

Margin Guide
for fixed income derivatives



EFFICIENT SECURITIES TRANSACTIONS

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One of the principal functions of the clearinghouse is to guarantee that all contracts registered with it for clearing will be honoured. This means that the clearing organization 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. This permits a secondary market to function more efficient since a clearing participant may close a position without recourse to the original counterparty.

OMX Derivatives Markets is registered as a secondary name to OMX Nordic Exchange Stockholm AB, and is used within the derivatives trading and clearing operations of OMX Nordic Exchange. OMX Derivatives Markets relies on an advanced portfolio-based margining system in order to determine the amount of required collateral that is appropriate to compensate for the counterparty risk it assumes in its capacity as a clearing organization.

This manual has been designed to provide a comprehensive guide to the margining process for fixed income derivatives. The manual is divided into two parts, the first containing a written description of the margin system and methodology, the second containing calculation examples of two different product types including a cross-margin calculation.

PART 1

RIVA – the margining system

The purpose of a margin system is to calculate sufficient margin requirement for each account. The margin requirement should theoretically be the market value of the account. However, an account cannot normally be closed at the instant the participant defaults at the prevailing market prices. Normally, it takes time to neutralize the account and the value of the account can change during this period.

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, OMX uses a system called RIVA, based on a methodology called OMS II.

RIVA looks at the portfolio as a whole to see how an adverse movement in the value of the underlying instruments would affect the value of the entire portfolio. RIVA uses a range of inputs in the margin calculation, a few of which are specified below.

VALUATION INTERVAL

Different values for the account must be calculated since the market often moves after collateral is pledged and until the clearing organization can close a position in the event of a default situation. In order to achieve this, RIVA varies the price for the underlying instrument for each series in order to calculate the neutralization cost. In this way, RIVA creates a “valuation interval” (or scanning range) for each underlying instrument.

The size of the valuation interval depends on the length of the lead-time and the size of the historic fluctuations in the price over this lead-time.

EXAMPLE:

Assume the valuation interval for a Bond forward contract is +25/-25 basis points of the closing yield. Based on a closing yield of 4%, the calculation would be as follows:

Upper limit = 4% + 25bp = 4,25%

Lower limit = 4% - 25bp = 3,75%

Therefore the RIVA system would calculate margins based on the premise that the yield for the bond forward contract will not go below 3,75% or above 4,25% during the time period corresponding to the lead time.

LEAD TIME

The lead time is the maximum length of time it takes to discover that there is a problem with an account, to determine if the account needs to be neutralized and to eventually close out the risk in the account.

VALUATION POINTS

The upper and lower limits of the valuation interval represent the worst expected movement (during the lead-time) for the underlying instrument. However, the worst-case scenario for a portfolio with different options and forwards/futures based on the same underlying can occur anywhere in the valuation interval. In order to reflect this, the valuation interval is divided into a number of valuation points; 201 for most fixed income products. RIVA calculates the neutralization cost for every series with the same underlying security in each valuation point; the actual margin requirement is then based on the valuation point that rendered the highest margins, i.e. the worst-case scenario. This means that a portfolio that contains series for which margins normally would be calculated at different ends of the valuation interval is calculated in the same valuation point. This methodology is justified since the underlying instrument can only go in one direction at the time.

CORRELATIONS

If two different instruments show a high correlation, a method is needed that takes this into consideration. The method used by RIVA is called "the window method". Here the valuation interval limits the individual movement for each series, but there is a maximum allowed difference between the valuation points of the two series. This range can be represented as a window, hence the name.

VECTOR FILES

RIVA produces a vector file for each contract cleared at OMX. A vector file consists of series data that is shared by all positions in the series. There are primarily two reasons to produce a vector file. The first is to achieve computational efficiency and the second is that the vector files can be distributed externally so that members can replicate the margin calculations in their own systems.

The vector file is a data file that contains the estimated liquidation prices for each series at each valuation point, and is similar to the files known as Price Arrays that are available from some clearinghouses.

Monthly Cash Settlement

Forward contracts based on Swedish fixed income instruments that are cleared by OMX 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.

As OMX's fixed income contracts are forward-style contracts, all positions remain open in the system until expiration occurs. Therefore a bond forward position that consists of 10 held and 10 written 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 unrealised 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.

