Fixed Income Margin Guide (SE)

A guide to margin calculations on Swedish fixed income products

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Introduction

Purpose of document

This document describes the methods applied by NOMX in order to calculate margins for Swedish fixed income products. The products covered include; bond forwards, forward rate agreements (FRA contracts), RIBA futures and NOIS futures (IRS futures). The document is divided into three main sections.

1. Naked margin calculations; describes the basic formulas applied to calculate the margins for a portfolio that consists of uncorrelated instruments.
2. Cross margining; describes the methodology applied by NOMX in order to give correlation benefits when margining portfolios with correlated instruments.
3. Expiration settlement margin; describes the margin calculations that are performed in between the expiration and settlement of the contracts.

Purpose of margin calculations

One of the principal functions of the clearinghouse is to guarantee that all contracts registered with it for clearing will be honored. This means that NOMX becomes the counterparty in all transactions, i.e. as buyer to the seller and as seller to the buyer. Each clearing participant thereby acquires rights and obligations with respect to the clearinghouse, not the original counterparty.

NOMX requires margins from the clearing participants. The margin requirement should theoretically be the market value of the participant's account. However, under normal conditions an account cannot be closed at the instant a participant defaults at the prevailing market prices. It typically takes time to neutralize the account and the value of the account can change during this period, and this market risk must be catered for in the margin methodology.

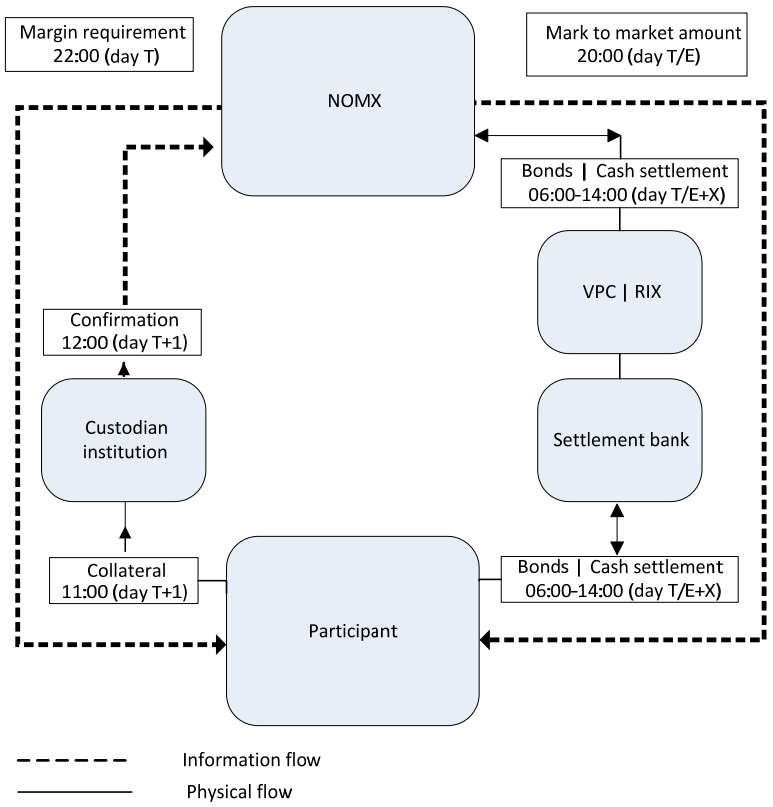
For a clearing organization the level of margins is of crucial importance. Low level of margins will affect the counterparty risk of the clearing organization in a negative manner. Very high level of margins will limit the counterparty risk taken by the clearing organization but may discourage trading. To achieve the right balance, NOMX uses a system called RIVA, based on a methodology called OMS II.

Basic flows

There are two main flows between NOMX and the clearing participants.

1. Margin – Collateral; NOMX calculates the margin requirement for all open contracts at the end of each trading day (T). The margin requirement becomes available to the clearing participants at around CET 22:00 on day T. The clearing participants cover their margin requirement with collateral. The collateral is placed at a custodian institution in an account pledged to NOMX. The clearing participants must have sufficient collateral in place before CET 11:00 on day T+1. The custodian institutions are required to confirm to NOMX before CET 12:00 on day T+1 that the margin requirements are covered with collateral.
2. Mark to market – Settlement; NOMX provides the clearing participants with settlement instructions. The daily mark to market amounts for the RIBA- and NOIS-futures are provided after each trading day (T), the monthly cash settlement amounts for the bond forwards and the FRA-contracts are provided at the end of each month and the final settlement instructions are provided on the expiration day (E) of the contracts. The cash settlement takes place in the Swedish central bank's electronic cash clearing system for banks (RIX) and the bond delivery takes place in the Swedish central securities depository (VPC). The settlement takes place at CET 11:45 on day T/E+X and the bond delivery takes place in between CET 06:00 – 14:00 on day E+X (X is product specific).

