

Margin Calculations

Introduction

The following sections show the calculations used to determine the margin requirement of a simple Forex portfolio containing Forex Spot and Forex Option positions. Worked examples of the calculations for Delta Margin and Vega Margin requirements are given; these figures are then combined to show how the total Portfolio Margin Requirement for this Forex portfolio is calculated.

Positions

The Forex Spot and Forex Option positions shown in Table 1 represent the Forex portfolio for which the Portfolio Margin Requirement will be calculated.

Table 1 – Forex Spot and Forex Option positions of the Forex portfolio.

| Position Type | Put/Call | Notional Amount | Ccy Pair | Strike | Expiry Date | Delta | Vega | Implied Volatility | Volatility Factor |
|---------------|----------|-----------------|----------|---------|-------------|---------|----------|--------------------|-------------------|
| Forex | Spot | -1,000,000 | EURCHF | 1.54191 | - | 1 | 0 | - | - |
| Forex Option | Call | -500,000 | EURUSD | 1.4055 | 1 Month | 0.5123 | 0.001630 | 26.24% | 11% |
| Forex Option | Call | -1,000,000 | USDCHF | 1.0980 | 1 Month | 0.5082 | 0.001274 | 24.93% | 11% |
| Forex Option | Call | 1,000,000 | GBPUSD | 1.5020 | 1 Month | 0.5097 | 0.001742 | 24.01% | 11% |
| Forex Option | Call | 1,000,000 | USDCHF | 1.0990 | 1 Week | 0.5116 | 0.000607 | 25.49% | 28% |
| Forex Option | Put | -500,000 | GBPUSD | 1.4980 | 1 Month | -0.4955 | 0.001736 | 24.00% | 11% |

Delta Margin

The tables, descriptions and calculation examples below illustrate how the Delta Margin requirement for this Forex portfolio is calculated.

1. The Delta Exposure in the first currency is calculated for every Forex Spot and Forex Option position in the Forex portfolio. The Delta of a Forex Spot position is 1.

EXAMPLE CALCULATION FOR THE EURUSD FOREX OPTION CALL POSITION (USING THE DATA FROM TABLE 1):

$$\text{DELTA EXPOSURE} = \text{NOTIONAL AMOUNT} * \text{DELTA}$$

$$\begin{aligned} &=> -500,000 * 0.5123 \\ &= \text{EUR } -256,150 \end{aligned}$$

This is the value for the Delta Exposure (Ccy1) for EURUSD shown in Table 2. The Ccy2 exposure is relative to the Delta Exposure in quoted currency at the current spot rate. When switching from base to quoted currency, the sign changes. This is done with a multiplication of -1.

Table 2 – Delta exposures for the Forex Spot and Forex Option positions.

| Cross | Delta Exposure (Ccy1) | Delta Exposure (Ccy2) | Current Spot Rate |
|--------|-----------------------|-----------------------|-------------------|
| EURCHF | -1,000,000 | 1,541,910 | 1.54191 |
| EURUSD | -256,150 | 358,830 | 1.40086 |
| USDCHF | -508,200 | 461,673 | 1.10078 |
| GBPUSD | 509,700 | -762,837 | 1.49664 |
| USDCHF | 511,600 | -464,761 | 1.10078 |
| GBPUSD | 247,750 | -370,793 | 1.49664 |

2. Netted single currency delta exposures are calculated across all the positions.

EXAMPLE CALCULATION FOR THE USD DELTA EXPOSURE (USING THE DATA FROM TABLE 2):

$$\begin{aligned} &=> (-1 * -256,150 * 1.40086) + (-508,200) + (-1 * 509,700 * 1.49664) + (511,600) + (-1 * 247,750 * \\ &1.49664) \\ &= \text{USD } -771,400 \end{aligned}$$

This is the value for the Net Delta Exposure for USD shown in **Table 3**.

3. These netted single currency delta exposures are converted into the account currency (USD for this Forex portfolio) using the current USD spot rate, and are separated into absolute long and absolute short positions.

