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## FLOW STRATEGY & SOLUTIONS



# HEDGING CREDIT PORTFOLIOS DIVERSIFYING SOURCES OF LIQUIDITY

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## EXECUTIVE SUMMARY

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- ❖ **Secondary trading liquidity continues to be relatively poor**, combined with a generally low degree of short interest in the market, there is some concern about gap risk in single name credit instruments
- ❖ In light of the poor secondary market liquidity, **CDX HY & IG and VIX indices have become increasingly relevant as a way to gain long exposure to the market and hedging portfolios.**
- ❖ We provide **CDX HY & CDX IG payers and VIX options** implementations with the aim of **hedging credit portfolios.**
- ❖ Optimal hedging depends on portfolio construction, investor market view and market conditions, including liquidity of hedging instruments.
- ❖ Therefore, we highly recommend to diversify sources of liquidity.

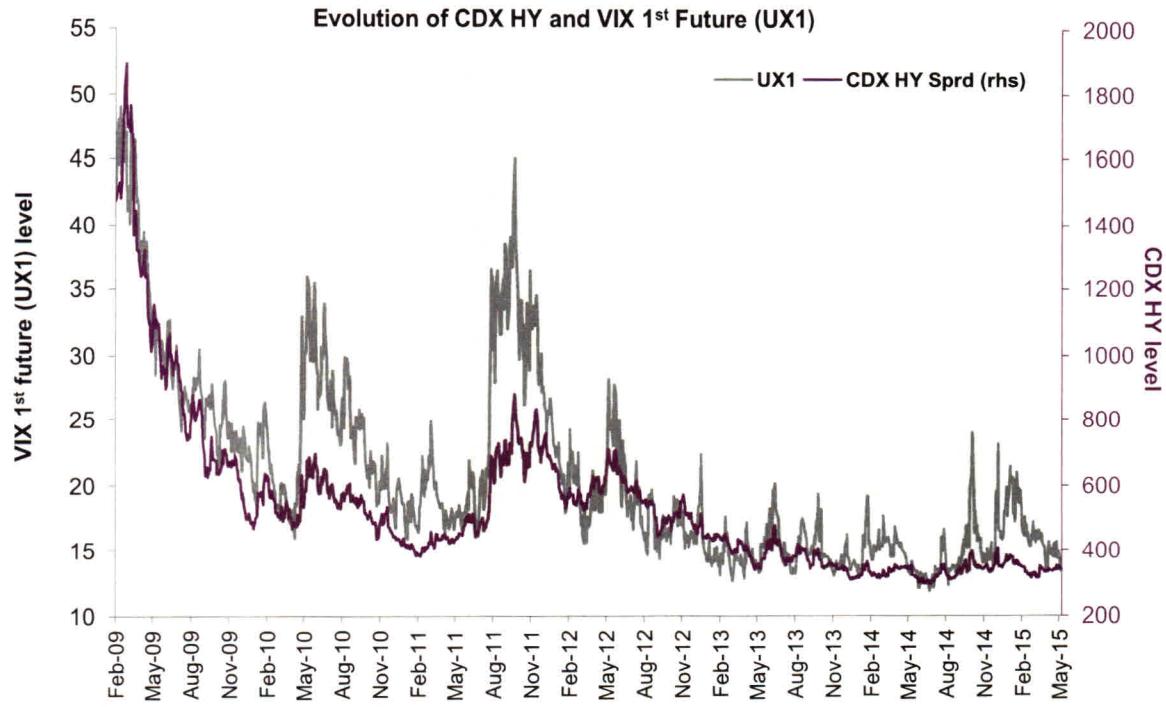
## STATE OF THE CREDIT MARKET

### US IG AND HY CORPORATE CREDIT MARKETS

- ❖ Despite elevated primary issuance over the past few years, **secondary trading liquidity continues to be relatively poor** and spotty driven by lower dealer inventories and risk appetite, a reduction in the number of active trading credit accounts (fewer bank prop desks and credit hedge funds), and a buy and hold mentality driven by a six year rally where it has paid to buy every dip (at least in part the result of ultra-supportive monetary policy).
- ❖ Given these conditions, combined with a generally low degree of short interest in the market, there is some concern about gap risk in single name credit instruments, which may have been previewed in the high yield oil and gas sector in Q4 14 and Q1 15.
- ❖ In light of poor secondary market liquidity diversified credit instruments, such as credit ETFs among retail investors, and High Yield CDX and VIX structures among institutional investors, have become increasingly relevant as a way to gain long exposure to the market quickly as way to hedge long exposure.

\*Source: SG HY & bank loan Strategy, Flow Strategy & Solutions

## CREDIT HY AND VIX INDICES DURING MARKET STRESS



Source: Financial Engineering Flow Strategy & Solutions

# CORRECTIONS IN CREDIT MARKETS

## Historical impact on main asset classes

**Methodology:** Define most of periods when credit spreads widened.

Max Drawdown during the periods when credit spreads widened

Period		CDX IG	CDX HY	VIX 1st	Typical Risk-Off Asset				Equity Indexes				
		Spred chg (bps)	Spred chg (bps)	VIX chg (pts)	Fut chg (pts)	Gold	JPY	CHF	TLT (20y+ Tr)	S&P 500	Rus 2000	MSCI EAFFE	
Mar-05	May-05	31		6.4	2.1	-4%	4%	-5%	8%	-5%	-7%	-5%	-5%
Jun-07	Jul-07	22		6.0	3.8	7%	3%	4%	5%	-3%	-5%	6%	-3%
Sep-07	Nov-07	33		15.0	10.6	15%	7%	6%	6%	-8%	-9%	-6%	0%
Dec-07	Mar-08	116		10.4	6.2	20%	13%	14%	3%	-14%	-17%	-15%	-17%
May-08	Dec-08	179		63.0	46.9	-27%	27%	-18%	41%	-46%	-50%	-52%	-63%
Apr-10	May-10	46	205	30.2	18.9	11%	5%	-9%	13%	-12%	-14%	-17%	-16%
Jul-11	Aug-11	36	281	32.1	19.8	24%	6%	17%	19%	-17%	-24%	-16%	-17%
May-12	Jun-12	27	107	7.8	8.4	-6%	3%	-5%	10%	-7%	-7%	-11%	-12%
Sep-12	Nov-12	28	127	5.2	2.8	-6%	-5%	4%	7%	-8%	-11%	-6%	-4%
Apr-13	Jul-13	29	140	8.0	6.5	-19%	10%	6%	-13%	-6%	-2%	-10%	-17%
Sep-14	Oct-14	18	76	14.2	9.9	-6%	-6%	-4%	9%	-7%	-10%	-10%	-9%
Mar-15	May-15	5	32	2.7	0.7	-2%	0%	-4%	-4%	-1%	-1%	1%	4%
Average		69%	36%	18.0	12.3	1%	6%	1%	10%	-12%	-14%	-13%	-15%
Median		56%	35%	10.4	8.4	-4%	5%	4%	8%	-8%	-10%	-10%	-12%
% of times up		100%	100%	100%	100%	45%	82%	55%	91%	0%	0%	9%	0%
% of times Down		0%	0%	0%	0%	55%	18%	45%	9%	100%	100%	91%	91%

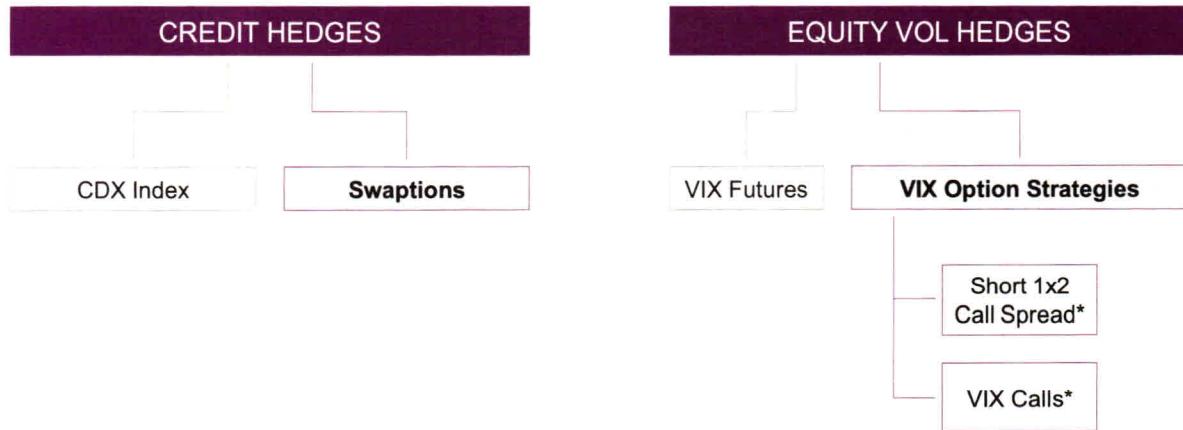
Source: SG Flow Strategy & Solutions

Taper Tantrum  
& US Rates Hikes

VIX futures correlate historically to Credit Spreads while other risk off assets lag

