

# Jet Fuel Hedging

**May 3, 1999**

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# Company Background

- ⌘ Continental Airlines is a major U.S. air carrier with \$7.9 billion in revenues and \$383 million in profits in 1998
- ⌘ Jet fuel expense is the second biggest cost item accounting for 10% of total operating costs
- ⌘ The company budgets its 1999 jet fuel expenses at approximately \$800 million (+/- 10%)
- ⌘ The company is risk averse

# Exposure

- ⌘ Jet fuel prices are highly volatile, since they are “...influenced significantly by international political and economic circumstances” (Continental’s Annual Report)
- ⌘ The company is willing to accept a 15.87% risk of fuel expense exceeding \$880 million (budget+10%) for the year (1999)
- ⌘ This would lead to a 1% increase in total operating expenses and at least 1% decrease in earnings (possibly a bigger drop due to decreases in demand)

# Exposure

- ⌘ Continental uses oil-based hedging (commodity CL) to mitigate its fuel exposure because:
  - ☑ jet fuel-based hedging is available only OTC and is too expensive
  - ☑ prices for jet fuel are highly correlated with oil prices
  - ☑ oil is readily traded on NYMEX
- ⌘ Jet fuel prices move approximately \$0.80 for each \$1 move in oil prices
- ⌘ Therefore, \$640 million oil exposure per annum (or \$160 million per quarter) is roughly equivalent to \$800 million jet fuel exposure

# Oil Market

- ⌘ Analysts report global surplus of oil finally going down
- ⌘ OPEC's efforts to trim supplies resulted in a 50% increase in oil prices in the last two months
- ⌘ However, there is significant uncertainty about sustainability of the recent high price levels
- ⌘ Additional uncertainty is due to a highly unstable political situation in the oil-producing regions --> fear of a sudden oil supply cut

# Analysts' Consensus

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- ➔ **prices will go down**
- ➔ **drop in prices will be limited**
- ➔ **prices remain volatile**
- ➔ **possibility of big price increase**

# Risk Summary

<b>Equivalent Underlying Exposure</b>	<b>-F of \$160 million (8,815 contracts for 1,000 barrels of oil)</b>
<b>Total Budgeted Expense (upper limit)</b>	<b>\$176 million (\$160 million+10%)</b>
<b>Probability of Exceeding Fuel Expense Budget</b>	<b>15.87% (one standard deviation)</b>
<b>Forward Contracts</b>	<b>August 1, 1999</b>
<b>Options</b>	<b>August 1999</b>
<b>Transaction Date</b>	<b>May 3, 1999</b>

# View Alternatives

## View

- ⌘ Limited down, concern about big up
- ⌘ "No risk"
- ⌘ Down, sure
- ⌘ Down, unsure
- ⌘ Down, less unsure relative to the previous view
- ⌘ Down, more sure relative to forward

## Corresponding Position

- ⌘ Short forward range-type position
- ⌘ Long forwards equal \$160 million
- ⌘ Long forwards sufficient to remain within risk limits
- ⌘ Synthetic long put
- ⌘ Synthetic long put sufficient to remain within risk limits
- ⌘ Long puts (opposite of Texas hedge) - trading position

**Direction View: Down**  
**Volatility View: Stable**

# Market Data

				<b>more</b>
	<b>Catm</b>	<b>Citm</b>	<b>Cotm</b>	<b>Cotm</b>
<b>Strike Price</b>	18.00	17.50	18.50	19.00
<b>Premium</b>	1.10	1.39	0.88	0.70

				<b>more</b>
	<b>Patm</b>	<b>Pitm</b>	<b>Potm</b>	<b>Potm</b>
<b>Strike Price</b>	18.00	18.50	17.50	17.00
<b>Premium</b>	1.07	1.35	0.86	0.66

<b>Crude Oil</b>	<b>\$ per barrel</b>
<b>3-month Forward</b>	<b>18.15</b>

# Value at Risk

## Price Value at Risk (V@R)

For VaR information,

[http://www.riskmetrics.com/rm/cde/var\\_index.html](http://www.riskmetrics.com/rm/cde/var_index.html)

For Volatility - standard deviation information,

[http://www.riskmetrics.com/rm/cde/cde\\_index.html](http://www.riskmetrics.com/rm/cde/cde_index.html)

Risk Limit **-16,000,000** # of contract underlying **1,000** Adjustment (+/-Contracts) **4,598**  
 # s.d. V@R (e.g. 1.00) **1.00** Exposure (+/-Contracts) **(8,815)** \$ underlying **-\$160,000,000**

