Report 4301: Currency Option MTM

See previous W5 version guide

PURPOSE

This document explains how CS Lucas computes MTM for currency options.

WHY IS THIS IMPORTANT?

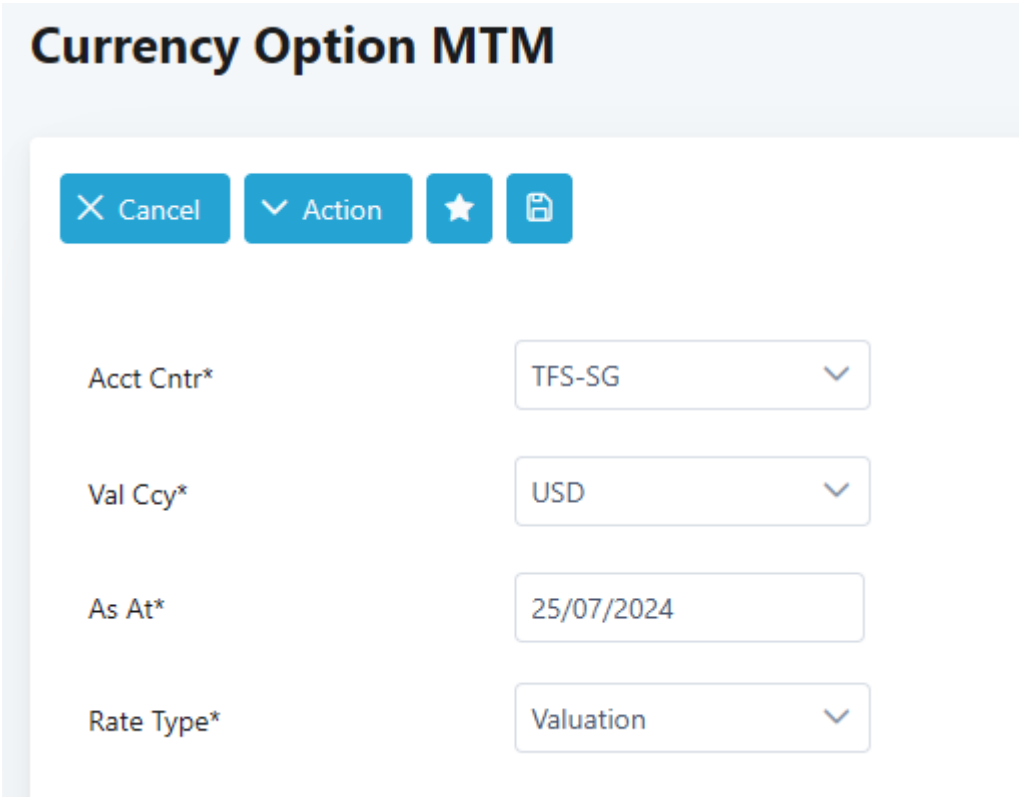
Allow users to verify the formula and methodology used by CS Lucas to compute the Currency Options MTM.

BACKGROUND

The Garman-Kohlhagen options pricing model is used by CS Lucas for valuing options.

QUERY

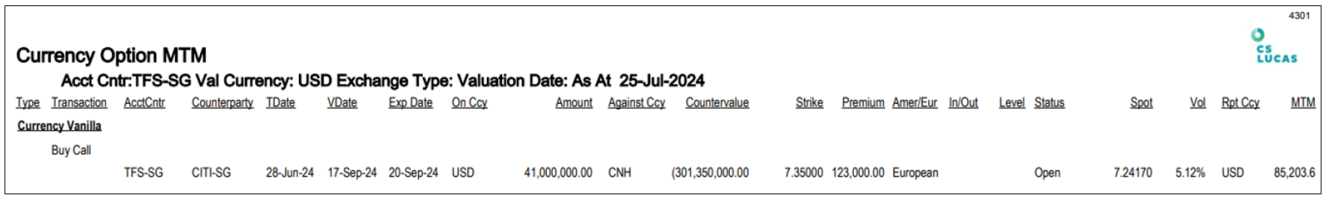
1. Navigate to Reporting > Standards > Report 4301: Currency Option MTM.



2. Fill in the mandatory parameter – Acct Cntr, Valuation Currency, As At Date and Rate Type.

3. Click Action and select the required format to print.

4. The report shows the Type, Transaction, Accounting Centre, Counterparty, TDate, VDate, Exp Date, On Currency, Amount, Against Ccy, Countervalue, Strike, Premium, Amer/Eur, In/Out, Level, Status, Spot Rate, Volatility, Rpt Ccy and MTM.



