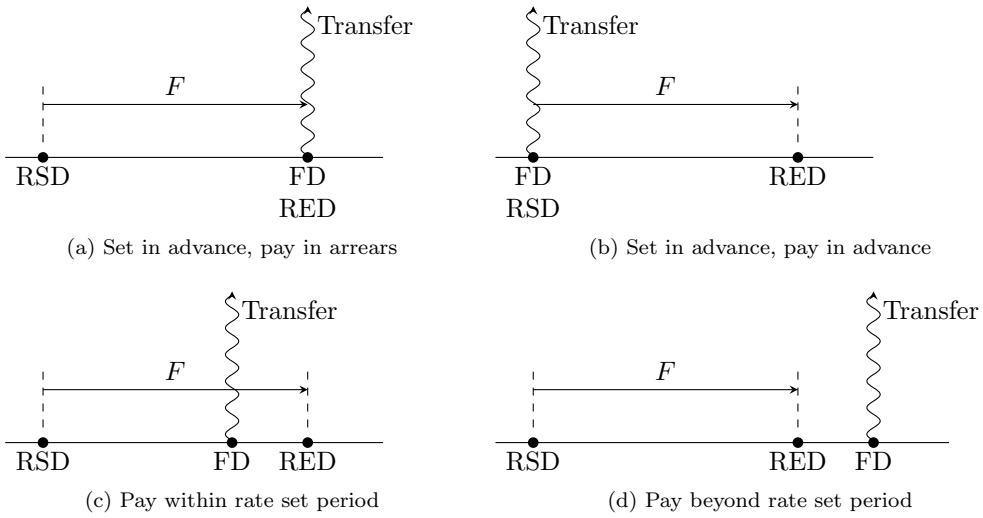
Variable Cashflow

1.1 Properties of Cashflow

A variable cashflow is a transfer of the interest component of a transfer schedule on the **flow date** (FD) where the interest payment is determined by a variable rate on a notional **amount** of N. The **accrual period** is specified by **accrual start date** (ASD) and **accrual end date** (AED). The variable rate (F) is the market rate for the period between rate set start date (RSD) and rate set end date (RED). The coupon payment of a floating rate note (FRA) is an example of variable cashflows.

Different types of variable cashflow are illustrated in Figure 1.1.



(a) Set in advance, pay in arrears

(b) Set in advance, pay in advance

(c) Pay within rate set period

(d) Pay beyond rate set period

Figure 1.1: Different types of variable cahflow

1.2 Definitions

In this section, we define terms that are specific to variable cashflow.

forward day count fraction is the day count fraction of the **accrual period**.

accrual end date is the end date of the **accrual period**.

accrual period is the tenor period over which the floating rate applies.

accrual start date is the start date of the **accrual period**.

amount is the notional amount in **currency** of the cashflow.

currency is currency that payment is in.

flow date is the date that the cashflow transfer occurs.

1.3 Cashflow Inputs

A variable cashflow is specified by the mandatory fields in Table 1.1, the optional fields in Table 1.2, with their restrictions in Table 1.3.

Field	*Description*	*Data Type*	*Symbol*
PayReceive	The pay/receive direction of the cashflow	string	direction
Currency	The currency the payment is in	string	ccy
InterestStyle	The interest style of the cashflow	string	style
ForwardDayCount	The day count convention for the forward rate	string	dcc
ForwardReference	The floating rate index, which determines the forward rate estimation curve	string	
FlowDate	The date of the cashflow's payment	date	FD
Amount	The notional amount	double	N
AccrualStartDate	The start date of the accrual period	date	ASD
AccrualEndDate	The end date of the accrual period	date	AED

Table 1.1: Mandatory fields for Variable Cashflow

Field	*Description*	*Data Type*	*Symbol*	*Default Value*
DiscountReference	Alternative discounting curve	string		
Margin	The margin on the interest rate	double	M	0
RateSetStartDate	The start date of the rate set period	date	RSD	ASD
RateSetEndDate	The end date of the rate set period	date	RED	AED
FloatingRateOnRateSetDate	The rate fixing value if floating rate has been fixed	double	R	
DiscountRate	For Discount flow, standard discounting method applies. This specifies the discount rate. If not specified, the flow will be discounted with the value of the floating rate that has been fixed.	string	D	
DiscountRateDayCount	For Discount flow, standard discounting method applies. This specifies the day count convention for the discount rate. If not specified, it takes the value of *ForwardDayCount*.	string	dcc_D	dcc
Frequency	Only required if *ForwardDayCount* is ACTACT(ICMA)	string		
RateSetDayCount	The day count convention for the floating rate index (*ForrwardReference*)	string		
LegID	The identifier of the leg	string		
Description	The description of the flow	string		

