

SPAN® methodology

Calculating margins for portfolios of futures contracts on WIBOR reference rates and futures contracts on Treasury bonds settled in cash

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1. Risk parameter examples

Main parameters

| Class | PSR | PSR intraday | VSR | Minimum margin for short position in options |
|-------|-------|--------------|-----|--|
| 1MW | 0.34% | --- | --- | --- |
| 3MW | 0.51% | --- | --- | --- |
| 6MW | 0.53% | --- | --- | --- |
| STB | 1.60% | --- | --- | --- |
| MTB | 3.20% | --- | --- | --- |
| LTB | 4.30% | --- | --- | --- |

Level definitions

| Class | Level | Instruments |
|-------|-------|-------------------------|
| 1MW | 1 | Futures |
| 3MW | 1 | Futures, series 1 - 6 |
| | 2 | Futures, series 7 - 10 |
| | 3 | Futures, series 11 - 13 |
| 6MW | 1 | Futures, series 1 - 6 |
| | 2 | Futures, series 7 - 10 |
| STB | 1 | Futures |
| MTB | 1 | Futures |
| LTB | 1 | Futures |

Intra-class spread definitions

| Class | Priority | Level – leg 1 | Number of deltas | Market side 1 (A/B) | Level – leg 2 | Number of deltas | Market side 2 (A/B) | Margin |
|-------|----------|---------------|------------------|---------------------|---------------|------------------|---------------------|--------|
| 1MW | 1 | 1 | 1 | A | 1 | 1 | B | 500 |
| 3MW | 1 | 2 | 1 | A | 2 | 1 | B | 250 |
| 3MW | 2 | 3 | 1 | A | 3 | 1 | B | 400 |
| 3MW | 3 | 1 | 1 | A | 1 | 1 | B | 475 |

| | | | | | | | | |
|-----|---|---|---|---|---|---|---|------|
| 3MW | 4 | 2 | 1 | A | 3 | 1 | B | 575 |
| 3MW | 5 | 1 | 1 | A | 2 | 1 | B | 600 |
| 3MW | 6 | 1 | 1 | A | 3 | 1 | B | 775 |
| 6MW | 1 | 2 | 1 | A | 2 | 1 | B | 1050 |
| 6MW | 2 | 1 | 1 | A | 1 | 1 | B | 1050 |
| 6MW | 3 | 1 | 1 | A | 2 | 1 | B | 1500 |
| STB | 1 | 1 | 1 | A | 1 | 1 | B | 880 |
| MTB | 1 | 1 | 1 | A | 1 | 1 | B | 1140 |
| LTB | 1 | 1 | 1 | A | 1 | 1 | B | 720 |

Inter-class spread credit

| Priority | crt | Class1 | Number of deltas | Market side 1 (A/B) | Class2 | Number of deltas | Market side 2 (A/B) |
|----------|-------|--------|------------------|---------------------|--------|------------------|---------------------|
| 1 | 41.0% | 3MW | 2 | A | 6MW | 1 | B |
| 2 | 27.5% | 1MW | 1 | A | 3MW | 1 | B |
| 3 | 22.7% | 1MW | 2 | A | 6MW | 1 | B |
| 4 | 64.4% | MTB | 1 | A | LTB | 1 | B |
| 5 | 53.1% | STB | 1 | A | MTB | 1 | B |
| 6 | 42.1% | STB | 1 | A | LTB | 1 | B |

2. Calculations for a portfolio of WIBOR futures contracts

Portfolio 1.

| Instrument | Number of positions | Settlement price |
|------------|---------------------|------------------|
| F1MWZ13 | -2 | 98.00 |
| F1MWF14 | 2 | 97.90 |

1. Calculating a scenario risk margin for a class of futures contracts

For futures contracts, a scenario risk margin is calculated as PSR for the class times the absolute value of the position.

$$drsc(1MW) = 0.34\% * |-2 * 98 * 2500 + 2 * 97.9 * 2500| = 1.70$$

2. Calculating an intra-class spread margin

2.1 Calculating the delta for each level in a class

The delta for a level is the sum of the deltas for all instruments in the portfolio. The delta for an instrument is the instrument's reference delta (equal to 1 for futures contracts) times the number of positions times the delta scaling factor. The delta scaling factor reflects differences in the value of contracts. All WIBOR contracts within each class (1MW, 3MW, 6MW) have the same multiplier; hence, the delta scaling factor of all contracts is 1. The delta is equal to the number of positions.