ACP - AVERAGE CONTRACT PRICE

If a position includes many different bought and sold trades on the same forward, RIVA does not perform the calculation for every trade involved. Instead RIVA calculates an ACP, one for bought contracts and one for sold contracts. The different ACP's are calculated as an average of forward prices weighted by volume.

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

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

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 revalue open positions to the monthly fixing yield, which is the yield used when calculating subsequent margin requirements.

PART 2

Margining of bond forwards

The general principle of margin calculation for bond forwards is to take the original trade price and compare it to the estimated worst case movement based on that day's closing prices, similar to the way stock and index forwards are calculated. There are a few changes that have to be made for this to work. The first is to convert the yield (on which the contract is traded) to a price. The second is to take the monthly cash settlement into consideration; the price of a position held over such settlement must be altered in the margin calculation to reflect the fact that profits and losses to the end of the previous month have been settled.

EXAMPLE: MARGINING CALCULATIONS FOR BOND FORWARD AND VECTOR FILE CALCULATIONS

On August 16th, the margin requirement was calculated for the following position in the September 5- Year Swedish Government Bond Forward:

R5UU	TRADED LOTS	TRADED RATE
Bought	100	5,150% (Traded in July)
Bought	20	5,500% (Traded in August)
Sold	100	5,400% (Traded in August)
July Fixing R5UU		5,328%
Closing mid yield		5,940%

The purchase of 100 bought contracts at 5,150% in July has already been subject to an interim settlement at the end of July, at the monthly fixing yield of 5,328%. Since the difference between the traded price and the monthly fixing yield has already been settled, the margin calculation is done by using the previous month fixing yield and not the trade price in the calculations.

Thus, the positions to be margined become:

Bought	100	5,328%
Bought	20	5,500%
Sold	100	5,400%

The general principle for margining of bond forwards, is to take the trade price and compare it to the estimated worst market move based on the settlement price. The contracts are traded on yield and must therefore be converted to a price quoted in money.

The formula below is used to convert yield to price in money and is applicable for instruments with one coupon per year.

$$P = \frac{\left(\frac{C}{Y}\right) \left((1+Y)^n - 1\right) + N}{(1+Y)^{\left((n-1) + \frac{t}{360}\right)}} \quad \text{Eq.1}$$

Where:

- P = Price
- C = Coupon (6%)
- Y = Yield to maturity
- n = Remaining number of coupons (e.g. 5)
- N = Redemption price (e.g. 100)
- t = Number of days until next coupon
(Every month is 30 days (30E))

$$P = \frac{\left(\frac{6}{5,328}\right) \left((1+5,328)^5 - 1\right) + 100}{(1+5,328)^{\left(5-1+\frac{360}{360}\right)}} = 102,883$$

Forward Price	5,328%	=102,883
Forward Price	5,5%	=102,135
Forward Price	5,4%	=102,569
ACP (Bought)		=102,759
ACP (Sold)		=102,569

According to the methodology for calculating the margin requirement for Swedish Fixed Income forwards, the locked in profit or loss (P&L) on the netted position is added to the margin requirement for the open net position, using the ACP.

The locked in P&L on the contracts is calculated as follows:

$$(102,569 - 102,759) \cdot 10000 \cdot 100 = -189\,325,745$$

The price is calculated in percent of nominal value. Since the nominal value is 1 000 000, the price is multiplied by 1 000 000/100=10 000 to get the actual contract value.

The required margin for the open position is calculated, as a first step, by calculating the yield at which the open contracts should, using the equation 1, be valued at:

Closing mid yield	=5,94%
Valuation Interval for 5 year government bond	25bp/-25bp
Upper limit 5,94+0,25	=6,19%
Forward price FP(u) 6,19%	=99,204 (By applying Eq. 1)
Lower limit 5,94-0,25	=5,69%
Forward price FP(l) 5,69%	=101,317 (By applying Eq. 1)

FP(u) is the forward price in the upper end point of the Valuation Interval, representing the worst case price movement for a bought bond forward.

FP(l) is the forward price in the lower end point of the Valuation Interval, representing the worst case price movement for a sold bond forward.

