ASX Clear (Futures)
SPAN Margining examples

In its simplest form, SPAN can be considered as a risk based portfolio approach system for calculating initial margin requirements.

Unlike other margining systems which make risk assessments based on individual positions within a portfolio, SPAN considers how the value of an entire portfolio of options and futures will respond to changes in futures (or underlying) prices and volatilities.

In calculating the profit or loss a portfolio will make, SPAN uses 16 'what if' scenarios where futures prices and volatilities are altered to varying degrees based on the 'Price Scan Range' and 'Volatility Scan Range' set by ASX Clear (Futures) and defined below.

Price Scan Range

The Price Scan Range (PSR) is the amount by which the instrument price (underlying instrument price in the case of options) for each underlying (known as a 'combined commodity') is changed in each scenario.

Volatility Scan Range

Similar to the PSR, the Volatility Scanning Range (VSR) is the amount by which the implied volatility of options in the combined commodity is changed in each scenario.

The scenarios defined by the Price and Volatility Scan Range used are:

1. Futures unchanged; Volatility up
2. Futures unchanged; Volatility down
3. Futures up 1/3 range; Volatility up
4. Futures up 1/3 range; Volatility down
5. Futures down 1/3 range; Volatility up
6. Futures down 1/3 range; Volatility down
7. Futures up 2/3 range; Volatility up
8. Futures up 2/3 range; Volatility down
9. Futures down 2/3 range; Volatility up
10. Futures down 2/3 range; Volatility down
11. Futures up 3/3 range; Volatility up
12. Futures up 3/3 range; Volatility down
13. Futures down 3/3 range; Volatility up
14. Futures down 3/3 range; Volatility down
15. Futures up extreme move (cover 35% of loss)
16. Futures down extreme move (cover 35% of loss)

Note:

- Futures up or down 1/3 range means 1/3 * PSR, and similarly futures up or down 2/3 range means 2/3 * PSR, whilst futures up or down 3/3 is referred to as the 'full futures price movement'.
- Volatility up or down represents an increase or decrease in the implied volatility at the close of business on each trading day.
- The extreme move is typically set a twice the PSR of the underlying futures contract. As the probability of such a movement is very low, only 35% of the loss generated is used.

The 16 scenarios above, form a 'risk array' which is calculated by ASX Clear (Futures) at the close of trading on each business day. Over 2000 risk arrays are calculated daily for all of the contracts listed on ASX. It should be noted that the risk array is calculated from the perspective of a long position, i.e. being long the instrument rather than being long the market. When calculating the margin of a short position this array will be multiplied by the appropriate negative number of contracts.

The risk arrays are then applied to the portfolio of positions, with profits and losses being aggregated by scenario. The largest loss (represented by a positive value) across the 16 scenarios becomes the SPAN margin for that portfolio.

This figure is known as a Scanning Risk and forms the first and key element in the initial margin calculation. This figure can then be adjusted for intra-commodity (inter-month) spreads, inter-commodity concessions and spot month isolation rates. That is:

Total Initial Margin = Scanning Risk
+ Intra-Commodity (Inter-Month) Spread Charge
+ Spot Month Isolation Rate
- Inter-Commodity Spread Concession

These key elements are explained in the following practical examples.

Scanning Risk

Price Scanning Range and Volatility Scanning Range

The following example illustrates how SPAN is used to margin a position consisting of both futures and options. Suppose a portfolio of 90 Day Bank Bills (IR) contains the following:

Position	Delivery Month	Contract	Type	Strike	Delta	Delta Equivalent	Net Inter-Month Position*
20 Long	Jun 12	IR	future	n/a	20	+20	n/a
10 Short	Jun 12	IR	call	95	-9.3	-9.3	Jun +10
40 Short	Sep 12	IR	call	95	0.86	-34.4	Jun -34
5 Long	Dec 12	IR	put	95.75	-0.41	-2.05	Dec -2

* SPAN assesses all spreads as whole integers.

At the end of each day risk arrays are produced for each combined commodity by ASX Clear (Futures) and provided to Clearing Participants in a Risk Parameter File ('RPF'). This risk array is the profit and loss profile of one long position in the specified contract.

