

# **Derivative Based Risk Management**

**Group Project**

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## **Team Members**

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## Project Assignment 1

### 1. Group Members

Cris Benavides  
 Warren Choi  
 Tatyana Litvak  
 Wei Sun

2. (From the WSJ) The Hoya Index Fund is a new fund started out of the ashes of the financial crisis. Four MBA classmates banded together (because they couldn't find a job) to start an index fund. Since they had done poorly in finance classes, they figured an index fund was a heck of a lot easier to manage than an actively managed fund where they would actually have to pick stocks. Fortunately for them, so many mutual funds had gone out of business that Hoya quickly became popular with the sovereign funds that now ruled the financial world. Hoya quickly had 100 million in assets, and the founders realized that if they suffered big losses, they would be out of business. So they devised a hedging strategy that would limit the downside risk for the \$100M invested in S&P 500 index futures.

Long exposure of  $+F_{SP}$  \$100,000,000 and a loss of 10% or more with only a 1/100 chance.  
 $+F_{SP}$

### 3. Futures market situation and evolution:

Underlying - SS = S&P 500 - SP	Dec-08	Mar-09	Jun-09	Sep-09
Current date <b>10/08/08</b> Settle (Close) Price	981.00	981.40	981.40	980.60
Actual Maturity date	12/19/2008	3/20/2009	6/19/2009	9/18/2009
Symbol	SPZ8	SPH9	SPM9	SPU9
Subsequent (next maturity) date <b>10/10/08</b> Settle (Close) Price	891.00	890.80	890.80	889.70
Subsequent (next maturity) date mark-to-market	(\$90.00)	(\$90.60)	(\$90.60)	(\$90.90)

Each contract represents:  $250 \times 981 = \$245,250$  for December 2008.

Last trade as of 10/10/2008: \$891

SP 500 Comp. - cme												
Data retrieved at Oct 11 14:17:12 GMT • All quotes are in Greenwich Mean Time • Data provided by eSignal												
	Contract	Month	Last	Chg	Open	High	Low	Volume	OpenInt	Exchange	Date	Time
	S&P 500	Dec '08	891.00s	-21.50	914.40	942.00	838.50	77684	613470	CME	10/10/08	20:24:15
	S&P 500	Mar '09	890.80s	-22.10	870.00	932.90	842.90	0	5064	CME	10/10/08	20:24:15
	S&P 500	Jun '09	890.80s	-22.10	890.80	890.80	890.80	0	2974	CME	10/10/08	20:24:15
	S&P 500	Sep '09	889.70s	-22.10	889.70	889.70	889.70	0	758	CME	10/10/08	20:24:15
	S&P 500	Dec '09	890.70s	-22.10	890.70	890.70	890.70	0	15	CME	10/10/08	20:24:15
	S&P 500	Mar '10	891.70s	-22.10	891.70	891.70	891.70	0	0	CME	10/10/08	20:24:15
	S&P 500	Jun '10	892.70s	-22.10	892.70	892.70	892.70	0	0	CME	10/10/08	20:24:15
	S&P 500	Sep '10	893.70s	-22.10	893.70	893.70	893.70	0	0	CME	10/10/08	20:24:15

- Chart - Options - Quotes [Save Quote Board](#)

#### 4. Brief overview of market outlook for the S&P 500:

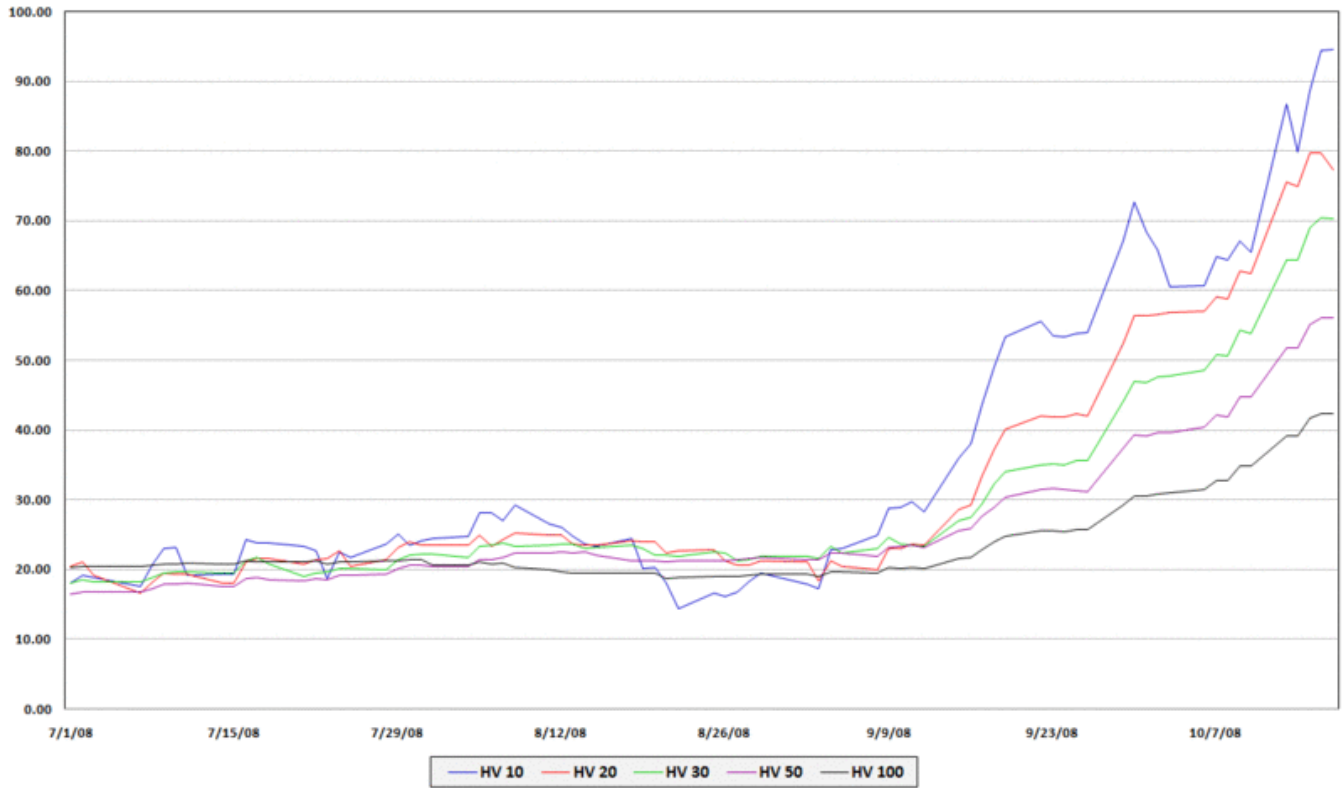
As we know with the recent events in the US economy, the market has become extremely volatile while stock prices have reach historical lows. Looking at the S&P chart 6 month chart, stock prices have decreased almost 20%, with the DOW dropping a whopping 800 points in one day this month. It is obvious to state that the economy, with all of its fluctuations have begun to show some signs of improvement once again, with all of the government aid to banks, and the hype of the new presidential hopeful in the next month. Warren Buffet's recently released statements about his belief that the economy can only rebound and that longing stocks is the wise thing to do.

We believe that as the S&P is at historical lows, and the air surrounding the market is so fickle according to its immediate environment, we believe the S&P will go up. So we are bullish on direction.

With volatility at historical highs due to uncertain future outlook on the economy, we believe that the volatility will more or less remain where it is without increasing to higher levels. In fact, we would expect in the long run for the volatility to decrease and revert back to pre-September times, but not until well into next year.