The second step when calculating the required margin for the open position, is to adjust for a synthetic spread with 0,999 and 1,001 since the upper and lower limits are derived from the closing mid yield. This adjustment should be expressed in SEK and is calculated using equation 1.

As RIVA use the mid price of the forward's bid and offer, a spread factor is applied to the price to achieve a synthetic spread. The spread factor currently used by OMX is 0,1 percent up and down from the mid price.

Bid side adjustment factor	=0,999
Adjustment yield 5,94·0,999	=5,934
Forward price 5,94	=100,253
Forward price 5,934%	=100,278
Adjustment factor, AF(b), in % of nominal amount	=(100,278-100,253) =0,02511
Offer side adjustment factor	=1,001
Adjustment yield 5,94·1,001	=5,946
Forward price 5,94%	=100,253
Forward price 5,94594%	=100,228
Adjustment factor , AF(s), in % of nominal amount	=(100,253-100,228) =0,02510

The required margin for an open position is calculated according to equation 2 and 3 below:

$$RM(b) = [FP(u) - ACP(b) - AF(b)] \cdot 10\,000 \cdot P \quad \text{Eq.2}$$

$$RM(s) = [ACP(s) - FP(l) - AF(s)] \cdot 10\,000 \cdot P \quad \text{Eq.3}$$

Where:

- RM(b) = Required margin for bought contracts
- RM(s) = Required margin for sold contracts
- ACP(b) = Average contract price for bought contracts
- ACP(s) = Average contract price for sold contracts
- AF(b) = Adjustment factor for bought contracts
- AF(s) = Adjustment factor for sold contracts
- P = Number of bought or sold contracts
- FP(u) = Forward price upper and point
- FP(l) = Forward price lower and point

Required margin for the open position in this example:

$$RM(b) = [99,204 - 102,759 - 0,02511] \cdot 10\,000 \cdot 20 = -715\,974,862$$

The total required margin for the open position is the sum of the locked in P&L and the required margin for the open position i.e.:

$$\text{Total Required Margin} = -189325,745 + (-715974,862) = -905\,301$$

VECTOR FILES

At each valuation point, the vector file contains the value of the bid and offer, of the bond contract. This means that the formula to calculate the required margin depends on whether the position is bought or sold. Since forwards/futures values, unlike those for options, are not affected by the changes in volatility, the first column for futures is repeated across the other two, so that the entire file retains the same format.

VECTOR FILE DATA

	R5	Bought	Sold	Bought	Sold	Bought	Sold
0	5,690	101,292	101,342	101,292	101,342	101,292	101,342
1	5,693	101,281	101,331	101,281	101,331	101,281	101,331
2	5,695	101,270	101,321	101,270	101,321	101,270	101,321
3	5,698	101,260	101,310	101,260	101,310	101,260	101,310
4	5,700	101,249	101,299	101,249	101,299	101,249	101,299
...
98	5,935	100,249	100,299	100,249	100,299	100,249	100,299
99	5,938	100,239	100,289	100,239	100,289	100,239	100,289
100	5,940	100,228	100,278	100,228	100,278	100,228	100,278
101	5,943	100,217	100,268	100,217	100,268	100,217	100,268
102	5,945	100,207	100,257	100,207	100,257	100,207	100,257
...
196	6,180	99,220	99,271	99,220	99,271	99,220	99,271
197	6,183	99,210	99,260	99,210	99,260	99,210	99,260
198	6,185	99,200	99,250	99,200	99,250	99,200	99,250
199	6,188	99,189	99,239	99,189	99,239	99,189	99,239
200	6,190	99,179	99,229	99,179	99,229	99,179	99,229

VALUATION POINT MARGIN REQUIREMENT

$$\text{MRVP}_{\text{bought}}(i) = [\text{VFB}(i) - \text{ACP}(b)]_{10\,000} \cdot P \quad \text{Eq.4}$$

$$\text{MRVP}_{\text{sold}}(i) = [\text{ACP}(s) - \text{VFO}(i)]_{10\,000} \cdot P \quad \text{Eq.5}$$

Where:

- MRVP(i) = Margin Requirement at Valuation Point i
- ACP(b) = Average Contract Price for bought contracts
- ACP(s) = Average Contract Price for sold contracts
- VFB(i) = Vector file bid at Valuation Point i
- VFO(i) = Vector file offer at Valuation Point i
- P = Number of contracts

POSITION VECTOR FILE DATA

From Eq. 4 and Eq.5 the positional vector file data can be constructed.
Do notice that the previously calculated P&L is added.