# Hedging – Preferred Hedges: Credit and Equity Volatility

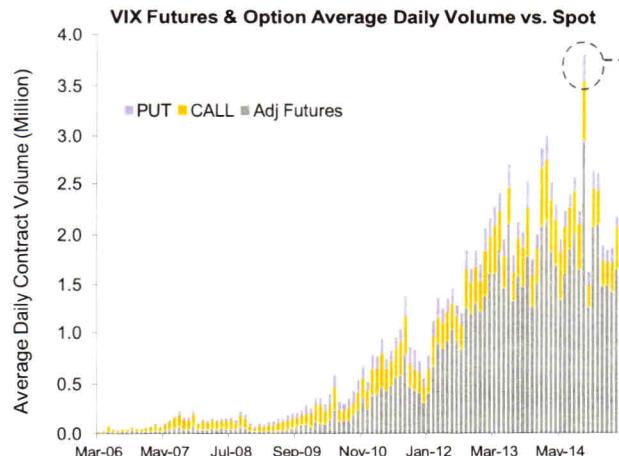
## Hedging Solutions at a Glance



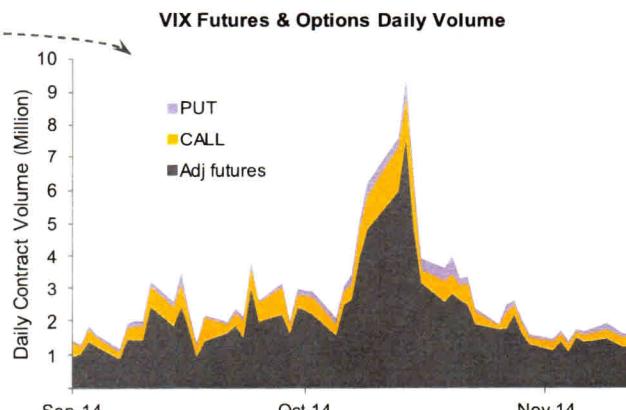
\* Either listed or OTC

# LIQUIDITY IN VIX OPTIONS AND FUTURES MARKET

Liquidity in VIX futures and options has historically increased in periods of stress



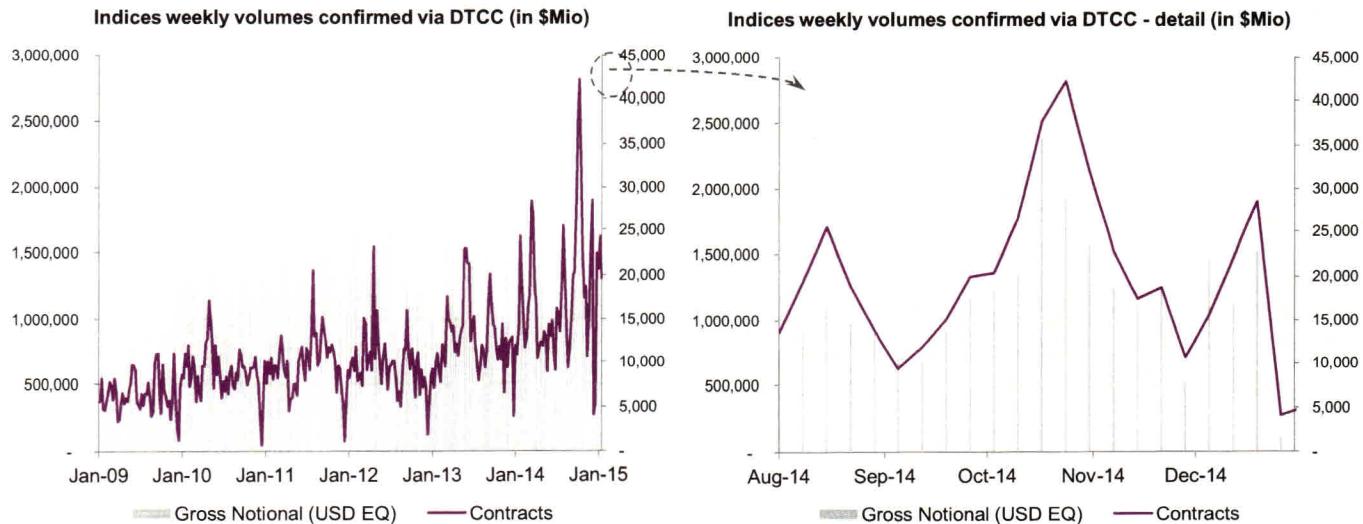
Source: Financial Engineering Flow Strategy & Solutions



Source: SG Global Engineering & Strategy

# LIQUIDITY IN CREDIT OPTIONS AND FUTURES MARKET

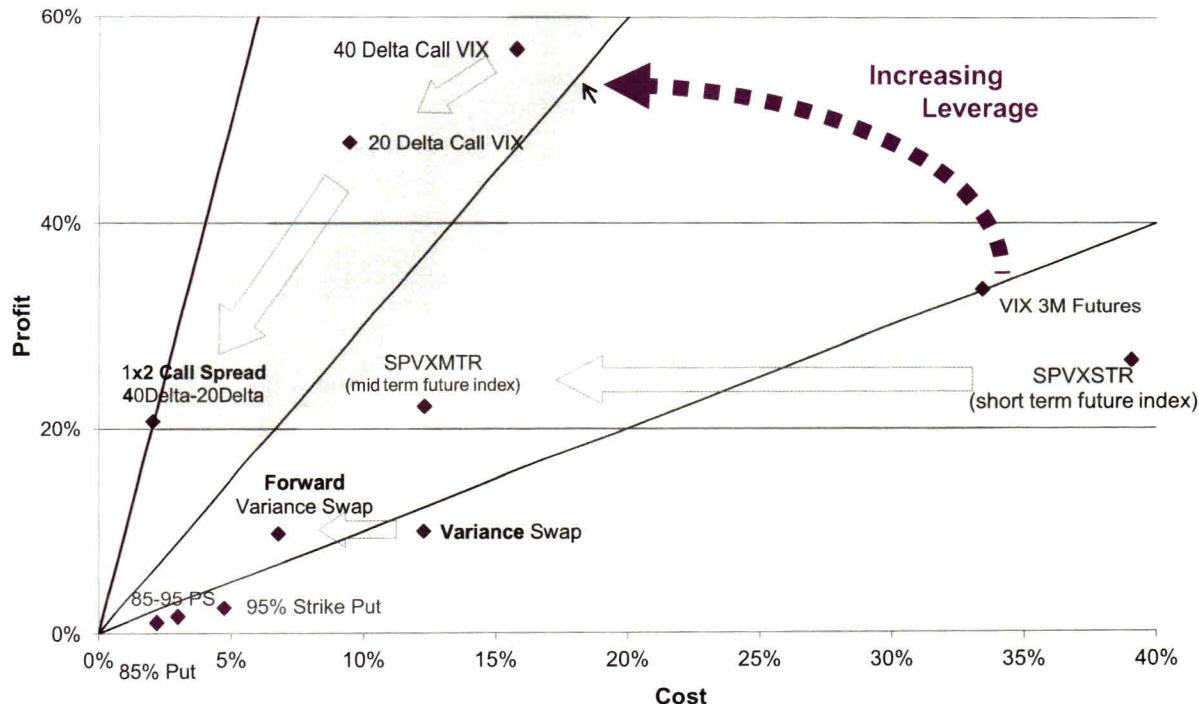
Liquidity in Credit has also historically increased in periods of stress



Sources : SG ENG

# COMPARISON OF SPX & VIX STRATEGIES (I)

LEVERAGE OF VARIOUS SYSTEMATIC HEDGING STRATEGIES (All 3 month maturities)



