

Quantifying Credit Volatility Strategies

How profitable are systematic volatility strategies?

- **Start of a new report series** — We attempt to quantify the performance of systematic volatility trading strategies in terms of actual P&L. Specifically, we look at the performance of strategies involving volatility levels, skews, and calendar spreads. We present data for both delta-hedged and naked option strategies, and hope to publish on a regular basis if there is enough interest.
- **Selling Volatility** — Selling volatility using 3M ATM delta hedged straddles has been profitable over the past year, with the exception of a 2 month period from April end to June end in 2013. This is because implied volatility has generally been higher than realized, except for the April end to June end period. The high yield indices (HY and Xover) gave up most of the accrued profits during that period, but recovered nicely. In contrast, selling volatility on FinSnr has been extremely profitable, and even the 2 month period of high realized volatility was unable to cause much of a dent.
- **Payer Spreads and Risk Reversals** — Selling delta hedged payer spreads (3M 20-50 delta) or buying bullish risk reversals (3M 10 delta) did not appear to be very profitable strategies over the past year. In most cases, the gamma and vega components of the P&L cancel each other out, keeping the P&L fairly low. The short 3M 20-50 delta FinSnr payer skew strategy is the one exception that has benefitted from a steady steepening of the payer skew over the past year. In contrast, the unhedged versions of these strategies were profitable, thanks mainly to the steady tightening in index spreads over the past year.
- **Calendar Spreads** — Buying 3M-6M calendar spreads (volatility steepeners) has been a consistently profitable strategy over the past year for the US indices, but the performance has reversed over the past month. In contrast, the performance for the European indices has not been so promising, especially for Main, where the strategy mostly lost money for the first half of the past 1 year period. Most of the positive P&L for this strategy across all five indices was generated since March 2013, mostly due to a substantial increase in vega P&L, which had been negative in the earlier period. Interestingly, the P&L for this strategy does not appear to be strongly correlated to the actual slope of the volatility term structure.
- **Effect of Transaction Costs** — We found that transaction costs often dominate P&L because option bid/ask can be relatively wide, and therefore mask how volatility movements would have affected P&L for a given strategy. In general, systematic strategies may require some optimizations to be profitable after transaction costs (e.g., less frequent option rolling).

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See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

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Why are we doing this?

Investing in options is not suitable for all investors. Please see the disclosures concerning the risks of investing in options below and discuss with your Financial Advisor whether this particular options strategy is suitable for you. Note that all option prices are indications, based on intraday prices as of 8 October 2013. Interested investors should contact our trading desk for updated price and liquidity information. Also, complex option strategies may entail higher commissions costs.

We often present trade ideas that attempt to arbitrage mispricings in volatility markets by trading ATM volatility, volatility skews and/or calendar spreads. However, simply examining how any of these metrics (volatility levels, skews or calendar spreads) have changed over time does not properly account for the actual P&L resulting from option trades, even if we leave aside the issue of transaction costs.

Specifically, the issue is that once an option trade has been executed, the strikes on the trade remain fixed for the duration of the trade. In contrast, when we examine metrics such as skews or ATM volatility levels, it reflects the skew or ATM volatility level as of a *given day, and the corresponding strikes are different every day*. Therefore, even if we can account for the effects of different factors on option P&L (such as delta hedging, changes in implied volatility levels, etc.), the fixed strikes can result in very different P&L profiles from what we may expect by looking at time series of volatility metrics.

A brief description of the strategies

We present the results for executing four different systematic volatility strategies on all the five major credit indices, namely CDX IG, CDX HY, iTraxx Main, iTraxx Xover, and iTraxx FinSnr. The four strategies include:

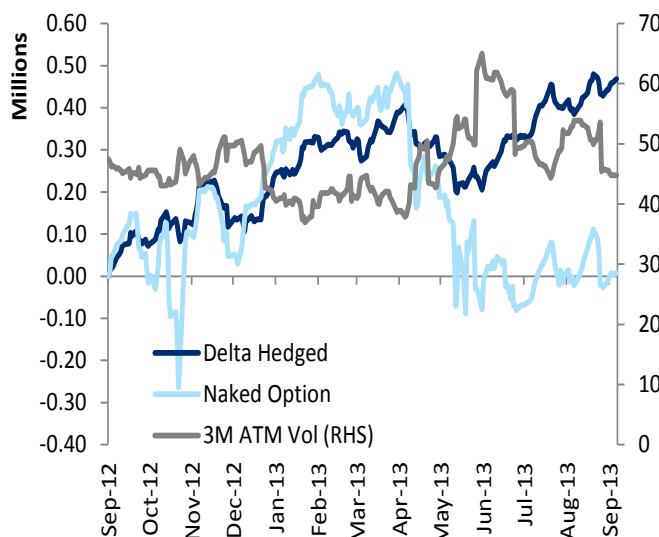
1. Sell 3M ATM straddles on the underlying index, and roll the position every month.
2. Buy 3M 10 delta bullish risk reversals on the underlying index (buy 3M 10 delta receiver, sell 3M 10 delta payer), and roll the position every month.
3. Sell 3M 10-50 delta payer spreads on the underlying index (buy 3M 10 delta payer, sell 3M 50 delta payer), and roll the position every month.
4. Buy 3M-6M ATM calendar spread on the underlying index (buy 6M ATM straddle, sell 3M ATM straddle), and roll the position every month. This is a volatility steepener trade.

For each of these strategies, we present the performance of executing the strategy using naked options, as well as delta hedging the option position daily. Each leg of the option trade has a 100 million face notional in the appropriate currency. The performance charts and statistics are shown in the next few sections.

Sell 3M ATM Straddles¹

Transaction costs not included in the P&L shown in the graphs.

Figure 1. CDX IG Perf. Chart, P&L (left), Volatility (right)



Source: Citi Research

Figure 2. CDX IG Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	7,236	468,348
Daily Volatility	36,740	13,404
Information Ratio	0.01	2.20
Max Draw down	(569,372)	(208,689)
Calmar Ratio	0.01	2.24

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

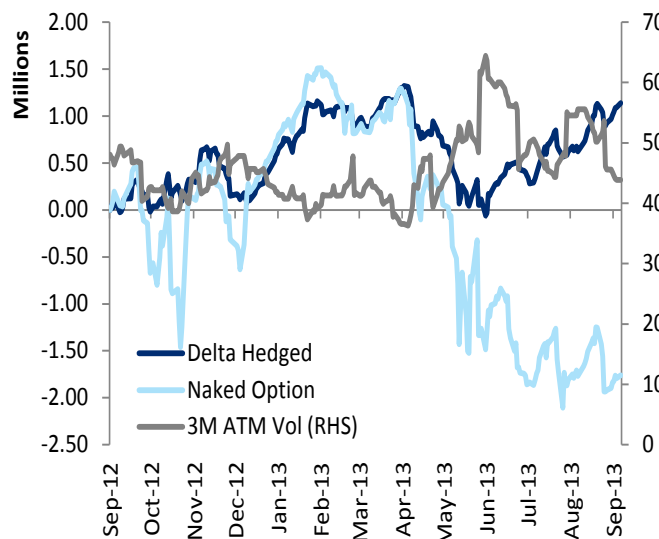
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	468,348	83,792
P&L due to gamma	601,187	60,251
P&L due to vega	(147,226)	17,490
Residual P&L	14,387	6,052

Bid/Ask Assumption	Option (cents)	Index (bp)
IG	2.00	0.50

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	468,348	83,792
Transaction Costs	(750,992)	(75,223)
Net Delta Hedged P&L	(282,644)	8,569

Source: Citi Research

Figure 3. CDX HY Perf. Chart, P&L (left), Volatility (right)



Source: Citi Research

Figure 4. CDX HY Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	(1,759,879)	1,139,351
Daily Volatility	182,968	68,990
Information Ratio	(0.61)	1.04
Max Draw down	(3,615,943)	(1,379,264)
Calmar Ratio	(0.49)	0.83

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,139,351	516,173
P&L due to gamma	395,323	41,498
P&L due to vega	(652,430)	268,435
Residual P&L	1,396,458	206,241

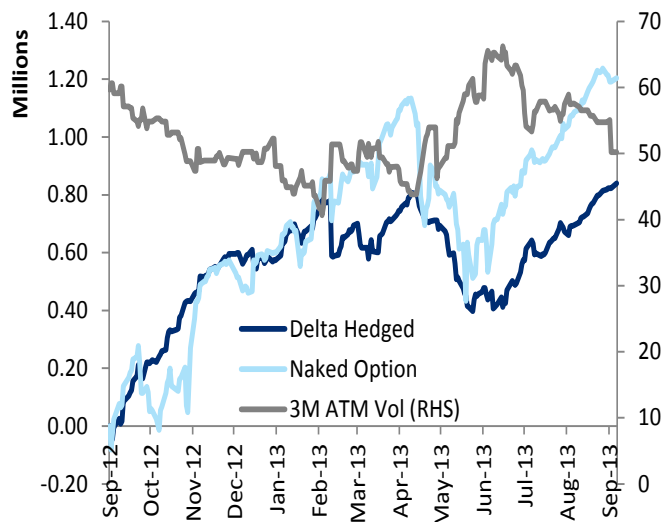
Bid/Ask Assumption	Option (cents)	Index (pt)
HY	15.00	0.25