S&P 500 Index Historical Volatility from 7/1/08



S&P 500 6-mo



## Project Assignment 2

### A. Price risk management as of 10/08/08.

1. We seek to manage the business risk of an S&P 500 Index Portfolio.
2. Our exposure is long, owning a \$100,062,000 portfolio.
  - a. (From the WSJ) The Hoya Follow-The-Herd Index Fund is a new fund started out of the ashes of the financial crisis. Four MBA classmates banded together (because they couldn't find a job) to start an index fund. Since they had done poorly in finance classes, they figured an index fund was a heck of a lot easier to manage than an actively managed fund where they would actually have to pick stocks. Fortunately for them, so many mutual funds had gone out of business that Hoya quickly became popular with the sovereign funds that now ruled the financial world. Hoya quickly had 100 million in assets, and the founders realized that if they suffered big losses, they would be out of business. So they devised a hedging strategy that would limit the downside risk for the \$100M invested in S&P 500 index futures.
3. IF OUR EXPOSURE WERE SHORT:
  - a. (From the WSJ) The Hoya Follow-The-Herd Hedge Fund is a new fund started out of the ashes of the financial crisis. Four MBA classmates banded together (because they couldn't find a job) to start this new hedge fund. They had done poorly in finance classes, but they figured shorting the S&P 500 index was a no-brainer since the markets continued to fall. Fortunately for them, so many hedge funds had gone out of business that Hoya quickly became popular with the sovereign funds that now ruled the financial world. Hoya quickly had 100 million in assets with which to short the S&P 500. The founders realized that if the markets moved up, they'd suffer big losses, and they would be out of business. So they devised a hedging strategy that would limit the downside risk for the \$100M invested in S&P 500 index futures.
4. The risk management problem we will address is a long exposure.
5. To set our business context we must determine our total exposure and a dollar loss limit. The dollar loss limit should be a reasonable fraction of our total exposure.
6. Total exposure value is \$100.062M.
7. A dollar and percentage loss limit for our exposure is \$10M and 10%.
8. We want only a 1% chance of losing more than \$10M and 10%.

# of standard deviations from current futures price: 2.33

Associated loss probability: 1%

# of times out of n that loss limit is exceeded: 1 out of 100

For the S&P 500 underlying 12/19/2008 maturity date and 72 (10/8/2008 - 12/19/2008) day futures contract:

${}_0F_t = 981$  with  $R = 2\%$  and  $RP = 5\%$

Our 10% loss limit critical price level is calculated relative to a measure of a consensus market expectation:

Expected future price = 990.64 and based on an annualized standard deviation estimate of 53.26% (from Riskmetrics 30-day monthly estimate of  $15.27\% \sqrt{(365/30)}$ )

For a long exposure, the lower critical price level = 570.87

For a short exposure, the upper critical price level = 1719.05

## B. If we had a Long Exposure

From the calculation above, there is a 1% chance that the underlying price will be at or below 570.87 in a year. The associated loss relative to selling the underlying at the current futures price of 981 equals the “loss at the lower critical price level” = -41.81%

Therefore, we determine how much of our long exposure may be retained:  
loss limit / loss at lower critical price level =  $-10\% / -41.81\% = 23.90\%$

Roughly, we must decrease our exposure by  $1 - (\text{loss limit/loss at critical price level})$   
 $= 1 - 23.9\% = 76.1\%$

For the underlying position of \$100.062M, we must sell \$76.095M or 76.1%.

Our underlying exposure equals 408 contracts ( $\$100,000,000 / (\$250 * \$981)$ ).

We must sell 311 futures contracts to meet our risk targets.

## C. If we had a Short Exposure

From the calculation above, there is a 1% chance that the underlying price will be at or above 1719.05 in a year. The associated loss relative to buying the underlying at the current futures price of 981 equals the “loss at the upper critical price level” = -75.23%

Therefore, we determine how much of our long exposure may be retained:  
loss limit / loss at lower critical price level =  $-10\% / -41.81\% = 23.90\%$

Roughly, we must decrease our exposure by  $1 - (\text{loss limit/loss at critical price level})$   
 $= 1 - 13.3\% = 86.7\%$

For the underlying position of \$100M, we must sell \$86.717M or 86.72%.

Our underlying exposure equals 408 contracts ( $\$100,000,000 / (\$250 * \$981)$ ).

We must buy 354 futures contracts to meet our risk targets.

## D. Spreadsheet analysis

### Long Position

Price Value at Risk (V@R)		Underlying		SP500	
Today	10/8/2008	Futures price	981	Monthly price volatility (stan. dev.)	15.27
Risk Limit	-10,000,000	# of contract underlying	250	For Volatility - standard deviation information, <a href="http://riskmetrics.com/clients/data/cde/index.cgi">riskmetrics.com/clients/data/cde/index.cgi</a>	
# s.d. V@R (e.g. 1.00)	2.33	Exposure (+/-Contracts)	408	user is <a href="#">guriskmetrics</a>	
Exposure (maturity) Date	12/19/2008	\$ underlying	\$100,062,000	password is <a href="#">riskmetrics</a>	
For risk premium-adjusted V@R	Adjustment (+/-Contracts)		-311	OK @ 97	
Funding Rate	2.00%	Monthly Estimates	T>30 days: 72		
Risk Premium Estimate	5.00%	Riskmetrics (optional)	Riskmetrics inferred (optional)		
		weight last 150 obs. Own estimate	monthly vol*sqrt(72/30) Own estimate		
Standard deviations (s.d. E.g. 1% as 1.0)	15.2700	15.2700	23.6562	23.6562	
Long V@R @ price*exp(-#*sd)	690.1272	690.1272	570.8690	570.8690	
\$ V@R	-7,053,666	-7,053,666	-9,945,677	-9,945,677	
Long upside @ price*exp(+*sd)	1405.9351	1405.9351	1719.0684	1719.0684	
\$ profit	10,304,676	10,304,676	17,898,160	17,898,160	

Notes Quick & Dirty Check	
Target Loss	-9.99%
Loss %	Simple Log
Keep	23.9% 18.5%
Hedge	-76.1% -81.5%

Set no hedge & To Match "Keep"		23.9%
	Probability	1 out of
for 1.00 s.d	15.87%	6 4.9% loss
for 1.28 s.d	10.03%	10 6.1% loss
for 1.44 s.d	7.49%	13 6.7% loss
for 1.65 s.d	4.95%	20 7.6% loss
for 2.00 s.d	2.28%	44 8.9% loss
for 2.33 s.d	1.00%	100 10.0% loss
for 3.09 s.d	0.100%	1000 12.3% loss
Check # s.d.	2.3	

Probability of doing worse than -2.33 standard deviation (or 570.8690) is 0.99%

Note: Riskmetrics assumes a zero risk premium.

If the graph doesn't plot, click the X-axis and format axis "scale" to bracket price range.

## Short Position

Price Value at Risk (V@R)		Underlying		SP500	
Today	10/8/2008	Futures price	981	Monthly price volatility (stan. dev.)	15.27
Risk Limit	-10,000,000	# of contract underlying	250	For Volatility - standard deviation information, <a href="http://riskmetrics.com/clients/data/cde/index.cgi">riskmetrics.com/clients/data/cde/index.cgi</a>	
# s.d. V@R (e.g. 1.00)	2.33	Exposure (+/-Contracts)	-408	user is <a href="#">guriskmetrics</a>	
Exposure (maturity) Date	12/19/2008	\$ underlying	-\$100,062,000	password is <a href="#">riskmetrics</a>	
For risk premium-adjusted V@R	Adjustment (+/-Contracts)		354	OK @ -54	
Funding Rate	2.00%	Monthly Estimates	T>30 days: 72		
Risk Premium Estimate	5.00%	Riskmetrics (optional)	Riskmetrics inferred (optional)		
		weight last 150 obs. Own estimate	monthly vol*sqrt(72/30) Own estimate		
Standard deviations (s.d. E.g. 1% as 1.0)	15.2700	15.2700	23.6562	23.6562	
Short V@R @ price*exp(+*sd)	1405.9351	1405.9351	1719.0684	1719.0684	
\$ V@R	-5,736,624	-5,736,624	-9,963,924	-9,963,924	
Short upside @ price*exp(-*sd)	690.1272	690.1272	570.8690	570.8690	
\$ profit	3,926,783	3,926,783	5,536,769	5,536,769	

Notes Quick & Dirty Check	
Target Loss	-9.99%
Loss %	Simple Log
Keep	13.3% 17.8%
Hedge	86.7% 82.2%

Set no hedge & To Match "Keep"		186.7%
	Probability	1 out of
for 1.00 s.d	15.87%	6 52.2% loss
for 1.28 s.d	10.03%	10 68.5% loss
for 1.44 s.d	7.49%	13 78.4% loss
for 1.65 s.d	4.95%	20 91.9% loss
for 2.00 s.d	2.28%	44 #####
for 2.33 s.d	1.00%	100 #####
for 3.09 s.d	0.100%	1000 #####
Check # s.d.	5.9	

Probability of doing worse than +2.33 standard deviation (or 1719.0684) is 0.99%

Note: Riskmetrics assumes a zero risk premium.