4301

Currency Option MTM

Acct Cntr:TFS-SG Val Currency: USD Exchange Type: Valuation Date: As At 25-Jul-2024

Type	Transaction	AcctCntr	Counterparty	TDate	VDate	Exp Date	On Ccy	Amount	Against Ccy	Countervalue	Strike	Premium	Amer/Eur	In/Out	Level	Status	Spot	Vol	Rpt Ccy	MTM
Currency Vanilla																				
	Buy Call																			
		TFS-SG	CITI-SG	28-Jun-24	17-Sep-24	20-Sep-24	USD	41,000,000.00	CNH	(301,350,000.00	7.35000	123,000.00	European			Open	7.24170	5.12%	USD	85,203.6

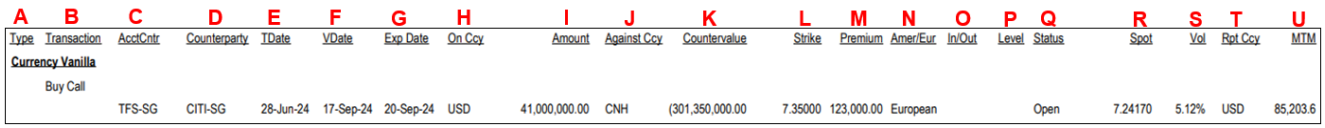
Note: One of the currency of the Option trade must be the Enterprise currency to generate MTM.

For explanation of Excel Raw export, please see link.

For explanation of  buttons, please see link.

DATA SOURCE

To view the following transaction,



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Type	Transaction	AcctCntr	Counterparty	TDate	VDate	Exp Date	On Ccy	Amount	Against Ccy	Countervalue	Strike	Premium	Amer/Eur	In/Out	Level	Status	Spot	Vol	Rpt Ccy	MTM
Currency Vanilla																				
	Buy Call																			
		TFS-SG	CITI-SG	28-Jun-24	17-Sep-24	20-Sep-24	USD	41,000,000.00	CNH	(301,350,000.00	7.35000	123,000.00	European			Open	7.24170	5.12%	USD	85,203.6

Follow the steps as shown below:

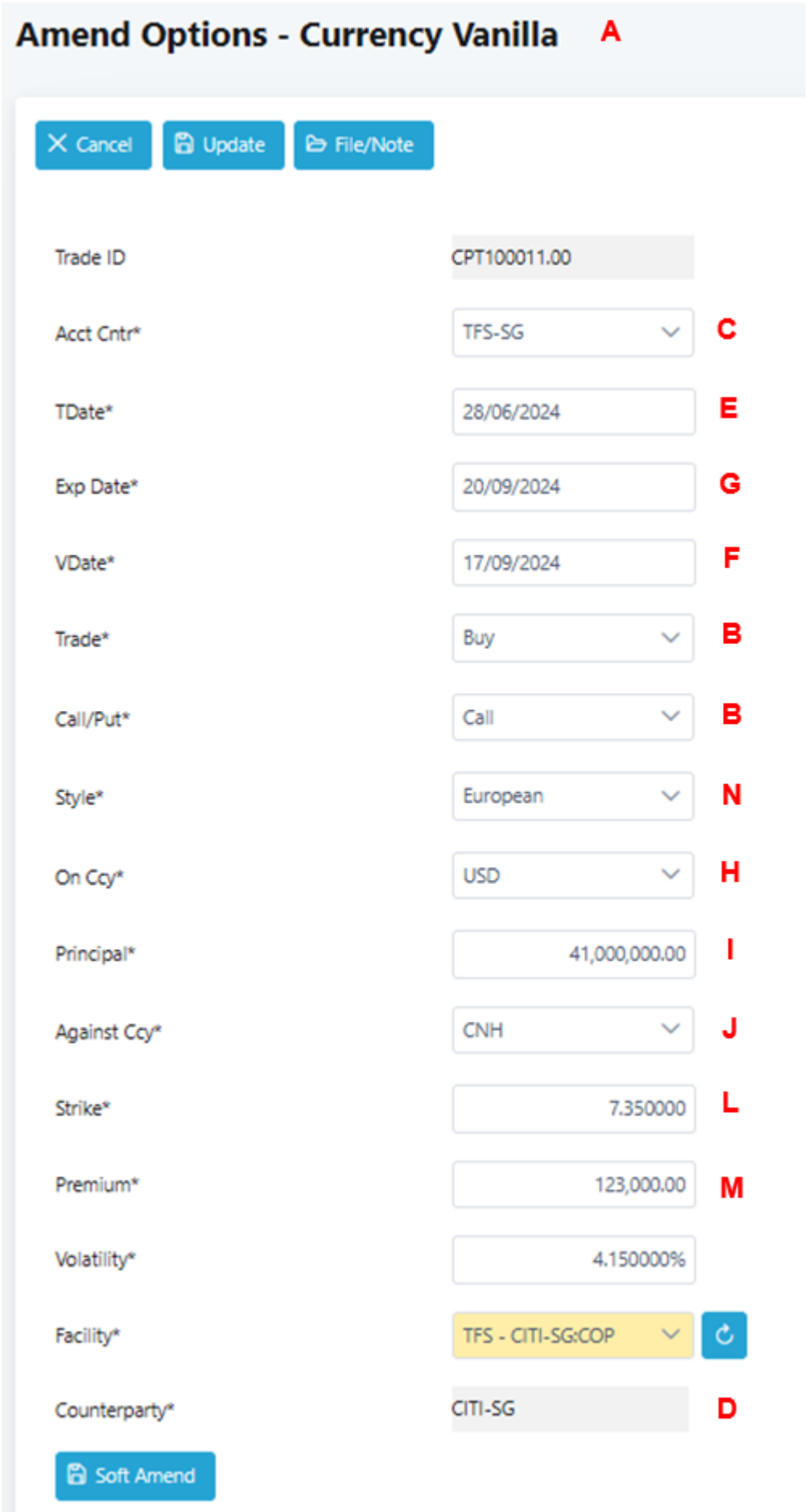
1. Navigate to Transaction > Options.