Table 1.2: Optional fields for Variable Cashflow

1.3.1 Required Curves

The following curves are required by a variable cashflow:

- *Currency FX spot curve*: FX Spot Curve — (FX.PRICE.Currency.BaseCurrency),

Field	*Restriction*
PayReceive	Pay, Receive, P, R
InterestStyle	Simple, Discount
Amount	$N > 0$
AccrualEndDate	AED > ASD
RateSetEndDate	RED > RSD

Table 1.3: Field restrictions for Variable Cashflow

- *Currency discounting curve*: Money Market Zero Curve: (MM.ZERO.SWAP.Currency) [1], and
- *ForwardReference forward rate estimation curve*: Forward Rate Estimation Curve determined by ForwardReference.

In the case of the optional field DiscountReference is provided, the reference curve is used as the Currency discounting curve instead.

1.4 Rate Fixing Priorities

If the rate set start date is before or on the valuation date, the rate fixing of the floating rate has occurred and the rate fixing is determined in the following order:

1) the value of *FloatingRateOnRateSetDate*, if provided,

2) look up the historic rate fixing value on *RateSetStartDate*, if available, else,

3) use the 'current' forward rate on the valuation date (with the tenor period having same length as rate set start date to rate set end date, e.g. if the rate set period is 3-month and we are one month into the rate set period, use current 3-month rate), determined from the forward rate estimation curve.

1.5 Formula

The transfer in **currency** on the **flow date** of a variable flow is

$$\begin{cases} N \times \mathbb{I}_{\text{pr}} \times (R+M)\tau, & \text{if style is 'Simple',} \\ N \times \mathbb{I}_{\text{pr}} \times \dfrac{(R+M)\tau}{1+(D+M)\tau_D}, & \text{if style is 'Discount',} \end{cases} \tag{1.1}$$

where

- N is the notional **amount** in **currency**,
- R is the value the floating interest rate fixed at,
- M is the margin,
- τ is the accrual tenor period, from **accrual start date** to **accrual end date**, according to the day count convention for the **accrual period** (dcc),
- D is the discount rate for discount flow,
- τ_D is the accrual tenor period, from **accrual start date** to **accrual end date**, according to the day count convention for the discount rate (dcc_D), and
- the indicator for pay or receive direction is

$$\mathbb{I}_{\text{pr}} = \begin{cases} 1, & \text{if direction is 'R',} \\ -1, & \text{if direction is 'P'.} \end{cases}$$

[1] For certain products, e.g. FX Forward or Cross Currency Swap, FX ZERO curve is used for discounting.

1.6 Examples

This section provides some deal examples of variable cashflow.

Example 1.1 (Simple interest)**.** A variable cashflow:

- PayReceive: Pay
- Currrency: GBP
- InterestStyle: Simple
- AccrualDayCount: ACT365(FIXED)
- FlowDate: 2013-11-15
- Amount: 60,000,000
- FloatingRateOnRateSetDate: 0.0315
- AccrualStartDate: 2013-08-15
- AccrualEndDate: 2013-11-15

There are 92 days from the accrual start date (2013-08-15) to the accrual end date (2013-11-15). The accrual tenor period of the cashflow is calculated using the Actual/365 (Variable) day count convention to give

$$\tau = \frac{92}{365}.$$

Using (1.1), on 2013-11-15, there is a payment of

$$N \times R\tau = 60,000,000 \times 0.0315 \times \frac{92}{365} = \$476,383.56 \text{ GBP}.$$

Example 1.2 (Discount interest)**.** A variable cashflow:

- PayReceive: Receive
- Currrency: USD
- InterestStyle: Discount
- AccrualDayCount: 30360
- FlowDate: 2013-11-15
- Amount: 100,000,000
- FloatingRateOnRateSetDate: 0.0145
- AccrualStartDate: 2013-08-15
- AccrualEndDate: 2013-11-15

Using 30/360 day count convention, there are 90 days from the accrual start date (2013-08-15) to the accrual end date (2013-11-15). The accrual tenor period of the cashflow is

$$\tau = \frac{90}{360} = 0.25.$$

Using (1.1), on 2013-11-15, one receives

$$N \times \frac{R\tau}{1 + R\tau} = 60,000,000 \times \frac{0.0145 \times 0.25}{1 + 0.0145 \times 0.25} = \$361,190.68 \text{ USD}.$$

Glossary

Base Currency The currency that the risk engine is configured to return values in.