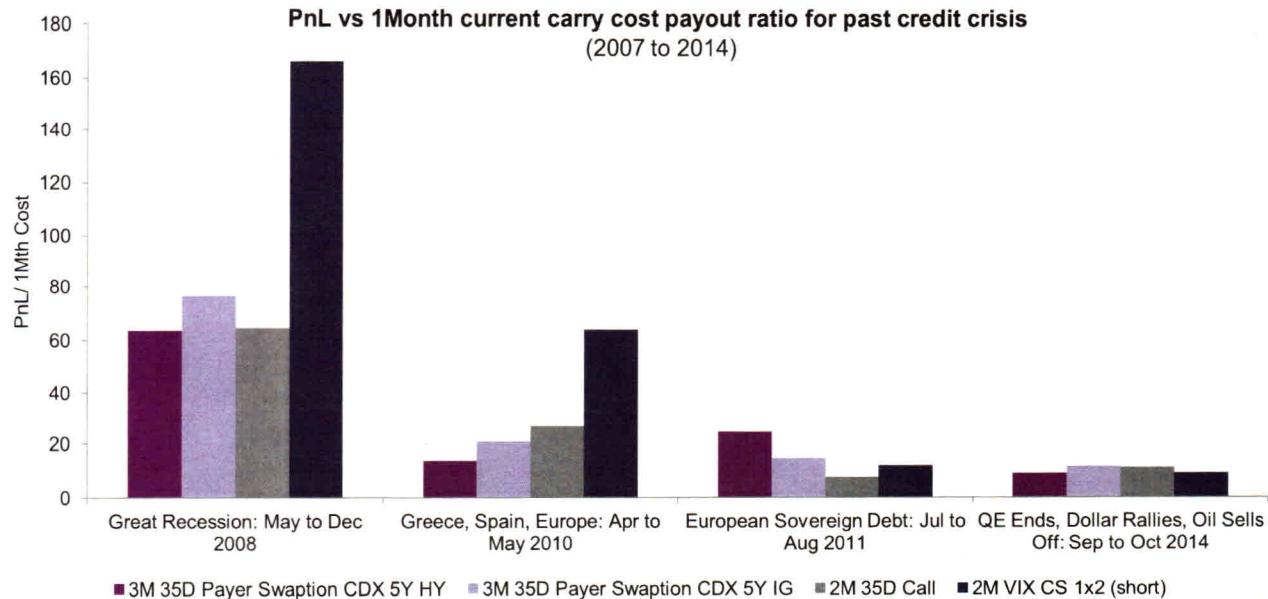
Source: SG Global Engineering and Strategy, Bloomberg

IMPORTANT NOTICE: THE FIGURES RELATING TO PAST PERFORMANCE REFER TO PAST PERIODS AND ARE NOT A RELIABLE INDICATOR OF FUTURE RESULTS. THIS ALSO APPLIES TO HISTORICAL MARKET DATA.

# CDX HY & VIX OPTIONS TO HEDGE EXPOSURE TO CREDIT RISK

Hedges comparison performance during the last 4 credit events (up more than 20%)

**Methodology:** We look at the current 1M carry cost\* of the structure vs. the payoff during the past crisis events.



Source: Financial Engineering Flow Strategy & Solutions

1. Price of Payers from "SG Cross-Asset Research Credit Option Trade Builder"
2. Prices for VIX options - Bloomberg.

\* Carry cost as of June 12<sup>th</sup> 2015

# USING VIX HEDGING STRATEGIES

## MARKET CONDITIONS

- VIX upside strategies – a tradeoff between high upside payoff and low carry cost
  - To minimize the carry cost, we usually consider the following 4 strategies as effective cheap tail hedge. Depending on the spot level, futures terms structure, VIX vol skew, the optimal strategy varies.

### OPTIMAL TAIL RISK HEDGE DEPENDS ON MARKET CONDITIONS

#### VIX HEDGING STRATEGY COMPARISON

VIX Ref 8/12/15	Spot	15.7	Aug15	15.8	Sep15	16.2	Oct15	16.7	Nov15
		Mat1	Mat2	Strikes	Initial Premium	1M est. Carry Cost *	Initial Delta	Hist Median	Premium** Min
Long Call Spread		Sep-15		18/25	\$ 0.85	\$ 0.45	23%	\$ 1.08	\$ 0.57
Long VIX Call Fly		Sep-15		18/25/30	\$ 0.65	\$ 0.35	16%	\$ 0.76	\$ 0.40
Long Call Calendar		Sep-15	Nov-15	18/23	\$ 0.10	\$ 0.80	9%	\$ 0.16	\$ (0.52)
Long Calendar Strangle		Sep-15	Nov-15	P15/C20	\$ 2.95	\$ 0.75	9%	\$ 4.02	\$ 0.40
Short 1x2 Call Spread			Oct-15	19/24	\$ 0.53	\$ 0.33	13%	\$ 0.44	\$ (0.15)
Short Straddle(strangle) & long 2x Call			Oct-15	15/16/2xC20	\$ (0.20)	\$ 0.33	51%	\$ (1.90)	\$ (7.84)
Long Medium Call			Oct-15	24	\$ 1.15	\$ 0.50	29%	\$ 1.18	\$ 0.62

Source: SG Flow Strategy & Solutions

# SIZING

## Hedges performance (PnL) during 2008

- For \$1 Bn notional HY bond portfolio, it incurs \$300M loss during 2008 (ref. IBOXHY index).
- Based on the performance (PnL) of strategies during 2008, table below shows the corresponding contract/notional size for hedging a similar credit event.

### Sizing based on PnL during 2008 Credit Events (\$300M loss)

Credit Events	3M 35D Payer Swaption CDX 5Y HY	3M 35D Payer Swaption CDX 5Y IG	2M (45D/+5pt) VIX CS 1x2	2M 35D VIX Call
	Notional (\$Bn)	Notional (\$Bn)	Number of Contracts (K)	Number of VIX Contracts (K)
Great Recession: May to Dec 2008	1.7	6.4	138	103

Note: VIX Option Contracts have a 100 multiplier.

Source: Financial Engineering Flow Strategy & Solutions



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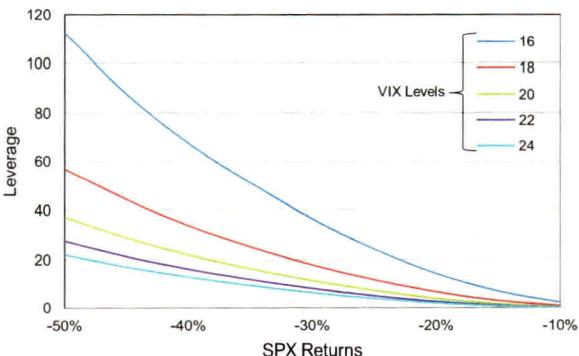
# APPENDIX

# HEDGING WITH VOLATILITY LEVERAGE BASED ON ENTRY LEVEL THE LOWER THE ENTRY POINT THE HIGHER THE LEVERAGE

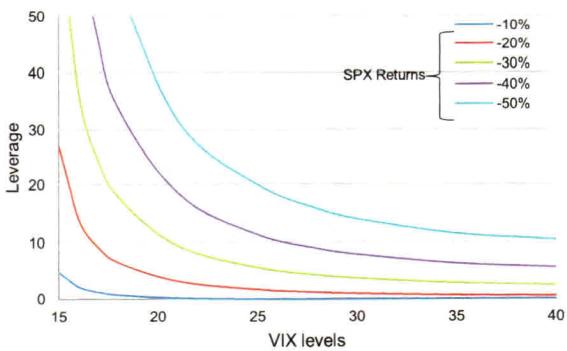
- Leverage vs. SPX returns for the different VIX levels
  - The chart demonstrates that the lower the VIX level at initiation, the more leveraged is the trade.
  - The leverage also depends on the projected S&P500 decline. With a larger decline, the leverage is clearly higher than before.

Leverage	VIX Levels				
	16	18	20	22	24
S&P500 Return	16	18	20	22	24
-10%	2.2	0.7	0.2	0.0	-0.1
-15%	6.7	2.8	1.5	0.9	0.6
-20%	14.1	6.4	3.8	2.5	1.8
-25%	24.1	11.4	7.1	4.9	3.7
-30%	36.3	17.7	11.2	8.0	6.1
-35%	50.7	25.1	16.1	11.6	9.1
-40%	67.5	33.7	21.8	16.0	12.6
-45%	87.5	44.0	28.7	21.2	16.8
-50%	111.8	56.5	37.1	27.5	21.9

Leverage vs. SPX Returns for Various VIX Levels



Leverage vs. VIX Levels for various SPX Returns



# VIX MONITOR (weekly publication)

FINANCIAL ENGINEERING – VIX MONITOR

Aug 12, 2015

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FLOW STRATEGY & SOLUTIONS

## VIX Monitor

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### Highlights of the week:

#### VIX Volatility

VIX implied volatility and SPX downside skew get bid as global markets were under pressure after the news from China.

#### VIX Futures Term Structure

VIX futures' curve flattened after the news of CNY depreciation with the spread between 5M and VIX spot at 2.