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,139,351	516,173
Transaction Costs	(14,394,084)	(1,200,323)
Net Delta Hedged P&L	(13,254,733)	(684,150)

Source: Citi Research

¹ 100 million face notional on each leg, in currency of underlying index.

Figure 5. iTraxx Main Perf.Chart, P&L (left), Volatility (right)



Source: Citi Research

Figure 6. iTraxx Main Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	1,203,871	839,504
Daily Volatility	42,963	22,937
Information Ratio	1.77	2.31
Max Draw down	(700,005)	(409,561)
Calmar Ratio	1.72	2.05

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

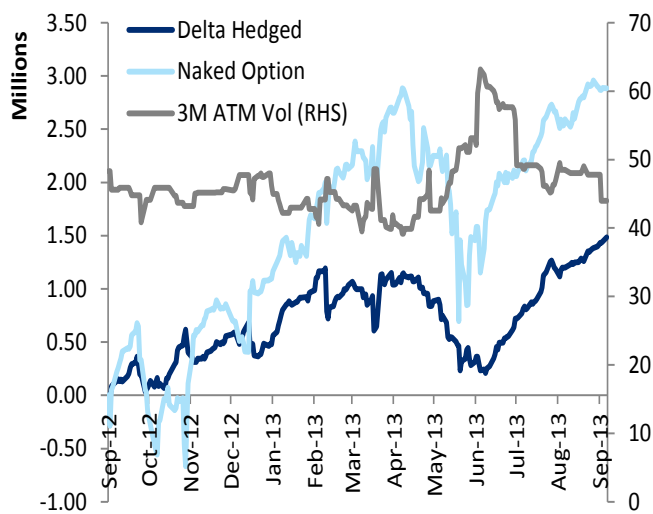
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	839,504	144,732
P&L due to gamma	882,411	102,214
P&L due to vega	78,993	43,942
Residual P&L	(121,899)	(1,424)

Bid/Ask Assumption	Option (cents)	Index (bp)
MAIN	2.00	1.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	839,504	144,732
Transaction Costs	(964,411)	(89,535)
Net Delta Hedged P&L	(124,907)	55,198

Source: Citi Research

Figure 7. iTraxx Xover Perf.Chart, P&L (left), Volatility (right)



Source: Citi Research

Figure 8. iTraxx Xover Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	2,882,945	1,482,680
Daily Volatility	149,650	68,126
Information Ratio	1.21	1.37
Max Draw down	(2,185,964)	(984,205)
Calmar Ratio	1.32	1.51

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

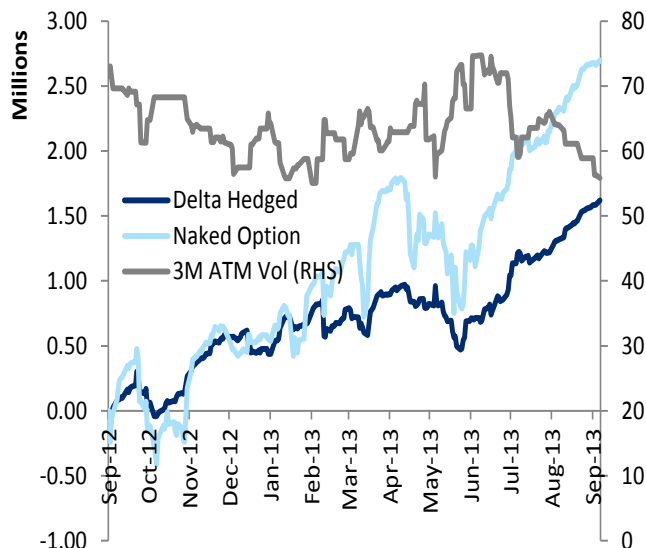
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,482,680	282,178
P&L due to gamma	1,793,522	216,912
P&L due to vega	(397,940)	38,024
Residual P&L	87,098	27,242

Bid/Ask Assumption	Option (cents)	Index (bp)
XO	12.00	3.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,482,680	282,178
Transaction Costs	(4,385,285)	(454,005)
Net Delta Hedged P&L	(2,902,605)	(171,827)