EXAMPLE CALCULATION FOR THE EUR POSITION (USING THE DATA FROM TABLE 3):

POSITION = DELTA EXPOSURE * USD SPOT RATE

$$\begin{aligned} &=> -1,256,150 * 1.40086 \\ &= \text{USD } -1,759,690 \end{aligned}$$

This is a short position, and the absolute value (of 1,759,690) for the Short Positions (USD Equivalent) for EUR is shown in **Table 3**.

4. The USD equivalent long and short positions across all currencies are summed separately.

EXAMPLE CALCULATION FOR THE LONG POSITIONS (USING THE DATA FROM TABLE 3):

$$\begin{aligned} &=> 1,397,343 + 1,133,630 \\ &= \text{USD } 2,530,973 \end{aligned}$$

This is the value for the sum of the Long Positions (USD Equivalent) shown in **Table 3**.

Table 3 – Netted single currency delta exposures for the Forex portfolio and separated USD equivalent long and short positions and their absolute totals.

| Currency | Net Delta Exposure | USD Spot Rate | Long Positions (USD Equivalent) | Short Positions (USD Equivalent) |
|----------|--------------------|---------------|---------------------------------|----------------------------------|
| EUR | -1,256,150 | 1.40086 | 0 | 1,759,690 |
| CHF | 1,538,821 | 1.10078 | 1,397,942 | 0 |
| GBP | 757,450 | 1.49664 | 1,133,630 | 0 |
| USD | -771,400 | 1.00000 | 0 | 771,400 |
| | | | 2,530,973 | 2,531,090 |

5. The largest absolute amount of the summed USD equivalent long and short positions is the delta exposure of the portfolio in the account currency.

EXAMPLE CALCULATION FOR THE FOREX PORTFOLIO (USING THE DATA FROM TABLE 3):

$$\begin{aligned} &=> 2,531,090 \text{ (sum of the Long Positions (USD Equivalent)) is greater than } 2,530,973 \text{ (sum of the Short Positions (USD Equivalent))} \\ &= \text{USD } 2,531,090 \end{aligned}$$

This is the value for the Delta Exposure (USD) shown in **Table 4**.

6. The Delta Margin requirement of the Forex portfolio is the spot exposure multiplied by the Forex spot margin requirement for the account currency.

EXAMPLE CALCULATION FOR THE DELTA MARGIN (USING THE DATA FROM TABLE 4):

$$\text{DELTA MARGIN} = \text{DELTA EXPOSURE} * \text{FOREX SPOT MARGIN REQUIREMENT}$$

$$\Rightarrow 2,531,090 * 2\%$$

$$= \text{USD } 50,622$$

This is the value of the Delta Margin (USD) shown in **Table 4**.

Table 4 – Delta Exposure and Delta Margin of the Forex portfolio.

| | | |
|-----------------------------|------------------|---------------|
| Delta Exposure (USD) | 2,531,090 | |
| Delta Margin (USD) | 2% | 50,622 |

Vega Margin

The vega margin calculation is designed to reflect the potential loss in the value of positions due to changes in volatility. This can be summarized as the following – for long positions there is a loss exposure from a decrease in volatility, while for short positions there is a loss exposure from an increase in volatility. The Tables, descriptions and calculation examples below illustrate how the Vega Margin requirement for this Option portfolio is calculated.

1. The Vega Margin requirement for each Forex Option position is calculated based on the change in value for a 1% (100 basis points) increase in implied volatility. The Vega of a Forex Spot position is 0 so these do not have a Vega Margin requirement.

EXAMPLE CALCULATION FOR THE EURUSD FOREX OPTION CALL POSITION (USING THE DATA FROM TABLE 1):

$$\text{VEGA MARGIN} = \text{NOTIONAL AMOUNT} * \text{VEGA} * \text{IMPLIED VOLATILITY} * \text{VOLATILITY FACTOR}$$

$$\begin{aligned} &=> -500,000 * 0.001630 * 26.24 * 11\% \\ &= \text{USD } -2,352 \end{aligned}$$

This is the value for the Vega Margin (Ccy2) for the EURUSD Forex Option position shown in Table 5.