#### VIX Futures Positioning

Outstanding vega of VIX ETFs is at 111M vega (38M incl. short interest), and net futures position is at -64M vega

#### VIX Strategy:

To hedge the further increase in volatility, we recommend short Oct \$15/16 straddle and long 2 x \$20 calls for \$0.2 credit. (ref \$16.7).

#### VIX HEDGING STRATEGY COMPARISON

VIX Ref 8/1/15	Spot	15.7	Aug15	15.8	Sep15	16.2	Oct15	16.7	Nov15
		Mat1	Mat2	Strikes	Initial Premium	# of Mkt	Initial Carry Cost*	Hgr Premium**	Min
Long Call Spread				18/25	\$ 0.65	5	0.45	23%	\$ 1.08 (\$ 0.57)
Long VIX Call Fly				18/25/30	\$ 0.65	5	0.35	16%	\$ 0.76 (\$ 0.40)
Long Call Calendar				Sept 15	\$ 0.10	5	0.80	9%	\$ 0.16 (\$ 0.52)
Long Calendar Strangle				Sept 15	\$ 19/20	5	0.75	9%	\$ 4.02 (\$ 0.40)
Short 1x2 Call Spread				Oct 15	\$ 0.24	5	0.53	33%	\$ 0.44 (\$ 0.15)
Short 2x2 Call Spread				Oct 15	15/16/20/25	5	0.20	0.33	51% (\$ 1.90) (\$ 7.84)
Short Strangle(straddle) & long 2x call				Oct 15	24	5	1.15	5	0.60 29% \$ 1.18 (\$ 0.62)
Long Medium Call				Oct 15					

\* Est. 1M cash forward is estimated with current term structure and vol surface

\*\* Hold until 1M prior to expiry except for Call Fly (hold to expiry) and Calendar strangle (windup 1-2 wks before expiry)

\*\* History premium is based on the cost of similar structure since June 2008

#### VIX CARRY STRATEGY COMPARISON

VIX Ref 8/1/15	Spot	15.5	Aug15	15.6	Sep15	16.1	Oct15	16.6	Nov15	17.3	
		Mat1	Mat2	Strikes	Premium	# of Mkt	Holdings	1M ex.	Initial Delta	Hgr Premium**	Min
Long Put (ATM)				15	\$ 1.10	12	\$ 0.45	34%	\$ 1.77	5	0.3
Long Put Straddle				15/15.5	\$ 0.78	12	\$ 0.30	-17%	\$ 0.77	5	0.3
Long 1x2 Put Spread				Sept 15	\$ 0.45	12	\$ 0.15	0%	\$ 0.30	5	0.1
2xM Put Calendar Spread				Sept 15	Nov 15	15/15/16	\$ 0.5	12	\$ 0.45	13%	\$ 0.55 (\$ 1)
VIX Put (ATM)				Sept 15		16	\$ 0.60	12	\$ 1.74	-14%	0%
Short Strangle(straddle) vs. 1x Call				Sept 15	\$15/16/17	5	(125)	12	\$ (0.25)	27%	\$ (2.9) (\$ 1.13)

\* Est. 1M cash forward is estimated with current term structure and vol surface

\*\* Hold until 1M prior to expiry

\*\* History premium is based on the cost of similar structure since June 2008

#### BUILDING TEAM SPIRIT TOGETHER



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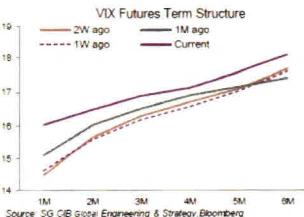
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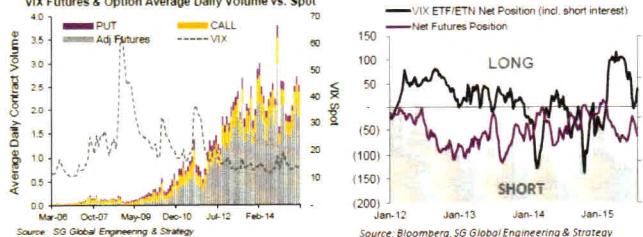
\* Skew is measured as downside V - ATM V / ATM V / ATM FV (Strike corresponds to expected 0.5 standard deviation move). Source: SG Global Engineering & Strategy Bloomberg

#### VIX Futures & Options Positioning

Outstanding vega of VIX ETFs has dropped to 111M vega (38M incl. short interest), and net futures position is at -64M vega

Please note: the ETF/ETN short interest data is as of 7/31/2015. VIX futures data is as of 8/4/15

#### VIX Futures & Option Average Daily Volume vs. Spot

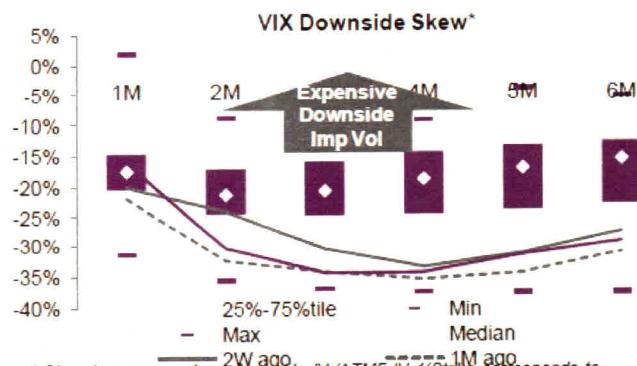
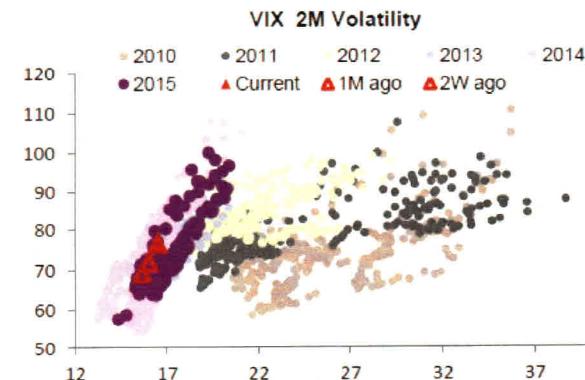
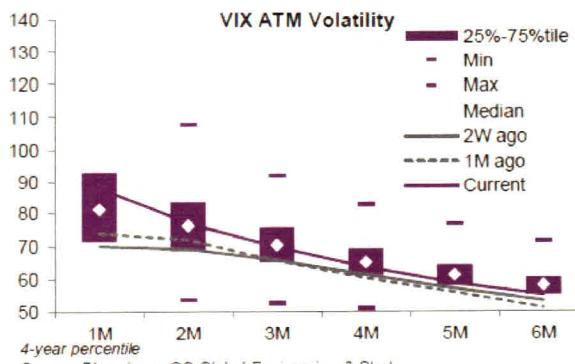


Beta\* defined as the beta between percentage change on SPX versus points change of VIX fut.

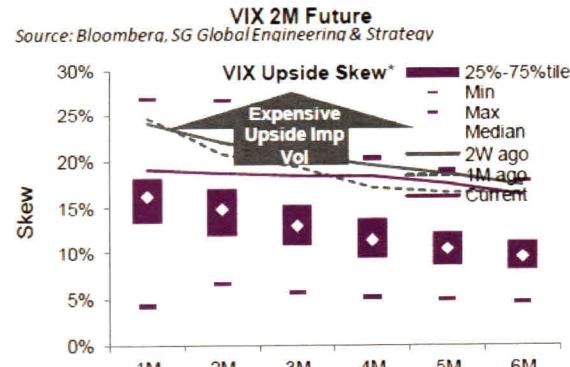
Hedge fund futures positions refer to future positions of non-commercial traders that hold positions above specific reporting levels set by CFTC regulations. Please see CFTC website for more details.