Source: Citi Research

Figure 9. iTraxx FinSnr Perf.Chart, P&L (left), Volatility (right)



Source: Citi Research

Figure 10. iTraxx FinSnr Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	2,697,072	1,620,396
Daily Volatility	95,343	44,427
Information Ratio	1.78	2.30
Max Draw down	(1,040,112)	(501,194)
Calmar Ratio	2.59	3.23

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,620,396	301,150
P&L due to gamma	1,219,475	148,373
P&L due to vega	373,785	135,207
Residual P&L	27,136	17,570

Bid/Ask Assumption	Option (cents)	Index (bp)
SNRFIN	7.00	3.00

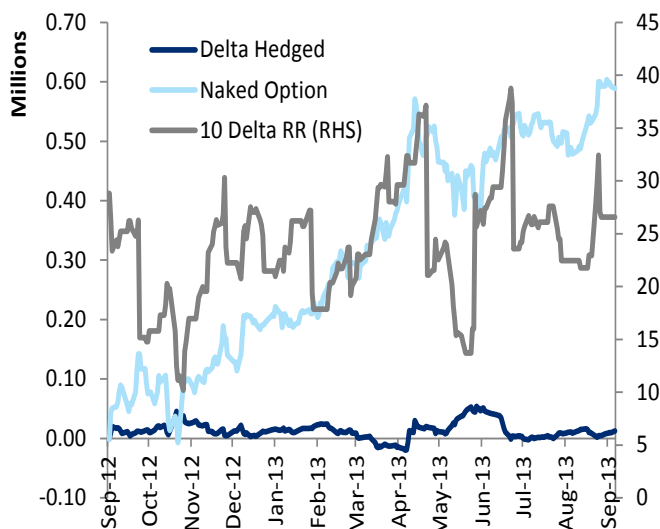
Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,620,396	301,150
Transaction Costs	(3,228,164)	(301,095)
Net Delta Hedged P&L	(1,607,768)	55

Source: Citi Research

Buy 3M 10 Delta Bullish Risk Reversals²

Transaction costs not included in the P&L shown in the graphs.

Figure 11. CDX IG Perf.Chart, P&L (left), 10 delta vol skew (right)



Source: Citi Research

Figure 12. CDX IG Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	588,731	12,645
Daily Volatility	18,823	4,470
Information Ratio	1.97	0.18
Max Draw down	(197,722)	(65,381)
Calmar Ratio	2.98	0.19

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

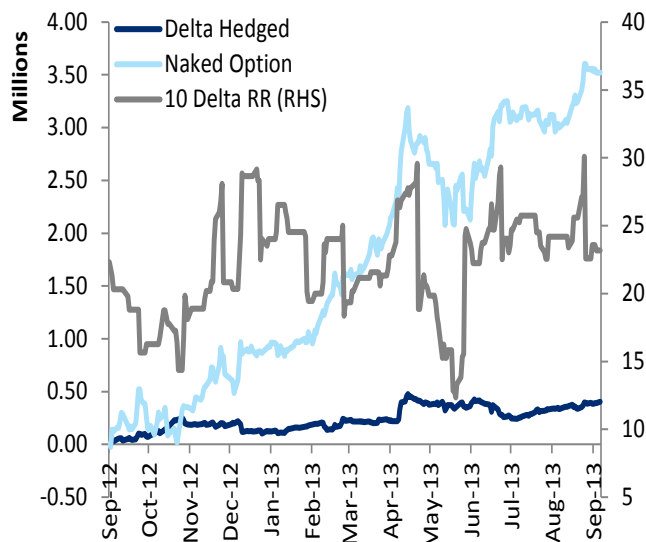
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	12,645	3,734
P&L due to gamma	183,831	16,807
P&L due to vega	(86,975)	(14,308)
Residual P&L	(84,211)	1,235

Bid/Ask Assumption	Option (cents)	Index (bp)
IG	2.00	0.50

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	12,645	3,734
Transaction Costs	(609,547)	(66,035)
Net Delta Hedged P&L	(596,902)	(62,301)

Source: Citi Research

Figure 13. CDX HY Perf.Chart , P&L (left), 10 delta vol skew (right)



Source: Citi Research

Figure 14. CDX HY Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	3,520,520	403,126
Daily Volatility	94,316	18,440
Information Ratio	2.35	1.38
Max Draw down	(1,107,797)	(236,120)
Calmar Ratio	3.18	1.71