	Bought	Sold	Bought	Sold	Bought	Sold
0	-482 670,909	-472 629,596	-482 670,909	-472 629,596	-482 670,909	-472 629,596
1	-484 812,828	-474 771,515	-484 812,828	-474 771,515	-484 812,828	-474 771,515
2	-486 954,455	-476 913,142	-486 954,455	-476 913,142	-486 954,455	-476 913,142
3	-489 095,789	-479 054,476	-489 095,789	-479 054,476	-489 095,789	-479 054,476
4	-491 236,831	-481 195,518	-491 236,831	-481 195,518	-491 236,831	-481 195,518
...
98	-691 197,072	-681 155,759	-691 197,072	-681 155,759	-691 197,072	-681 155,759
99	-693 310,574	-683 269,261	-693 310,574	-683 269,261	-693 310,574	-683 269,261
100	-695 423,789	-685 382,476	-695 423,789	-685 382,476	-695 423,789	-685 382,476
101	-697 536,716	-687 495,403	-697 536,716	-687 495,403	-697 536,716	-687 495,403
102	-699 649,355	-689 608,042	-699 649,355	-689 608,042	-699 649,355	-689 608,042
...
196	-896 960,173	-886 918,860	-896 960,173	-886 918,860	-896 960,173	-886 918,860
197	-899 045,706	-889 004,393	-899 045,706	-889 004,393	-899 045,706	-889 004,393
198	-901 130,956	-891 089,643	-901 130,956	-891 089,643	-901 130,956	-891 089,643
199	-903 215,923	-893 174,610	-903 215,923	-893 174,610	-903 215,923	-893 174,610
200	-905 300,607	-895 259,294	-905 300,607	-895 259,294	-905 300,607	-895 259,294

The largest negative value occurs at valuation point 200, producing a margin requirement of -905 300, 607.

Margining of FRA contracts

The FRA contract is a standardized Forward Rate Agreement based on STIBOR or NIBOR. In common with other Swedish fixed income derivatives the FRA price is quoted in yields and marked to market on a monthly basis. It differs from conventional cleared interest rate futures in that, for the FRA, the buyer of the contract is the notional borrower who is therefore looking for interest rates to rise.

Another difference is that the term of notional loan of the FRA is the number of days between IMM days, i.e. the IMM day that is the expiration settlement day, and the following IMM day. This means that the term of the notional loan is specific to each series.

The specification of the FRA, therefore, means that it has to be margined using the calculated interest payable/receivable for a contract, based on its transaction rate (or the prior monthly settlement rate) versus the estimated largest possible adverse move in interest rates.

EXAMPLE: MARGIN CALCULATION FOR STIBOR-FRA AND VECTOR FILE CALCULATIONS

For the following position, bought 700 STIBOR-FRA at 2,1%.
The parameters are:

Y	=2,180%
ACY(b)	=2,100%
VI	=25 basis points =0,0025
P	=700
d	=98

Where:

d	= The number of days between Expiration Settlement Day and the following IMM day (third Wednesday in March, June, September and December)
Y	= Closing mid yield as a decimal (5%=0,05)
VI	= Valuation interval as a decimal (25 basis points=0,0025)
ACY(b)	= Average Contract Yield for bought contracts
ACY(s)	= Average Contract Yield for sold contracts
P	= Number of open contracts
FPIC(b)	= $[Y \cdot 0,999 - VI] (d/360) 1\ 000\ 000$ Interest receivable per contract at the lowest adjusted valuation point rounded to whole SEK
FPIC(s)	= $[Y \cdot 1,001 - VI] (d/360) 1\ 000\ 000$ Interest receivable per contract at the lowest adjusted valuation point rounded to whole SEK

As for the Bond and T-Bill positions, the locked in P&L has to be added to the margin requirement for the open position. But since the position only consists of 700 bought contracts no locked in P&L needs to be calculated.