2. Select Acct Cntr* (From example: TFS-SG)

3. Key in Expiry Fr* (From example: 01/07/2024)

4. Click Refresh.

5. Click the Edit button next to the Trade ID to drill down to trade details.

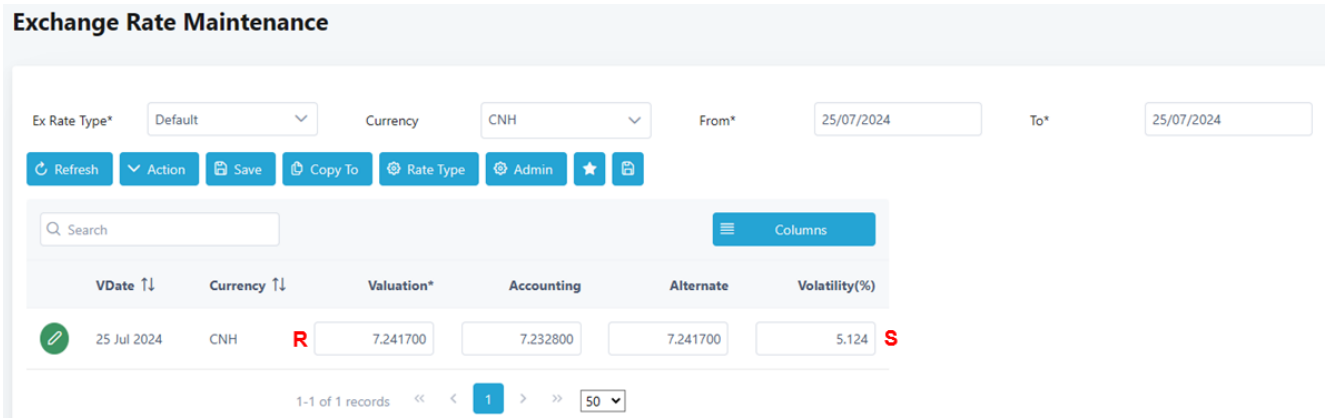


6. Countervalue: Amount * Strike -> K.

7. To compute MTM for Currency Options as at a particular reporting date, e.g. 25 Jul 2024, the following parameters are required.