Figure



Contract styles

Swedish fixed income contracts may either be future- or forward-styled. The figure below shows which contracts that belong to the respective group.

Figure

Contract	Style
Bond forwards	Forward
Forward rate agreements	Forward
RIBA futures	Future
NOIS futures	Future

Forward contracts

Monthly cash settlement

The fixed income forwards are hybrid futures/forward contracts. The hybrid style arises from the fact that the contract is not settled daily; instead a monthly cash settlement is carried out. This means that margin calculations for fixed income forwards must consider the trade yield or the previous month fixing yield depending on if the trade was carried out during the month or previous to the last monthly cash settlement. Furthermore, the margin calculation must consider the current market price of the forward and the potential movement of the underlying value.

At the end of each month the accrued profit and losses on all fixed income forwards contracts are settled at a closing yield for that month, the monthly fixing yield. This effectively revalues open positions to the monthly fixing yield, which is the yield used when calculating subsequent margin requirements.

Margin style

These contracts are forward-style contracts. This means that all positions remain open in the system until expiration occurs. Therefore a bond forward position that consists of 10 bought and 10 sold contracts, whilst being technically flat, will have a margin calculation that consists of the locked in profit or loss of the net position. If the number is positive, i.e. the trade has resulted in profits, this unrealized amount will be used to offset margin of other positions in the portfolio. Do notice that after a monthly settlement the required margin will be zero for a net position, as the profit or loss will have been settled, although the net positions remain on the customer's account until expiration.

When a position is partially netted the calculations are divided in two separate parts:

1. For the net open position margin is calculated using the average contract yield as trade price.
2. The P&L of the netted part is calculated by comparing the average contract yield for bought positions with the respective average contract yield for sold positions. The resulting P&L is added to the margin calculated in 1.

Future styled contracts

Daily cash settlement

The fixed income futures are daily cash settled contracts. This implies that their profit or loss is daily marked to market. The open margin calculations for fixed income futures therefore consider the last fixing yield of the future and the potential movement of the underlying value.

Margin style

These contracts are future-style contracts. This means that all positions that may be netted will be netted in the system. A future position that consists of 10 bought and 10 sold contracts will therefore not get an open margin.

Naked margin calculations

Bond forwards

Definitions

t	-	Day
n	-	Outstanding coupons
C	-	Coupon rate
N	-	Nominal value
d	-	Number of days between the contract's expiration date and next coupon payment (30E)
Q_n	-	Number of contracts that may be netted against opposite positions
Q_o	-	Number of open contracts
Par	-	Risk interval parameter
$r_{cb/s}$	-	Average contracted yield for bought/sold contract
r_t	-	Fixing yield at day t
Adj	-	Adjustment factor for bought/sold contracts (expressed in percent)
Ad_n	-	Adjustment factor for bought/sold contracts (expressed in money)

Formulas

Conversion formula

Equation (1) is used to convert a price quoted in yield to a price in money.

$$P_{bond}(r) = N \cdot \frac{\left(\frac{C}{r}\cdot((1+r)^n-1)+1\right)}{\left((1+r)^{\left(\frac{d}{360}+n-1\right)}\right)} \quad (1)$$

Margin

A position's open margin, also referred to as initial margin, shall cover market movements for two days. The naked open margin is the open margin if there are no correlated contracts in the portfolio. The naked open margin is calculated according to Equation (2) – Equation (6).

Netted contracts

The netted contracts will contribute to the open margin with a closed in profit or loss (P&L). This is calculated according to Equation (2).

$$P\&L = [\ P_{bond}(r_{cs}) - P_{bond}(r_{cb})\ ] \cdot Q_n \quad (2)$$

Bought open contracts

If the portfolio contains bought contracts that cannot be netted towards sold contracts, then the naked open margin will be given by Equation (4).

$$Ad_n = [\ P_{bond}(r_t \cdot (1 - Adj)) - P_{bond}(r_t)\ ] \quad (3)$$

$$\text{Naked open margin} = P\&L + [\ P_{bond}(r_t + Par) - P_{bond}(r_{cb}) - Ad_n\ ] \cdot Q_o \quad (4)$$

Sold open contracts

If the portfolio contains sold contracts that cannot be netted towards bought contracts, then the naked open margin will be given by Equation (6).

$$Ad_n = [\ P_{bond}(r_t) - P_{bond}(r_t \cdot (1 + Adj))\ ] \quad (5)$$

$$\text{Naked open margin} = P\&L + [\ P_{bond}(r_{cs}) - P_{bond}(r_t - Par) - Ad_n\ ] \cdot Q_o \quad (6)$$

Note

1. All contracts that have participated in a monthly cash settlement shall use the previous month fixing yield as $r_{cb/s}$ in Equation (2) – (7).
2. R2, R5, R10, ST2 and ST5 are all based on a synthetic underlying bond with exactly 2-, 5-, 10-years to maturity from the expiration date of the forward contract. They will therefore always use $d = x \cdot 360$, were x is the contract's underlying rate period (i.e. 2-, 5- or 10-years).
3. NBHYP2, NBHYP5, SPA2 and SPA5 are based on a real underlying bond. Their value of d will therefore be equal to the number of days from the expiration of the forward contract to the next coupon payment of the underlying bonds (every month is considered to have 30 days (30E)).
4. The risk interval parameters are reviewed regularly by NOMX. They can be found on http://nordic.nasdaqomxtrader.com.