$$\text{Locked in P\&L} = [ACY(s) - ACY(b)] (d/360) 1\ 000\ 000 \cdot P \quad \text{Eq.6}$$

The following equations are used for margining of STIBOR-FRA contracts

$$RM_{bought} = [FPIC(b) - (ACY(b) (d/360) 1\ 000\ 000)] \cdot P \quad \text{Eq.7}$$

$$RM_{sold} = [(ACY(s) (d/360) 1\ 000\ 000 - FPIC(s))] \cdot P \quad \text{Eq.8}$$

The margin is calculated according to equation 7:

$$\begin{aligned} RM_{bought} &= [(0,0218 \cdot 0,999 - 0,0025) (98/360) 1\ 000\ 000 \\ &\quad - 0,021 (98/360) 1\ 000\ 000] \cdot 700 \\ &= -328\ 098,556 \end{aligned}$$

VECTOR FILES

The values for the STIBOR-FRA in the vector file are the interest payable/receivable on the notional loan, calculated with reference to the level of the underlying value at the relevant Valuation Point. This number is compared to the interest payable/receivable, based on the contract yield and calculated as follows:

$$\text{Interest Payment} = \text{ACY}(d/360)1\ 000\ 000$$

Note that this calculation is exactly the same, regardless of whether the position is held or written.

$$\text{MRVP}_{\text{bought}}(i) = [(\text{VFB}(i)/100) - (\text{ACY}(b)(d/360)1\ 000\ 000)] \cdot P$$

$$\text{MRVP}_{\text{sold}}(i) = [(\text{ACY}(s)(d/360)1\ 000\ 000) - (\text{VFO}(i)/100)] \cdot P$$

VALUATION POINT MARGIN REQUIREMENT

Where:

- MRVP(i) = Margin Requirement at Valuation Point i
- ACY(b) = Average Contract Yield for bought contracts
- ACY(S) = Average Contract Yield for sold contracts
- VFB(i) = Vector file bid at Valuation Point i
- VFO(i) = Vector file offer at Valuation Point i
- P = Number of contracts
- d = The number of days between Expiration Settlement Day and the following IMM day (the third Wednesday in March, June, September and December)

VECTOR FILE DATA

	FRA	Bought	Sold	Bought	Sold	Bought	Sold
0	1,930	524 795,444	525 982,333	524 795,444	525 982,333	524 795,444	525 982,333
...
100	2,180	592 851,000	594 037,889	592 851,000	594 037,889	592 851,000	594 037,889
...
200	2,430	660 906,556	662 093,444	660 906,556	662 093,444	660 906,556	662 093,444

POSITION VECTOR FILE DATA

Valuation

point	Bought	Sold	Bought	Sold	Bought	Sold
0	-328 098,56	456,843	-328 098,56	456,843	-328 098,56	456,843
...
100	148 290,333	-223,712	148 290,333	-223,712	148 290,333	-223,712
...
200	624 679,222	-904,268	624 679,222	-904,268	624 679,222	-904,268

Calculating the margin at Valuation Point 0, which is where the worst case occurs, is as follows:

$$\text{MRVP}_{\text{bought}}(0) = ((524795,444/100) - (0,021(98/360)1\ 000\ 000)) \cdot 700 = -328\ 099$$

Window margining

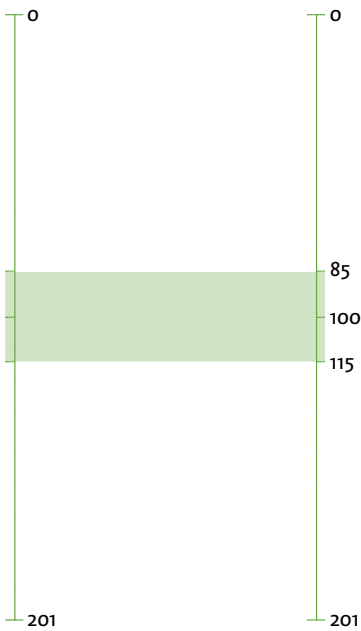
A number of the fixed income contracts cleared by OMX demonstrate a historical statistical relationship which would seem to indicate that they are correlated in some way, i.e. they tend to move in the same direction with a similar magnitude. It is therefore required that the margining system takes such relationship into account when calculating the required margin. The functionality in RIVA to cross-margin contracts based on different underlying instruments is called the "Window Method". Calculations of allowed correlation between two or more instruments are based on the strength of the historical relationship.

