

Investment Fund Risk Management



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Business Overview

- Patel Investment Fund is based out of New York and has a \$100 million portfolio
- Exposure: Long S&P 500 of \$100 million
- Risk Guideline: 5%, i.e. \$5 million
- Loss Probability: 1% (2.33 std dev) of losing \$5 million

S&P 500 Performance (6 months)

- Up 6.57%, in last 6 months, YTD: 4.5%
- Markets have bounced 7.7% since the lowest point in March 5, 2007
- Risks persists despite the recent run-up



CBOE Volatility Index: VIX

- 3 Month VIX Range: 19.63 – 10.08
- April 2007 saw decreased volatility as S&P 500 increased
- VIX may increase in upcoming months
 - Earnings announcements will impact VIX
 - Geopolitical tensions persist



Futures Contracts

- June Futures (SPM07): 1,488.50
(As of 4-24-07)
- 1 Contract Price = \$250
- Total Contact Price: \$372,125
(=1488.50 * 250)
- Total Contracts Needed: 268
(=\$100 million / \$372,125)

Our Market View

- Direction
 - Price Up and Unsure
- Volatility
 - Up

Hedging Strategy

□ Given:

- RP = 5%, Assumed
- R=4.622%, 3 Month Treasury Note
- t = 0.142 (=52/365)
- Monthly Vol (sigma) = 5.79% (From Risk Metrics)
- 52 Day Vol (sigma) = 7.62% (=5.79%* sqrt(52/30))
- Standard Deviation = 2.33
- ${}_0F_t = 1488.50$, SPM07 as of 4-24-2007

□ St market = 1499.03

$$\bar{S}_t^{\text{market}} = {}_0F_t \left[\frac{1 + ({}_0R_t + {}_0\text{Risk Prem}_t) * t}{1 + {}_0R_t * t} \right]$$

$$= 1488.5 * [(1 + (4.622\% + 5\%) * 0.142) / (1 + 5\%)]$$

Critical Price Calculations

- ❑ Critical Price (down) = 1401.85

$$\text{Expected future price} * e^{-\#\sigma\sqrt{T}}$$

$$= 1499.03 * \text{EXP}(-2.33 * 7.62\% * \text{sqrt}(.142))$$

- ❑ Critical Price (up) = 1602.95

$$\text{Expected future price} * e^{+\#\sigma\sqrt{T}}$$

$$= 1499.03 * \text{EXP}(+2.33 * 7.62\% * \text{sqrt}(.142))$$

- ❑ Target loss = -5%,
- ❑ Actual loss = -5.8% (= 1401.85/1499.03 - 1)
- ❑ Keep 86% (= Target/Actual = -5%/-5.8%)
- ❑ Hedge = 14% (= 1 - Keep)
- ❑ Contracts:
 - Keep: 230 (= 268 * .86), Hedge: 38 (= 268 - 230)

Target Position

	Current Position, +268F	Level of Confidence		
		Uncertain	=market	certain
P R I C E S	Up	+268C, Long Call	+268C _{itm} -268C _{otm} , Bull Call Spread	
	Stable	+268C+ 268P, Long Straddle	Flat (Have to maintain +230F)	
	Down			

Trade Needed, Given +268 Underlying

	Current Position, +268F	Level of Confidence		
		Uncertain	=market	certain
P R I C E S	Up	+268P	$+268P_{otm} - 268C_{otm}$	
	Stable	+536P	-38F	
	Down			

Call/Put Market Prices

	CALLS		PUTS	
ITM/OTM	Strike Price	Price Quote	Strike Price	Price Quote
More OTM	1600	0.4	1400	6.5
OTM	1530	7.5	1450	13.70
ATM	1490	25	1490	26
ITM	1450	52.40	1530	49
More ITM	1400	90	1600	109