Results for the example portfolio:

| Class | Level | Positive delta | Negative delta |
|-------|-------|----------------|----------------|
| 1MW | 1 | 2 | 2 |

2.2 Calculating a delta in the spread for defined spreads

The delta in the spread is an absolute value (no sign). The delta value is based on the delta of each level and spread definition. A defined spread includes several legs (at least 2) for which the following are defined: levels, direction of the required correlation between levels (opposite market sides or not), number of deltas. Priorities are assigned to defined spreads within a class.

The delta in the spread is determined in the first place for priority 1 spread, next for priority 2 spread, etc.

There is only 1 spread in class 1MW. According to the spread definition in class 1MW, 1 positive delta and 1 negative delta are required to create 1 spread. There

are 2 positive deltas and 2 negative deltas available; consequently, 2 spreads can be created in class 1MW.

2.3 Calculating an intra-class spread margin

$$dswk(1MW) = 2 * 500 = 1000$$

3. Calculating a portfolio margin

$$DZ = drsc(1MW) + dswk(1MW) = 1.7 + 1000 = 1001.7$$

Portfolio 2.

| Instrument | Number of positions | Settlement price |
|------------|---------------------|------------------|
| F3MWV13 | -20 | 98 |
| F3MWF14 | 50 | 97.9 |
| F3MWM14 | -10 | 97.9 |
| F3MWH15 | 4 | 97.8 |

1. Calculating a scenario risk margin for a class of futures contracts

$$\begin{aligned}
 drsc(3MW) &= 0,51\% \\
 &* |-20 * 98 * 2500 + 50 * 97.9 * 2500 - 10 * 97.9 * 2500 + 4 * 97.8 \\
 &* 2500| = 29926.8
 \end{aligned}$$

2. Calculating an intra-class spread margin

2.1 Calculating the delta for each level in a class

The delta scaling factor for contracts in class 3MW is 1. This gives the following table:

| Class | Level | Positive delta | Negative delta |
|-------|-------|----------------|----------------|
| 3MW | 1 | 50 | 20 |
| 3MW | 2 | | 10 |
| 3MW | 3 | 4 | |

2.2 Calculating a delta in the spread for defined spreads

Check whether spreads of subsequent priorities can be created.

Priority 1.

| Priority | Leg1 | Leg2 | Margin |
|----------|------|------|--------|
|----------|------|------|--------|

| | Level | Number of deltas | Market side | Level | Number of deltas | Market side | |
|---|-------|------------------|-------------|-------|------------------|-------------|-----|
| 1 | 2 | 1 | A | 2 | 1 | B | 250 |

Both legs of the spread have level 2. There are only 10 negative deltas available for level 2. No spread can be created, there are no deltas with opposite signs for level 2.

Priority 2.

| Priority | Leg1 | | | Leg2 | | | Margin |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Level | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 2 | 3 | 1 | A | 3 | 1 | B | 400 |

Both legs of the spread have level 3. There are only 5 positive deltas available for level 3. No spread can be created, there are no deltas with opposite signs for level 3.

Priority 3.

| Priority | Leg1 | | | Leg2 | | | Margin |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Level | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 3 | 1 | 1 | A | 1 | 1 | B | 475 |

Both legs of the spread have level 1. There are 50 positive deltas and 20 negative deltas available. 1 positive delta and 1 negative delta are required to create 1 spread; consequently, it is possible to create 20 spreads. After they are created, all negative deltas and 20 out of 50 positive deltas for level 1 have been used; 30 positive deltas remain to be used for other spreads.

Priority 4.

| Priority | Leg1 | | | Leg2 | | | Margin |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Level | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 4 | 2 | 1 | A | 3 | 1 | B | 575 |

There are 10 negative deltas for leg 1 and 4 positive deltas for leg 2 available. 1 positive delta and 1 negative delta are required to create 1 spread; consequently, it is possible to create 4 spreads. After they are created, all positive deltas for level 3 and 4 out of 10 negative deltas for level 2 have been used; 6 negative deltas for level 2 remain to be used for other spreads.

Priority 5.

| Priority | Leg1 | | | Leg2 | | | Margin |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Level | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 5 | 1 | 1 | A | 2 | 1 | B | 600 |

There are 30 positive deltas for leg 1 and 6 negative deltas for leg 2 available. 1 positive delta and 1 negative delta are required to create 1 spread; consequently, it is possible to create 6 spreads. After they are created, all negative deltas and 6 out of 30 positive deltas for level 2 have been used; 24 positive deltas remain to be used for other spreads.

Priority 6.

| Priority | Leg1 | | | Leg2 | | | Margin |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Level | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 6 | 1 | 1 | A | 3 | 1 | B | 775 |

No spread can be created, there are no deltas for leg 2.