The window size is based on the maximum anticipated amount that the two contracts can deviate from each other in terms of the number of valuation points in the valuation interval.

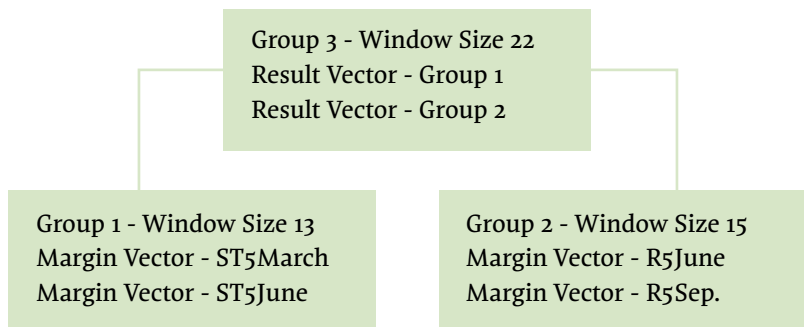
For example a window size of 15% gives a valuation window size of 31 points (15% of 201 valuation points which must be an odd number), and indicates that at for example valuation point 100, the correlated contracts will be valued at any of the valuation points between 85 and 115. The combination of margining requirements within this "window" which has the largest negative value then becomes the margin requirement for valuation point 100.

Window Margining is used calculation margins between different correlated instruments but also used to calculate margins in the same fixed income contracts but with different expiration months. The smaller the window size, the higher the assumed correlation.

The basic methodology is to cross-margin contracts with the smallest window size (i.e. the contracts whose price history displays the closest similarity). The relevant Result Vector for the given margin group is then combined with the next most similar group to create a new margin vector, along the lines of the following diagram:



Window margining with two vector files.



EXAMPLE: WINDOW MARGINING

The window technique is used when correlation between several instruments are deemed significant enough to affect the margin calculations. In the following example two positions will be used to exemplify this.

Margin requirement is calculated for a portfolio including March 5-year Swedish Government Bond forward and March 5-Year Swedish Mortgage Bond forward.

A window size of 22%, for trading in different 5-year bonds, represents a correlation of about 80%. Similar window groups exist for 2-year government and mortgage bonds.

	Traded lots	Traded rate / yield
Bought ST500	1600	4,437%
Sold R500	747	4,09%

The position is margined using the following window size:

Group (R500/ST500)- 22% window size

The example will start by calculating margins for respective position. After this the window technique will be applied (using a window of 22% size) to illustrate the effect adjusting for correlation. The price is calculated in percent of nominal value. Since the nominal value is SEK 1 000 000, the price is multiplied by $1\,000\,000/100 = 10\,000$ to get the actual contract value. The required margin for the open position is calculating by the yield at which the open contracts should be valued.

MARGIN CALCULATION ON R500

Closing mid yield	=4,09%
ACP sold	=108,482
Valuation Interval for 5 year government bond	=25/-25 bp
Upper limit $4,09+0,25$	=4,34
Forward price FP(u) 4,34%	=107,32
Lower limit $4,09-0,25$	=3,84
Forward price FP(l) 3,84%	=109,659
Offer side adjustment factor	=1,001
Adjustment yield $4,09 \cdot 1,001$	=4,094
Forward price 4,09%	=108,482
Forward price 4,094%	=108,462
Adjustment factor, AF(s), in % of nominal amount	=0,019

The required margin for an open bought or sold position is calculated according to equation 2 below:

$$RM(b) = [FP(u) - ACP(b) - AF(b)] \cdot 10\,000 \cdot P \quad \text{Eq.2}$$

$$RM(s) = [ACP(s) - FP(l) - AF(s)] \cdot 10\,000 \cdot P \quad \text{Eq.3}$$

Where:

- RM(b) = Required margin for bought contracts
- RM(s) = Required margin for sold contracts
- ACP(b) = Average contract price for bought contracts
- ACP(s) = Average contract price for sold contracts
- AF(b) = Adjustment factor for bought contracts
- AF(S) = Adjustment factor for sold contracts
- P = Number of contracts