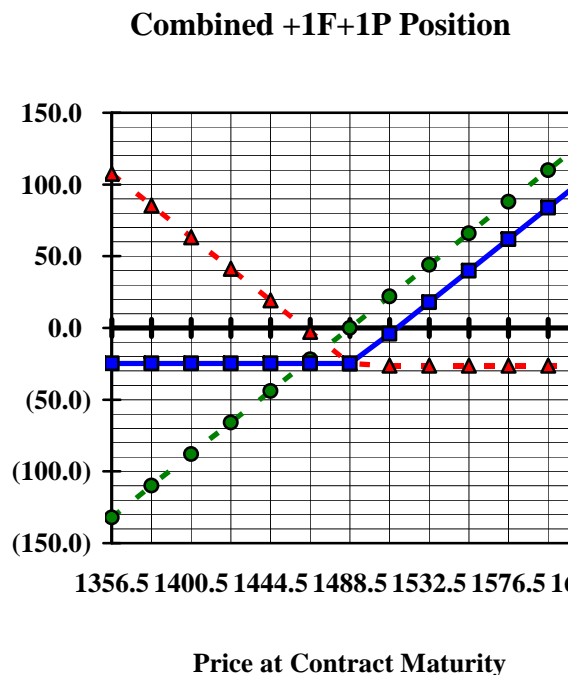
Data as of April 24, 2007, Yahoo Finance

+268F +268P Position Graph

- \$24.7 is the maximum loss
- Position Maximum Loss: \$1,654,900 = (24.7 * 268 * 250)
- Less than risk limit of \$ 5 million

L or S (Long/Short)	L	L
F, C, or P (Forward, Call, Put)	F	P
Forward/Strike Price	1488.5	1490.0
Price (C or P), 0.0 (F) - FV	0.00	26.17
Number of Contracts	1	1

Calculated Profit of a Combined +1F+1P Position				
Prices at Maturity	+1F	+1P	+1F+1P	
1356.5	(132.0)	107.3	(24.7)	
1378.5	(110.0)	85.3	(24.7)	
Step size 22.00	1400.5	(88.0)	63.3	(24.7)
	1422.5	(66.0)	41.3	(24.7)
	1444.5	(44.0)	19.3	(24.7)
Input Futures=> 1488.5	1466.5	(22.0)	(2.7)	(24.7)
Price	1510.5	22.0	(26.2)	(4.2)
	1532.5	44.0	(26.2)	17.8
	1554.5	66.0	(26.2)	39.8
Strike F9 to update	1576.5	88.0	(26.2)	61.8
	1598.5	110.0	(26.2)	83.8
	1620.5	132.0	(26.2)	105.8

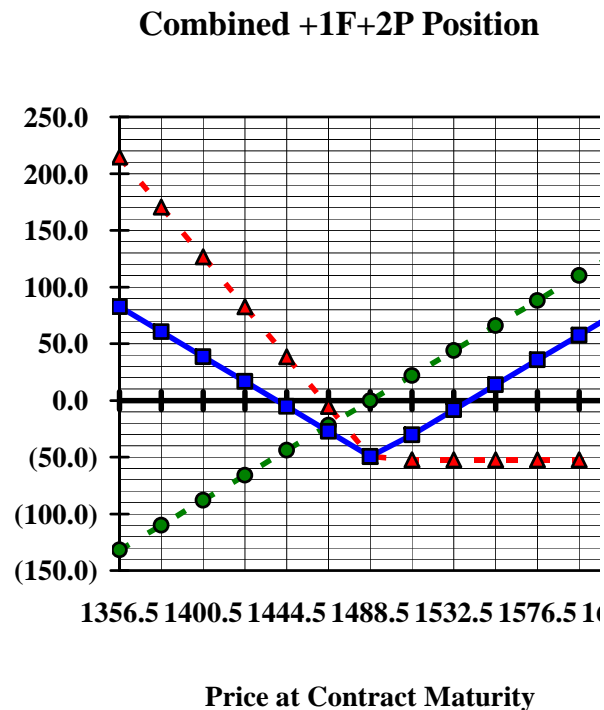


+268F+536P Position Graph

- \$49.3 is the maximum loss
- Position Maximum Loss: \$3,303,100 = (49.3 * 268 * 250)
- Less than risk limit of \$ 5 million

L or S (Long/Short)	L	L
F, C, or P (Forward, Call, Put)	F	P
Forward/Strike Price	1488.5	1490.0
Price (C or P), 0.0 (F) - FV	0.00	26.17
Number of Contracts	1	2

		Calculated Profit of a Combined +1F+2P Position		
		+1F	+2P	+1F+2P
Prices at Maturity	1356.5	(132.0)	214.7	82.7
	1378.5	(110.0)	170.7	60.7
Step size	1400.5	(88.0)	126.7	38.7
	1422.5	(66.0)	82.7	16.7
	1444.5	(44.0)	38.7	(5.3)
Input	1466.5	(22.0)	(5.3)	(27.3)
Futures=> Price	1488.5	0.0	(49.3)	(49.3)
	1510.5	22.0	(52.3)	(30.3)
	1532.5	44.0	(52.3)	(8.3)
	1554.5	66.0	(52.3)	13.7
Strike F9 to update	1576.5	88.0	(52.3)	35.7
	1598.5	110.0	(52.3)	57.7
	1620.5	132.0	(52.3)	79.7