2. The Vega Margin requirement for each position is converted into the account currency (USD for this Forex portfolio) using the current USD spot rate

EXAMPLE CALCULATION FOR THE USDCHF POSITION (USING THE DATA FROM TABLE 5):

$$\begin{aligned} &=> -3,494 / 1,10078 \\ &= \text{USD } -3,174 \end{aligned}$$

This is the value of the Vega Margin (USD Equivalent) of the USDCHF 1 Month Forex Option position shown in Table 5.

3. The Vega Margin requirements in the account currency are netted for each currency pair and exact expiry date (not maturity bucket).

EXAMPLE CALCULATION FOR THE GBPUSD 1 MONTH POSITIONS (USING THE DATA FROM TABLE 5):

$$\begin{aligned} &=> 4,601 + (-2,292) \\ &= \text{USD } 2,309 \end{aligned}$$

This is the value of the absolute Vega Margin (USD Equivalent) for the GBPUSD 1 Month Forex Option positions shown in Table 5.

Table 5 – Vega Margin calculations for the Forex Option positions in the Forex portfolio.

| Cross | Expiry Date | Vega Margin (Ccy2) | USD Spot Rate | Vega Margin (USD Equivalent) |
|--------|-------------|--------------------|---------------|------------------------------|
| EURUSD | 1 Month | -2,352 | 1.00000 | -2,352 |
| | | | | 2,352 |
| USDCHF | 1 Month | -3,494 | 1,10078 | -3,174 |
| | | | | 3,174 |
| GBPUSD | 1 Month | 4,601 | 1.00000 | 4,601 |
| GBPUSD | 1 Month | -2,292 | 1.00000 | -2,292 |
| | | | | 2,309 |
| USDCHF | 1 Week | 4,332 | 1,10078 | 3,936 |
| | | | | 3,936 |

4. The Vega Margin requirement for the Forex portfolio is the sum of the absolute value of the netted (by currency pair and expiry date) Vega Margin requirements.

EXAMPLE CALCULATION FOR THE VEGA MARGIN (USING THE DATA FROM TABLE 5):

$$\Rightarrow 2,352 + 3,174 + 2,309 + 3,936$$

$$= \text{USD } 11,771$$

This is the value of the Vega Margin (USD) shown in Table 6.

Table 6 – Vega Margin for the Forex portfolio.

| | |
|--------------------------|---------------|
| Vega Margin (USD) | 11,771 |
|--------------------------|---------------|

Portfolio Margin Requirement

The tables, descriptions and calculation examples below describe how the Delta Margin and Vega Margin requirements are combined to determine the Portfolio Margin Requirement for this Forex portfolio.

1. The Delta Margin and Vega Margin requirements in the account currency (taken from Table 4 and Table 6, respectively) are summed to determine the Margin Required for the Forex portfolio.

EXAMPLE CALCULATION FOR THE MARGIN REQUIRED (USING THE DATA FROM TABLE 7):

MARGIN REQUIRED = DELTA MARGIN + VEGA MARGIN

$$\begin{aligned} &=> 50,622 + 11,771 \\ &= \text{USD } 62,393 \end{aligned}$$

This is the value for the Margin Required shown in Table 7.

2. Across Forex products, the margin rates for the first EUR 50,000 of investment collateral are 50% of the normal margin rates. This “double equity” level must be taken into consideration to determine the Portfolio Margin Requirement for the Forex portfolio.

EXAMPLE CALCULATION FOR THE PORTFOLIO MARGIN REQUIREMENT (USING THE DATA FROM TABLE 7):

$$\begin{aligned} &=> \text{As } 62,393 \text{ is less than the “double equity” level of USD } 70,043 \text{ (given EURUSD spot rate @ } 1,40086) \\ &=> 62,393 / 2 \\ &= \text{USD } 31,196 \end{aligned}$$

This is the value for the Portfolio Margin Requirement shown in Table 7.

Table 7 – Margin calculations for the Forex portfolio.

| | USD |
|-------------------------------------|---------------|
| Delta Margin | 50,622 |
| Vega Margin | 11,771 |
| Margin Required | 62,393 |
| “Double Equity” (EUR 50,000) | 70,043 |
| Portfolio Margin Requirement | 31,196 |

The above calculations show that the Portfolio Margin Requirements for the Forex portfolio shown in Table 1 is **USD 31,196**.