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	403,126	67,765
P&L due to gamma	13,442	499
P&L due to vega	(377,846)	(51,557)
Residual P&L	767,530	118,823

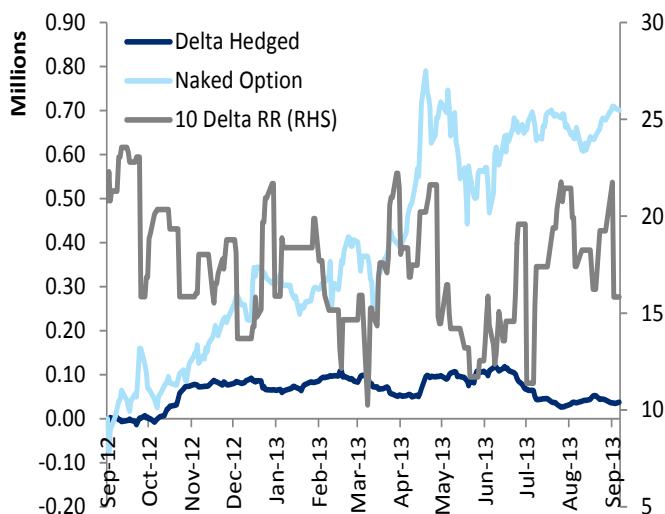
Bid/Ask Assumption	Option (cents)	Index (pt)
HY	15.00	0.25

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	403,126	67,765
Transaction Costs	(8,616,692)	(803,862)
Net Delta Hedged P&L	(8,213,565)	(736,097)

Source: Citi Research

² 100 million face notional on each leg, in currency of underlying index.

Figure 15. iTraxx Main Perf.Chart, P&L (left), 10 delta vol skew (right)



Source: Citi Research

Figure 16. iTraxx Main Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	700,359	37,767
Daily Volatility	28,536	4,994
Information Ratio	1.55	0.48
Max Draw down	(346,898)	(93,803)
Calmar Ratio	2.02	0.40

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

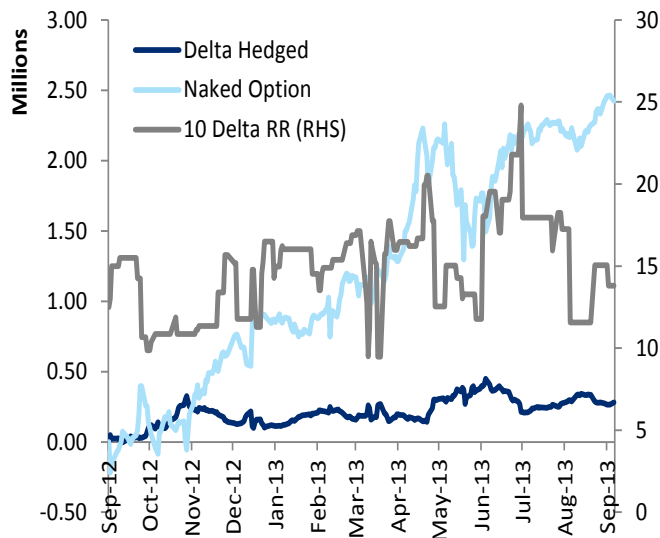
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	37,767	1,585
P&L due to gamma	190,622	10,497
P&L due to vega	(107,628)	(10,804)
Residual P&L	(45,227)	1,892

Bid/Ask Assumption	Option (cents)	Index (bp)
MAIN	2.00	1.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	37,767	1,585
Transaction Costs	(691,736)	(70,407)
Net Delta Hedged P&L	(653,969)	(68,822)

Source: Citi Research

Figure 17. iTraxx Xover Perf.Chart, P&L (left), 10 delta vol skew (right)



Source: Citi Research

Figure 18. iTraxx Xover Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	2,424,168	281,005
Daily Volatility	84,891	22,364
Information Ratio	1.80	0.79
Max Draw down	(960,189)	(240,306)
Calmar Ratio	2.52	1.17