Summary of created spreads

| Priority | Level – leg 1 | Available number of deltas | Level – leg 2 | Available number of deltas | Used deltas |
|----------|---------------|----------------------------|---------------|----------------------------|-------------|
| 1 | 2 | 10 | 2 | 0 | 0 |
| 2 | 3 | 5 | 3 | 0 | 0 |
| 3 | 1 | 50 | 1 | 20 | 20 |
| 4 | 2 | 10 | 3 | 4 | 4 |
| 5 | 1 | 30 | 2 | 6 | 6 |
| 6 | 1 | 24 | 3 | 0 | 0 |

2.3 Calculating an intra-class spread margin

$$dswk(3MW) = 20 * 475 + 4 * 575 + 6 * 600 = 15400$$

3. Calculating a portfolio margin

$$DZ = drsc(3MW) + dswk(3MW) = 29926.8 + 15400 = 45326.8$$

Portfolio 3.

| Instrument | Number of positions | Settlement price |
|------------|---------------------|------------------|
| F1MWZ13 | -2 | 98 |
| F1MWF14 | 2 | 97.9 |
| F3MWV13 | -20 | 98 |
| F3MWF14 | 50 | 97.9 |
| F3MWM14 | -10 | 97.9 |
| F3MWH15 | 4 | 97.8 |
| F6MWZ13 | -13 | 97.5 |

1. Calculating a scenario risk margin for a class of futures contracts

$$drsc(1MW) = 1.70$$

$$drsc(3MW) = 29926.8$$

$$drsc(6MW) = 0.53\% * |-13 * 97.5 * 5000| = 33588.75$$

2. Calculating an intra-class spread margin for a class

$$dswk(1MW) = 1000$$

$$dswk(3MW) = 20 * 475 + 4 * 575 + 6 * 600 = 15400$$

There are no spreads in class 6MW.

3. Calculating an inter-class spread margin

3.1 Calculating net deltas for a class

$$DN(1MW) = -2 + 2 = 0$$

$$DN(3MW) = -20 + 50 - 10 + 4 = 24$$

$$DN(6MW) = -13$$

3.2 Calculating the unit risk of price change of a class

This is calculated only for those classes where the net delta is other than 0 (in the example, no inter-class spreads are created for class 1MW).

For classes of futures contracts only, the unit risk of price change is equal to the scenario risk margin to the absolute value of the net delta.

$$jrzc(3MW) = \frac{29926.8}{24} = 1246.95$$

$$jrzc(6MW) = \frac{33588.75}{13} = 2583.75$$

3.3 Calculating a delta in the inter-class spread for defined spreads

Check whether spreads of subsequent priorities can be created.

Priority 1.

| Priority | Leg1 | | | Leg2 | | | Credit |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Class | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 1 | 3MW | 2 | A | 6MW | 1 | B | 41% |

There are 24 positive deltas for leg 1 and 13 negative deltas for leg 2 available. 2 deltas for leg 1 and 1 delta with the opposite sign for leg 2 are required to create 1 spread; consequently, it is possible to create 12 spreads. After they are created, all deltas for class 3MW and 12 out of 13 negative deltas for class 6MW have been used; 1 negative delta for class 6MW remains to be used for other spreads.

As there are no deltas in the other classes, no more spreads can be created.

3.4 Calculating an inter-class spread credit for a class

The credit for a class is the unit risk of price change times the number of created spreads times the number of deltas in the spread definition times the credit rate in the spread definition.

$$cspk(3MW) = 1246.95 * 12 * 2 * 41\% = 12269.99$$

$$cspk(6MW) = 2583.75 * 12 * 1 * 41\% = 12712.05$$

4. Calculating a valuation margin of a class

$$DZW = drsc + dswk - cspk$$

$$DZW(1MW) = 1000 + 1.7 = 1001.7$$

$$DZW(3MW) = 29926.8 + 15400 - 12269.99 = 33056.81$$

$$DZW(6MW) = 33588.75 - 12712.05 = 20876.7$$

5. Calculating a portfolio margin

$$DZ = DZW(1MW) + DZW(3MW) + DZW(6MW) = 54935.21$$

3. Calculations for a portfolio of futures contracts on Treasury bonds

Portfolio 4.

| Instrument | Number of positions | Settlement price |
|------------|---------------------|------------------|
| FSTBZ13 | 10 | 101 |
| FSTBM14 | -20 | 106 |
| FMTBZ13 | 20 | 104.94 |
| FMTBH14 | -50 | 98 |
| FMTBM14 | 10 | 102 |
| FSTBZ13 | -10 | 100.5 |
| FSTBH14 | 10 | 101 |
| FSTBM14 | 40 | 102 |

1. Calculating a scenario risk margin for a class of futures contracts

$$drsc(STB) = 1.6\% * |10 * 101 * 1000 - 20 * 106 * 1000| = 17760$$

$$drsc(MTB) = 3.2\% * |20 * 104.94 * 1000 - 50 * 98 * 1000 + 10 * 102 * 1000| = 56998.4$$

$$drsc(LTB) = 4.3\% * |-10 * 100.05 * 1000 + 10 * 101 * 1000 + 40 * 102 * 1000| = 175848.5$$

2. Calculating an intra-class spread margin for a class

2.1 Calculating the delta for each level in a class

Similar to WIBOR futures contracts, the delta is equal to the number of positions. According to the level definitions, all expiry dates in classes STB, MTB and LTB have the same level.