+268P_{otm} - 268C_{otm} Position Graph

- \$44.7 is the maximum loss
- Position Maximum Loss : \$2,994,900 = (44.7 * 268 * 250)
- Less than risk limit of \$ 5 million

L or S (Long/Short)

F, C, or P

Forward/Strike Price

Price (C or P), 0.0 (F) - FV

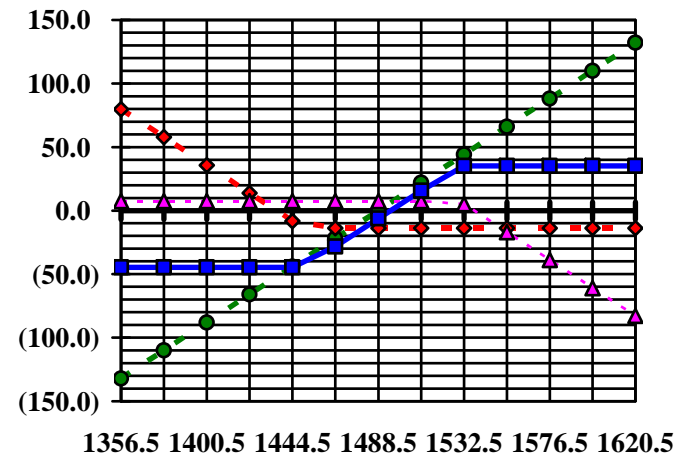
Number of Contracts

L	L	S
F	P	C
1488.5	1450.0	1530.0
0.00	13.79	7.55
1	1	1

Calculated Profit of a
Combined +1F+1P-1C Position

Prices at Maturity	+1F	+1P	-1C	+1F+1P-1C
1356.5	(132.0)	79.7	7.5	(44.7)
1378.5	(110.0)	57.7	7.5	(44.7)
Step size 22.0	(88.0)	35.7	7.5	(44.7)
1422.5	(66.0)	13.7	7.5	(44.7)
1444.5	(44.0)	(8.3)	7.5	(44.7)
Input Futures=> 1466.5	(22.0)	(13.8)	7.5	(28.2)
Price 1488.5	0.0	(13.8)	7.5	(6.2)
1510.5	22.0	(13.8)	7.5	15.8
1532.5	44.0	(13.8)	5.0	35.3
1554.5	66.0	(13.8)	(17.0)	35.3
Strike F9 to update 1576.5	88.0	(13.8)	(39.0)	35.3
1598.5	110.0	(13.8)	(61.0)	35.3
1620.5	132.0	(13.8)	(83.0)	35.3

Combined +1F+1P-1C Position



Price at Contract Maturity

● +1F ◆ +1P ▲ -1C ■ +1F+1P-1C

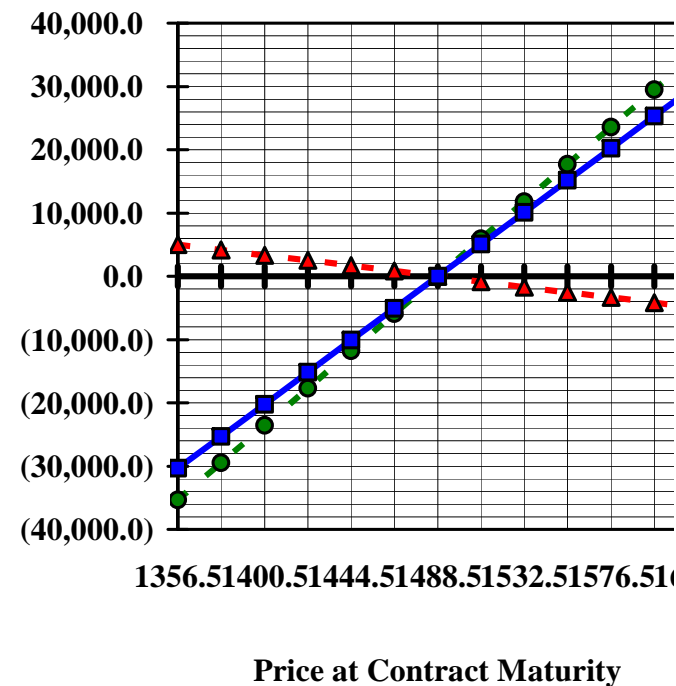
+268F-38F Position Graph

- Maximum loss at 99% CI is \$4.98 million (1% VaR)
- Less than risk limit of \$ 5 million