Example

Consider the below portfolio of 100 bought R2U contracts.

t	-	2009-07-27
n	-	2
C	-	6 %
N	-	SEK 1 000 000
d	-	720
Q_o	-	100
Par	-	30 basis points
r_{cb}	-	1,05 %
r_t	-	1,041 %
Adj	-	0,1 %
Ad_n	-	Adjustment factor for bought/sold contracts (expressed in money)

Margin

Since this portfolio only contains the R2U contracts the open margin is equal to the naked open margin calculated according to Equation (3) and Equation (4).

$Ad_n = [\ P_{bond}(1{,}041\ \% \cdot (1 - 0{,}001)) - P_{bond}(1{,}041\ \%)\ ] = [\ 1\ 097\ 674{,}53 - 1\ 097\ 652{,}52\ ] = \text{SEK } 22{,}01.$

$\text{Open margin} = [\ P_{bond}(1{,}041\ \% + 0{,}30\ \%) - P_{bond}(1{,}05\ \%) - 22{,}01\ ] \cdot 100 =$

$[\ 1\ 091\ 338{,}64 - 1\ 097\ 462{,}30 - 22{,}01\ ] \cdot 100 = \text{SEK } -614\ 566.$

Forward rate agreements

Definitions

t	-	Day
d	-	Number of days between expiration of the contract and the following IMM date (30E)
N	-	Nominal value
Q_n	-	Number of contracts that may be netted against opposite positions
Q_o	-	Number of open contracts
Par	-	Risk interval parameter
$r_{cb/s}$	-	Average contracted yield for bought/sold contracts
r_t	-	Fixing yield at day t
Adj	-	Adjustment factor for bought/sold contracts

Formulas

Conversion formula

Equation (7) is used to convert a price quoted in yield to a price in money.

$$P_{FRA}(r) = r \cdot \frac{d}{360} \cdot N \qquad (7)$$

Margin

A position's open margin, also referred to as initial margin, shall cover market movements for two days. The naked open margin is the open margin if there are no correlated contracts in the portfolio. The naked open margin is calculated according to Equation (8) – Equation (10).

Locked in profit or loss

The netted contracts will contribute to the open margin with a closed in profit or loss (P&L). This is calculated according to Equation (8).

$$P\&L = [\ P_{FRA}(r_{cs}) - P_{FRA}(r_{cb})\ ] \cdot Q_n \qquad (8)$$

Bought open contracts

If the portfolio contains bought contracts that cannot be netted towards sold contracts, then the naked open margin will be given by Equation (9).

$$\text{Naked open margin} = P\&L + [\ [\ P_{FRA}(r_t \cdot (1 - Adj) - Par)\ ]_0 - P_{FRA}(r_t)\ ] \cdot Q_O \qquad (9)$$

Sold open contracts

If the portfolio contains sold contracts that cannot be netted towards bought contracts, then the naked open margin will be given by Equation (10).

$$\text{Naked open margin} = P\&L + [\ P_{FRA}(r_t) - [\ P_{FRA}(r_t \cdot (1 + Adj) + Par)\ ]_0\ ] \cdot Q_O \qquad (10)$$

Note

1. $[\ldots]_x$ means rounding to x decimals.
2. All contracts that have participated in a monthly cash settlement shall use the previous month fixing yield as $r_{cb/s}$ in Equation (8) – (10).
3. The risk interval parameters are reviewed regularly by NOMX. They can be found on http://nordic.nasdaqomxtrader.com.