Assuming that:

- the Price Scan Range or full futures price movement is $920;
- the volatility shift is 0.05%;
- the current futures price is 95.70 for June 12, 95.75 for September 12 and 95.77 for December 12; and

- the implied volatility is 0.26% for June 12, 0.29% for September 12 and 0.29% for December 12.

Then the following risk arrays would result:

No.	Scenario	IRM12F	IRM12 95 Call	IRU12 95 Call	IRZ12 95.75 Put
1	Futures unchanged; Vol up	0	-34	-82	-164
2	Futures unchanged; Vol down	0	24	71	169
3	Futures up 1/3 range; Vol up	-307	-315	-339	-40
4	Futures up 1/3 range; Vol down	-307	-277	-210	281
5	Futures down 1/3 range; Vol up	307	237	165	-300
6	Futures down 1/3 range; Vol down	307	318	344	40
7	Futures up 2/3 range; Vol up	-613	-605	-605	72
8	Futures up 2/3 range; Vol down	-613	-581	-499	377
9	Futures down 2/3 range; Vol up	613	492	400	-449
10	Futures down 2/3 range; Vol down	613	602	604	-108
11	Futures up 3/3 range; Vol up	-920	-901	-879	171
12	Futures up 3/3 range; Vol down	-920	-887	-794	456
13	Futures down 3/3 range; Vol up	920	730	623	-611
14	Futures down 3/3 range; Vol down	920	868	850	-273
15	Futures up extreme move	-644	-632	-599	182
16	Futures down extreme move	644	491	470	-357

These risk arrays for the futures and options contracts are calculated by taking the difference between the original future or option value (settlement value) and the recalculated future or option value given the relevant scenario. For options, the value is calculated given the underlying futures price, volatility and days to maturity and the option is then re-valued based on the scenario (say futures up 1/3, volatility down). The difference gives the risk array for that scenario.

To determine the margin, each array value is multiplied by the position size, giving the Scanning Risk. Then the 16 lines are each added across and the largest total loss from all 16 lines is selected as the margin. Note that under the SPAN methodology, the maximum loss is the largest positive value.

Using this method, the SPAN initial margin for this portfolio would coincide with Scenario 11 and would equate to $26,625, as can be seen below:

No.	IRM12F	IRM12 95 Call	IRU12 95 Call	IRZ12 95.75 Put	Scanning Risk
1	0	340	3,280	-820	2,800
2	0	-240	-2,840	845	-2,235
3	-6,140	3,150	13,560	-200	10,370
4	-6,140	2,770	8,400	1,405	6,435
5	6,140	-2,370	-6,600	-1,500	-4,330
6	6,140	-3,180	-13,760	200	-10,600
7	-12,260	6,050	24,200	360	18,350
8	-12,260	5,810	19,960	1,885	15,395
9	12,260	-4,920	-16,000	-2,245	-10,905
10	12,260	-6,020	-24,160	-540	-18,460

11	-18,400	9,010	35,160	855	26,625
12	-18,400	8,870	31,760	2,280	24,510
13	18,400	-7,300	-24,920	-3,055	-16,875
14	18,400	-8,680	-34,000	-1,365	-25,645
15	-12,880	6,320	23,960	910	18,310
16	12,880	-4,910	-18,800	-1,785	-12,615

The Scanning Risk does not take into account intra-commodity (inter-month) spread movements and in determining the Scanning Risk it assumes perfect correlation between months. The actual correlation between months is accounted for by intra-commodity (inter-month) spreads which calculate additional margin to account for the risk on these spreads.

Tiered (and Percentage Based) Price Scanning Range and Tiered Volatility Scanning Range

SPAN has the ability to levy varying margin rates through the tiering of Price Scan Ranges and Volatility Scan Ranges. Each tier established will represent either an individual contract expiry or a group of neighbouring contract expiries whose tier is assigned one common rate. Note that the tiering of Volatility Scan Ranges for each contract will mirror the tiering of Price Scan Ranges for that contract.

Furthermore through SPAN, Price Scan Ranges can be set as percentages with the percentages based on contract value converted to a dollar value internally by SPAN.

In the case below, 1 long position in Quarter 1 will attract an initial margin requirement of $6,028. This Price Scan Range dollar equivalent and Volatility Scan Range will form the basis of how risk arrays are calculated - refer to the above example.