If the graph doesn't plot, click the X-axis and format axis "scale" to bracket price range.

### Project Assignment 3

1. Business problem and risk: The Hoya Index Fund has a portfolio with \$100M invested in S&P 500 index futures. This is equivalent to 408 S&P 500 futures contracts. We want only a 1% chance of losing more than \$10M.
2. See Project Assignment 2.
3. Market outlook: Our view for December futures is up and stable. We expect the market to move up. Even though volatility is high, we expect it will remain at these levels for the foreseeable future.
4. Closest to maturity futures price and maturity date is December 2008 futures price of **\$981**.

Strikes	Calls	Puts
800.0	ATM 204.1	OTM 23.8
960.0	ATM 91.5	OTM 70.6
980.0	ATM 80.2	ATM 79.2
1150.0	OTM 17.6	ATM 186
1250.0	OTM 5	ATM 273.2

Direction View	Volatility View		
	Volatility Up	Volatility Stable	Volatility Down
Direction Up	+408F+408P (S#3) +408F+408Potm (S#4)	+97F+48P (S#16) +408F-408Cotm+408Potm (S#9)	+97F (S#1) +97F+48P-49C (S#14)
No Direction	+250F+500P (S#5) -250F+500C (S#6)	Preferred Practice for +F: Bull Spread (S#9)	+66F-132C (S#11) -66F-132P (S#12)
Direction Down	-408F+408Cotm (S#8) -408F+408C (S#7)	-408F+408Cotm-408Potm (S#10) -54F+27C (S#15)	-54F-27Potm+27Cotm (S#13) -54F (S#2)

Note: Positions are in black font if we start with long exposure, red font with short exposure. The S# indicates the number of scenario that contains the detail description for the corresponding position in the following section.



Scenario	View	Purpose	Position
# 2	Down/Sure	Trade	-54F

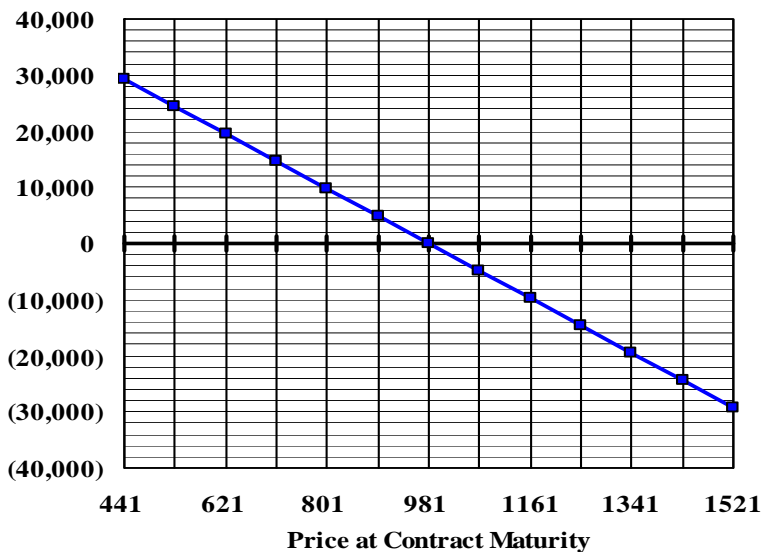
**Description:** Based on our risk control requirement specified in Project Assignment #2, we must buy 354 future contracts. The remaining short exposure is 408-354=54 contracts. This position has 1 out of 100 chance of losing more than \$10M.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S
F
981.0
0.00
54

Calculated Profit of a Short Forward Position		Underlying per Contract	
		250	Total Gain (Loss)
		-54F	
Prices at Maturity	441.0	29,160.00	7,290,000.00
	531.0	24,300.00	6,075,000.00
	621.0	19,440.00	4,860,000.00
Step size	711.0	14,580.00	3,645,000.00
90.00	801.0	9,720.00	2,430,000.00
	891.0	4,860.00	1,215,000.00
Input futures price	981.0	0.00	0.00
	1071.0	(4,860.00)	(1,215,000.00)
	1161.0	(9,720.00)	(2,430,000.00)
	1251.0	(14,580.00)	(3,645,000.00)
	1341.0	(19,440.00)	(4,860,000.00)
	1431.0	(24,300.00)	(6,075,000.00)
	1521.0	(29,160.00)	(7,290,000.00)

**-54F V@R**  
 down-sure/trade



Scenario	View	Purpose	Position
# 3	Up/Unsure	Trade, Insure	+408F+408P (Syn +408C)

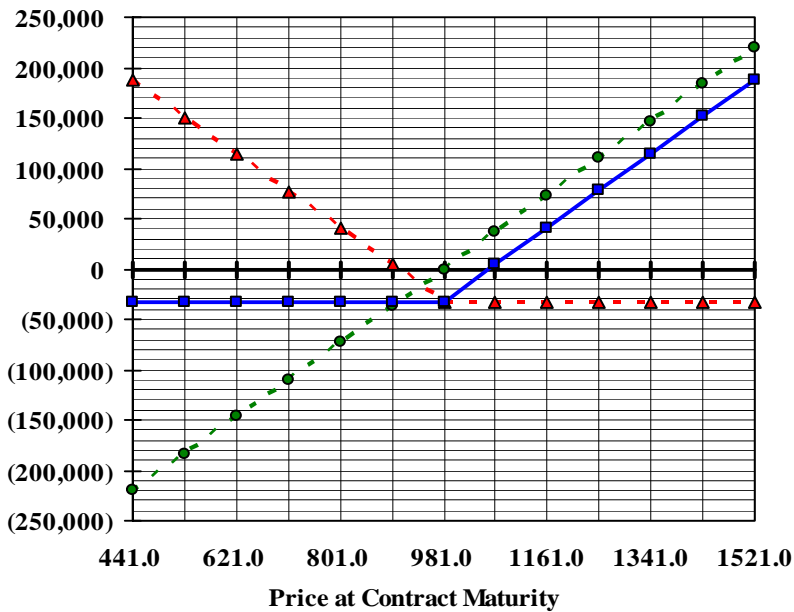
**Description:** The maximum loss for this position is \$8.18M, which meets our risk control requirement.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

L	L
F	P
981.0	980.0
0.00	79.20
408	408

Prices at Maturity	Step size 90.00	Input Futures=> Price	Calculated Profit of a Combined +408F+408P Position			Underlying per Contract
			+408F	+408P	+408F+408P	250
441.0			(220,320)	187,598	(32,722)	Total Gain(Loss)
531.0			(183,600)	150,878	(32,722)	(8,180,400)
621.0			(146,880)	114,158	(32,722)	(8,180,400)
711.0			(110,160)	77,438	(32,722)	(8,180,400)
801.0			(73,440)	40,718	(32,722)	(8,180,400)
891.0			(36,720)	3,998	(32,722)	(8,180,400)
981.0			0	(32,314)	(32,314)	(8,078,400)
1071.0			36,720	(32,314)	4,406	1,101,600
1161.0			73,440	(32,314)	41,126	10,281,600
1251.0			110,160	(32,314)	77,846	19,461,600
1341.0			146,880	(32,314)	114,566	28,641,600
1431.0			183,600	(32,314)	151,286	37,821,600
1521.0			220,320	(32,314)	188,006	47,001,600