Example

Consider the below portfolio of 100 sold FRA09U contracts.

t	-	2009-07-27
d	-	91 days
N	-	SEK 1 000 000
Q_o	-	1 000
Par	-	40 basis points
r_{cs}	-	1,30 %
r_t	-	1,25 %
Adj	-	0,1 %

Margin

Since this portfolio only contains the FRA09U contracts the open margin is equal to the naked open margin calculated according to Equation (10).

$$\text{Open margin} = [\ P_{FRA}(1{,}30\ \%) - [\ P_{FRA}(1{,}25\ \% \cdot (1{,}001) + 0{,}40\ \%)\ ]_0\ ] \cdot 1\,000 =$$

$$= [\ 3\,286{,}11 - [\ 4\,173{,}99\ ]_0\ ] \cdot 1\,000 = \text{SEK } -887\,889.$$

RIBA future

Definitions

t	-	Day
IMM	-	Number of days in IMM period
N	-	Nominal value
Q	-	Number of contracts
Par	-	Risk interval parameter
r_c	-	Average contracted yield
r_t	-	Fixing yield at day t
Adj	-	Adjustment factor for bought/sold contracts

Formulas

Conversion formula

Equation (11) is used to convert a price quoted in yield to a price in money.

$$P_{RIBA}(r) = r \cdot \frac{IMM}{360} \cdot N \quad (11)$$

Margin

A position's open margin, also referred to as initial margin, shall cover market movements for two days. The naked open margin is the open margin if there are no correlated contracts in the portfolio. The naked open margin is calculated according to Equation (12) and Equation (13).

Bought contracts

$$\text{Naked open margin} = [\, P_{RIBA}(r_t - Par - Adj) - P_{RIBA}(r_t) \,]_2 \cdot Q \quad (12)$$

Sold contracts

$$\text{Naked open margin} = [\, P_{RIBA}(r_t) - P_{RIBA}(r_t + Par + Adj) \,]_2 \cdot Q \quad (13)$$

Mark to market

The RIBA futures are daily cash settled products. This implies that the contracts are daily marked to market. The mark to market amount is given by Equation (14) and Equation (15).

Bought contracts

$$\text{Mark to market amount} = [\, P_{RIBA}(r_t) - P_{RIBA}(r_{t-1}) \,] \cdot Q \quad (14)$$

Sold contracts

$$\text{Mark to market amount} = [\, P_{RIBA}(r_{t-1}) - P_{RIBA}(r_t) \,] \cdot Q \quad (15)$$

Note

1. $[\ldots]_x$ means rounding to x decimals.
2. For positions that were bought/sold on day t the average contracted yield is used instead of r_{t-1} in Equation (14) and Equation (15).
3. The risk interval parameters are reviewed regularly by NOMX. They can be found on http://nordic.nasdaqomxtrader.com.

Example

Consider a portfolio of 1 000 bought RIBAU9 contracts.

t	-	2009-08-04
IMM	-	91 days
N	-	SEK 1 000 000
Q	-	1 000
Par	-	35 basis points
r_c	-	1,15 %
r_t	-	1,10 %
Adj	-	0,02 %

Open margin

Since this portfolio only contains RIBAU9 contracts the open margin is equal to the naked open margin calculated according to Equation (12).

Open margin = $[\ P_{RIBA}(1{,}10\ \% - 0{,}35\ \% - 0{,}02\ \%) - P_{RIBA}(1{,}10\ \%)\ ]_2 \cdot 1\ 000 =$

$= [1\ 845{,}28 - 2\ 780{,}56]_2 \cdot 1\ 000 = \text{SEK } -935\ 280.$

Mark to market

The daily cash settlement amount is equal to the position's profit or loss and it is calculated according to Equation (14).

Mark to market amount = $[\ P_{RIBA}(1{,}10\ \%) - P_{RIBA}(1{,}15\ \%)\ ] \cdot 1\ 000 =$

$= [\ 2\ 780{,}56 - 2906{,}94\ ] \cdot 1\ 000 = \text{SEK } -126\ 389.$

NOIS future

Definitions

t	-	Day
n	-	Number of periods (2, 5 or 10)
N	-	Nominal value
Q	-	Quantity
Par	-	Risk interval parameter
r_c	-	Average contracted yield
r_t	-	Fixing yield at day t
Adj	-	Adjustment factor for bought/sold contracts

Formulas

Conversion formula

Equation (16) is used to convert a price quoted in yield to a price in money.

$$P_{NOIS}(r) = \sum_{i}^{n} \frac{r \cdot N}{(1+r)^{i}} \tag{16}$$

Margin

A position's open margin, also referred to as initial margin, shall cover market movements for two days. The naked open margin is the open margin if there are no correlated contracts in the portfolio. The naked open margin is calculated according to Equation (17) and Equation (18).

Bought contracts

Naked open margin = $[\ P_{NOIS}(r_t - Par - Adj) - P_{NOIS}(r_t)\ ]_2 \cdot Q$ (17)

Sold contracts

Naked open margin = $[\ P_{NOIS}(r_t) - P_{NOIS}(r_t + Par + Adj)\ ]_2 \cdot Q$ (18)

Mark to market

The NOIS futures are daily cash settled products. This implies that the contracts are daily marked to market. The mark to market amount is given by Equation (19) and Equation (20).