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

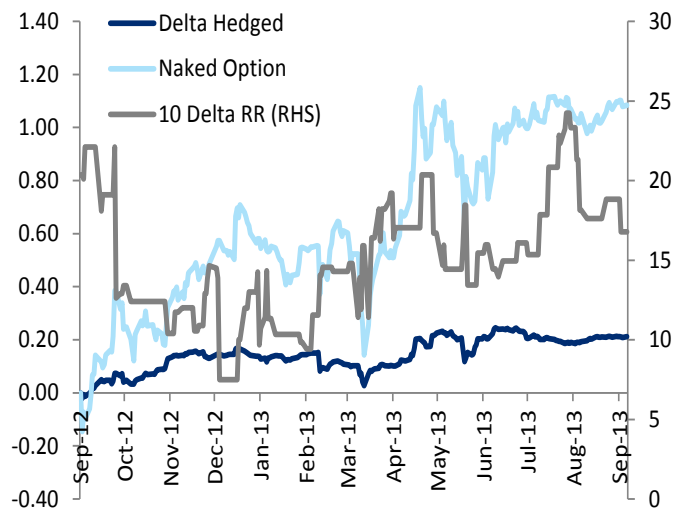
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	281,005	(6,151)
P&L due to gamma	457,564	11,948
P&L due to vega	(228,913)	(39,431)
Residual P&L	52,354	21,332

Bid/Ask Assumption	Option (cents)	Index (bp)
XO	12.00	3.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	281,005	(6,151)
Transaction Costs	(3,599,114)	(392,948)
Net Delta Hedged P&L	(3,318,109)	(399,099)

Source: Citi Research

Figure 19. iTraxx FinSnr Perf.Chart, P&L (left), 10 delta vol skew (right)



Source: Citi Research

Figure 20. iTraxx FinSnr Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	1,083,974	212,143
Daily Volatility	52,890	11,372
Information Ratio	1.29	1.18
Max Draw down	(565,868)	(142,149)
Calmar Ratio	1.92	1.49

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	212,143	19,311
P&L due to gamma	294,033	12,637
P&L due to vega	(101,868)	2,636
Residual P&L	19,978	4,039

Bid/Ask Assumption	Option (cents)	Index (bp)
SNRFIN	7.00	3.00

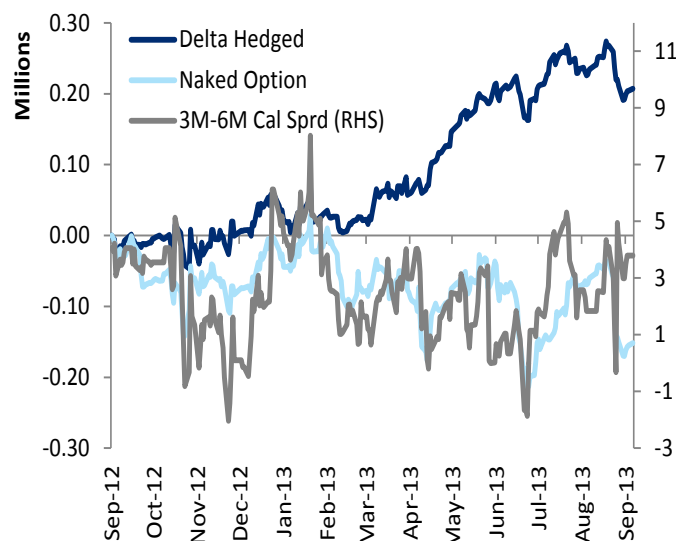
Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	212,143	19,311
Transaction Costs	(2,297,823)	(238,861)
Net Delta Hedged P&L	(2,085,680)	(219,550)

Source: Citi Research

Buy 3M-6M ATM Calendar Spreads³

Transaction costs not included in the P&L shown in the graphs.

Figure 21. CDX IG Perf.Chart, P&L (left),3M-6M cal skew (right)



Source: Citi Research

Figure 22. CDX IG Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	(151,661)	207,016
Daily Volatility	16,367	11,697
Information Ratio	(0.58)	1.11
Max Draw down	(241,588)	(82,657)
Calmar Ratio	(0.63)	2.50

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

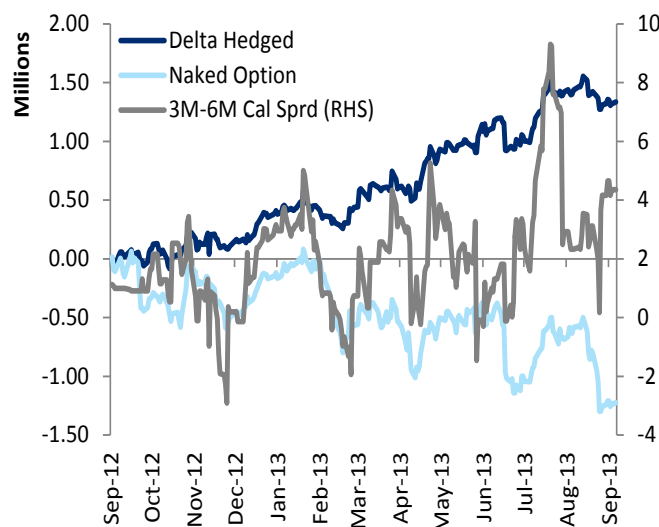
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	207,016	(26,875)
P&L due to gamma	88,682	11,426
P&L due to vega	(37,526)	(55,429)
Residual P&L	155,861	17,128