Exposure (maturity) Date **8/1/99**

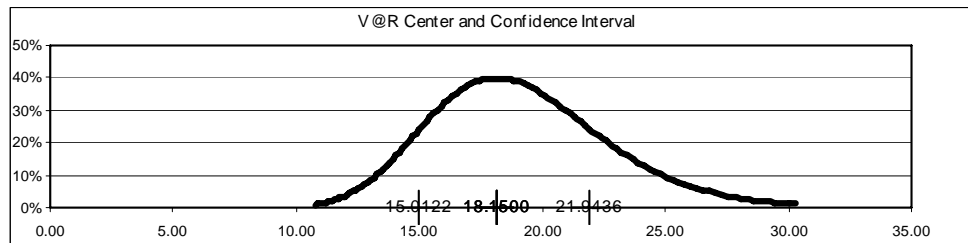
For risk premium-adjusted V@R

Funding Rate **5.00%**  
 Risk Premium Estimate **0.00%**

		Daily Estimates		Monthly Estimates		T>25 days=	
		Risk- metrics weight last 75	(optional) Own estimate	Risk- metrics weight last 150	(optional) Own estimate	Riskmetrics inferred monthly%qrt(90/25)	(optional) Own estimate
Standard deviations (s.d. E.g. 1% as 1.0)		1.8024	1.8024	10.0036	10.0036	18.9806	18.9806
Short V@R @ price*exp(+##*sd)		18.4801	18.4801	20.0596	20.0596	21.9436	21.9436
\$ V@R		-1,392,236	-1,392,236	-8,053,876	-8,053,876	-16,000,000	-16,000,000
Short upside @ price*exp(-##*sd)		17.8258	17.8258	16.4222	16.4222	15.0122	15.0122
\$ profit		1,367,368	1,367,368	7,287,183	7,287,183	13,233,918	13,233,918

Probability of doing worse than +1.00 standard deviation (or 21.94) is 15.87%

Note: Riskmetrics assumes a zero risk premium.



Note: zero risk premium assumed, as oil prices are relatively unaffected by macroeconomic factors and do not have systematic risk

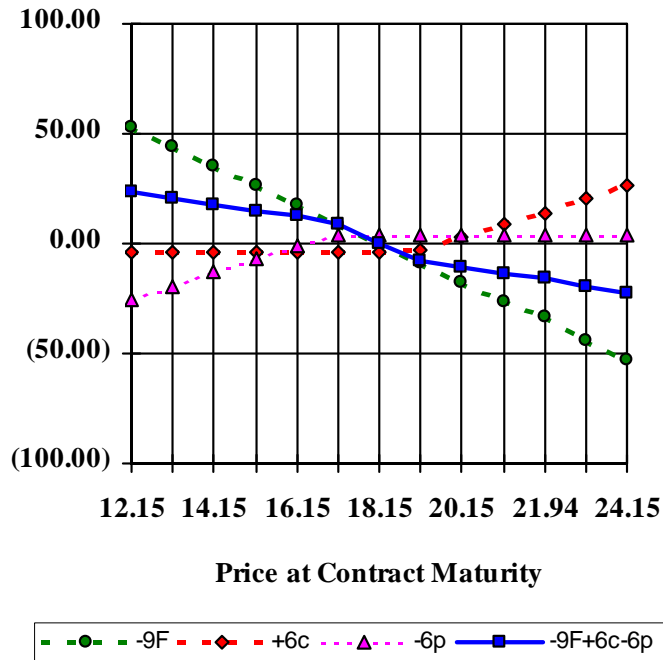
# Recommended Position: Limited Down, Worry Big Up

L or S (Long/Short)	s	L	s
F, C, or P	F	c	p
Forward/Strike Price	18.15	19.00	17.00
Premium (C or P only) - FV	0.00	0.70	0.66
Number of Contracts	8.815	6.007	6.007

Calculated Profit of a

\$ millions	Combined $-9F+6c-6p$ Position			
	$-9F$	$+6c$	$-6p$	$-9F+6c-6p$
12.15	52.89	(4.20)	(25.17)	23.52
13.15	44.08	(4.20)	(19.16)	20.71
14.15	35.26	(4.20)	(13.15)	17.90
15.15	26.45	(4.20)	(7.15)	15.09
16.15	17.63	(4.20)	(1.14)	12.28
17.15	8.82	(4.20)	3.96	8.57
18.15	0.00	(4.20)	3.96	(0.24)
19.15	(8.82)	(3.30)	3.96	(8.15)
20.15	(17.63)	2.70	3.96	(10.96)
21.15	(26.45)	8.71	3.96	(13.77)
21.94	(33.44)	13.48	3.96	(16.00)
23.15	(44.08)	20.72	3.96	(19.39)
24.15	(52.89)	26.73	3.96	(22.20)