Bought contracts

Mark to market amount = $[\ P_{NOIS}(r_t) - P_{NOIS}(r_{t-1})\ ] \cdot Q$ (19)

Sold contracts

Mark to market amount = $[\ P_{NOIS}(r_{t-1}) - P_{NOIS}(r_t)\ ] \cdot Q$ (20)

Note

1. $[\ldots]_x$ means rounding to x decimals.
2. For positions that were bought/sold on day t the average contracted yield is used instead of r_{t-1} in Equation (19) and Equation (20).
3. The risk interval parameters are reviewed regularly by NOMX. They can be found on http://nordic.nasdaqomxtrader.com.

Example

Consider a portfolio of 2 000 bought IRS2U9 contracts.

t	-	2009-08-04
n	-	2
N	-	SEK 1 000 000
Q	-	2 000
Par	-	30 basis points
r_c	-	1,75 %
r_t	-	1,70 %
Adj	-	0,02 %

Margin

Since this portfolio only contains the IRS2U9 contracts the open margin is equal to the naked open margin calculated according to Equation (17).

Open margin = $[\ P_{NOIS}(1{,}70\ \% - 0{,}30\ \% - 0{,}02\ \%) - P_{NOIS}(1{,}70\ \%)\ ]_2 \cdot 2\,000 =$

$= [\ 27\,093{,}01 - 33\,152{,}24\ ]_2 \cdot 2\,000 = \text{SEK } -12\,226\,460.$

Mark to market

The mark to market amount equals the position's profit and loss and it is calculated according to Equation (19).

Mark to market amount = $[\ P_{NOIS}(1{,}70\ \%) - P_{NOIS}(1{,}75\ \%)\ ] \cdot 2000 = [\ 33\,152{,}24 - 34\,102{,}23\ ]_2 \cdot 2\,000 =$

$= \text{SEK } -1\,899\,971.$

Cross margining

Background

A number of the fixed income contracts cleared by NOMX demonstrate a historical statistical relationship that indicates that they are correlated in some way, i.e. they tend to move in the same direction with a similar magnitude. It is therefore required that the margining system takes such relationship into account when calculating the margin requirement. Calculations of allowed correlation between two or more instruments are based on the strength of the historical relationship.

The figures below show which products that are given correlation benefits by NOMX, a cross (X) in the figures implies that correlation benefits are given between the contracts. The first figure shows the correlation benefits given between different bond forwards and the IRS futures while the second figure shows the correlation benefits given between different FRA contracts and the RIBA futures.

Figure

	R2	R5	R10	ST2	ST5	SPA2	SPA5	NBHYP2	NBHYP5	IRS2	IRS5	IRS10
R2	X			X		X		X		X		
R5		X			X		X		X		X	
R10			X									X
ST2	X			X		X		X		X		
ST5		X			X		X		X		X	
SPA2	X			X		X		X		X		
SPA5		X			X		X		X		X	
NBHYP2	X			X		X		X		X		
NBHYP5		X			X		X		X		X	
IRS2	X			X		X		X		X		
IRS5		X			X		X		X		X	
IRS10			X									X

Figure

	RIBA	FRA
RIBA	X	X
FRA	X	X

The methodology applied by NOMX in order to perform cross margining between different contracts is called the window method. This document describes the window method with an example.

Example

Portfolio

Consider a portfolio consisting of 1 000 bought contracts of RIBAU9 at a contracted yield of 1,05% and 700 sold contracts of RIBAH9 at a contracted yield of 1,15%.

RIBAU9 (bought)		
T	-	2009-09-03
IMM	-	91
N	-	SEK 1 000 000
Q	-	1 000
Par	-	35 basis points
r_{cb}	-	1,05 %
r_t	-	1,05 %
Adj	-	0,02 %

RIBAH9 (sold)		
t	-	2009-09-03
IMM	-	91
N	-	SEK 1 000 000
Q	-	700
Par	-	35 basis points
r_{cs}	-	1,15 %
r_t	-	1,15 %
Adj	-	0,02 %

Vector files

RIVA produces vector files for each contract cleared at NOMX. The vector files are built up of several nodes and each node contains its corresponding stressed margin price as well as the open margin calculated with that price. This document gives a simplified description of the vector file concept. A more profound description of the different vector files and their construction is given in the NOMX API Manual.

The fixed income vector files contain 201 nodes, and the margin price (i.e. the fixing yield) will scan between $r_t \pm$ Par evenly distributed over the 201 nodes. Each node of the vector file also contains an open margin calculated according to Equation (21) and Equation (22). It should be noted that Equation (21) and Equation (22) in fact are the same as Equation (12) and Equation (13) but rewritten as functions of the fixing yield, r_t, and the adjusted fixing yield at the node, r_{node}.