<http://www.cftc.gov/MarketReports/CommitmentsOfTraders/ExplanatoryNotes/index.htm>

# VIX VOLATILITY (I)



\* Skew is measured as downside IV / ATM IV-1 (Strike corresponds to expected 0.5 standard deviation move); Source: SG Global Engineering & Strategy;



\* Skew is measured as upside IV / ATM IV-1 (Strike corresponds to expected 0.5 standard deviation move); Source: SG Global Engineering & Strategy;

# Long VIX Call Options: PnL Comparison

- ✓ %time with positive PnL: long 3M call option generated +ve pnl for ~15% of the time

3M Call Mthly PnL		VIX 3M 30D Call		VIX 3M 20D Call		VIX 3M 140% Call	
	% time	Avg		% time	Avg		% time
+ve	17%	2.61	15%	2.29	14%	2.60	
-ve	83%	-0.63	85%	-0.42	86%	-0.56	
Cum PnL **		-7.21		-0.21			-9.08

- ✓ Cumulated pnl since 2008: long 3M 20D call has highest cumulated PnL since 2008

- ✓ Lowest average cost: 20D call

**Conclusion:** Optimal Strategy– long 3M 20D call (Roll 1mth before maturity)

2M Call Mthly PnL		VIX 2M 30D Call		VIX 2M 20D Call		VIX 2M 140% Call	
	% time	Avg		% time	Avg		% time
+ve	14%	2.44	11%	2.32	12%	2.39	
-ve	86%	-0.82	89%	-0.56	88%	-0.69	
Cum PnL **		-29.38		-20.91			-26.94

•option initiation/roll time: 1 day before expiration

•PnL size:1 unit of option

•2M and 3M strategies require to roll the position 1 month before the maturity

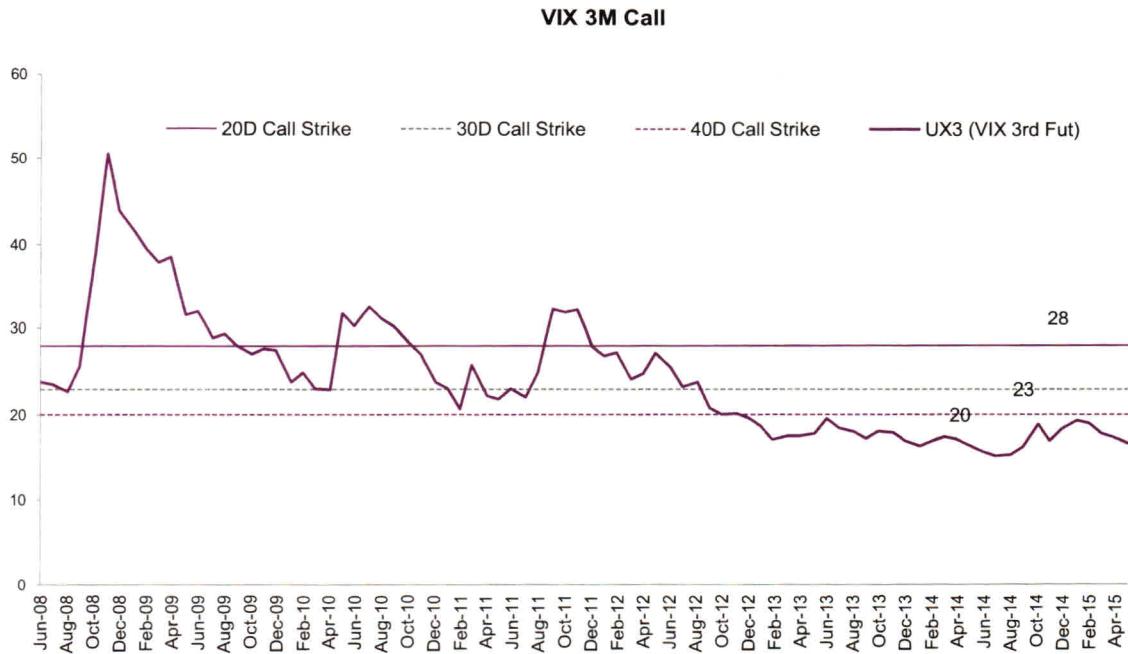
bid-offer spread and transaction cost are included

1M Call Mthly PnL		VIX 1M 30D Call		VIX 1M 20D Call		VIX 1M 140% Call	
	% time	Avg		% time	Avg		% time
+ve	10%	5.81	7%	4.57	5%	7.01	
-ve	90%	-1.03	93%	-0.69	95%	-0.72	
Cum PnL **		-31.64		-26.15			-29.45

Lowest average cost

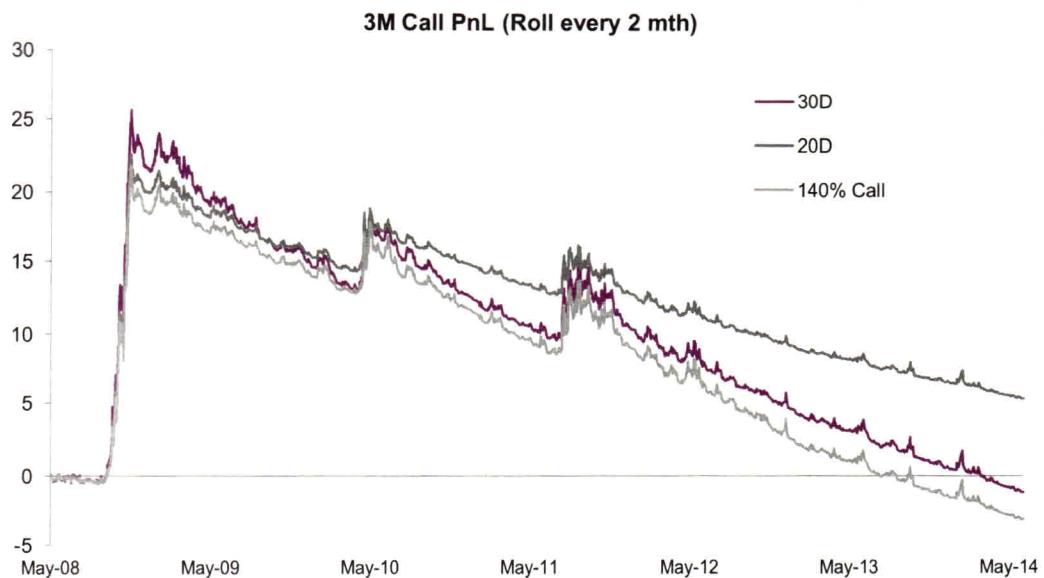
\*\* Cumulated PnL since May 2008

# From Delta to \$Strikes



Source: SG CIB Global Engineering & Strategy, Bloomberg

## Daily Cumulated PnL



Source: SG Flow Strategy & Solutions, Bloomberg

# Total PnL by Year

- ✓ **Carry cost:** Systematically long VIX 3M or 2M call (roll 1 month before maturity) has lowest 12M carry around \$3.6 (\$4.2) during 2014

## ✓ Potential Max payout:

During 2008, the payout ratio (+ve PnL/-ve PnL) are 9:1 for systematically long 3M call strategy, 4:1 for 2M strategy, and 5:1 for 1M strategy

• option initiation/roll time: 1 day before expiration

• PnL size: 1 unit of option

• 2M and 3M strategies require to roll the position 1 month before the maturity

bid-offer spread and transaction cost are included

3M Call	Total PnL			Total +ve PnL			Total -ve PnL		
	30D Call	20D Call	140% Call	30D Call	20D Call	140% Call	30D Call	20D Call	140% Call
2008	22.08	20.06	18.78	25.10	22.21	21.28	-3.01	-2.15	-2.50
2009	-7.27	-4.88	-4.86	1.92	1.34	1.56	-9.19	-6.21	-6.42
2010	-3.38	-1.66	-3.40	4.83	3.81	3.92	-8.21	-5.47	-7.32
2011	-2.79	-2.56	-3.22	3.46	1.69	3.17	-6.25	-4.25	-6.40
2012	-6.14	-3.97	-6.76	0.23	0.20	0.23	-6.37	-4.17	-6.99
2013	-4.71	-3.24	-4.77	0.00	0.00	0.00	-4.71	-3.24	-4.77
2014	-2.91	-2.31	-2.84	1.03	0.57	1.09	-3.93	-2.88	-3.92
2015	-2.09	-1.66	-2.01	0.00	0.00	0.00	-2.09	-1.66	-2.01
Sum	-7.21	-0.21	-9.08	36.57	29.81	31.24	-43.79	-30.02	-40.32