Combined  $-9F+6c-6p$  Position



**Short Forward Range-type position ( $-9F+6C_{otm}-6P_{otm}$ )  
Buy 6,007 Cotm and sell 6,007 Potm**

# Position 1: "No Risk"

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

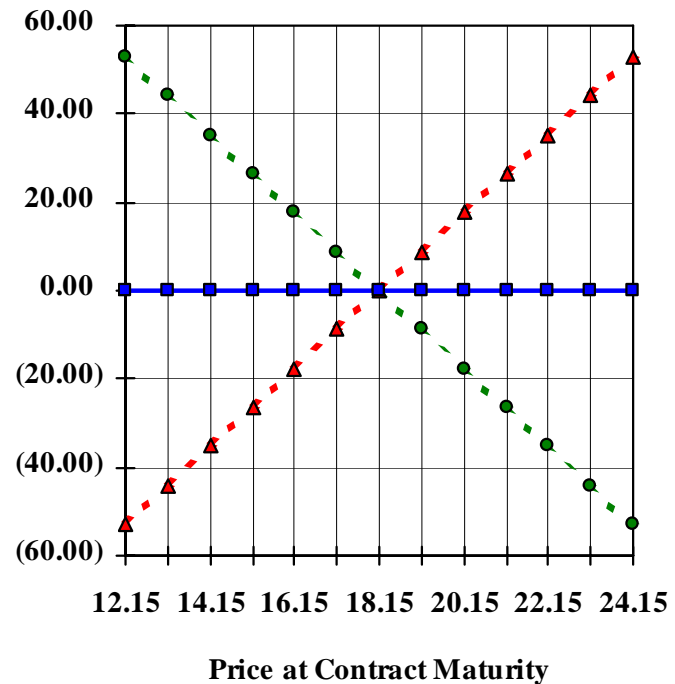
s	l
F	F
18.15	18.15
0.00	0.00
8.815	8.815

Calculated Profit of a  
 Combined -9F+9F Position

\$ millions

	-9F	+9F	-9F+9F
12.15	52.89	(52.89)	0.00
13.15	44.08	(44.08)	0.00
14.15	35.26	(35.26)	0.00
15.15	26.45	(26.45)	0.00
16.15	17.63	(17.63)	0.00
17.15	8.82	(8.82)	0.00
18.15	0.00	0.00	0.00
19.15	(8.82)	8.82	0.00
20.15	(17.63)	17.63	0.00
21.15	(26.45)	26.45	0.00
22.15	(35.26)	35.26	0.00
23.15	(44.08)	44.08	0.00
24.15	(52.89)	52.89	0.00

Combined -9F+9F Position



**Fully hedged (-9F+9F)**  
**Buy 8,815 forward contracts**

# Position 2: Down, Sure

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

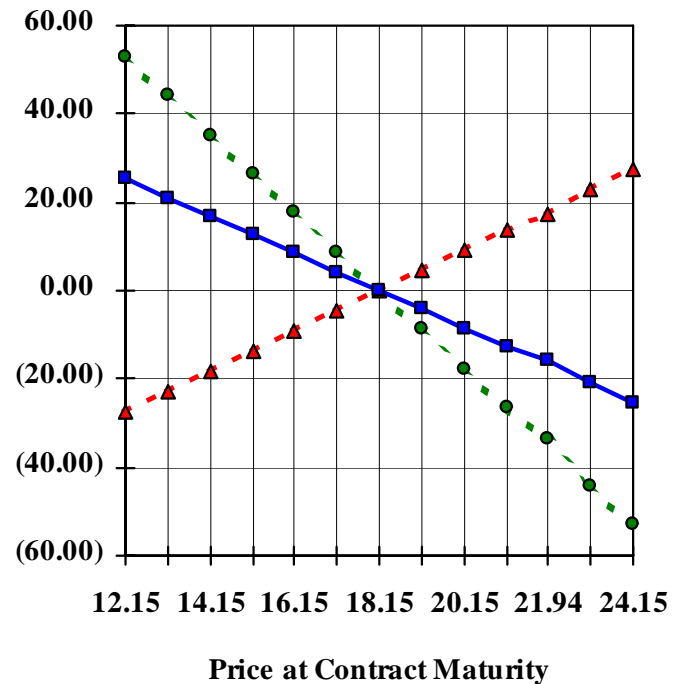
s	l
F	F
18.15	18.15
0.00	0.00
8.815	4.598