**+F Insure  
 up-unsure/trade-insure  
 +408F+408P Position**



Scenario	View	Purpose	Position
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# 4	Up/Unsure	Trade, Insure	+408F+408Potm
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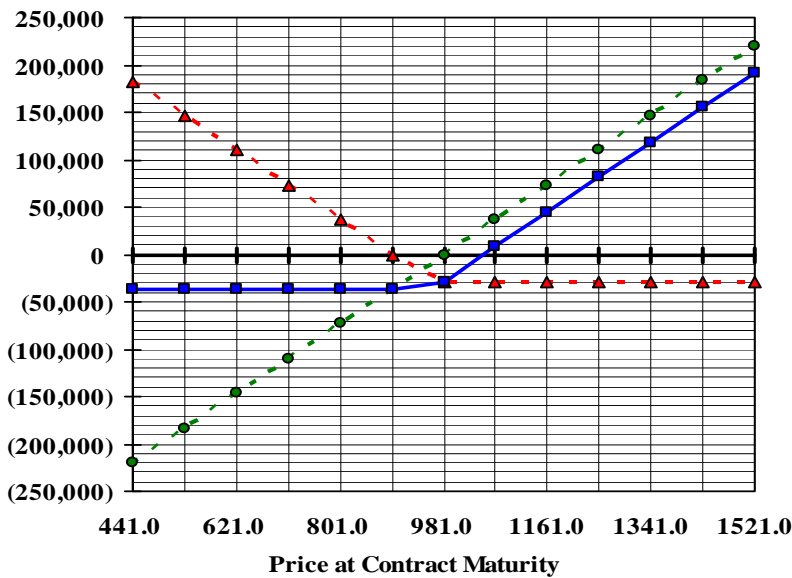
**Description:** The maximum loss for this position is \$9.34M, which meets our risk control requirement. When compared with +F+Pitm, this position's maximum loss is bigger and its potential gain on the up side is also bigger.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

L	L
F	P
981.0	960.0
0.00	70.60
408	408

Calculated Profit of a Combined +408F+408Potmotm Position					Underlying per Contract
					250
Prices at Maturity		+408F	+408Potm	+408F+408Potm	Total (Gain/Loss)
	441.0	(220,320)	182,947	(37,373)	(9,343,200)
	531.0	(183,600)	146,227	(37,373)	(9,343,200)
Step size	621.0	(146,880)	109,507	(37,373)	(9,343,200)
90.00	711.0	(110,160)	72,787	(37,373)	(9,343,200)
	801.0	(73,440)	36,067	(37,373)	(9,343,200)
Input	891.0	(36,720)	(653)	(37,373)	(9,343,200)
Futures=>	981.0	0	(28,805)	(28,805)	(7,201,200)
Price	1071.0	36,720	(28,805)	7,915	1,978,800
	1161.0	73,440	(28,805)	44,635	11,158,800
	1251.0	110,160	(28,805)	81,355	20,338,800
	1341.0	146,880	(28,805)	118,075	29,518,800
	1431.0	183,600	(28,805)	154,795	38,698,800
	1521.0	220,320	(28,805)	191,515	47,878,800

**+F Insure OTM**  
**up-unsure/trade-insure**  
**+408F+408Potm Position**



Scenario	View	Purpose	Position
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# 5	No Direction/Volatile	Trade, Insure	+250F+500P (Syn Long Straddle)
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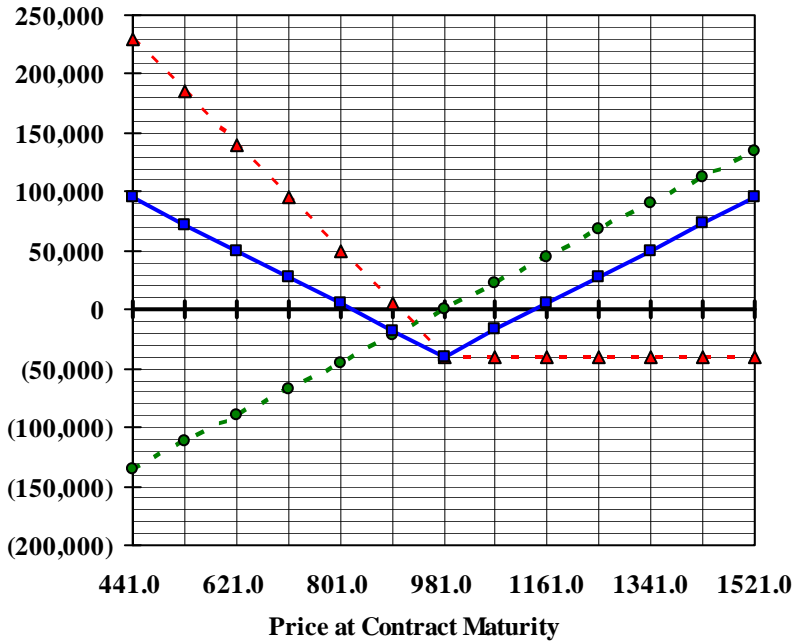
**Description:** The maximum loss for this position is \$9.9M, which meets our risk control requirement.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

L	L
F	P
981.0	980.0
0.00	79.20
250	500

Calculated Profit of a Combined +250F+500P Position				Underlying per Contract	
				250	
Prices at Maturity	+250F	+500P	+250F+500P	Total Gain(Loss)	
441.0	(135,000)	229,900	94,900	23,725,000	
531.0	(112,500)	184,900	72,400	18,100,000	
Step size 90.00	621.0	(90,000)	139,900	49,900	12,475,000
	711.0	(67,500)	94,900	27,400	6,850,000
	801.0	(45,000)	49,900	4,900	1,225,000
Input Futures=> Price	891.0	(22,500)	4,900	(17,600)	(4,400,000)
	981.0	0	(39,600)	(39,600)	(9,900,000)
	1071.0	22,500	(39,600)	(17,100)	(4,275,000)
	1161.0	45,000	(39,600)	5,400	1,350,000
	1251.0	67,500	(39,600)	27,900	6,975,000
	1341.0	90,000	(39,600)	50,400	12,600,000
	1431.0	112,500	(39,600)	72,900	18,225,000
	1521.0	135,000	(39,600)	95,400	23,850,000

**+F Vol**  
**volative/trade(vol)-insure**  
**+250F+500P Position**



Scenario	View	Purpose	Position
# 6	No Direction/Volatile	Trade, Insure	-250F+500C (Syn Long Straddle)

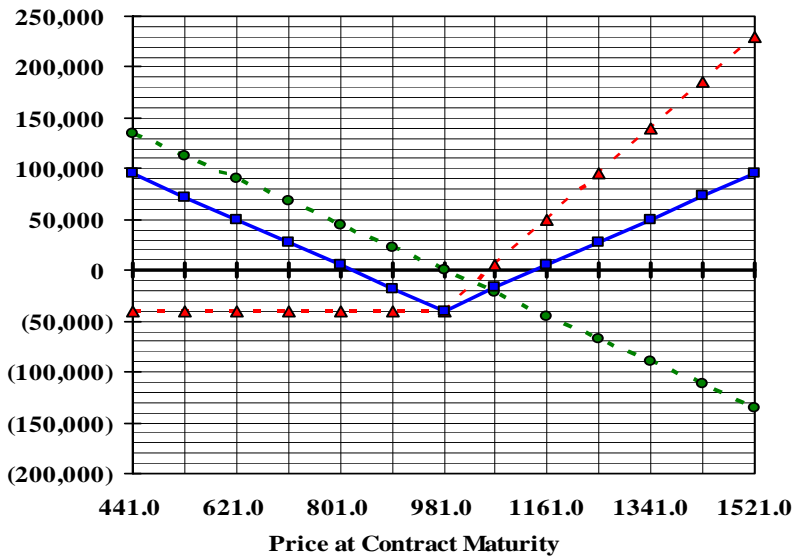
**Description: The maximum loss for this position is \$9.9M, which meets our risk control requirement.**

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	L
F	C
981.0	980.0
0.00	80.20
250	500

Calculated Profit of a Combined -250F+500C Position				Underlying per Contract	
Prices at Maturity		-250F	+500C	-250F+500C	250
					Total Gain(Loss)
	441.0	135,000	(40,100)	94,900	23,725,000
	531.0	112,500	(40,100)	72,400	18,100,000
Step size	621.0	90,000	(40,100)	49,900	12,475,000
90.00	711.0	67,500	(40,100)	27,400	6,850,000
	801.0	45,000	(40,100)	4,900	1,225,000
Input	891.0	22,500	(40,100)	(17,600)	(4,400,000)
Futures=>	981.0	0	(39,600)	(39,600)	(9,900,000)
Price	1071.0	(22,500)	5,400	(17,100)	(4,275,000)
	1161.0	(45,000)	50,400	5,400	1,350,000
	1251.0	(67,500)	95,400	27,900	6,975,000
	1341.0	(90,000)	140,400	50,400	12,600,000
	1431.0	(112,500)	185,400	72,900	18,225,000
	1521.0	(135,000)	230,400	95,400	23,850,000

