LCH.CLEARNET

ForexClear
Sovereign Risk Margin: SRM
Methodology Document

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Contents

1. Purpose

This document is a technical information specification for ForexClear's *Sovereign Risk Margin* ("*SRM*") add-on. This document provides full details of the *SRM* methodology, specifically focused on foreign exchange non-deliverable forward ("NDF") contracts.

2. Overview

ForexClear is a foreign exchange clearing service for inter-bank and client clearers. ForexClear currently clears OTC foreign exchange non-deliverable forward ("NDF") contracts.

Initial Margin ("IM") is collected from each ForexClear member to cover the potential losses arising from a member's portfolio over a specified close-out period under prevailing market conditions. It represents the potential market risk on any open position. It is called regularly throughout the day and is used to cover an estimate of the worst probable potential future losses in the event of default of a clearing house member, given normal market conditions.

ForexClear IM is calculated using the *FxPAR ("Foreign Exchange Portfolio Analysis and Risk")* methodology based on a five-day holding period for House accounts (seven-day holding period for Client accounts) and an Expected Shortfall tail measure reflecting a minimum confidence level of 99.7%, consistent with LCH.Clearnet Board risk appetite. The model uses approximately ten years (2500 scenarios) of historical market to simulate potential changes in portfolio value. An estimate of potential loss is calculated based on the average of the 8 worst case simulated losses, which reflects a minimum confidence level of 99.7%.

The ForexClear IM measure considers normal market trading conditions and does not account for the potential risk due to a sovereign default event or an unexpected sovereign-related currency regime change. The *SRM* accounts for the risk that a government could default on its sovereign debt or other obligations. Generally, it is viewed as the risk associated with investing in a particular country.

For each currency pair in which a member has exposure, a margin multiplier is calculated to reflect the related underlying sovereign risk.

Note: In this paper, we assume that the quotation basis of all the non-deliverable currency pairs is USD/xxx which means that we will have "xxx" units of the non deliverable currency per 1 unit of USD.

3. Methodology

In the context of sovereign risk, there are two main sovereign events and risks that could severely impact the exchange rate level, and which we quantify separately:

1. Sovereign default risk
2. Currency regime change risk

3.1 Sovereign default risk

The first type of sovereign risk comes from a ***default of a country*** on part or all of its debt.

Indeed, in such a case, foreign investment as well as foreign capital immediately stops which may potentially lead to a severe devaluation of the currency, as witnessed in the Argentinean crisis in 2001 and in the Russian crisis in 1998. The devaluation would then result in losses for holders of the devalued currency.

Given the fact that there are instruments in the market that reflect the credit quality of a country and provide an estimation of the probability of the country defaulting on its debt, we can quantify the potential losses of long positions on the currency of the defaulted country.

At an account level (member or client), for long currency pair positions, the potential loss is calculated based on:

- an assumed price shock;
- an implied probability of default of the underlying sovereign country; and
- the size of the position;

3.1.1 Shock factor

For each currency pair, we assume a potential currency devaluation factor of **50%** against the USD currency in the event of a sovereign default.

Historical country default events and economic research indicates that it would be appropriate to assume a general default shock of 50% in the event of a country default. The 50% level has been calibrated in line with recent country default or near default estimation, as well as general recommendations from international monetary fund (IMF).

The devaluation factor will be reviewed on a regular basis by ForexClear Risk Management and the ForexClear Default Management Group, and in particular for the case of new currencies to be cleared.

3.1.2 Sovereign default probability

The country Credit Default Spread (CDS) gives insight into the level of risk associated with investing in a particular country.