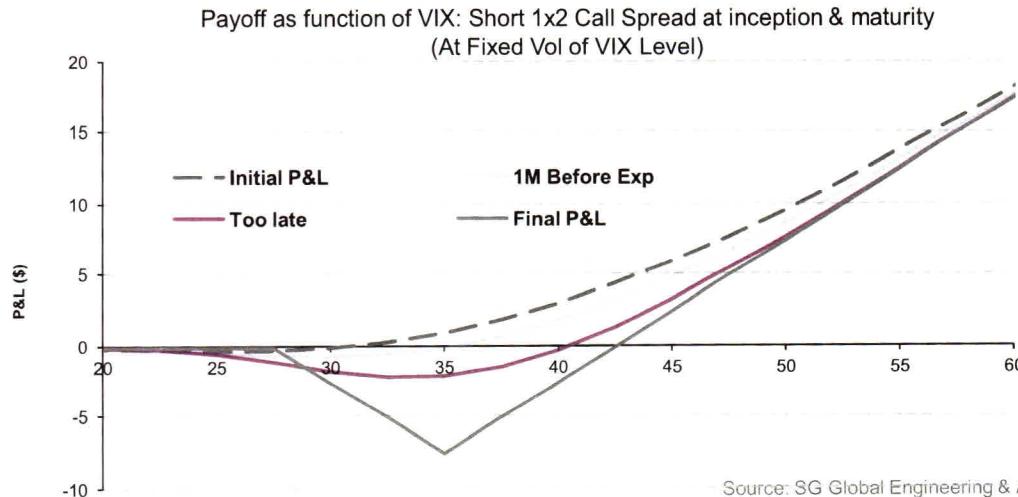
2M Call	Total PnL			Total +ve PnL			Total -ve PnL		
	30D Call	20D Call	140% Call	30D Call	20D Call	140% Call	30D Call	20D Call	140% Call
2008	13.13	9.78	10.88	17.50	12.85	13.91	-4.37	-3.07	-3.03
2009	-9.67	-6.63	-6.25	2.16	1.73	1.28	-11.83	-8.36	-7.53
2010	-5.64	-3.50	-4.50	4.92	3.79	4.55	-10.56	-7.29	-9.05
2011	-6.78	-5.46	-6.56	2.48	1.07	2.17	-9.26	-6.53	-8.73
2012	-9.25	-6.28	-9.87	0.00	0.00	0.00	-9.25	-6.28	-9.87
2013	-5.62	-4.10	-5.49	0.31	0.20	0.25	-5.93	-4.30	-5.74
2014	-2.66	-2.45	-2.60	1.94	1.22	1.77	-4.60	-3.68	-4.37
2015	-2.90	-2.27	-2.55	0.00	0.00	0.00	-2.90	-2.27	-2.55
Sum	-29.38	-20.91	-26.94	29.30	20.87	23.93	-58.69	-41.78	-50.88

1M Call	Total PnL			Total +ve PnL			Total -ve PnL		
	30D Call	20D Call	140% Call	30D Call	20D Call	140% Call	30D Call	20D Call	140% Call
2008	22.66	14.14	11.23	28.62	18.45	14.81	-5.96	-4.31	-3.58
2009	-17.57	-11.96	-7.60	0.00	0.00	0.00	-17.57	-11.96	-7.60
2010	-3.79	-3.31	-3.35	6.90	3.69	6.00	-10.69	-6.99	-9.35
2011	-6.78	-6.12	-5.28	7.46	3.77	5.94	-14.24	-9.89	-11.22
2012	-10.30	-6.84	-10.14	0.00	0.00	0.00	-10.30	-6.84	-10.14
2013	-7.28	-5.23	-6.33	0.00	0.00	0.00	-7.28	-5.23	-6.33
2014	-3.53	-3.42	-4.11	3.48	1.50	1.27	-7.01	-4.91	-5.38
2015	-5.05	-3.41	-3.87	0.00	0.00	0.00	-5.05	-3.41	-3.87
Sum	-31.64	-26.15	-29.45	46.46	27.41	28.02	-78.09	-53.55	-57.47

# SHORT 1X2 CALL SPREAD STRATEGY (I)

ROLL ONE-MONTH BEFORE EXPIRATION

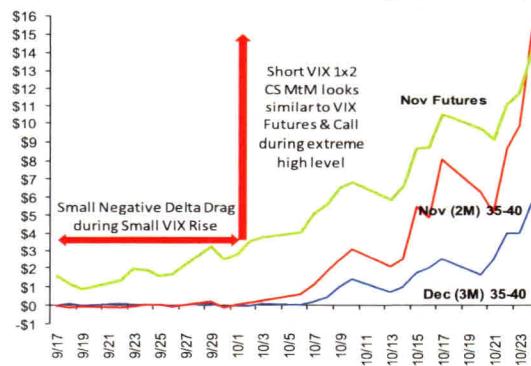
- **Strategy construction:**
  - Short 1x Low Strike Call (eg. 40 Delta) & Long 2x High Strike Call (eg. 20 Delta)
  - Maturity selection: usually 3M
- Structure needs to be rolled (one month) before expiry, to minimize Futures Decay Impact
- **Strategy at inception:** Flat Delta, Vega (and premium). Long Vanna.
- **Sensitivities as VIX rises:** Long Delta, Long Vega and Long Skew.
- **Pros:** (i) Low Delta -> Low Cost (ii) Unlimited Upside like a Call (iii) High Leverage
- **Cons:** (i) Possible Loss on roll date and (ii) Requires dynamic or systematic implementation



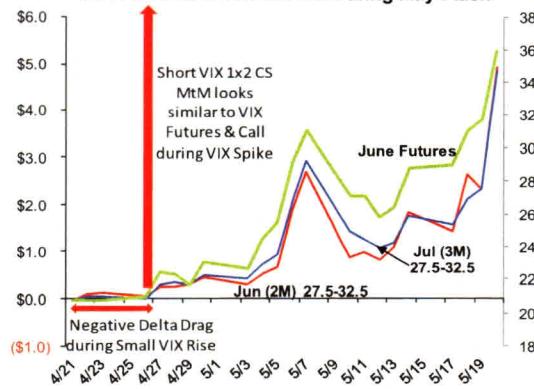
# SHORT 1X2 CALL SPREAD STRATEGY (II)

## STRATEGY P&L DURING PREVIOUS CRISIS

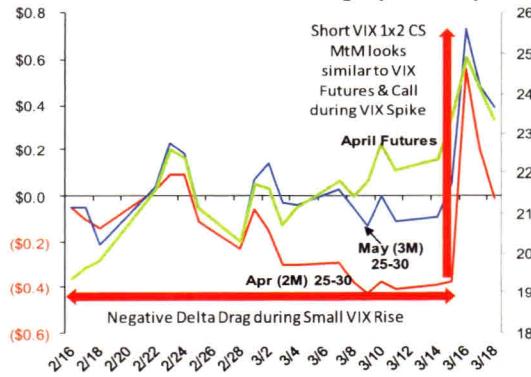
PnL Profile for Short VIX 1x2 During Lehman Crisis



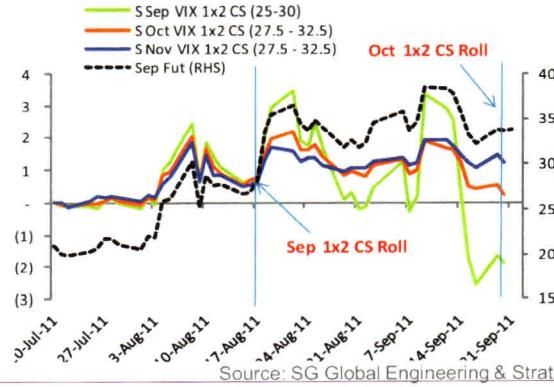
PnL Profile for Short VIX 1x2 During May Flash



PnL Profile for Short VIX 1x2 During Japan Earthquake



VIX Strategies PnL in Aug 11-Sep 11 (K diff = 5pts)