VECTOR FILES R500

	R500	Bought	Sold	Bought	Sold	Bought	Sold
0	3,840	109,640	109,678	109,640	109,678	109,640	109,678
...
100	4,090	108,462	108,501	108,462	108,501	108,462	108,501
...
200	4,340	107,301	107,339	107,301	107,339	107,301	107,339

VALUATION POINT MARGIN REQUIREMENT

$$MRVP_{bought}(i) = [VFB(i) - ACP(b)] \cdot 10\,000 \cdot P \quad \text{Eq.4}$$

$$MRVP_{sold}(i) = [ACP(s) - VFO(i)] \cdot 10\,000 \cdot P \quad \text{Eq.5}$$

- MRVP(i) = Margin Requirement at Valuation Point i
- ACY(b) = Average Contract Yield for bought contracts
- ACY(S) = Average Contract Yield for sold contracts
- VFO(i) = Vector file offer number at Valuation Point i
- VFB(i) = Vector file bid number at Valuation Point i
- P = Number of contracts

POSITION VECTOR FILE DATA

	Bought	Sold	Bought	Sold	Bought	Sold
0	8 655 139,88	-8 941 018,29	8 655 139,88	-8 941 018,29	8 655 139,88	-8 941 018,29
...
100	-142 922,99	-142 955,43	-142 922,99	-142 955,43	-142 922,99	-142 955,43
...
156	-5 016 757,82	4 730 879,40	-5 016 757,82	4 730 879,40	-5 016 757,82	4 730 879,40
...
200	-8 819 757,30	8 533 878,88	-8 819 757,30	8 533 878,88	-8 819 757,30	8 533 878,88

The largest negative value occurs at valuation point 0, producing a margin requirement of -8 941 018,29

MARGIN CALCULATION ON ST500

Closing mid yield	=4,437
ACP sold	=106,874
Valuation Interval for 5 year government bond	=30/-30
Upper limit $4,437+0,3$	=4,737
Forward price FP(u) 4,737%	=105,508
Lower limit $4,437-0,3$	=4,137
Forward price FP(l) 4,137%	=108,262
Offer side adjustment factor	=0,999
Adjustment yield $4,437 \cdot 0,999$	=4,433
Forward price 4,437	=106,874
Forward price 4,433%	=106,894
Adjustment factor, AF(s), in % of nominal amount	=0,0204

VECTOR FILES ST500

	ST500	Bought	Sold	Bought	Sold	Bought	Sold
0	4,140	108,228	108,268	108,228	108,268	108,228	108,268
...
100	4,440	106,839	106,880	106,839	106,880	106,839	106,880
...
200	4,737	105,488	105,528	105,488	105,528	105,488	105,528

POSITION VECTOR FILE DATA

	Bought	Sold	Bought	Sold	Bought	Sold
0	21 663 468,382	-22 315 094,247	21 663 468,382	-22 315 094,247	21 663 468,382	-22 315 094,247
...
100	-325 772,962	-325 852,903	-325 772,962	-325 852,903	-325 772,962	-325 852,903
...
200	-22 173 512,619	21 521 886,754	-22 173 512,619	21 521 886,754	-22 173 512,619	21 521 886,754

The largest negative value occurs at valuation point 200, producing a margin requirement of -22 173 512,619

WINDOW/MARGINING

The required margin for the positions in this example, without using window margining, would be:

R500	-8 941 018	(valuation point 0)
ST500	<u>-22 173 513</u>	(valuation point 200)
Total	-31 114 531	

However, the established window size of 22%, i.e. a maximum price fluctuation of 45 valuation points between a 5 Year government bond and a 5-year mortgage bond result in a lower margin requirement. Using the Window Margining method, the worst case would be in valuation point 200 for ST500 and valuation point 156 for R500 and gives the following total margin requirement:

R500	4 730 879	(valuation point 156)
ST500	<u>-22 173 513</u>	(valuation point 200)
Total	-17 442 633	

The example shows that using Window Margining method gives a lower margin requirement than if the method was not used.

Expiration Settlement margin

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

Swedish fixed income 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 contracts are non-deliverable instruments and only cash settled.

To allow for this structure, RIVA 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 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.