Calculated Profit of a  
 Combined -9F+5F Position

\$ millions

	-9F	+5F	-9F+5F
12.15	52.89	(27.59)	25.30
13.15	44.08	(22.99)	21.09
14.15	35.26	(18.39)	16.87
15.15	26.45	(13.79)	12.65
16.15	17.63	(9.20)	8.43
17.15	8.82	(4.60)	4.22
18.15	0.00	0.00	0.00
19.15	(8.82)	4.60	(4.22)
20.15	(17.63)	9.20	(8.43)
21.15	(26.45)	13.79	(12.65)
21.94	(33.44)	17.44	(16.00)
23.15	(44.08)	22.99	(21.09)
24.15	(52.89)	27.59	(25.30)

Combined -9F+5F Position



**Hedge to risk limit (-9F+5F)**  
**Buy 4,598 forward contracts**

# Position 3: Down, Unsure

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

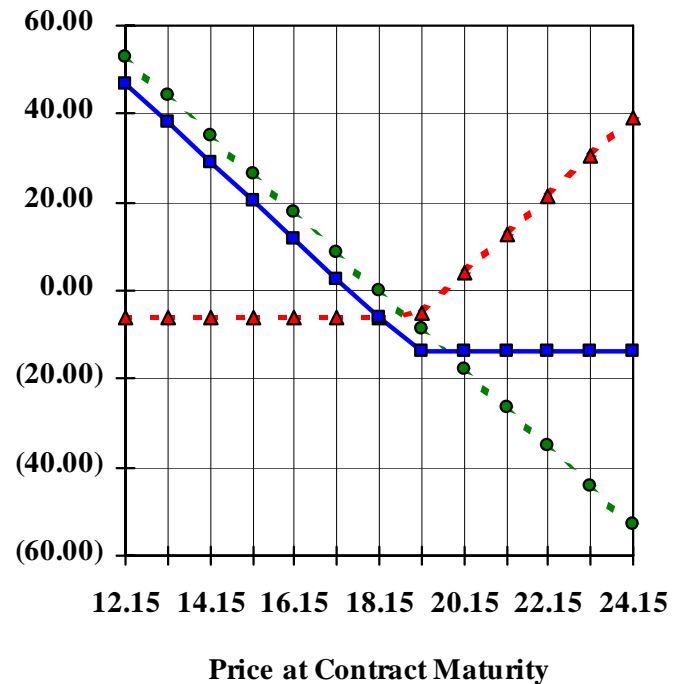
s	L
F	C
18.15	19.00
0.00	0.70
8.815	8.815

Calculated Profit of a  
 Combined -9F+9C Position

\$ millions

	-9F	+9C	-9F+9C
12.15	52.89	(6.17)	46.72
13.15	44.08	(6.17)	37.90
14.15	35.26	(6.17)	29.09
15.15	26.45	(6.17)	20.27
16.15	17.63	(6.17)	11.46
17.15	8.82	(6.17)	2.64
18.15	0.00	(6.17)	(6.17)
19.15	(8.82)	(4.85)	(13.66)
20.15	(17.63)	3.97	(13.66)
21.15	(26.45)	12.78	(13.66)
22.15	(35.26)	21.60	(13.66)
23.15	(44.08)	30.41	(13.66)
24.15	(52.89)	39.23	(13.66)