Source: SG Global Engineering & Strategy

# SHORT 1X2 CALL SPREAD STRATEGY (II)

## SYSTEMATIC STRATEGY PNL

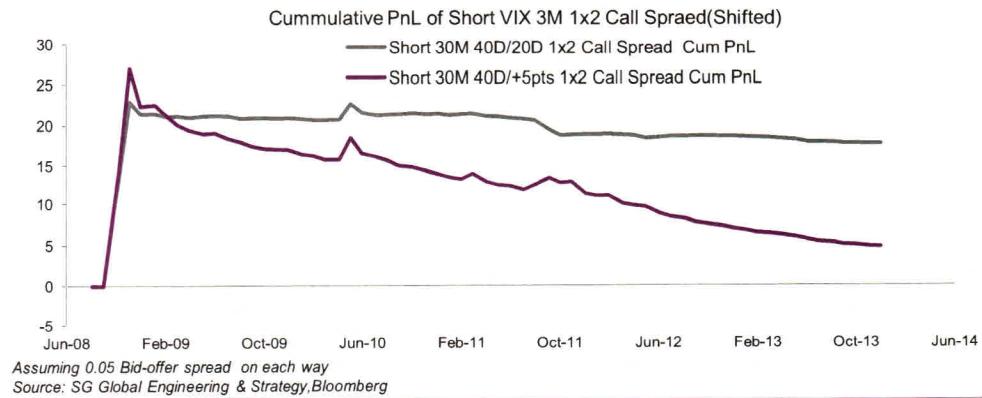
	short 3M 40D/+5pts 1x2 Call Spread			short 3M 40D/20D 1x2 Call Spread		
	Credit (cost)/contract	Total Carry/contract**	Avg Portfolio mthly PnL	Credit (cost)/contract	Total Carry/contract*	Avg Portfolio mthly PnL
Since Jun08	0.81	(1.01)	22.32	(0.57)	(0.52)	21.40
2009	0.70	(0.81)	(5.38)	(0.40)	(0.04)	(0.47)
2010	0.60	(0.75)	(3.06)	(0.32)	(0.17)	0.49
2011	0.83	(0.77)	(2.56)	(0.30)	(0.47)	(2.57)
2012	0.57	(0.61)	(4.33)	(0.33)	(0.08)	(0.23)
2013	0.12	(0.29)	(2.24)	(0.20)	(0.10)	(0.89)
<b>Avg</b>	<b>0.59</b>	<b>(0.67)</b>	<b>0.07</b>	<b>(0.34)</b>	<b>(0.25)</b>	<b>0.27</b>
<b>Max</b>	<b>2.81</b>	<b>(2.18)</b>	<b>14.18</b>	<b>(0.13)</b>	<b>(2.30)</b>	<b>13.28</b>
<b>Min</b>	<b>(0.20)</b>	<b>0.00</b>	<b>(4.60)</b>	<b>(1.09)</b>	<b>0.00</b>	<b>(1.49)</b>
<b>% of time wt -ve</b>	<b>10%</b>	<b>14%</b>	<b>17%</b>	<b>100%</b>	<b>45%</b>	<b>37%</b>

\*Backtest is based on approximately 3M 40D/20D or 40D/+5pts (strike difference 5 pts)

\* bid/ask spreads are included

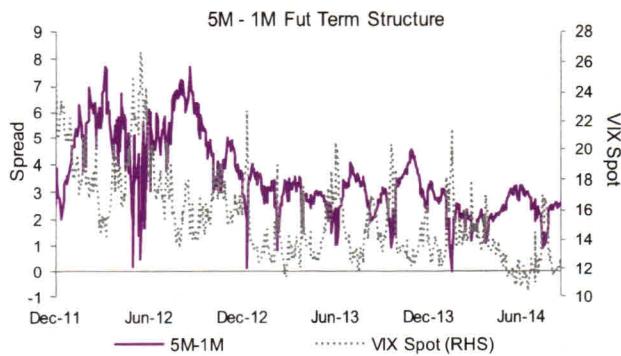
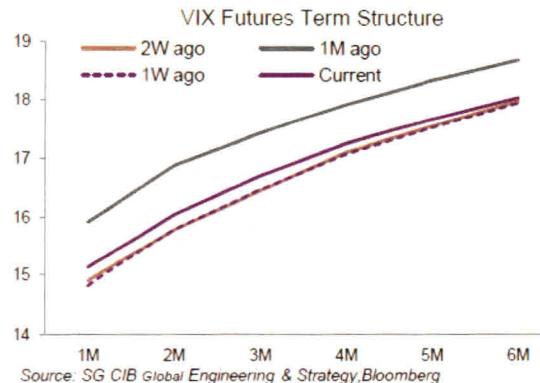
\*\* Average carry over the holding period (2 months) per contract

Position is rolled every 2 months



# LONG VIX CALL CALENDAR (I)

## HEDGE FOR MODERATE INCREASE VIX SCENARIOS: CHEAP VIX HEDGE



- Why VIX Call Calendar Spread: Long near-term call option & short long-term call option

- Offers protection with very small upfront cost (or even credit)
- Since front month Future is more sensitive to VIX spike than the back month, strategy profits from VIX spike or VIX futures curve flattening

### ■ Strategy construction:

- Strike selection: the wider strike difference and the lower the Long call strike, the higher the upside.
- Maturity selection: usually two month apart to limit the future roll down cost
- Holding period: we recommend roll/unwind the strategy 1 month before the expiration to reduce the exposure to large roll down of front month futures. In the case of the front month call becomes ITM for the structure, client may want to hold longer to capture the potential further upside.

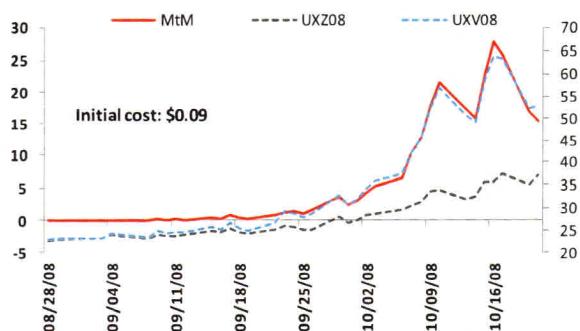
### ■ Risks of the strategy:

- The strategy usually involves carry at unwind if VIX doesn't spike due to Futures roll down cost.
- Small strike difference of the two legs caps the upside

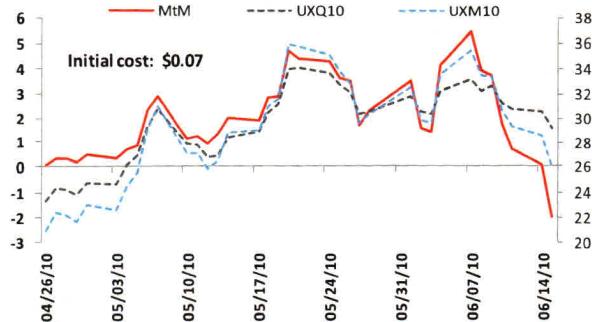
# LONG VIX CALL CALENDAR (II)

## HISTORIC PERFORMANCE DURING PREVIOUS CRISIS

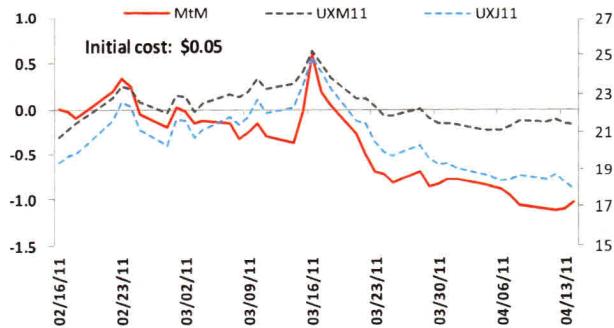
Lehman Crisis: VIX Oct \$27.5/Dec \$30 Call Calendar Spread



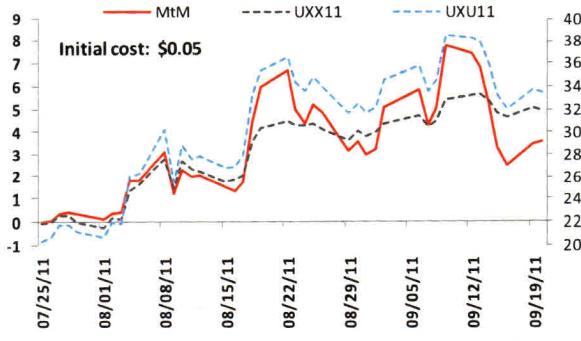
Flash Crash: VIX Jun \$25/Aug \$32.5 Call Calendar Spread



Japan Earthquake: VIX Apr \$25/Jun \$30 Call Calendar Spread



August Crash: VIX Sep \$25 / Nov \$30 Call Calendar

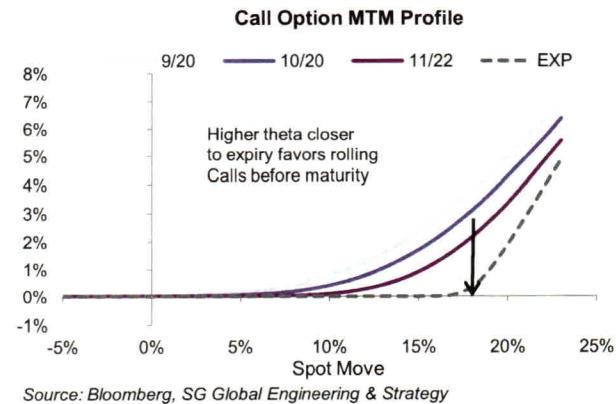
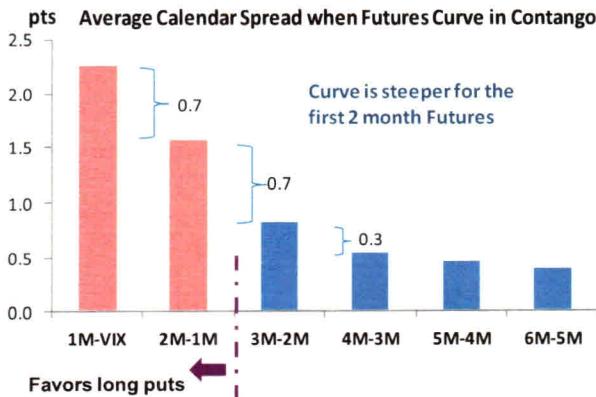


Source: SG Global Engineering & Strategy

# CALENDAR STRANGLE ON VIX (I)

## INTRODUCTION

- Historically VIX upside Call provides attractive payoff during market crash, but the carry cost could also be high if market experiences prolonged quite period.
- On the other hand, VIX Puts usually offers positive carry by taking the advantage of contango effect in VIX futures' term structure.
- Combined Structure:**
  - long short term VIX Put given the steeper curve at short-end. See left Fig.
  - long mid-term OTM VIX Call with cheap entry cost, and roll at least 1month before maturity to mitigate the fast decay in the last month of the life of option. See right Fig.