**-F Vol**  
**unsure/trade(vol)-insure**  
**-250F+500C Position**



Scenario	View	Purpose	Position
# 7	Down/Unsure	Trade, Insure	-408F+408C (Syn +408P)

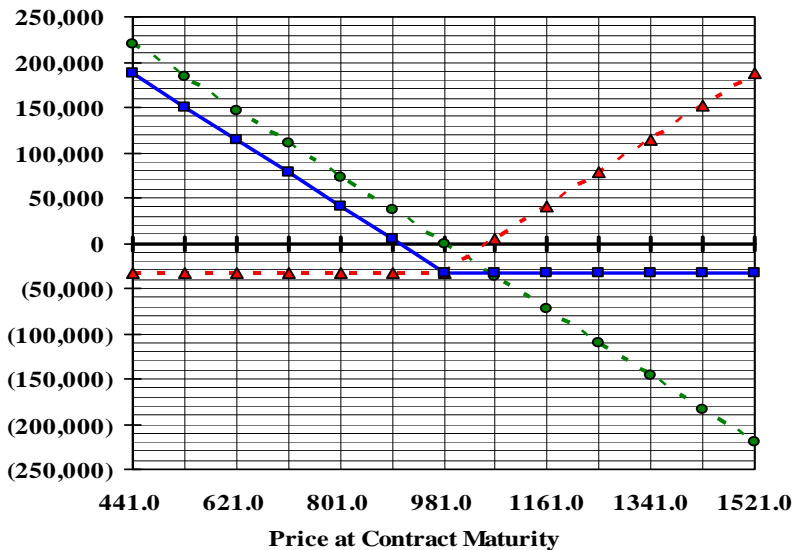
**Description:** The maximum loss for this position is \$8.08M, which meets our risk control requirement.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	L
F	C
981.0	980.0
0.00	80.20
408	408

Calculated Profit of a Combined -408F+408C Position				Underlying per Contract	
				250	
Prices at Maturity	-408F	+408C	-408F+408C	Total Gain(Loss)	
441.0	220,320	(32,722)	187,598	46,899,600	
531.0	183,600	(32,722)	150,878	37,719,600	
Step size 90.00	621.0	146,880	(32,722)	114,158	28,539,600
	711.0	110,160	(32,722)	77,438	19,359,600
	801.0	73,440	(32,722)	40,718	10,179,600
Input Futures=> Price	891.0	36,720	(32,722)	3,998	999,600
	981.0	0	(32,314)	(32,314)	(8,078,400)
	1071.0	(36,720)	4,406	(32,314)	(8,078,400)
	1161.0	(73,440)	41,126	(32,314)	(8,078,400)
	1251.0	(110,160)	77,846	(32,314)	(8,078,400)
	1341.0	(146,880)	114,566	(32,314)	(8,078,400)
	1431.0	(183,600)	151,286	(32,314)	(8,078,400)
	1521.0	(220,320)	188,006	(32,314)	(8,078,400)

**-F Insure  
 down-unsure/trade-insure  
 -408F+408C**



Scenario	View	Purpose	Position
# 8	Down/Unsure	Trade, Insure	-408F+408Cotm

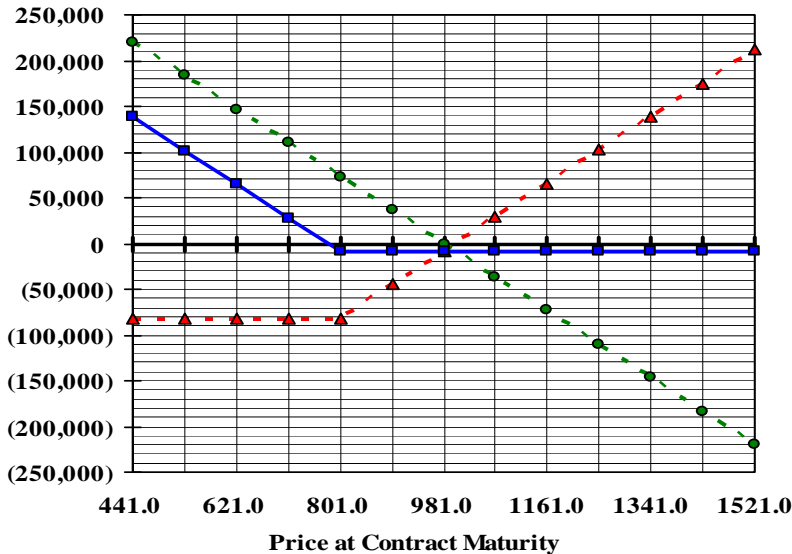
**Description:** The maximum loss for this position is \$2.05M, which meets our risk control requirement. When compared with -F+Citm, this position's maximum loss is smaller and its potential gain on the down side is also smaller.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	L	FV 0 days <-@ 0.00%
F	C	
981.0	800.0	
0.00	201.10	
408	408	

		Calculated Profit of a Combined -408F+408Cotm Position			Underlying per Contract
		-408F	+408Cotm	-408F+408Cotm	250
Prices at Maturity					Total
	441.0	220,320	(82,049)	138,271	34,567,800
	531.0	183,600	(82,049)	101,551	25,387,800
Step size	621.0	146,880	(82,049)	64,831	16,207,800
90.00	711.0	110,160	(82,049)	28,111	7,027,800
	801.0	73,440	(81,641)	(8,201)	(2,050,200)
Input	891.0	36,720	(44,921)	(8,201)	(2,050,200)
Futures=>	981.0	0	(8,201)	(8,201)	(2,050,200)
Price	1071.0	(36,720)	28,519	(8,201)	(2,050,200)
	1161.0	(73,440)	65,239	(8,201)	(2,050,200)
	1251.0	(110,160)	101,959	(8,201)	(2,050,200)
	1341.0	(146,880)	138,679	(8,201)	(2,050,200)
	1431.0	(183,600)	175,399	(8,201)	(2,050,200)
	1521.0	(220,320)	212,119	(8,201)	(2,050,200)

**-F Insure otm**  
 down-unsure(<atm)/trade-insure(<atm)  
**-408F+408Co**



Scenario	View	Purpose	Position
# 9	Limited Up/Volatility Stable	Trade, Insure, Income	+408F-408Cotm+408Potm (Syn Bull Spread)

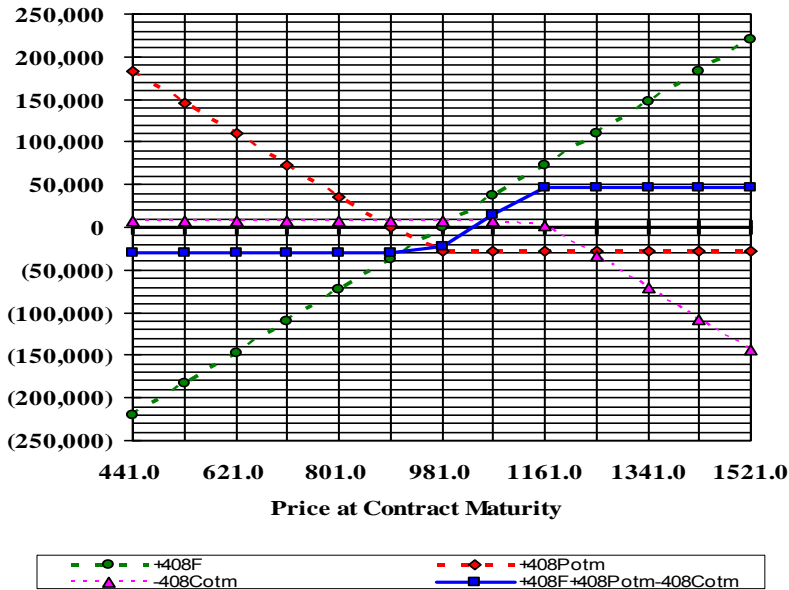
**Description:** The maximum loss for this position is \$7.55M, which meets our risk control requirement.