Combined -9F+9C Position



**Insure with long call (-9F+9Cotm)**  
**Buy 8,815 Cotm**

# Position 4: Down, Less Unsure

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

s	L
F	C
18.15	19.00
0.00	0.70
8.815	7.773

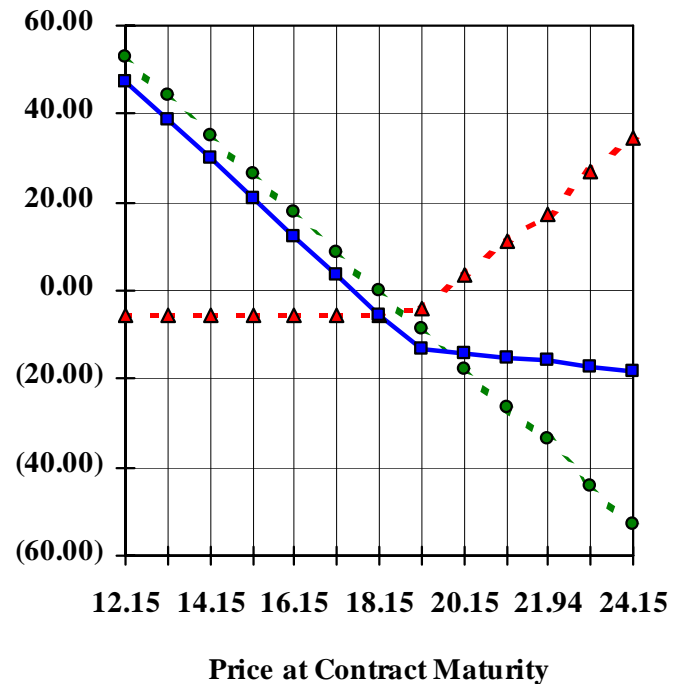
Calculated Profit of a

\$ millions

Combined -9F+8C Position

	-9F	+8C	-9F+8C
12.15	52.89	(5.44)	47.45
13.15	44.08	(5.44)	38.63
14.15	35.26	(5.44)	29.82
15.15	26.45	(5.44)	21.00
16.15	17.63	(5.44)	12.19
17.15	8.82	(5.44)	3.37
18.15	0.00	(5.44)	(5.44)
19.15	(8.82)	(4.28)	(13.09)
20.15	(17.63)	3.50	(14.13)
21.15	(26.45)	11.27	(15.17)
21.94	(33.44)	17.44	(16.00)
23.15	(44.08)	26.82	(17.26)
24.15	(52.89)	34.59	(18.30)

Combined -9F+8C Position



**Insure with long call to risk limit (-9F+8Cotm)**  
**Buy 7,773 Cotm**

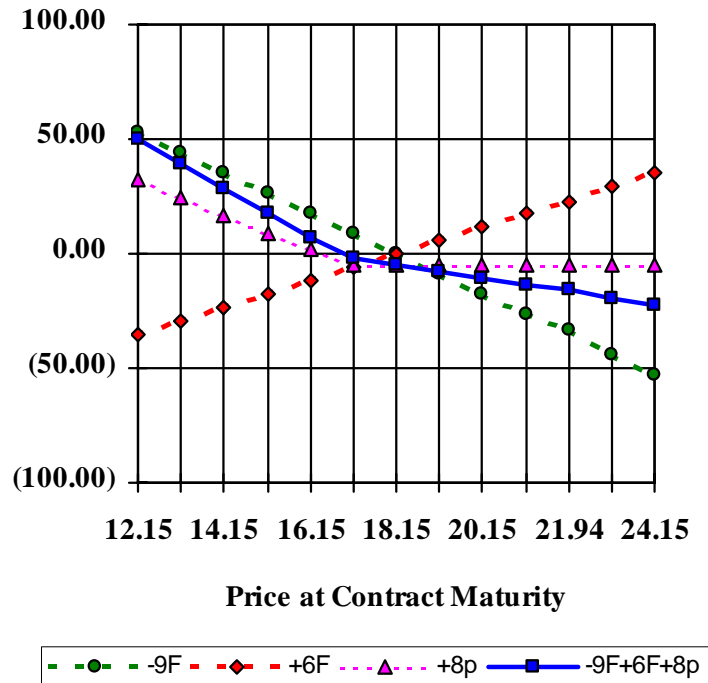
# Position 5a: Down, Most Sure

L or S (Long/Short)	s	L	L
F, C, or P	F	F	p
Forward/Strike Price	18.15	18.15	17.00
Premium (C or P only) - FV	0.00	0.00	0.66
Number of Contracts	8.815	5.950	7.773

Calculated Profit of a

\$ millions	Combined -9F+6F+8p Position			
	-9F	+6F	+8p	-9F+6F+8p
12.15	52.89	(35.70)	32.57	49.76
13.15	44.08	(29.75)	24.80	39.12
14.15	35.26	(23.80)	17.02	28.48
15.15	26.45	(17.85)	9.25	17.85
16.15	17.63	(11.90)	1.48	7.21
17.15	8.82	(5.95)	(5.13)	(2.26)
18.15	0.00	0.00	(5.13)	(5.13)
19.15	(8.82)	5.95	(5.13)	(8.00)
20.15	(17.63)	11.90	(5.13)	(10.86)
21.15	(26.45)	17.85	(5.13)	(13.73)
21.94	(33.44)	22.57	(5.13)	(16.00)
23.15	(44.08)	29.75	(5.13)	(19.46)
24.15	(52.89)	35.70	(5.13)	(22.32)