Bid/Ask Assumption	Option (cents)	Index (bp)
IG	2.00	0.50

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	207,016	(26,875)
Transaction Costs	(1,125,102)	(126,431)
Net Delta Hedged P&L	(918,086)	(153,307)

Source: Citi Research

Figure 23. CDX HY Perf.Chart, P&L (left),3M-6M cal skew (right)



Source: Citi Research

Figure 24. CDX HY Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	(1,225,100)	1,335,249
Daily Volatility	79,037	50,416
Information Ratio	(0.98)	1.67
Max Draw down	(1,379,994)	(323,545)
Calmar Ratio	(0.89)	4.13

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,335,249	(102,042)
P&L due to gamma	97,127	10,524
P&L due to vega	631,691	(182,688)
Residual P&L	606,432	70,122

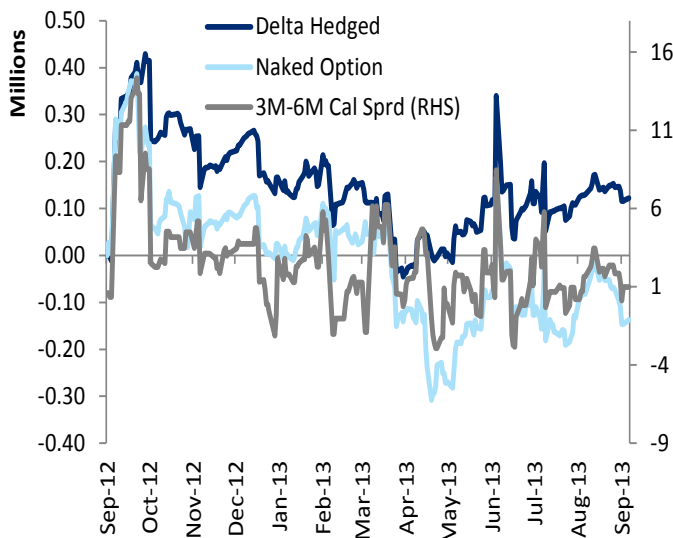
Bid/Ask Assumption	Option (cents)	Index (pt)
HY	15.00	0.25

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	1,335,249	(102,042)
Transaction Costs	(11,760,762)	(1,230,434)
Net Delta Hedged P&L	(10,425,513)	(1,332,477)

Source: Citi Research

³ 100 million face notional on each leg, in currency of underlying index.

Figure 25. iTraxx Main Perf.Chart, P&L (left),3M-6M cal skew (right)



Source: Citi Research

Figure 26. iTraxx Main Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	(137,197)	122,225
Daily Volatility	40,739	37,142
Information Ratio	(0.21)	0.21
Max Draw down	(694,208)	(474,279)
Calmar Ratio	(0.20)	0.26

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

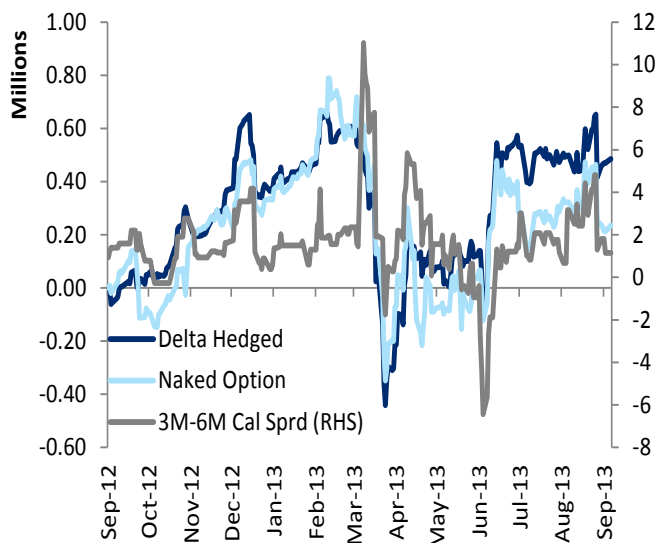
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	122,225	(7,062)
P&L due to gamma	139,944	25,241
P&L due to vega	(164,095)	(46,559)
Residual P&L	146,377	14,256