Using the country's 5-year CDS spread, the probability of default is calculated using the closed analytical formula[1] shown below:

$$P_{T,i} = 1 - \mathrm{e}^{-\lambda \times \mathrm{T}} \quad (1)$$

where,

λ, hazard rate	$= \frac{S}{(1-R)}$
$P_{T,i}$	= probability of default at time T for currency pair i
T	= maturity for which the probability of default would be calculated. In our case, *T* would be equal to 0.25 (3 months)
S	= CDS spread for relevant sovereign
R	= assumed recovery rate

3.1.3 SRM charge

The sovereign default-related *SRM* add-on is calculated at an aggregated level for each currency pair. In the event of a sovereign default, investors holding a long position in the non-deliverable currency will incur a loss stemming from the devaluation of this currency (ie. an appreciation of the base currency) whereas the investors holding short positions will not incur any loss caused by a sovereign default.

[1] John C. Hull, Options, Futures, and Other Derivatives

The SRM charge to account for this risk is measured as:

$$SRM_{i,default} = \begin{cases} -P_{T,default} \times \delta_i \times \frac{X_{i,default}}{Spot_i(1+X_{i,default})} & , \delta_i > 0 \\ 0 & , \delta_i \leq 0 \end{cases} \quad (2)$$

where,

$SRM_{i,default}$	= the SRM charge for currency pair *i* due to a sovereign default
$X_{i,default}$	= the devaluation factor due to a sovereign default (expressed as an appreciation of the base currency)
$P_{T,default}$	= CDS-implied probability of default at time *T*
δ_i	= non-deliverable currency spot delta for currency pair *i*
$Spot_i$	= spot rate for currency pair *i* expressed as units of non-deliverable currency per 1 USD

3.2 Currency regime change risk

The second type of event, which can occur without necessarily having the country defaulting on its debt, is a ***currency regime change***.

Indeed, this can happen for pegged and semi-pegged currencies with exchange rates under high market pressure or for currencies with high political instability or increased volatility. In this case, a country can decide to modify the exchange rate regime of its currency due to:

- **Political factors** such as when the Chinese government decided to let the yuan float within tight boundaries on July 21st 2005; or
- **Economic factors** such as when the central bank of a country does not have enough foreign reserves to maintain the exchange rate at a certain level or intervene actively to maintain it at a specific level.

Geo-political decisions entailing a country to abandon its prevailing exchange rate regime and to switch to another regime are, by their nature, difficult to predict.

3.2.1 Currency eligibility

The currency regime change-related *SRM* add-on is applied on specific currencies that are exposed to cap, floor, peg, fixed and corridor or where a pair is subject to durable and unprecedented excess of volatility.

3.2.2 Shock factor

The relevant shock factor for each applicable currency pair considers the perceived price risk not already captured within the core IM model and is subject to review and approval by LCH Group Risk. Where applied, the shock factor provides a minimum margin cover level defined at the specific currency pair level over and above the core IM. The calibration of relevant shock parameters may consider stress events beyond the historical data window used in the Initial Margin calculation or the likely trading band of a managed currency.

The relevant shock factor, X_i, is calibrated as the difference between the minimum margin cover level ("TargetCoverage") and the core IM cover level for a specific currency pair *i*:

$$X_{i,regime} = TargetCoverage_{Ccy} - IM_{Ccy}$$

The SRM parameters are reviewed quarterly.

3.2.3 SRM charge

The currency regime change-related *SRM* add-on is calculated at an aggregated level for each currency pair. In the event of a currency regime change, the currency can be either depreciated or appreciated depending on the direction of the market pressure toward the currency. The SRM charge to account for this risk is measured as follows:

Scenario 1: currency depreciation

Investors holding a long position in the non-deliverable currency will incur a loss stemming from the depreciation of this currency (ie. an appreciation of the base currency), whereas investors holding short positions will not incur any loss. The SRM charge to account for this risk is measured as:

$$SRM_{i,regime\_D} = \begin{cases} -\delta_i \times \frac{X_{i,regime,D}}{Spot_i(1+X_{i,regime,D})} & , \delta_i > 0 \\ 0 & , \delta_i \leq 0 \end{cases} \quad (3)$$

where,

$SRM_{i,regime\_D}$	= the SRM charge for currency pair *i* due to a currency regime change resulting in non-deliverable currency depreciation
$X_{i,regime,D}$	= the shock factor due to a currency regime change (expressed as an appreciation of the base currency)
δ_i	= non-deliverable currency spot delta for currency pair *i*
$Spot_i$	= spot rate for currency pair *i* expressed as units of non-deliverable currency per 1 USD