L or S (Long/Short)	L	S
F, C, or P (Forward, Call, Put)	F	F
Forward/Strike Price	1488.5	1488.5
Price (C or P), 0.0 (F) - FV	0.00	0.00
Number of Contracts	268	38

Calculated Profit of a Combined +268F-38F Position				
Prices at Maturity	+268F	-38F	+268F-38F	
1356.5	(35,376.0)	5,016.0	(30,360.0)	
1378.5	(29,480.0)	4,180.0	(25,300.0)	
Step size 22.00	1400.5	(23,584.0)	3,344.0	(20,240.0)
	1422.5	(17,688.0)	2,508.0	(15,180.0)
	1444.5	(11,792.0)	1,672.0	(10,120.0)
Input	1466.5	(5,896.0)	836.0	(5,060.0)
Futures=> 1488.5	0.0	0.0	0.0	
Price	1510.5	5,896.0	(836.0)	5,060.0
	1532.5	11,792.0	(1,672.0)	10,120.0
	1554.5	17,688.0	(2,508.0)	15,180.0
Strike F9	1576.5	23,584.0	(3,344.0)	20,240.0
to update	1598.5	29,480.0	(4,180.0)	25,300.0
	1620.5	35,376.0	(5,016.0)	30,360.0

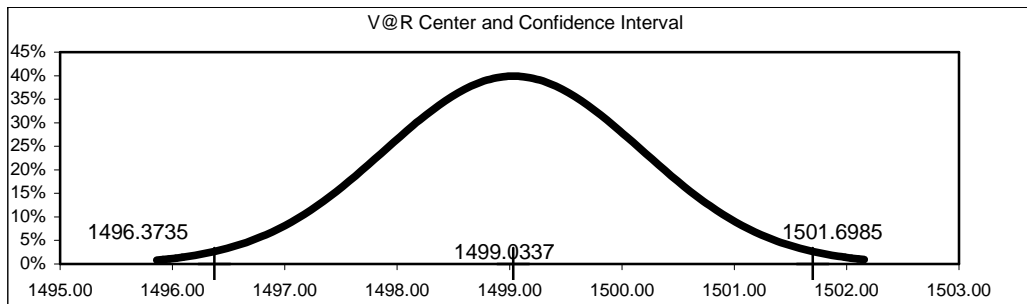
Combined +268F-38F Position



Portfolio VaR (at 99% CI)

□ 1% VaR is \$4.98 million

Price Value at Risk (V@R)		Underlying S&P 500	
Today 4/24/2007	Futures price 1488.5	Monthly price volatility (stan. dev.) 0.0579	
Risk Limit -5,000,000	# of contract underlying 250		
# s.d. V@R (e.g. 1.00) 2.33	Exposure (+/-Contracts) 268		
Exposure (maturity) Date 6/15/2007	\$ underlying \$99,729,500		
For risk premium-adjusted V@R	Adjustment (+/-Contracts)	-38	OK@ 230
Funding Rate 4.62%	Monthly Estimates		T>30 days= 52
Risk Premium Estimate 5.00%	Riskmetrics (optional)	Riskmetrics inferred (optional)	
	weight last 150 obs.	Own estimate	monthly vol*sqrt(52/30)
Standard deviations (s.d. E.g. 1% as 1.0)	0.0579	0.0579	0.0762
Long V@R @ price*exp(-#*sd)	1492.5790	1492.5790	1401.8337
\$ V@R	234,544	234,544	-4,983,312
Long upside @ price*exp(+##*sd)	1496.6116	1496.6116	1602.9732
\$ profit	466,420	466,420	6,582,210



Probability of doing worse than -2.33 standard deviation(or 1401.8337) is 0.99%

Note: Riskmetrics assumes a zero risk premium.

Recommended Strategy

- Of the four position, we recommend
 - Long Call
- This limits our losses from price decline and we can profit from price increases
- Purpose of this position is trading and insurance