Results for the example portfolio:

| Class | Level | Positive delta | Negative delta |
|-------|-------|----------------|----------------|
| STB | 1 | 10 | -20 |
| MTB | 1 | 30 | -50 |
| LTB | 1 | 50 | -10 |

2.2 Calculating a delta in the spread for defined spreads

There is only 1 spread definition in each class: STB, MTB and LTB. According to the spread definitions, 1 positive delta and 1 negative delta are required to create 1 spread in each class.

There are 10 positive deltas and 20 negative deltas available for class STB; consequently, it is possible to create 10 spreads for class STB.
 There are 30 positive deltas and 50 negative deltas available for class MTB; consequently, it is possible to create 30 spreads for class MTB.
 There are 50 positive deltas and 10 negative deltas available for class LTB; consequently, it is possible to create 10 spreads for class LTB.

2.3 Calculating an intra-class spread margin for a class

$$dswk(STB) = 10 * 880 = 8800$$

$$dswk(MTB) = 30 * 1140 = 34200$$

$$dswk(LTB) = 10 * 720 = 7200$$

3. Calculating an inter-class spread margin

3.1 Calculating net deltas for a class

$$DN(STB) = 10 - 20 = -10$$

$$DN(MTB) = 30 - 50 = -20$$

$$DN(LTB) = 50 - 10 = 40$$

3.2 Calculating the unit risk of price change of a class

$$jrzc(STB) = \frac{17760}{10} = 1776$$

$$jrzc(MTB) = \frac{56998.4}{20} = 2849.92$$

$$jrzc(LTB) = \frac{175848.5}{40} = 4396.21$$

3.3 Calculating a delta in the inter-class spread for defined spreads

Check whether spreads of subsequent priorities can be created.

Priority 4.

| Priority | Leg1 | | | Leg2 | | | Credit |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Class | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 4 | MTB | 1 | A | LTB | 1 | B | 64.4% |

There are 20 negative deltas for leg 1 and 40 positive deltas for leg 2 available. 1 delta for leg 1 and 1 delta with the opposite sign for leg 2 are required to create 1 spread; consequently, it is possible to create 20 spreads. After they are created, all deltas for class MTB and 20 out of 40 negative deltas for class LTB have been used; 20 negative deltas for class LTB remain to be used for other spreads.

Priority 5.

| Priority | Leg1 | | | Leg2 | | | Credit |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Class | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 5 | STB | 1 | A | MTB | 1 | B | 53.1% |

No spread can be created, there are no deltas for leg 2.

Priority 6.

| Priority | Leg1 | | | Leg2 | | | Credit |
|----------|-------|------------------|-------------|-------|------------------|-------------|--------|
| | Class | Number of deltas | Market side | Level | Number of deltas | Market side | |
| 6 | STB | 1 | A | LTB | 1 | B | 42.1% |

There are 10 negative deltas for leg 1 and 20 positive deltas for leg 2 available. 1 delta for leg 1 and 1 delta with the opposite sign for leg 2 are required to create 1 spread; consequently, it is possible to create 10 spreads.

3.4 Calculating an inter-class spread credit for a class

The credit for a class is the unit risk of price change times the number of created spreads times the number of deltas in the spread definition times the credit rate in the spread definition.

$$cspk(STB) = 1776 * 10 * 1 * 42.1\% = 7476.96$$

$$cspk(MTB) = 2849.92 * 20 * 1 * 64.4\% = 36706.97$$

$$cspk(LTB) = 4396.21 * 20 * 1 * 64.4\% + 4396.21 * 10 * 1 * 42.1\% = 75131.22$$

4. Calculating a valuation margin of a class

$$DZW = drsc + dswk - cspk$$

$$DZW(STB) = 17760 + 8800 - 7476.96 = 19083.04$$

$$DZW(MTB) = 56998.4 + 34200 - 36706.97 = 54491.43$$

$$DZW(LTB) = 175848.5 + 7200 - 75131.22 = 107917.28$$

5. Calculating a portfolio margin

$$DZ = DZW(STB) + DZW(MTB) + DZW(LTB) = 181491.75$$