L or S (Long/Short)  
 F, C, or P  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

	L	L	S
	F	P	C
	981.0	960.0	1150.0
	0.00	70.60	17.60
	408	408	408

Calculated Profit of a Combined +408F+408Potm-408Cotm Position						Underlying per Contract
						250
Prices at Maturity	+408F	+408Potm	- 408Cotm	+408F+408Potm-408Cotm	Total Gain(Loss)	
441.0	(220,320)	182,947	7,181	(30,192)	(7,548,000)	
531.0	(183,600)	146,227	7,181	(30,192)	(7,548,000)	
621.0	(146,880)	109,507	7,181	(30,192)	(7,548,000)	
711.0	(110,160)	72,787	7,181	(30,192)	(7,548,000)	
801.0	(73,440)	36,067	7,181	(30,192)	(7,548,000)	
891.0	(36,720)	(653)	7,181	(30,192)	(7,548,000)	
981.0	0	(28,805)	7,181	(21,624)	(5,406,000)	
1071.0	36,720	(28,805)	7,181	15,096	3,774,000	
1161.0	73,440	(28,805)	2,693	47,328	11,832,000	
1251.0	110,160	(28,805)	(34,027)	47,328	11,832,000	
1341.0	146,880	(28,805)	(70,747)	47,328	11,832,000	
1431.0	183,600	(28,805)	(107,467)	47,328	11,832,000	
1521.0	220,320	(28,805)	(144,187)	47,328	11,832,000	

**Syn. Bull Spread**  
 limited up-worry big down/T-Inc-Ins  
 +408F+408Potm-408Cotm



Scenario	View	Purpose	Position
# 10	Limited Down / Volatility Stable	Trade, Insure, Income	-408F+408Cotm-408Potm (Syn Bear Spread)

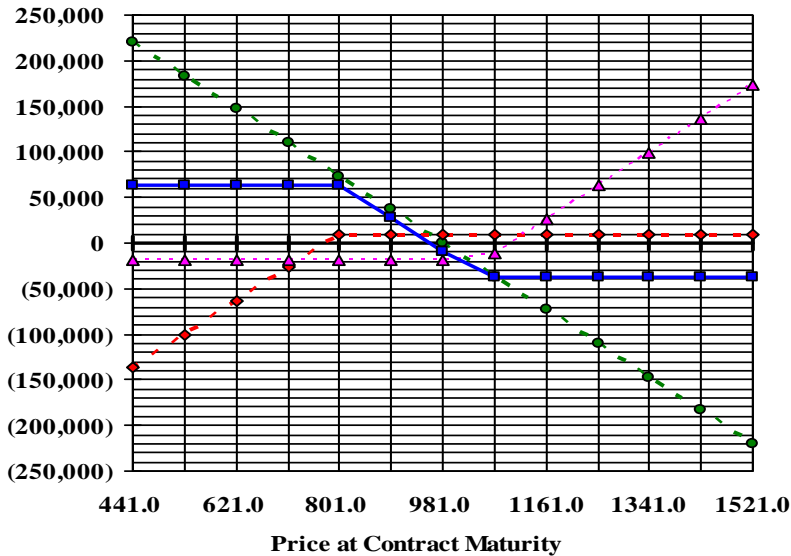
**Description:** The maximum loss for this position is \$9.45M, which meets our risk control requirement.

L or S (Long/Short)  
 F, C, or P  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	S	L
F	P	C
981.0	800.0	1050.0
0.00	23.80	47.40
408	408	408

Calculated Profit of a Combined -408F-408Potm+408Cotm Position						Underlying per Contract
						250
Prices at Maturity		-408F	-408Potm	+408Cotm	-408F-408Potm+408Cotm	Total Gain(Loss)
441.0	220,320	(136,762)	(19,339)	64,219	16,054,800	
531.0	183,600	(100,042)	(19,339)	64,219	16,054,800	
Step size 90.00	621.0	146,880	(63,322)	(19,339)	64,219	16,054,800
	711.0	110,160	(26,602)	(19,339)	64,219	16,054,800
	801.0	73,440	9,710	(19,339)	63,811	15,952,800
Input Futures=> Price	891.0	36,720	9,710	(19,339)	27,091	6,772,800
	981.0	0	9,710	(19,339)	(9,629)	(2,407,200)
	1071.0	(36,720)	9,710	(10,771)	(37,781)	(9,445,200)
	1161.0	(73,440)	9,710	25,949	(37,781)	(9,445,200)
	1251.0	(110,160)	9,710	62,669	(37,781)	(9,445,200)
	1341.0	(146,880)	9,710	99,389	(37,781)	(9,445,200)
	1431.0	(183,600)	9,710	136,109	(37,781)	(9,445,200)
	1521.0	(220,320)	9,710	172,829	(37,781)	(9,445,200)

Syn. Bear Spread  
 Limited down-Worry big up/T-Ins-Inc  
 -408F-408Potm+408Cotm



-408F	-408Potm
+408Cotm	-408F-408Potm+408Cotm

Scenario	View	Purpose	Position
# 11	No Direction/Sure	Trade, Income	+66F-132C (Syn Short Straddle)

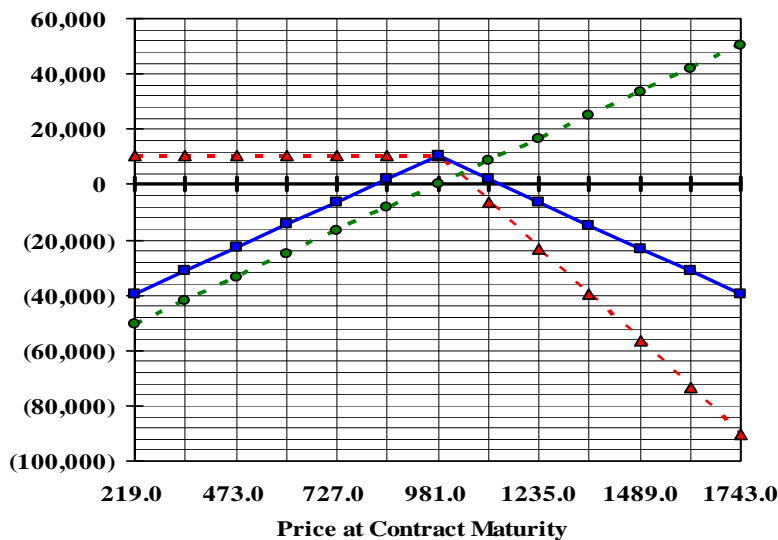
**Description:** The loss of this position is greater than \$10M when future price is below \$219 or above \$1,743. This price range corresponds to below  $-6.39 \times \text{Sigma}$  and above  $+2.39 \times \text{Sigma}$  around the expected future price. The probability is 0.83%, which meets our risk control (less than 1%).

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

L	S
F	C
981.0	980.0
0.00	80.20
66	132

Calculated Profit of a Combined +66F-132C Position					Underlying per Contract
					250
Prices at Maturity		+66F	-132C	+66F-132C	Total Gain(Loss)
219.0		(50,292)	10,586	(39,706)	(9,926,400)
346.0		(41,910)	10,586	(31,324)	(7,830,900)
Step size	473.0	(33,528)	10,586	(22,942)	(5,735,400)
127.00	600.0	(25,146)	10,586	(14,560)	(3,639,900)
	727.0	(16,764)	10,586	(6,178)	(1,544,400)
Input	854.0	(8,382)	10,586	2,204	551,100
Futures=>	981.0	0	10,454	10,454	2,613,600
Price	1108.0	8,382	(6,310)	2,072	518,100
	1235.0	16,764	(23,074)	(6,310)	(1,577,400)
	1362.0	25,146	(39,838)	(14,692)	(3,672,900)
	1489.0	33,528	(56,602)	(23,074)	(5,768,400)
	1616.0	41,910	(73,366)	(31,456)	(7,863,900)
	1743.0	50,292	(90,130)	(39,838)	(9,959,400)

