

STANDARD PORTFOLIO ANALYSIS of RISK (SPAN®)

Chapter 11

SPAN Overview

Developed by the Chicago Mercantile Exchange in 1988, the Standard Portfolio Analysis of Risk (SPAN) performance bond margining system for calculating requirements has become the futures industry standard.

SPAN evaluates the risk of an entire account's futures/options portfolio and assesses a margin requirement based on such risk. It accomplishes this by establishing reasonable movements in futures prices over a one day period. The resulting effect of these "risk arrays" is to capture respective gains or losses of futures and options positions within that commodity. Each Exchange maintains the responsibility of determining these risk arrays as well as the option calculations that are needed to determine the effect of various futures price movements on option values.

Advantages and Rationale of SPAN

SPAN recognizes the special characteristics of options, and seeks to accurately assess the impact on option values from not only futures price movements but also changes in market volatility and the passage of time. The end result is that the minimum margin on the portfolio will more accurately reflect the inherent risk involved with those positions as a whole.

Option Equity and Risk Margin

One of the special characteristics of options is that a long option position can never be at risk for more than its premium. In order for SPAN to assess the risk of all positions in the portfolio and at the same time allow credit for the premium involved, SPAN allows the excess of the option premium over the risk margin for any option position to be applied to the risk margin on other positions.

Margin Calculations

Under SPAN, firms will receive risk arrays from the respective clearing organizations to calculate margins for their accounts. These firms will then calculate minimum margin requirements for all of its accounts based on the arrays on a daily basis. Individuals are able to calculate their own margin requirements through loading the risk arrays and their positions into PC-SPAN.

STANDARD PORTFOLIO ANALYSIS of RISK (SPAN®)

Risk Arrays

Under SPAN, each Exchange will provide risk arrays for each commodity traded. These arrays are comprised of 16 “what if” scenarios that cover a range of reasonable futures price and volatility changes over the course of a day. For example, what if crude oil futures prices rose by \$1 and volatility on crude oil options fell? Each scenario measures the impact on profit and loss of the hypothetical movements on futures and options positions within that commodity. Each answer becomes a component of the risk array, and SPAN will take the largest loss from that array as the minimum margin for the day. In order to construct arrays, each Exchange provides both the futures and volatility scan ranges.

Futures Scan Range

The futures scan range is equal to a firm’s maintenance margin requirement for outright positions. This represents the interval that a futures contract’s prices are likely to move (up or down) over a single day. For example, if the scan range is \$1,500 for crude oil contracts, it implies that crude oil futures prices are most likely to fluctuate within a band of \$1.50/barrel up or down (since each contract represents 1,000 barrels) from the last settlement price. To construct the risk arrays, SPAN sets fractions (multiples of 1/3) of the range both up and down as the plausible price changes. Each commodity traded has its own scan range.

Volatility Scan Range

In addition to futures price changes, a major determinant of option value is the inherent volatility that is expected in the market. Each Exchange will set parameters, both up and down, for likely changes in expected market volatility. The impact on option value of these hypothetical changes are then used to capture the profit (or loss) on option positions, and hence the risk of options in a given portfolio.

Extreme Move Scenario

Each Exchange will set an extreme move parameter, usually set equal to a multiple of the futures scan range, as well as a percent of this move it believes it needs to be covered for possible abrupt changes of futures prices.

STANDARD PORTFOLIO ANALYSIS of RISK (SPAN®)

Sixteen “What If” Scenarios

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)

Other Factors Affecting SPAN Margin Requirements

In addition to the above risk arrays, each Exchange will also assess intermonth spread charges, intercommodity spread credits, and short option minimum margins. These will affect the final margin requirements for large portfolios.

The intermonth spread charges represent additional margin payments that are assessed on positions on different contract months within a commodity that are on opposite sides of the market. This is to capture the risk that price changes between different contract months of the same commodity often do not match each other exactly. In fact, there are often times when different contract months within the same commodity experience opposite price change. Since this suggests a higher level of risk to the portfolio, an additional margin charge is assessed to these spread positions.

SPAN also recognizes that many commodities tend to experience similar price movements. For offsetting positions in different commodities that are related, SPAN allows certain credits be given to the portfolio's total margin to reflect this lower overall risk.

