



# Interest Rate Future Options and Valuation

FinPricing

# Interest Rate Future Option

## Summary

- ◆ Interest Rate Future Option Definition
- ◆ Advantages of Trading Interest Rate Future Options
- ◆ Valuation
- ◆ A Real World Example

# Interest Rate Future Option

## Interest Rate Future Option Definition

- ◆ An interest rate future option gives the holder the right but not the obligation to buy or sell an interest rate future at a specified price on a specified date.
- ◆ Interest rate future options are usually traded in an exchange.
- ◆ It is used to hedge against adverse changes in interest rates.
- ◆ The buyer normally can exercise the option on any business day (American style) prior to expiration by giving notice to the exchange.
- ◆ Option sellers (writers) receive a fixed premium upfront and in return are obligated to buy or sell the underlying asset at a specified price.
- ◆ Option writers are exposed to unlimited liability.

# Interest Rate Future Option

## Advantages of Trading Interest Rate Futures Options

- ◆ An investor who expected short-term interest rates to decline would also be expecting the price of the future contracts to increase. Thus, they might be inclined to purchase a 3-month Eurodollar futures call option to speculate on their belief.
- ◆ The advantage of future options over options of a spot asset stems from the liquidity of futures contracts.
- ◆ Futures markets tend to be more liquid than underlying cash markets.
- ◆ Interest rate futures options are leveraged instruments.

# Interest Rate Future Option

## Valuation

- ◆ The price of an interest rate future option is quoted by the exchange.
- ◆ A model is mainly used for calculating sensitivities and managing risk.
- ◆ European option approximation
  - ◆ Interest rate future options are normally American options. One may use an European option to approximate.
  - ◆ The present value of a call option is given by

$$V(t) = N\tau D(L(t)\Phi(d_1) - K\Phi(d_2))$$

- ◆ The present value of a put option is given by

$$V(t) = N\tau D(K\Phi(-d_2) - L(t)\Phi(-d_1))$$

# Interest Rate Future Option

## Valuation (Cont)



where

- $t$  - the valuation date,
- $L(t) = 100 - Y(t; T, T_E) + C$  - the forward rate;  $C$  is used to match market future price.
- $K$  - the strike
- $N$  - the notional
- $\tau$  - the day count fraction for the forward period  $[T, T_E]$
- $T$  - the maturity of the future contract and also the start date of forward period
- $T_E$  - the end date of the forward period
- $D = D(t, T)$  - the discount factor
- $\Phi$  - the accumulative normal distribution function
- $d_{1,2} = \left( \ln \left( \frac{L}{K} \right) \pm 0.5\sigma^2 (T - t) \right) / (\sigma\sqrt{T - t})$

# Interest Rate Future Option

## Valuation (Cont)

- ◆ American option
  - ◆ Price interest rate future options as American options
  - ◆ Tree, PDE or lattice can be used to price an American option
  - ◆ Given interest rate future options are simple products, we use Black Scholes dynamics plus binomial tree to price an American interest rate future option.

# Interest Rate Future Option

## A Real World Example

Future option specification		Underlying future specification	
Quote Price	0.05	Contract Size	10000
Trade Date	11/23/2016	First Delivery Date	5/30/2017
Option Maturity Date	6/19/2017	Last Delivery Date	6/30/2017
Settlement Amount	-62500	Future Maturity Date	6/19/2017
Settlement Date	11/23/2016	Tenor	3M
Strike	98.75	Future Ticker	EDM17
Option Ticker	EDM17P 98.75	Future Ticker Size	100
Call Put	Put	Number of Contract	500
Currency	USD		
Buy Sell	Buy		





# Thanks!



You can find more details at  
<https://finpricing.com/lib/EqRainbow.html>

