# Tool: MTM Interest Rate Swap (W5)

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**PURPOSE**

To explain how Interest Rate Swap are revalued in the CS Lucas system.

**WHY IS THIS IMPORTANT?**

The gains and losses incurred arising from interest rate swap transaction has implications for financial risk management and the accounting instrument.

**PREREQUISITE**

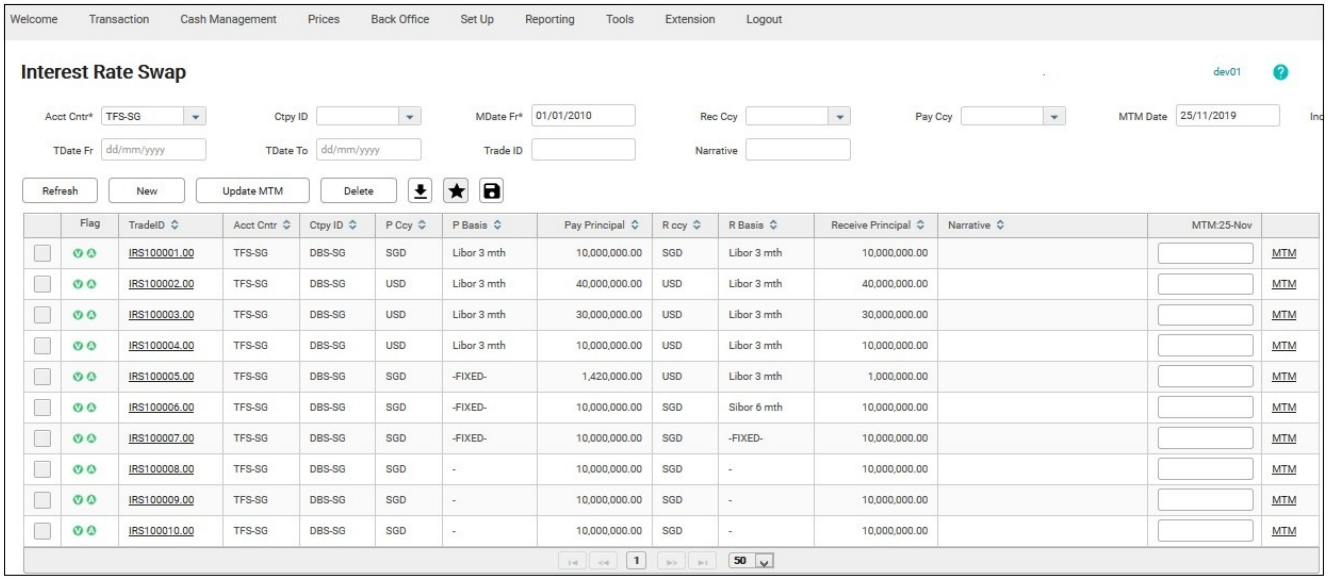
1. The appropriate rate structure has been set up in the system at the date for the revaluation.