STANDARD PORTFOLIO ANALYSIS of RISK (SPAN®)

Finally, unlike long option positions which have a maximum potential loss, the value of the option premium, short options have virtually unlimited risk. SPAN accounts for this characteristic of short option positions by having a minimum margin assessed, regardless of the losses determined in the above risk arrays.

Each Exchange maintains the responsibility of setting the intermonth spread charge, the intercommodity spread credit, and the short option minimum margin.

A Simple Margin Calculation

Assume a position contains a single long January Crude Oil futures contract. Assuming an underlying futures price of \$20, a SPAN futures scan range of \$1,500, and volatility scan range of 2%. The risk array would look like the following:

<u>SCENARIO</u>	<u>VALUE LOSS</u>
1. Futures unchanged, volatility up	\$0
2. Futures unchanged, volatility down	\$0
3. Futures up 1/3 range, volatility up	-\$500
4. Futures up 1/3 range, volatility down	-\$500
5. Futures down 1/3 range, volatility up	\$500
6. Futures down 1/3 range, volatility down	\$500
7. Futures up 2/3 range, volatility up	-\$1,000
8. Futures up 2/3 range, volatility down	-\$1,000
9. Futures down 2/3 range, volatility up	\$1,000
10. Futures down 2/3 range, volatility down	\$1,000
11. Futures up 3/3 range, volatility up	-\$1,500
12. Futures up 3/3 range, volatility down	-\$1,500
13. Futures down 3/3 range, volatility up	\$1,500
14. Futures down 3/3 range, volatility down	\$1,500
15. Futures up extreme move (cover 35% of loss)	-\$1,050
16. Futures down extreme move (cover 35% of loss)	\$1,050

Scanning the value loss column, \$1,500 can be seen to be the worst case loss, and therefore becomes the margin. This also happens to be the outright margin level, which illustrates that for simple outright positions, margin levels will be set the same way as they are currently established.

STANDARD PORTFOLIO ANALYSIS of RISK (SPAN®)

Suppose a position contains one short January \$20 Crude Oil Call Option. The risk array would look like the following:

<u>SCENARIO</u>	<u>VALUE LOSS</u>
1. Futures unchanged, volatility up	\$37
2. Futures unchanged, volatility down	-\$52
3. Futures up 1/3 range, volatility up	\$339
4. Futures up 1/3 range, volatility down	\$255
5. Futures down 1/3 range, volatility up	-\$170
6. Futures down 1/3 range, volatility down	-\$252
7. Futures up 2/3 range, volatility up	\$696
8. Futures up 2/3 range, volatility down	\$633
9. Futures down 2/3 range, volatility up	-\$317
10. Futures down 2/3 range, volatility down	-\$374
11. Futures up 3/3 range, volatility up	\$1115
12. Futures up 3/3 range, volatility down	\$1,075
13. Futures down 3/3 range, volatility up	-\$369
14. Futures down 3/3 range, volatility down	-\$429
15. Futures up extreme move (cover 35% of loss)	\$890
16. Futures down extreme move (cover 35% of loss)	-\$159

To determine the margin, SPAN takes the maximum loss from the risk arrays (note: negative values refer to gains). In the above example, the margin resolves to line 11: \$1,115.

STANDARD PORTFOLIO ANALYSIS of RISK (SPAN®)

A somewhat more complicated example would be if we combined the two simple positions above. Adding the two risk array results in the following:

<u>SCENARIO</u>	<u>VALUE LOSS</u>
1. Futures unchanged, volatility up	\$37
2. Futures unchanged, volatility down	-\$52
3. Futures up 1/3 range, volatility up	-\$161
4. Futures up 1/3 range, volatility down	-\$245
5. Futures down 1/3 range, volatility up	\$330
6. Futures down 1/3 range, volatility down	\$248
7. Futures up 2/3 range, volatility up	-\$304
8. Futures up 2/3 range, volatility down	-\$367
9. Futures down 2/3 range, volatility up	\$683
10. Futures down 2/3 range, volatility down	\$626
11. Futures up 3/3 range, volatility up	-\$385
12. Futures up 3/3 range, volatility down	-\$425
13. Futures down 3/3 range, volatility up	\$1,104
14. Futures down 3/3 range, volatility down	\$1,071
15. Futures up extreme move (cover 35% of loss)	-\$160
16. Futures down extreme move (cover 35% of loss)	\$891

In this case the worse case loss resolves to \$1,104.