Bought contracts

$$\text{Open margin}_{node}(r_{node}, r_t) = [\, P_{RIBA}(r_{node} - \text{Adj}) - P_{RIBA}(r_t)\,]_2 \cdot Q \qquad (21)$$

Sold contracts

$$\text{Open margin}_{node}(r_{node}, r_t) = [\, P_{RIBA}(r_t) - P_{RIBA}(r_{node} + \text{Adj})\,]_2 \cdot Q \qquad (22)$$

The given portfolio would result in two vector files, one for RIBAU9 and one for RIBAH9, as can be seen by the figures below. It should be noted that in order to easier facilitate an understanding of the window concept the vector files of this example contain 31 nodes instead of 201.

Figure

RIBAU9 vector file

Node	r_{node}	Open $margin_{node}(r_{node}, r_t)$
0	0,70 %	-935 280
1	0,72 %	-876 300
2	0,75 %	-817 310
3	0,77 %	-758 330
4	0,79 %	-699 350
5	0,82 %	-640 370
6	0,84 %	-581 390
7	0,86 %	-522 410
8	0,89 %	-463 430
9	0,91 %	-404 440
10	0,93 %	-345 460
11	0,96 %	-286 480
12	0,98 %	-227 500
13	1,00 %	-168 520
14	1,03 %	-109 540
15	1,05 %	-50 560
16	1,07 %	8 430
17	1,10 %	67 410
18	1,12 %	126 390
19	1,14 %	185 370
20	1,17 %	244 350
21	1,19 %	303 330
22	1,21 %	362 310
23	1,24 %	421 300
24	1,26 %	480 280
25	1,28 %	539 260
26	1,31 %	598 240
27	1,33 %	657 220
28	1,35 %	716 200
29	1,38 %	775 190
30	1,40 %	34 170

RIBAH9 vector file

Node	r_{node}	Open $margin_{node}(r_{node}, r_t)$
0	0,80 %	583 919
1	0,82 %	542 633
2	0,85 %	501 340
3	0,87 %	460 054
4	0,89 %	418 768
5	0,92 %	377 482
6	0,94 %	336 196
7	0,96 %	294 910
8	0,99 %	253 617
9	1,01 %	212 331
10	1,03 %	171 045
11	1,06 %	129 759
12	1,08 %	88 473
13	1,10 %	47 187
14	1,13 %	5 901
15	1,15 %	-35 392
16	1,17 %	-76 678
17	1,20 %	-117 964
18	1,22 %	-159 250
19	1,24 %	-200 536
20	1,27 %	-241 822
21	1,29 %	-283 108
22	1,31 %	-324 401
23	1,34 %	-365 687
24	1,36 %	-406 973
25	1,38 %	-448 259
26	1,41 %	-489 545
27	1,43 %	-530 831
28	1,45 %	-572 117
29	1,48 %	-613 410
30	1,50 %	-654 696

Window size

In this example the window size between RIBAU9 and RIBAH9 is 40 % (which corresponds to a correlation of around 60 %). A window of 13 nodes (40% of 31 that must be an odd number) is therefore created. The window represents the maximum number of nodes that the RIBAU9 and the RIBAH9 fixing prices may differ from each other in the margin calculations.

Window method

The window will slide through the RIBAU9 and RIBAH9 vector files and during this process a result vector file is created. The value in the result vector file is the sum of the worst open margin for RIBAU9 and RIBAH9 within the window.

The 13 nodes wide window will start in the first node of the vector files i.e. at node 0. The worst possible combined margin at this node is equal to RIBAU9's open margin from node 0 plus RIBAH9's open margin from node 6. This can be seen in the figure below.

Figure

RIBAU9				RIBAH9				Result vector			
Node	r_{node}	Open margin		Node	r_{node}	Open margin		Node	r_{node}		Combined Margin
0	**0,70 %**	**-935 280**		0	0,80 %	583 919		0	0,70 %	0,94 %	-599 084
1	0,72 %	-876 300		1	0,82 %	542 633		1			
2	0,75 %	-817 310		2	0,85 %	501 340		2			
3	0,77 %	-758 330		3	0,87 %	460 054		3			
4	0,79 %	-699 350		4	0,89 %	418 768		4			
5	0,82 %	-640 370		5	0,92 %	377 482		5			
6	0,84 %	-581 390		**6**	**0,94 %**	**336 196**		6			
7	0,86 %	-522 410		7	0,96 %	294 910		7			
8	0,89 %	-463 430		8	0,99 %	253 617		8			
9	0,91 %	-404 440		9	1,01 %	212 331		9			
10	0,93 %	-345 460		10	1,03 %	171 045		10			
11	0,96 %	-286 480		11	1,06 %	129 759		11			
12	0,98 %	-227 500		12	1,08 %	88 473		12			
13	1,00 %	-168 520		13	1,10 %	47 187		13			
14	1,03 %	-109 540		14	1,13 %	5 901		14			
15	1,05 %	-50 560	+	15	1,15 %	-35 392	=	15			
16	1,07 %	8 430		16	1,17 %	-76 678		16			
17	1,10 %	67 410		17	1,20 %	-117 964		17			
18	1,12 %	126 390		18	1,22 %	-159 250		18			
19	1,14 %	185 370		19	1,24 %	-200 536		19			
20	1,17 %	244 350		20	1,27 %	-241 822		20			
21	1,19 %	303 330		21	1,29 %	-283 108		21			
22	1,21 %	362 310		22	1,31 %	-324 401		22			
23	1,24 %	421 300		23	1,34 %	-365 687		23			
24	1,26 %	480 280		24	1,36 %	-406 973		24			
25	1,28 %	539 260		25	1,38 %	-448 259		25			
26	1,31 %	598 240		26	1,41 %	-489 545		26			
27	1,33 %	657 220		27	1,43 %	-530 831		27			
28	1,35 %	716 200		28	1,45 %	-572 117		28			
29	1,38 %	775 190		29	1,48 %	-613 410		29			
30	1,40 %	834 170		30	1,50 %	-654 696		30			