**+F Stable**  
 stable/trade(vol)-income  
**+66F-132C Position**



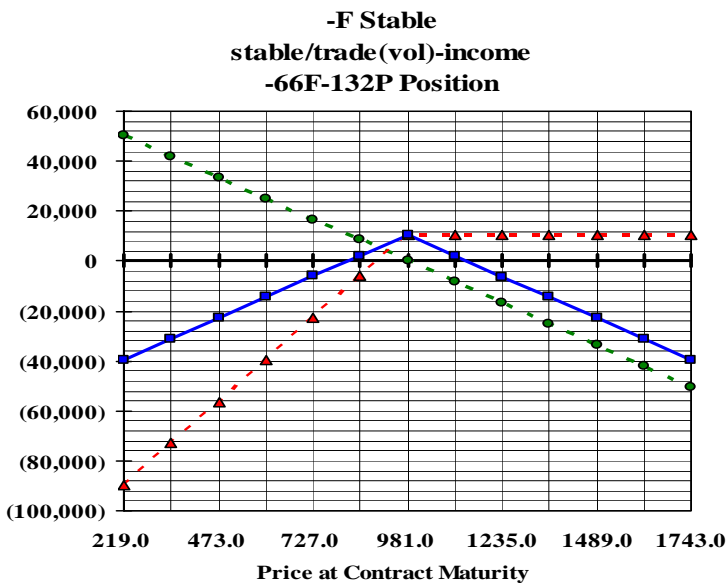
Scenario	View	Purpose	Position
# 12	No Direction/Sure	Trade, Income	-66F-132P (Syn Short Straddle)

**Description:** The loss of this position is greater than \$10M when future price is below \$219 or above \$1,743. This price range corresponds to below  $-6.39 \times \text{Sigma}$  and above  $+2.39 \times \text{Sigma}$  around the expected future price. The probability is 0.83%, which meets our risk control (less than 1%).

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	S
F	P
981.0	980.0
0.00	80.20
66	132

Calculated Profit of a Combined -66F-132P Position					Underlying per Contract
					250
Prices at Maturity		-66F	-132P	-66F-132P	Total Gain(Loss)
219.0		50,292	(89,866)	(39,574)	(9,893,400)
346.0		41,910	(73,102)	(31,192)	(7,797,900)
473.0		33,528	(56,338)	(22,810)	(5,702,400)
600.0	Step size 127.00	25,146	(39,574)	(14,428)	(3,606,900)
727.0		16,764	(22,810)	(6,046)	(1,511,400)
854.0	Input	8,382	(6,046)	2,336	584,100
981.0	Futures=> Price	0	10,586	10,586	2,646,600
1108.0		(8,382)	10,586	2,204	551,100
1235.0		(16,764)	10,586	(6,178)	(1,544,400)
1362.0		(25,146)	10,586	(14,560)	(3,639,900)
1489.0		(33,528)	10,586	(22,942)	(5,735,400)
1616.0		(41,910)	10,586	(31,324)	(7,830,900)
1743.0		(50,292)	10,586	(39,706)	(9,926,400)



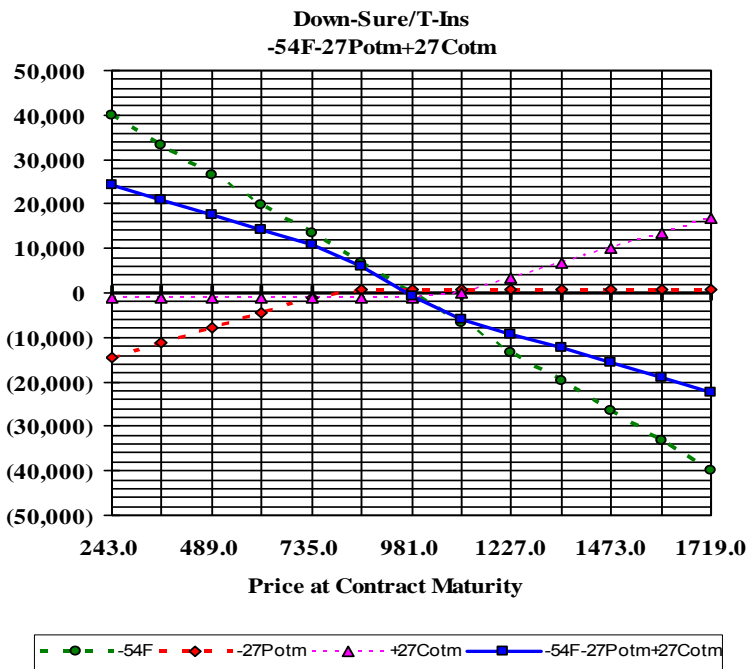
Scenario	View	Purpose	Position
# 13	Down/Sure	Trade, Insure	-54F-27Potm+27Cotm

**Description:** This position is benchmarked by the -F only position (-54F). The loss will be smaller on the upside, and the gain will be smaller on the downside.

L or S (Long/Short)  
 F, C, or P  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	S	L
F	P	C
981.0	800.0	1050.0
0.00	23.80	47.40
54	27	27

		Calculated Profit of a Combined -54F-27Potm+27Cotm Position				Underlying per Contract
						250
Prices at Maturity		-54F	-27Potm	+27Cotm	-54F-27Potm+27Cotm	Total Gain(Loss)
	243.0	39,852	(14,396)	(1,280)	24,176	6,043,950
	366.0	33,210	(11,075)	(1,280)	20,855	5,213,700
Step size	489.0	26,568	(7,754)	(1,280)	17,534	4,383,450
123.00	612.0	19,926	(4,433)	(1,280)	14,213	3,553,200
	735.0	13,284	(1,112)	(1,280)	10,892	2,722,950
Input	858.0	6,642	643	(1,280)	6,005	1,501,200
Futures=>	981.0	0	643	(1,280)	(637)	(159,300)
Price	1104.0	(6,642)	643	178	(5,821)	(1,455,300)
	1227.0	(13,284)	643	3,499	(9,142)	(2,285,550)
	1350.0	(19,926)	643	6,820	(12,463)	(3,115,800)
	1473.0	(26,568)	643	10,141	(15,784)	(3,946,050)
	1596.0	(33,210)	643	13,462	(19,105)	(4,776,300)
	1719.0	(39,852)	643	16,783	(22,426)	(5,606,550)



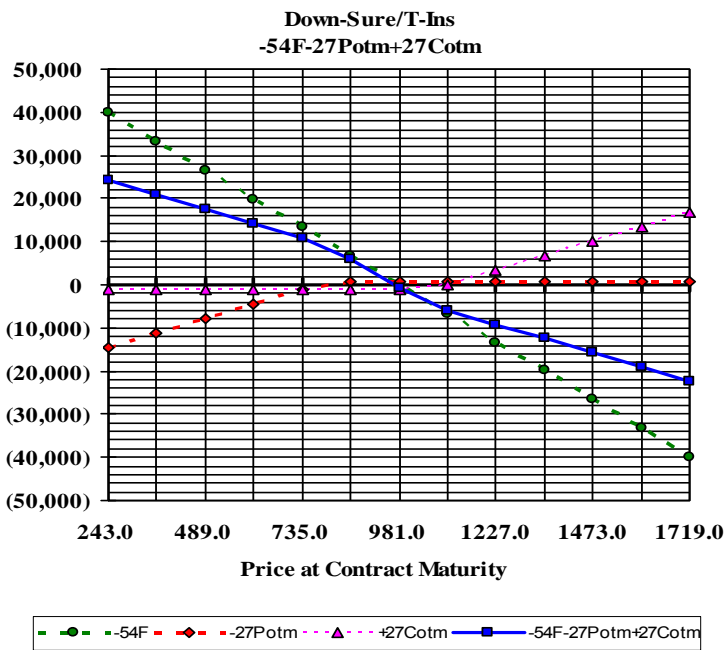
Scenario	View	Purpose	Position
# 14	Up/Sure	Trade, Insure	+97F+48Potm-49Cotm

**Description:** This position is benchmarked by the +F only position (+97F). The loss will be smaller on the downside, and the gain will be smaller on the upside.

