# Pricing of Interest Rate Swaps without credit risks

An interest rate swap can be thought of as an exchange of a series of fixed payments by one party for a series of variable (floating) payments by the other party involved in the swap. For the fixed leg, the present value of the payments is given by:

Where: CF is the (fixed) cash flow, is the risk-free rate for period , is the time at which CF will be received and is the tenor (total length of the swap contract)

The present value of the floating leg is:

Where: is the floating leg payment at period , and all the other variables are as defined previously.

The net present value of the contract for the party paying the fixed leg and receiving the floating leg is:

*(The counterpart's value is given by a similar formula, but with the signs reversed on the right-hand side.)*

Floating rate payments are unknown in advance, but are usually determined by a relevant yield curve. For instance, if the floating leg payment is based on LIBOR, the LIBOR curve, constructed by interpolating short-term deposit rates, medium-term Eurodollar futures, and long-term instruments like forward rate agreements and existing swaps, is used.

At the outset of the contract, the contract's value is zero. This is achieved by determining the present value of the floating leg using the assumed payments, and then setting the fixed rate such that the present values of both legs align.

# Counterparty Risk and CVA/DVA

The interest rate swap market is dominated by a handful of substantial swap dealers (SDs) and Major Swap Participants (MSPs) rather than many atomistic market participants. These SDs and MSPs offer buy and sell quotes for swaps, potentially finding other participants to balance their swap exposures. Figure 1 depicts a hypothetical network model of such a market.Diagram

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Dealers might engage in interdealer trading and bulk futures markets for cash flow or risk management, customers might trade with multiple dealers or occasionally engage in bilateral trades amongst themselves. However, such bilateral trades typically have low volume. It is believed that the dealer-centric network structure lowers search costs compared to a direct customer-to-customer market.

In practice, both customers and dealers must account for the risk associated with counterparties defaulting. The "risk-free" present values above need to be adjusted for counterparty default. If *Si*​ represents the survival probability of the counterparty at period *i*, the expected present value is:

Note that a swap's value with counterparty risk requires two adjustments. A defaulting counterparty means missed expected payments but also fewer obligations. This requires a "credit value adjustment" to account for missed expected future payments and a "debit value adjustment" for reduced obligations.

# Central Clearing

The structure of a dealer-dominated market means that a dealer's failure, possibly due to inadequate risk management or customer defaults, could affect other dealers and potentially the entire market. To counter this, regulators introduced central counterparties (clearinghouses). These clearinghouses voids (novates) the initial swap contract and establish two new contracts, mirroring the original, with each counterparty. Now participants only need to be concerned about the clearinghouse's potential default, rather than their counterparties. Owing to their robust capitalization, regulation, and sound risk management, clearinghouses are perceived to decrease default and contagion risks. Figure 2 visualizes a hypothetical market structure with mandated central clearing.Diagram, text, letter

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