The window will slide down the vector files until all nodes have been covered and the result vector is completely filled. The value in the result vector is always the worst outcome within the window which can be seen by the figure below.

Figure

RIBAU9				RIBAH9				Result vector			
Node	r_{node}	Open margin		Node	r_{node}	Open margin		Node	r_{node}		Combined Margin
0	0,70 %	-935 280		0	0,80 %	583 919		0	0,70 %	0,94 %	-599 084
1	0,72 %	-876 300		1	0,82 %	542 633		1	0,70 %	0,96 %	-640 370
2	0,75 %	-817 310		2	0,85 %	501 340		2	0,70 %	0,98 %	-681 663
3	0,77 %	-758 330		3	0,87 %	460 054		3	0,70 %	1,01 %	-722 949
4	0,79 %	-699 350		4	0,89 %	418 768		4	0,70 %	1,03 %	-764 235
5	0,82 %	-640 370		5	0,92 %	377 482		5	0,70 %	1,06 %	-805 521
6	0,84 %	-581 390		6	0,94 %	336 196		6	0,70 %	1,08 %	-846 807
7	0,86 %	-522 410		7	0,96 %	294 910		7	0,74 %	1,10 %	-829 113
8	0,89 %	-463 430		8	0,99 %	253 617		8	0,75 %	1,13 %	-811 409
9	0,91 %	-404 440		9	1,01 %	212 331		9	0,77 %	1,15 %	-793 722
10	0,93 %	-345 460		10	1,03 %	171 045		10	0,79 %	1,17 %	-776 028
11	0,96 %	-286 480		11	1,06 %	129 759		11	0,82 %	1,20 %	-758 334
12	**0,98 %**	**-227 500**		12	1,08 %	88 473		12	0,84 %	1,22 %	-740 640
13	1,00 %	-168 520		13	1,10 %	47 187		13	0,86 %	1,24 %	-722 946
14	1,03 %	-109 540		14	1,13 %	5 901		14	0,89 %	1,27 %	-705 252
15	1,05 %	-50 560	+	15	1,15 %	-35 392	=	15	0,91 %	1,29 %	-687 548
16	1,07 %	8 430		16	1,17 %	-76 678		16	0,93 %	1,31 %	-669 861
17	1,10 %	67 410		17	1,20 %	-117 964		17	0,96 %	1,34 %	-652 167
18	1,12 %	126 390		18	1,22 %	-159 250		**18**	**0,98 %**	**1,36 %**	**-634 473**
19	1,14 %	185 370		19	1,24 %	-200 536		19			
20	1,17 %	244 350		20	1,27 %	-241 822		20			
21	1,19 %	303 330		21	1,29 %	-283 108		21			
22	1,21 %	362 310		22	1,31 %	-324 401		22			
23	1,24 %	421 300		23	1,34 %	-365 687		23			
24	1,26 %	480 280		**24**	**1,36 %**	**-406 973**		24			
25	1,28 %	539 260		25	1,38 %	-448 259		25			
26	1,31 %	598 240		26	1,41 %	-489 545		26			
27	1,33 %	657 220		27	1,43 %	-530 831		27			
28	1,35 %	716 200		28	1,45 %	-572 117		28			
29	1,38 %	775 190		29	1,48 %	-613 410		29			
30	1,40 %	834 170		30	1,50 %	-654 696		30			

The margin requirement for the combined portfolio is chosen as the worst value in the result vector. In this example this is equal to SEK -846 807, which is the value at node 6 in the result vector. The result shall be interpreted as follows.

The worst value for the portfolio is that the price for RIBAU9 goes down to 0,70 %. If this happens the worst possible outcome for RIBAH9, given the correlation history of the two contracts, is that it goes down to 1,08 %. Therefore the margin requirement for the complete portfolio is the sum of the open margin for the two contracts given that the RIBAU9 fixing goes down to 0,70 % and the RIBAH9 fixing goes down to 1,08 %.