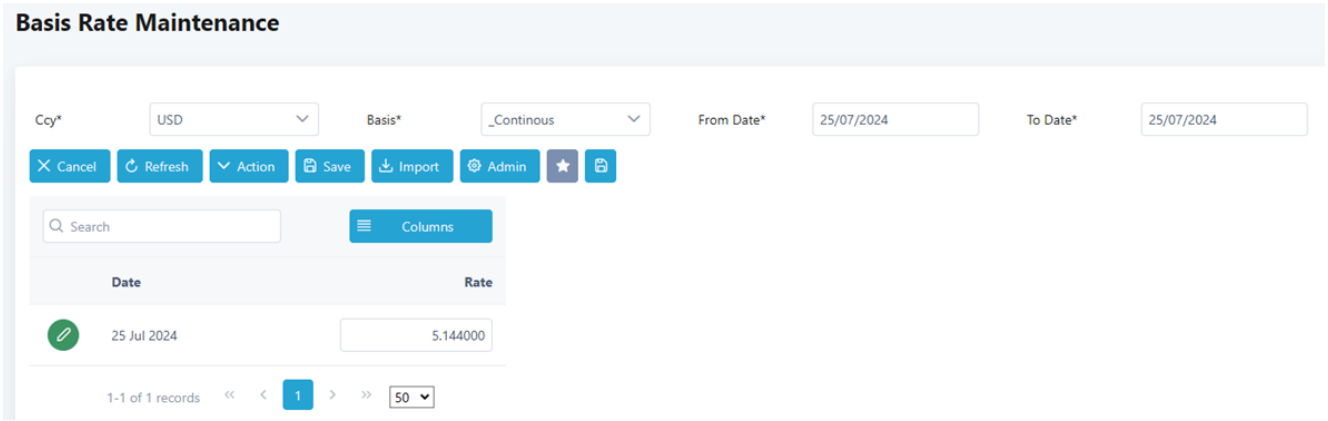
Spot: Navigate to Prices > Exchange Rate (Valuation/Accounting/Alternate) -> R.

Vol: Navigate to Prices > Exchange Rate (Volatility) -> S.

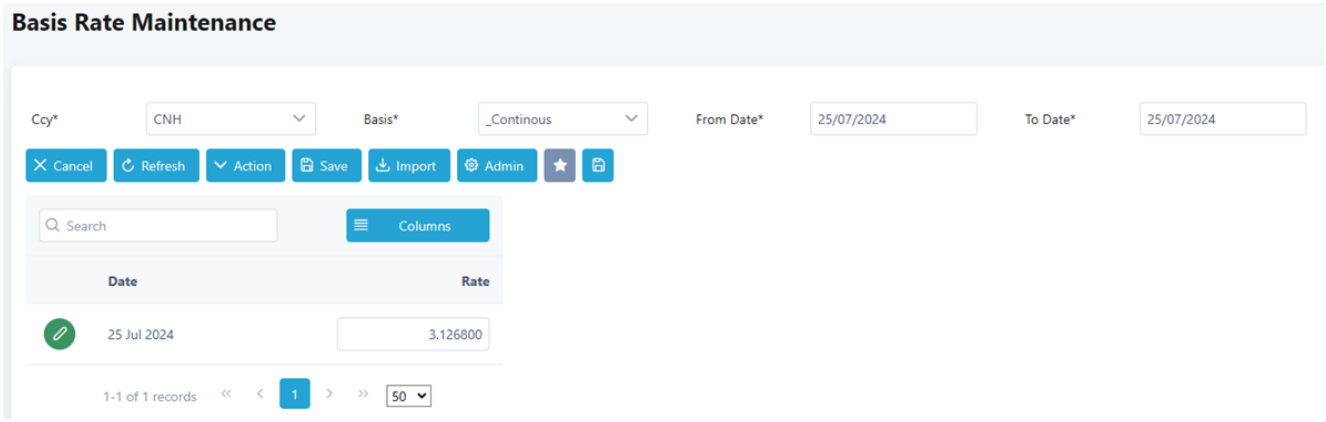


For details on how to maintain exchange rates and volatility, see maintaining exchange rates.

Foreign interest rate: Navigate to Prices > Interest Rate. Foreign interest rate needs to be maintained under "_Continous" basis as at the reporting date. For details on how to add and maintain basis rates, see maintaining basis rate.



Domestic interest rate: Navigate to Prices > Interest Rate. Domestic interest rate needs to be maintained under "_Continous" basis as at the reporting date. For details on how to add and maintain basis rates, see maintaining basis rate.



FORMULA AND EXAMPLE

Note that, in the FX context, you can write the formula in terms of the **forward rate** so that the foreign interest rate (or even the spot rate!) does not appear.