2. The exchange change has been set up in the system at the date for the valuation.

**PROCEDURE**

1. Navigate to the IRS module and filter the trade to revalue. (Transaction > Interest Rate Swap)

2. Click on the hyperlink MTM against the trade.



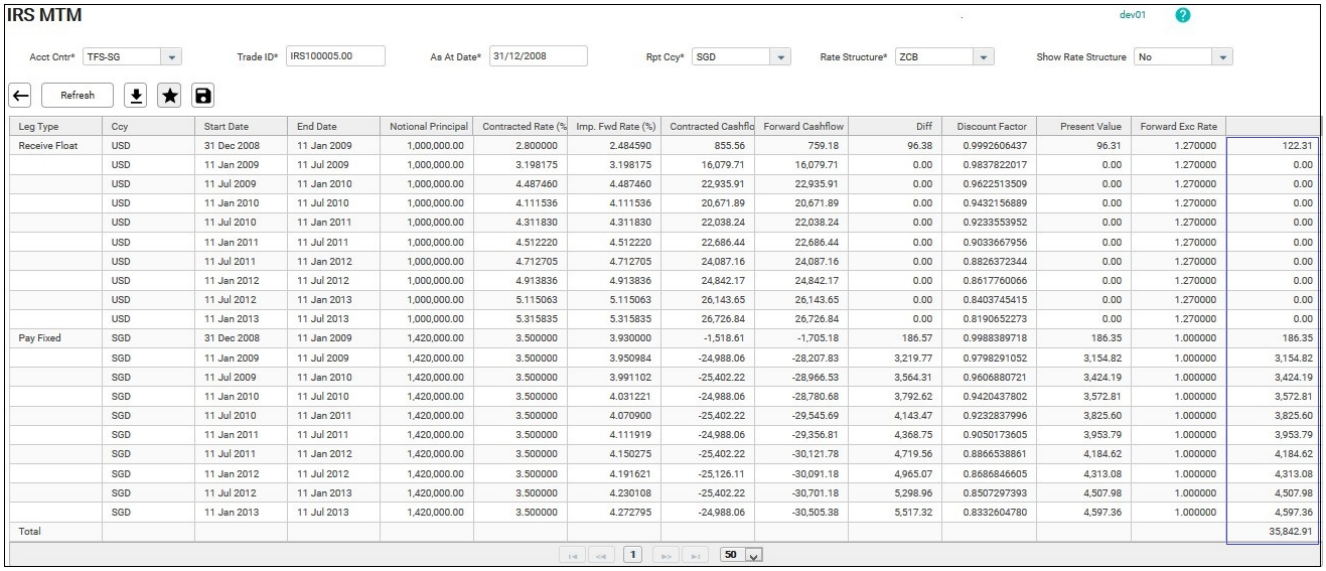

3. The system brings you to the tool for MTM IRS.

4. If you do not have access rights to the IRS module to select the trades in the steps above, you may launch the tool directly. Tools > MTM IRS. Then select the accounting centre and enter the TradeID of the relevant trade.

5. Select the As At Date for the MTM and the reporting currency you wish to use to revalue this position.

6. Select the Rate Structure that you want to use to revalue.

7. Click Refresh.




8. The system displays the MTM of the outstanding individual legs of the IRS and a total in the reporting currency.

## ANALYSIS OF THE COMPUTATION

(In the illustration below, numbers may have been rounded for display purposes.)

Consider the following scenario.

As At Date: 31-Dec-2008

IRS Structure

| | Start Date | End Date | Leg Type | CCY | Notional Principal | Contracted | |
|---|---|---|---|---|---|---|---|
| Pay Fixed Leg | 31-Dec-08 | 11-Jan-09 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jan-09 | 11-Jul-09 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jul-09 | 11-Jan-10 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jan-10 | 11-Jul-10 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jul-10 | 11-Jan-11 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jan-11 | 11-Jul-11 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jul-11 | 11-Jan-12 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jan-12 | 11-Jul-12 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jul-12 | 11-Jan-13 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| | 11-Jan-13 | 11-Jul-13 | Pay Fixed | USD | 1,000,000.00 | 2.800000% | |
| Received Float Leg | 31-Dec-08 | 11-Jan-09 | Received Float | SGD | 1,420,000.00 | 3.500000% | Float reset pending |
| | 11-Jan-09 | 11-Jul-09 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jul-09 | 11-Jan-10 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jan-10 | 11-Jul-10 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jul-10 | 11-Jan-11 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jan-11 | 11-Jul-11 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jul-11 | 11-Jan-12 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jan-12 | 11-Jul-12 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jul-12 | 11-Jan-13 | Received Float | SGD | 1,420,000.00 | 3.500000% | |
| | 11-Jan-13 | 11-Jul-13 | Received Float | SGD | 1,420,000.00 | 3.500000% | |

Rate Structure (USD)

| Date | Tenor | Rate |
|---|---|---|
| 1-Jul-09 | 182 | 3.120000% |
| 31-Dec-10 | 365 | 3.800000% |
| 31-Dec-11 | 730 | 4.000000% |

Rate Structure (SGD)

| Date | Tenor | Rate |
|---|---|---|
| 11-Jan-09 | 11 | 3.930000% |
| 13-Jul-09 | 194 | 3.950000% |
| 11-Jan-10 | 376 | 3.970000% |
| 12-Jul-10 | 558 | 3.990000% |
| 11-Jan-11 | 741 | 4.010000% |
| 11-Jul-11 | 922 | 4.030000% |
| 11-Jan-12 | 1,106 | 4.050000% |
| 11-Jul-12 | 1,288 | 4.070000% |
| 11-Jan-13 | 1,472 | 4.090000% |
| 11-Jul-13 | 1,653 | 4.110000% |

## I. Computation of the implied forward interest rate.

The forward rate is the future yield that can be implied from the prevailing zero coupon curve. The formula is given as:

$$r_{t1,t2} = \left(\frac{(1 + r_2)^{d_2}}{(1 + r_1)^{d_1}}\right)^{\frac{1}{d_2 - d_1}} - 1$$

$r_{t1,t2}$ is the forward rate between term $t_1$ and term $t_2$,

$d_1$ is the time length between time 0 and term $t_1$ (in years)

$d_2$ is the time length between time 0 and term $t_2$ (in years)

$r_1$ is the zero-coupon yield for the time period $(0, t_1)$

$r_2$ is the zero-coupon yield for the time period $(0, t_2)$

See also

Illustration of computing zero coupon rates from known implied rates and vice versa using the above formula.

Example 1

To compute the forward rate on SGD between 11 Jul 11 and 11 Jan 12.

| | Ref | d1 | d2 |
|---|---|---|---|
| End Date | | 11-Jul-11 | 11-Jan-12 |
| Zero Coupon Rate | r | 4.030000% | 4.050000% |
| Tenor (Days) | | 922 | 1,106 |
| Tenor (Yrs) | d = Days/365 | 2.526027 | 3.030137 |

**Working Breakdown**

| | | |
|---|---|---|
| $\frac{1}{d_2 - d_1}$ | 1.983695652 | |
| $(1 + r_i)^{d_i}$ | 1.10495118 | 1.12783581 |
| $\left(\frac{(1 + r_2)^{d_2}}{(1 + r_1)^{d_1}}\right)^{\frac{1}{d_2 - d_1}} - 1$ | 4.150275% | |

Example 2

In general, the dates of the zero coupon rate curve do not coincide with the

periodic cash flow date of the interest rate swap.