Figure

Result vector

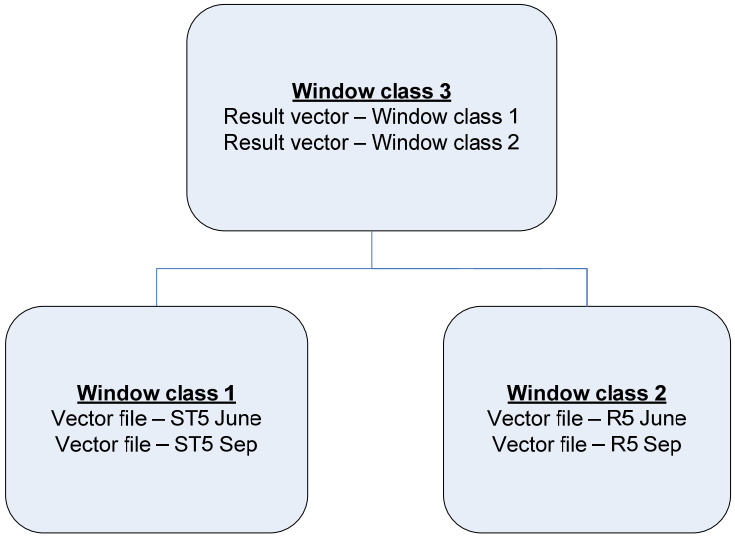
Node	r_{node}		Combined Margin
0	0,70 %	0,94 %	-599 084
1	0,70 %	0,96 %	-640 370
2	0,70 %	0,98 %	-681 663
3	0,70 %	1,01 %	-722 949
4	0,70 %	1,03 %	-764 235
5	0,70 %	1,06 %	-805 521
6	**0,70 %**	**1,08 %**	**-846 807**
7	0,74 %	1,10 %	-829 113
8	0,75 %	1,13 %	-811 409
9	0,77 %	1,15 %	-793 722
10	0,79 %	1,17 %	-776 028
11	0,82 %	1,20 %	-758 334
12	0,84 %	1,22 %	-740 640
13	0,86 %	1,24 %	-722 946
14	0,89 %	1,27 %	-705 252
15	0,91 %	1,29 %	-687 548
16	0,93 %	1,31 %	-669 861
17	0,96 %	1,34 %	-652 167
18	0,98 %	1,36 %	-634 473
19	1,00 %	1,38 %	-616 779
20	1,03 %	1,41 %	-599 085
21	1,05 %	1,43 %	-581 391
22	1,07 %	1,45 %	-563 687
23	1,10 %	1,48 %	-546 000
24	1,12 %	1,50 %	-528 306
25	1,14 %	1,50 %	-469 326
26	1,17 %	1,50 %	-410 346
27	1,19 %	1,50 %	-351 366
28	1,21 %	1,50 %	-292 386
29	1,24 %	1,50 %	-233 396
30	1,26 %	1,50 %	-174 416

Window trees

The fixed income instruments are placed in window trees. A window tree is built up of several layers of window classes and the instruments with the closest correlation are placed in the same window class in the bottom of the tree.

The window method is a recursive method; it is first applied to the window classes in the bottom of the window tree. It is here applied on the vector files of the instruments within the same window class. During this process a new vector file, the result vector, is created according to the procedures described by the above example. The result vector is then combined with result vectors from the other window classes in the tree and, as a result, a new result vector is created. This procedure is repeated until the top of the window tree has been reached.

Figure



Please note that a complete list of the current window trees and their respective window sizes can be found on http://nordic.nasdaqomxtrader.com.

Expiration settlement margin

When a contract expires there is a period of time before settlement of expired contracts is effected, during which time the clearinghouse still guarantees fulfillment of all expired contracts. In view of this, margins are required for the period between expiration and settlement.

Swedish bond forwards have a two part expiration settlement procedure. First the contracts are cash settled against the expiration fixing yield. Second, the net open positions are delivered, priced to the expiration fixing yield. Thus profits and losses on the notional contract are cash settled and net open positions are delivered at prevailing market price. The FRA-, RIBA- and NOIS-contracts are non-deliverable instruments and are only cash settled.

To allow for this structure, NOMX applies a two tier expiration margin requirement. First, the margin requirement is credited/debited with an amount equal to the cash settlement due to/from the participant. Then an additional margin is required for bond positions to be delivered, to cover the risk of the market moving between expiration and settlement, the participant defaulting on his delivery obligation and the exchange having to step in to purchase/sell bonds at a disadvantageous price. This margin is calculated as the difference between the price of the bond based on the expiration settlement price and the price of the bond based on a specific move in the yield between expiration and settlement.