Since $F = Se^{(i^d - i^f)\tau}$,

$$C = e^{-i^d\tau}[FN(d_1) - KN(d_2)], \qquad P = e^{-i^d\tau}[KN(-d_2) - FN(-d_1)] \qquad (3)$$

where

$$d_1 \equiv \frac{\ln(F/K) + \frac{1}{2}\sigma^2\tau}{\sigma\sqrt{\tau}}, \qquad d_2 \equiv \frac{\ln(F/K) - \frac{1}{2}\sigma^2\tau}{\sigma\sqrt{\tau}} = d_1 - \sigma\sqrt{\tau} \qquad (4)$$

- Discounting by the risk-free rate in Equation (3) indicates that the terms in the square brackets are **certainty equivalent** of the option payoff at maturity.
- Note: you do have to use the forward rate that **corresponds to the maturity** of the option.

Example.

- Spot S = 1.15\$/€
- Strike K = 1.15\$/€
- Domestic interest rate $i^{\$}$ = 1.2% (continuously compounded)
- Foreign interest rate $i^{€}$ = 2.2% (continuously compounded)

(Or you might observe the forward rate, F = 1.1443\$/€. Then use (3)-(4))

- Volatility σ = 10%
- Time to maturity = 6 months

$d_1 = [\ln(1.15/1.15) + (.012 - .022 + .1^2/2)\times.5]/(.1\times\sqrt{.5}) = -.035355$

$d_2 = d_1 - .1\times\sqrt{.5} = -.10607$

$N(d_1) = .48590, \quad N(-d_1) = 1 - N(d_1) = .51410$

$N(d_2) = .44776, \quad N(-d_2) = 1 - N(d_2) = .54224$

$C = 1.15\times e^{-.22\times.5}\times.48590 - 1.15\times e^{-.12\times.5}\times.44776 = .02939$

$P = 1.15\times e^{-.12\times.5}\times.54224 - 1.15\times e^{-.22\times.5}\times.51410 = .03509$

Vdate As At	25-Jul-24	A
Expdate	20-Sep-24	B
Vol	0.05124	C
Spot	7.2417	D
Strike	7.35	E
Rf	0.051440	F
Rd	0.031268	G
days=Edate-Vdate	57	
Year=days/365	0.156164384	
year_vol=Year*Vol	0.020248839	
t1=Ln(Spot/Strike)	-0.014844328	
t2=[Rd-Rf+(Vol^2)/2]*Year	-0.00294514	
nz1=(t1+t2)/year_vol	-0.878542637	
nz2=nz1-year_vol	-0.898791475	
N(nz1)	0.189824655	
N(nz2)	0.184381871	
N(-nz1)	0.810175345	
N(-nz2)	0.815618129	
exp_for=Year*Rf	0.991999083	
exp_dom=Year*Rd	0.995128954	
Call=[Spot*exp_for*N(nz1)] - [Strike*exp_dom*N(nz2)]	**0.01504924223**	H
Put=[Spot*exp_dom*N(-nz2)] - [Strike*exp_for*N(-nz1)]	-0.0294538551	I
Quantity	41,000,000.00	J
Transaction Ccy P/L	617,018.93	K=J*H
Valuation Ccy P/L	85,203.60	L=K*(1/D)

Click here to download the sample Excel tool to compute MTM. Enter VDate As At, Expiry Date, Volatility, Spot Rate, Strike Price, Foreign Interest Rate, Domestic Interest Rate and Quantity.

Note: If the system cannot compute the MTM, it will use the MTM as at the report date saved by the user on the Options listing screen. This MTM is in the transaction currency, so the system will convert it to the valuation currency using the spot rate (Valuation/Accounting/Alternate) as of the report date before displaying it in the report.

For example, if the user saved the MTM as 598,287.52 (CNH), then the MTM in the valuation currency (USD) is calculated as 598,287.52 * (1/7.2417) = 82,617.

FREQUENTLY ASKED QUESTIONS

RELATED INFORMATION

General Formatting For All Reports

CHANGE HISTORY

Date	By	Changes
6-Dec-2016	Li Ping	Created.
30-Oct-2018	TS	Updated.
17-Dec-2019	Lyra	Updated screenshots.
2-Aug-2024	TS	Updated instructions.
3-Sep-2024	TS	Updated to W6 instructions and screenshots.