Quarter	Contract Value	PSR Tier	PSR%	PSR $ Equivalent	VSR
1	75,348	1	8%	$6,028	4%
2	120,115	2	5%	$6,006	4%
3	140,940			$7,047	

For further information and detailed worked examples of tiered and percentage based Price Scan Ranges, please refer to Notice 046/12 titled "CME SPAN Implementation Phase 1 - Go-live Date and Margin Rate Setting Changes" which is accessible via the following link: http://www.sfe.com.au/content/notices/2012/notice2012_046.pdf

Intra-Commodity (Inter-Month) Spread Charge

When the Scanning Risk of a portfolio is determined, SPAN assumes perfect correlation across delivery months. To take account of the potential for a less than perfect correlation between different delivery dates, SPAN is able to determine intra-commodity (inter-month) spread margins where offsetting positions are held across delivery months.

Similar to Price and Volatility Scan Ranges, SPAN has the capability of levying varying spread rates. This process, which is known as 'tiering', groups spreads within defined tiers dependent upon the months used in the spread.

For this example assume a trade date of 1 November 2011 and that the Clearing Participant holds the following positions:

Position	Delivery Month	Contract	Type	Delta	Net Position
15	Mar 12	IR	future	1	15
-18	Jun 12	IR	future	1	3

4	Sep 12	IR	future	1	1
-1	Mar 13	IR	future	1	

The spread rates which apply for this example are shown below:

	Bank Bill	Months in Tier	Tier 1	Tier 2	Tier 3
1	Tier 1	1			
2	Tier 2	2 to 3	$240	$135	
3	Tier 3	4 to 8	$325	$160	$80

The March 12 to June 12 positions are grouped in Tier 2 (months two and three respectively) with September 12 and March 13 grouped in Tier 3 (months 4 and 6 respectively). In this example the 15 net long inter-month positions in March 12 have been offset against the 18 net short inter-month positions in June 12 (Tier 2 v Tier 2). The three net short inter-month positions left in June 12 (Tier 2) are offset against the four net long positions in September 12 (Tier 3). In addition the one net long position left in September 12 can be offset against March 13 (Tier 3 v Tier 3). The total amount of margins payable on the portfolio after inter-month spread charges will therefore be:

Total Margins Payable			
Total Scanning Risk			= $26,625
Inter-Month Spread	Tier 2 v Tier 2	15 x $135	= $2,025
	Tier 2 v Tier 3	3 x $160	= $480
	Tier 3 v Tier 3	1 x $80	= $80
SPAN Margin Payable	$26,625 + $2,025 + $480 + $80		= $29,210

Inter-Commodity Spread Concession

SPAN has the ability to calculate concessions to total initial margins payable due to offsetting positions in closely correlated contracts. The percentage concession is set by ASX Clear (Futures) and depends on the level of stable correlation between any two contracts.

Assume that the Clearing Participant holds the following positions:

Position	Delivery month	Contract	Type	Delta	Net position
-200	Dec 12	IR	future	1	-200
-60	Dec 12	YT	future	1	-60
100	Dec 12	XT	future	1	+100

In calculating the appropriate initial margins to levy on the portfolio in total, the Scanning Risk for all components of the transaction must first be evaluated.

In the case of the 200 sold 90 Day Bank Bill futures positions, the Scanning Risk or amount payable by way of initial margins would be $184,000. This is calculated using SPAN scenario number 12 (i.e. Futures up 3/3; Volatility down). Therefore the calculation would be the full initial margin of $920 x 200 contracts = $184,000.

In the case of the 60 sold 3 Year Bond futures positions, the Scanning Risk or amount payable by way of initial margins would be $66,000. This is calculated using SPAN scenario number 12 (i.e. Futures up 3/3 range; Volatility down). Therefore the calculation would be the full initial margin of $1,100 x 60 contacts = $66,000.

In the case of the 100 bought 10 Year Bond futures position , the same calculation is applied using SPAN scenario number 13 (i.e. Futures down 3/3 range; Volatility up). This results in a calculation of the full initial margin of $2,400 x 100 contracts = $260,000.

If no offsetting mechanism was available, the total Scanning Risk or amount payable in initial margins would be equal to the sum of the above figures, i.e. $510,000 plus any Intra-Commodity (inter-month)spread charges.