For example, the fixed leg, on the USD leg.

| | | Available |
|---|---|---|
| End Date | Tenor | ZCR |
| 1-Jul-09 | 182 | 3.120000 |
| 31-Dec-09 | 365 | 3.800000 |

Interpolation for 11 July 09

| | | | |
|---|---|---|---|
| 11-Jul-09 | 192 | 3.157158 | $\left(\frac{3.80-3.12}{365-182} \times (192-182)\right) + 3.12$ |

The rate of 3.157158% is then used as in Example 1 to compute the forward rate between 11 Jan 09 and 11 Jul 09.

| | Ref | d1 | d2 |
|---|---|---|---|
| End Date | | 11-Jan-09 | 11-Jul-09 |
| Zero Coupon Rate | r | 2.484590% | 3.157158% |
| Tenor (Days) | | 11 | 192 |
| Tenor (Yrs) | d = Days/365 | 0.030137 | 0.526027 |

Working Breakdown

| | | |
|---|---|---|
| $\frac{1}{d_2 - d_1}$ | 2.016574586 | |
| $(1 + r_i)^{d_i}$ | 1.00073990 | 1.01648515 |
| $\left(\frac{(1 + r_2)^{d_2}}{(1 + r_1)^{d_1}}\right)^{\frac{1}{d_2 - d_1}} - 1$ | 3.198175% | |

## II. Compute the present value of all cash flow differences between contracted and implied rate.

All the fixed leg cash flow will be revalued between the contracted rate and the implied forward rate.

In the case of the floating legs, the appropriate reset rates in the future would be best represented by the implied forward rate. The exception will be the current float leg, where the interest rate has been determined. This leg is, in fact, fixed.

| | Start Date | End Date | CCY | Notional Principal | Contracted | Implied Rate | Period Tenor | Cash Flow Contracted | Cash Flow Revalued | Diff | ZCR | Tenor | DF | PV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pay Fixed Leg | 31-Dec-08 | 11-Jan-09 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |
| | 11-Jan-09 | 11-Jul-09 | USD | 1,000,000.00 | 2.800000% | 3.198175% | 181 | 14,077.78 | 16,079.71 | 2,001.93 | 3.157158 | 192 | 0.9837822 | 1,969.46 |
| | 11-Jul-09 | 11-Jan-10 | USD | 1,000,000.00 | 2.800000% | | Note A | Note B | Note C | Note D | Note E | Note F | Note G | Note H |
| | 11-Jan-10 | 11-Jul-10 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |
| | 11-Jul-10 | 11-Jan-11 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |
| | 11-Jan-11 | 11-Jul-11 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |
| | 11-Jul-11 | 11-Jan-12 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |
| | 11-Jan-12 | 11-Jul-12 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |
| | 11-Jul-12 | 11-Jan-13 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |
| | 11-Jan-13 | 11-Jul-13 | USD | 1,000,000.00 | 2.800000% | | | | | | | | | |

| Ref | Column | Remarks |
|---|---|---|
| A | Period Tenor | 11-Jan-09 to 11-Jul-09 = 181 days |
| B | Cash Flow Contracted | Notional Principal (1m) * Contract Rate (2.8%) * A / 360<br>This amount is rounded to 2 dp.<br>The day count of 360 follows the currency (USD)<br><br>For the purpose of revaluation, the pay leg will be signed positive and received leg would be signed negative. |
| C | Cash Flow Revalued | Same as B but using 3.198175% instead of 2.800000% |
| D | Difference | C – B |
| E | Zero Coupon Rate | Based on Zero coupon rate curve. Interpolated if necessary. |
| F | Tenor | This is the number of days from the As At date to the End Date<br>31-Dec-2008 to 11-Jul-09 = 192 |
| G | Discount Factor (DF) | $\frac{1}{(1+ZCR)^{\frac{Tenor}{365}}} = \frac{1}{(1+3.157158\%)^{\frac{192}{365}}} = 0.9837822$ |
| H | Present Value | D * G<br>Rounded to 2 dp. |

## III. Translating to reporting currency

To translate the present value of currency amount to the reporting currency, the system will compute the forward rates using the End Date of each periodic item.

## FREQUENTLY ASKED QUESTIONS

### FAQ01. What happens when there is no zero coupon rate curve at the As At Date of the valuation?

The system will look up the latest available curve before the As At Date and use that curve for revaluation.

## RELATED INFORMATION

Illustration of computing zero coupon rates from known implied rates and vice versa

## CHANGE HISTORY

| Date | By | Changes |
| --- | --- | --- |
| 15-Feb-2016 | CS | Created |
| 14-Jun-2016 | Douglas | Proofread. |
| 25-Nov-2019 | Lyra | Updated Screenshots. |