Scenario 2: currency appreciation

Investors holding a short position in the non-deliverable currency will incur a loss stemming from the appreciation of this currency (ie. an depreciation of the base currency), whereas investors holding long positions will not incur any loss. The SRM charge to account for this risk is measured as:

$$SRM_{i,regime\_A} = \begin{cases} -\delta_i \times \frac{X_{i,regime,A}}{Spot_i(1+X_{i,regime,A})} & , \delta_i < 0 \\ 0 & , \delta_i \geq 0 \end{cases} \quad (4)$$

where,

$SRM_{i,regime\_A}$	= the SRM charge for currency pair *i* due to a currency regime change resulting in non-deliverable currency appreciation
$X_{i,regime,A}$	= the shock factor due to a currency regime change (expressed as an depreciation of the base currency)

3.3 SRM charge by currency pair

The total SRM charge for each currency pair will be the sum of the charges that apply for both short and long positions, noting that for short positions the default-related SRM and the regime change-related SRM potentially overlap and should therefore be viewed as non-additive.

The SRM charge for currency pair *i* is then calculated as follows:

$$SRM_i = \begin{cases} \min(SRM_{i,default}, SRM_{i,regime\_D}) & , \quad \delta_i > 0 \\ SRM_{i,regime\_A} & , \quad \delta_i \leq 0 \end{cases} \tag{5}$$

where,

SRM_i = the total SRM charges for currency pair *i*

3.4 SRM charge for portfolio

The total *SRM* charge for a portfolio is the sum of the total SRM charge of each currency pair:

$$SRM_{portfolio} = \sum_i^n SRM_i \tag{6}$$

4. Example

Consider a member with a portfolio that includes long and short positions on the currency pairs shown below.

Following the methodology detailed in the previous section, the default charge for each currency pair is calculated as follows:

Ccy Pair	Exchange Rate	Spot Delta (ccy)	CDS Spread	Recovery rate	PD 3M,Default	Shock Default	Shock Regime D	Shock Regime A	SRM Default	SRM Regime	SRM Total
USD/BRL	3.5547	108,861,543	323	25%	1.07%	50%			-109,321	0	-109,321
USD/CLP	696.13	-70,544,882,683	96	25%	0.32%	50%			0	0	0
USD/CNY	6.5453	1,824,264,012	125	40%	0.52%	50%	-2.00%	2.00%	-482,622	-5,464,993	-5,464,993
USD/COP	3,024.00	-125,966,384,984	220	25%	0.73%	50%			0	0	0
USD/IDR	13,540	-126,179,361,053	181	40%	0.75%	50%	-1.90%	1.30%	0	-180,494	-180,494
USD/INR	67.32	-12,677,540,043	172	40%	0.71%	50%			0	0	0
USD/KRW	1,191.28	123,346,220,341	62	40%	0.26%	50%			-89,046	0	-89,046
USD/MYR	4.0844	-284,508,797	154	40%	0.64%	50%	-1.70%	1.20%	0	-1,204,648	-1,204,648
USD/PEN	3.3261	-4,242,495,864	150	25%	0.50%	50%			0	0	0
USD/PHP	46.8225	-583,110,409	111	40%	0.46%	50%			0	0	0
USD/RUB	66.3352	242,563,124	249	25%		50%	-4.20%	2.70%		-96,133	
USD/TWD	32.762	15,009,554,151	83	20%	0.26%	50%			-395,586	0	-395,586
									-1,076,574	**-6,946,268**	**-7,444,087**

The Sovereign Risk Margin for the example above is therefore equal to **USD 7,444,087** and this would be added to the other liabilities generated after each margin run.

The attached spreadsheet contains an example of the SRM calculation.

SRM Example v8 0.xlsx