Combined -9F+6F+8p Position



**Aggressive trading based on volatility up view (-9F+6F+8Potm)**  
**Buy 7,773 Potm and 5,950F**

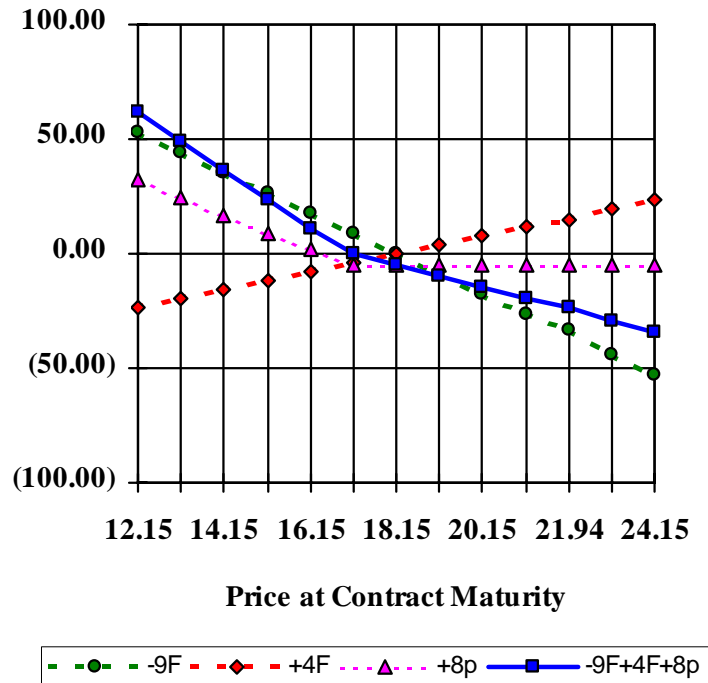
# Position 5b: Down, Most Sure

L or S (Long/Short)	s	L	L
F, C, or P	F	F	p
Forward/Strike Price	18.15	18.15	17.00
Premium (C or P only) - FV	0.00	0.00	0.66
Number of Contracts	8.815	4.000	7.773

Calculated Profit of a

\$ millions	Combined -9F+4F+8p Position			
	-9F	+4F	+8p	-9F+4F+8p
12.15	52.89	(24.00)	32.57	61.46
13.15	44.08	(20.00)	24.80	48.87
14.15	35.26	(16.00)	17.02	36.28
15.15	26.45	(12.00)	9.25	23.69
16.15	17.63	(8.00)	1.48	11.11
17.15	8.82	(4.00)	(5.13)	(0.32)
18.15	0.00	0.00	(5.13)	(5.13)
19.15	(8.82)	4.00	(5.13)	(9.95)
20.15	(17.63)	8.00	(5.13)	(14.76)
21.15	(26.45)	12.00	(5.13)	(19.58)
21.94	(33.44)	15.17	(5.13)	(23.40)
23.15	(44.08)	20.00	(5.13)	(29.21)
24.15	(52.89)	24.00	(5.13)	(34.02)

Combined -9F+4F+8p Position



**Aggressive trading based on volatility up view (-9F+4F+8Potm)**  
**Although exceeds risk limits, this position may be possible, since rate of loss increase is lower than that of the original position.**

# Comparative Analysis

<b>Long (Recommended)</b>	<b>Short</b>	<b>Approximate range of underlying prices with positive outcomes *</b>
<b><math>-9F+6C-6P</math></b>	<b><math>-9F+8C</math></b>	<b>[16.2, 22.0]</b>
<b><math>-9F+6C-6P</math></b>	<b><math>-9F+5F</math></b>	<b>[13.2, 14.2], &gt;22.0</b>

**\* Ranges of underlying prices with positive outcomes implies the price ranges where outcome of the recommended position exceeds the outcome of an alternative position**

# Recommendation

- ⌘ Use partial **short forward range**:  
buy 6,007 Cotm, sell 6,007 Potm
- ⌘ Most consistent with Continental's direction and volatility view
- ⌘ At one standard deviation of underlying price (\$21.94), losses are limited to \$16 million - our risk limit

# Recommendation

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- ⌘ Inexpensive relative to other hedging options (give up some upside in return for income)
- ⌘ As the comparative analysis indicates, the recommended position yields higher outcomes in the underlying price ranges most likely to occur based on our view