L or S (Long/Short)  
 F, C, or P  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	S	L
F	P	C
981.0	800.0	1050.0
0.00	23.80	47.40
54	27	27

		Calculated Profit of a Combined -54F-27Potm+27Cotm Position				Underlying per Contract
		-54F	-27Potm	+27Cotm	-54F-27Potm+27Cotm	250
Prices at Maturity						Total Gain(Loss)
	243.0	39,852	(14,396)	(1,280)	24,176	6,043,950
	366.0	33,210	(11,075)	(1,280)	20,855	5,213,700
Step size	489.0	26,568	(7,754)	(1,280)	17,534	4,383,450
123.00	612.0	19,926	(4,433)	(1,280)	14,213	3,553,200
	735.0	13,284	(1,112)	(1,280)	10,892	2,722,950
Input	858.0	6,642	643	(1,280)	6,005	1,501,200
Futures=>	981.0	0	643	(1,280)	(637)	(159,300)
Price	1104.0	(6,642)	643	178	(5,821)	(1,455,300)
	1227.0	(13,284)	643	3,499	(9,142)	(2,285,550)
	1350.0	(19,926)	643	6,820	(12,463)	(3,115,800)
	1473.0	(26,568)	643	10,141	(15,784)	(3,946,050)
	1596.0	(33,210)	643	13,462	(19,105)	(4,776,300)
	1719.0	(39,852)	643	16,783	(22,426)	(5,606,550)



Scenario	View	Purpose	Position
# 15	Down/Stable	Trade, Insure	-54F+27C

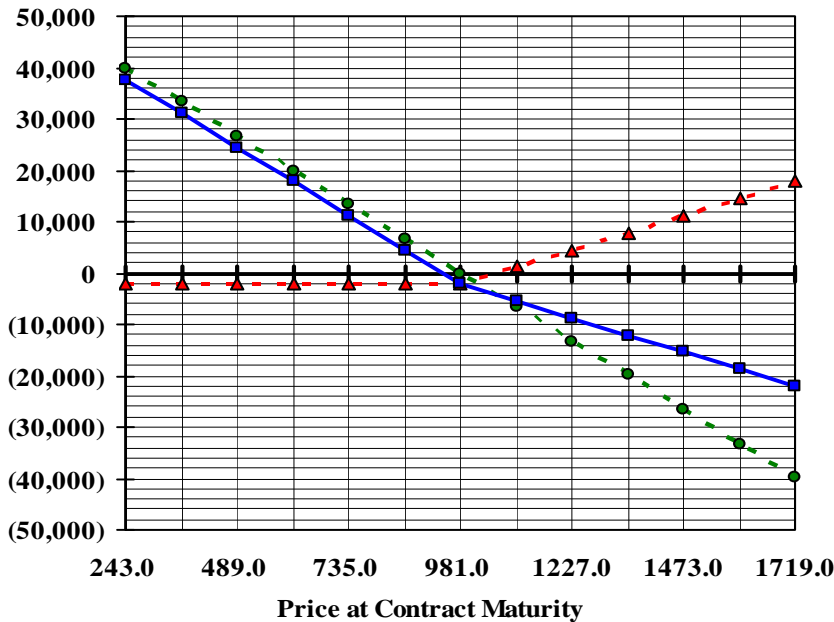
**Description:** This position is benchmarked by the -F only position (-54F). The loss will be smaller on the upside, and the gain will be almost the same on the downside.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

S	L
F	C
981.0	980.0
0.00	80.20
54	27

Prices at Maturity	Step size 123.00	Input Futures=> Price	Calculated Profit of a Combined -54F+27C Position			Underlying per Contract
			-54F	+27C	-54F+27C	250 Total Gain(Loss)
243.0			39,852	(2,165)	37,687	9,421,650
366.0			33,210	(2,165)	31,045	7,761,150
489.0			26,568	(2,165)	24,403	6,100,650
612.0			19,926	(2,165)	17,761	4,440,150
735.0			13,284	(2,165)	11,119	2,779,650
858.0			6,642	(2,165)	4,477	1,119,150
981.0			0	(2,138)	(2,138)	(534,600)
1104.0			(6,642)	1,183	(5,459)	(1,364,850)
1227.0			(13,284)	4,504	(8,780)	(2,195,100)
1350.0			(19,926)	7,825	(12,101)	(3,025,350)
1473.0			(26,568)	11,146	(15,422)	(3,855,600)
1596.0			(33,210)	14,467	(18,743)	(4,685,850)
1719.0			(39,852)	17,788	(22,064)	(5,516,100)

**down-stable/trade-insure  
 -54F+27C Position**



Scenario	View	Purpose	Position
# 16	Up/Stable	Trade, Insure	+97F+48P

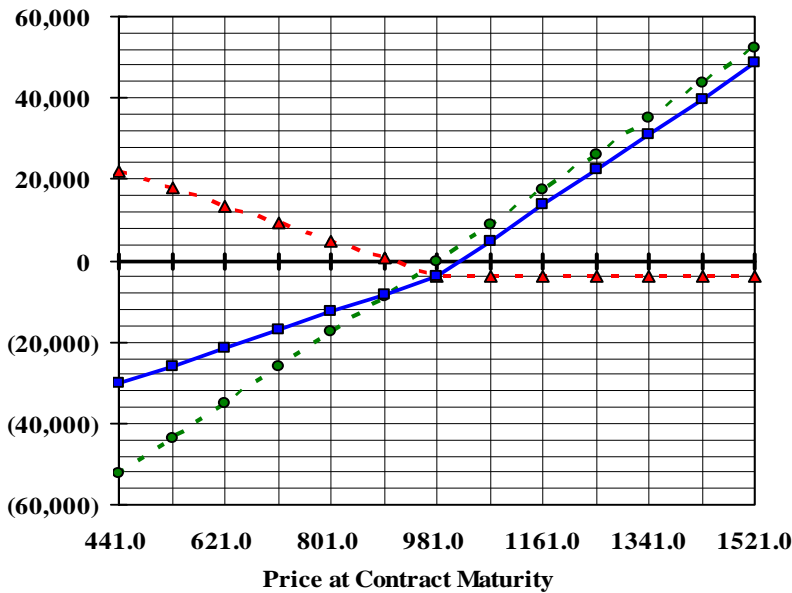
**Description:** This position is benchmarked by the +F only position (+97F). The loss will be smaller on the downside, and the gain will be almost the same on the upside.

L or S (Long/Short)  
 F, C, or P (Forward, Call, Put)  
 Forward/Strike Price  
 Price (C or P), 0.0 (F) - FV  
 Number of Contracts

L	L
F	P
981.0	980.0
0.00	79.20
97	48

		Calculated Profit of a Combined +97F+48P Position			Underlying per Contract
		+97F	+48P	+97F+48P	250
Prices at Maturity					Total Gain(Loss)
	441.0	(52,380)	22,070	(30,310)	(7,577,400)
	531.0	(43,650)	17,750	(25,900)	(6,474,900)
Step size	621.0	(34,920)	13,430	(21,490)	(5,372,400)
90.00	711.0	(26,190)	9,110	(17,080)	(4,269,900)
	801.0	(17,460)	4,790	(12,670)	(3,167,400)
Input	891.0	(8,730)	470	(8,260)	(2,064,900)
Futures=>	981.0	0	(3,802)	(3,802)	(950,400)
Price	1071.0	8,730	(3,802)	4,928	1,232,100
	1161.0	17,460	(3,802)	13,658	3,414,600
	1251.0	26,190	(3,802)	22,388	5,597,100
	1341.0	34,920	(3,802)	31,118	7,779,600
	1431.0	43,650	(3,802)	39,848	9,962,100
	1521.0	52,380	(3,802)	48,578	12,144,600

up-stable/trade-insure  
 +97F+48P Position



5. We recommend hedging our long position in 408 futures contracts by selling 408  $C_{otm}$  (out of money) call options with a strike price of \$1150 and a premium of \$17.60, and buying 408  $P_{otm}$  (out of money) put options with a strike price of \$960 and a premium of \$70.60. This limits our loss in case of a market downturn to \$7.55M. (This is Scenario #9 in the charts above).

Especially with the current volatility of the market, with this bull spread it will greatly reduce our position cost due to the fact that we are selling calls and buying puts out of money.