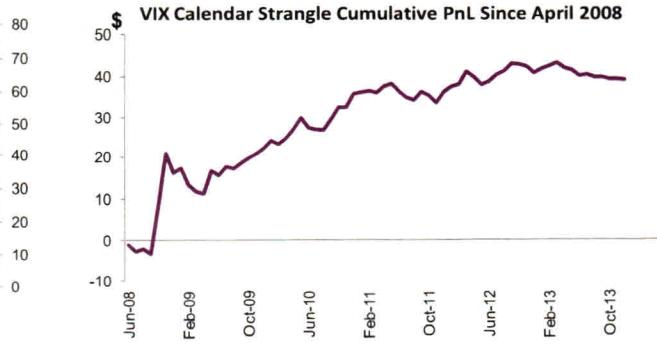
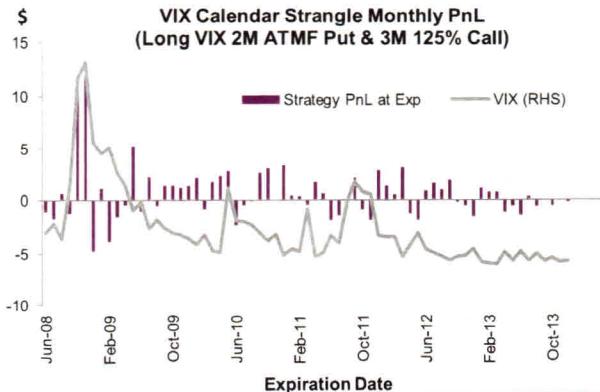
# CALENDAR STRANGLE ON VIX (II)

## STRATEGY PERFORMANCE

- **Strategy:** Long 2M ATMF put + Long 3M 125% Call
- **Roll:** roll both Call and Put every 2M; at the expiration of put option
- **Allocation:** any point of time, the portfolio consists of two position: new initiated 2<sup>nd</sup> & 3<sup>rd</sup> month strangle; 1<sup>st</sup> & 2<sup>nd</sup> month strangle which entered in previous month
- Backtest shows the calendar strangle provides an average positive PnL of \$2.4 for more than 53% of the time since 2008.

Strategy PnL(3M 125%Call +2M ATM Put)				
PnL	% time	Avg	Median	Max
+ve	53%	2.2	1.6	12.4
-ve	47%	-1.3	-1.2	0.0
+ve/-ve PnL Ratio		2.4	Cum PnL	43.0

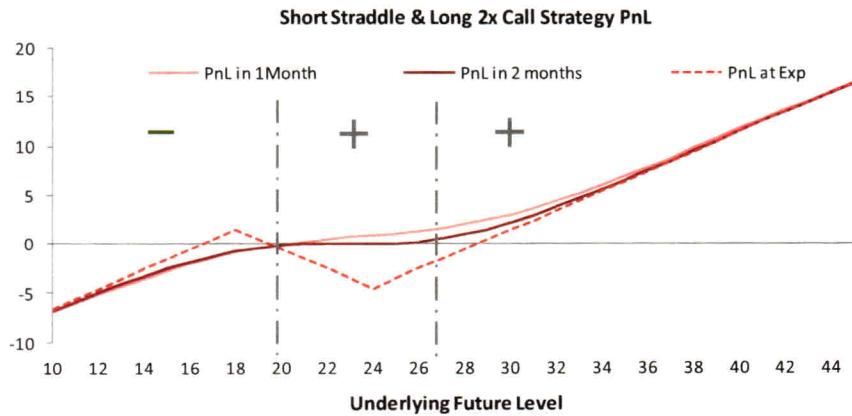
Year	3M 125% Call			2M ATM Put			Strategy Total PnL
	Avg Cost	Avg PnL	Total PnL	Avg Cost	Avg PnL	Total PnL	
2008	2.1	3.5	24.3	4.0	-1.2	-8.3	16.0
2009	1.9	-0.7	-8.3	3.4	1.2	14.3	6.0
2010	1.8	-0.4	-4.7	2.9	1.5	18.4	13.7
2011	2.1	0.0	-0.2	3.0	0.1	0.6	0.5
2012	2.0	-0.7	-8.5	2.6	1.1	13.1	4.6
2013	1.3	-0.4	-5.4	1.6	0.3	3.6	-1.8
	1.8	0.2	-2.7	2.9	0.5	41.7	39.0



# SHORT VIX STRADDLE & LONG 2 VIX CALLS (I)

## INTRODUCTION

- **Structure:** Short 3M ITM Straddle (strike at front month future level) + Long 2x 40D Call
- **Holding period:** 1 month (or 2 month)
- Strategy provides upside protection under moderate or extreme VIX move.
- Short in-the-money straddle provide partial financing to the long call leg, while downside breakeven will be around straddle strike level.

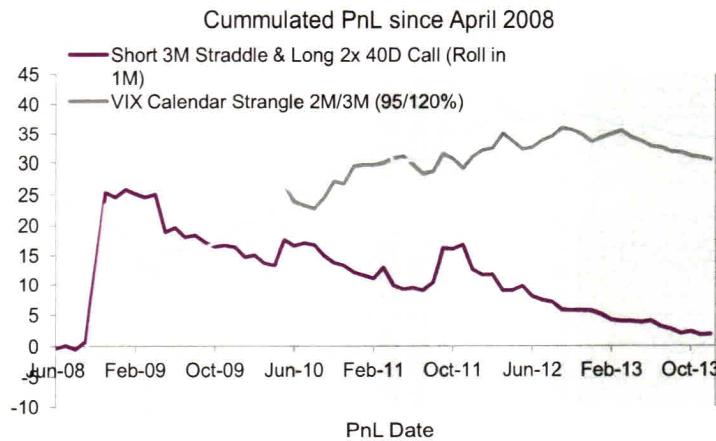


Source: SG Global Engineering & Advisory

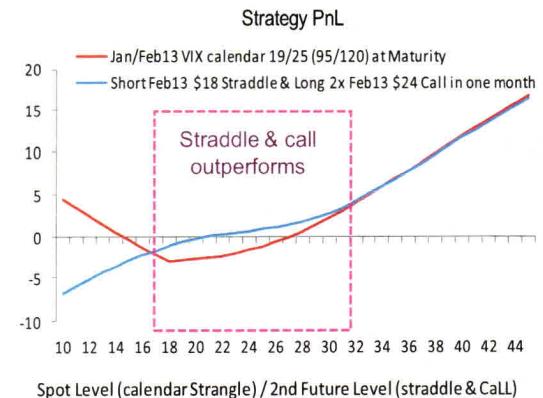
# SHORT VIX STRADDLE & LONG 2 VIX CALLS (II)

COMBINE WITH VIX CALENDAR STRANGLE TO IMPROVE PNL PROFILE

- In a low VIX environment, risk/reward profile of VIX calendar strangle becomes less attractive due to potentially low payout ratio on the long put leg. We propose to use straddle & call strategy as an alternative during the low volatility environment.
- MTM profiles of the two strategies show that the straddle & call provides a superior PNL profile when volatility is moderately elevated. In a volatility environment where this range is the most likely scenario, this strategy will be less costly and provide similar tail protection if VIX spikes.
- Our backtest shows the combined strategy outperformed VIX calendar strangle strategy approximately by 12% since 2008.
- The dynamic strategy in backtest is long 2M/3M 95%/120% calendar strangle (hold for 2 months) and switching to short straddle (ITM) & long 2x Call strategy when the put strike of calendar strangle is below 20 (95% \* 2<sup>nd</sup> month future)



Source: SG Global Engineering & Advisory



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