Using SPAN, ASX Clear (Futures) offers Inter-Commodity spreads between designated pairs of commodities. In the case of the 10-Year and 3-Year Bond contracts, we will assume that the spread is calculated on a delta spread ratio of 1:3, i.e. one 10-Year Bond contract for every three 3-Year Bond contracts. This parameter is determined by ASX Clear (Futures) and is subject to adjustment. On that basis, 20 of the 100 10-Year Bond contracts (60/3 x 1 = 20) and all 60 of the 3-Year Bond contracts can be utilised in the spread.

In the case of the 10-Year Bond and 90 Day Bank Bill contracts, we will assume that the spread is calculated on a delta spread ratio of 1:4, i.e. one 10-Year Bond contract for every four 90 Day Bank Bill contracts. On that basis, the remaining 50 of the 100 10-Year Bond contracts and all 200 of the 90 Day Bank Bill contracts can be utilised in the spread.

In addition to establishing the ratio and priority of contracts used in the spread, ASX Clear (Futures) also assigns the spread a percentage 'concession' on the Scanning Risk which is dependent upon the pricing correlation of the instruments involved. Assuming an inter-commodity concession of 75% for a 10-Year Bond : 3-Year Bond spread, and 60% for a 10-Year Bond : 90 Day Bank Bill spread, 75% and 60% of the Scanning Risk for all the commodities will be rebated in recognition of the reduced risk profile of the inter-commodity spreads.

The total amount payable by way of margins is calculated as set out below:

Total Margins Payable		
Total Scanning Risk	($920 x 200) + ($1,100 x 60) + ($2,600 x 100)	= $510,000
Deduct XT Rebate	(20 x $2,600 x 75%) + (50 x $2,600 x 60%)	= ($117,000)
Deduct YT Rebate	60 x $1,100 x 75%	= ($49,500)
Deduct IR Rebate	200 x $920 x 60%	= ($110,400)
Final SPAN margin payable	$510,000 - $117,000 - $49,500 - $110,400	= $233,100

Note that there is no 3-Year-Bond : 90 Day Bank Bill spread as all 3-Year-Bond positions were used in the 10-Year-Bond : 3-Year Bond spread.

Spot Month Isolation Rate

The initial margin requirement calculation based on the Scanning Risk, Intra-Commodity Charge and Inter-Commodity Concession described above only determines initial margin obligations for contract positions up until their expiry and calculates none thereafter.

Thus, in conjunction with the application of these main margin rates, SPAN also calculates spot risks associated with near-expiring contracts, using the Spot Month Isolation Rate to calculate exposures such as price risks arising in the interval between a contract's expiry and settlement.

Spot Month Isolation Rates are currently set as a flat rate change and are applied throughout a contract's settlement period. Thus, for such contracts, the initial margin calculation will be based on the Scanning Risk, Intra-Commodity Charge and Inter-Commodity Concession before expiry, and following expiry, will be based on the Spot Month Isolation Rate only and calculated up until

settlement of the contract. Note, no Intra-Commodity or Inter-Commodity spreads are formed at this post-expiry stage.

Similar to previous cases and assuming that the Clearing Participant now only holds positions in the IR, the initial margin requirement prior to IR's expiry will be based on the Scanning Risk, Intra-Commodity Charge and Inter-Commodity Concession and is calculated at $920 x 200 contracts = $184,000.

The Spot Month Isolation Rate is applied once IR expires and covers the one day it takes for the contract to settle. Thus, assuming the Spot Month Isolation Rate is set at $300, the initial margin requirement calculated on Expiry + 1 (Settlement day) is $300 x 200 contracts = $60,000.

	Expiry - 1	Expiry	Expiry + 1 (Settlement day)
Net position of spot contract	200	200	200
Price Scanning Range	$700	$700	$0
Intra-commodity Spread Charge	$0	$0	$0
Inter-commodity Concession	$0	$0	0%
Spot Month Isolation Rate	$0	$0	$60,000
Total Initial Margin Requirement	*$184,000*	*$184,000*	*$60,000*

More Information

To assist Clearing Participants and clients with information on SPAN, a PC-based SPAN calculator developed by the Chicago Mercantile Exchange (CME) known as PC-SPAN is available from CME.

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