Bid/Ask Assumption	Option (cents)	Index (bp)
MAIN	2.00	1.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	122,225	(7,062)
Transaction Costs	(1,212,450)	(132,898)
Net Delta Hedged P&L	(1,090,225)	(139,960)

Source: Citi Research

Figure 27. iTraxx Xover Perf.Chart, P&L (left),3M-6M cal skew (right)



Source: Citi Research

Figure 28. iTraxx Xover Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	234,897	485,696
Daily Volatility	64,002	55,335
Information Ratio	0.23	0.55
Max Draw down	(1,136,985)	(1,102,690)
Calmar Ratio	0.21	0.44

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

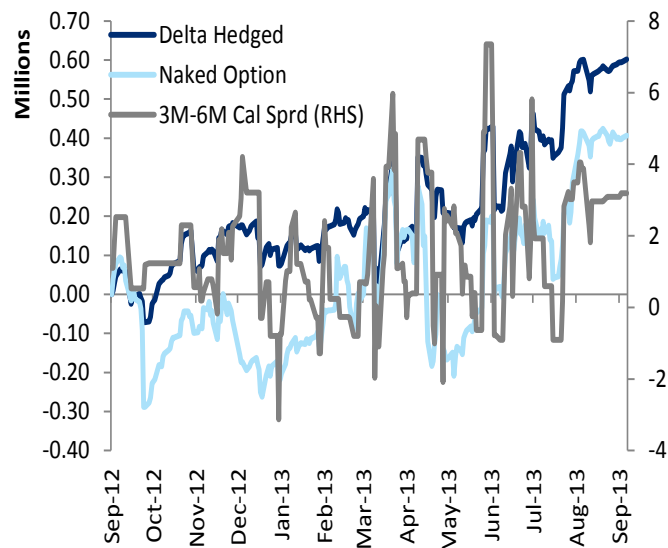
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	485,696	(13,091)
P&L due to gamma	323,287	38,574
P&L due to vega	(321,680)	(104,018)
Residual P&L	484,090	52,353

Bid/Ask Assumption	Option (cents)	Index (bp)
XO	12.00	3.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	485,696	(13,091)
Transaction Costs	(6,634,617)	(754,544)
Net Delta Hedged P&L	(6,148,921)	(767,635)

Source: Citi Research

Figure 29. iTraxx FinSnr Perf.Chart, P&L (left),3M-6M cal skew (right)



Source: Citi Research

Figure 30. iTraxx FinSnr Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	406,221	602,014
Daily Volatility	46,710	37,492
Information Ratio	0.55	1.01
Max Draw down	(529,921)	(222,843)
Calmar Ratio	0.77	2.70

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	602,014	1,430
P&L due to gamma	240,564	29,788
P&L due to vega	(76,275)	(71,752)
Residual P&L	437,726	43,394

Bid/Ask Assumption	Option (cents)	Index (bp)
SNRFIN	7.00	3.00

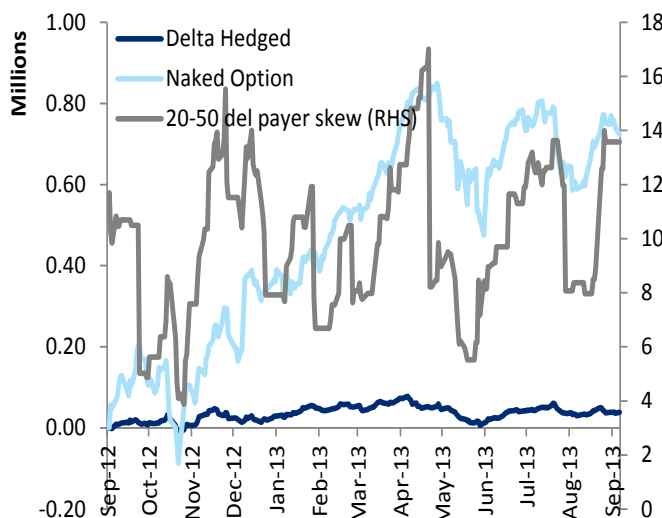
Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	602,014	1,430
Transaction Costs	(4,126,175)	(452,698)
Net Delta Hedged P&L	(3,524,161)	(451,268)

Source: Citi Research

Sell 3M 20-50 Delta Payer Spreads⁴

Transaction costs not included in the P&L shown in the graphs.

Figure 31. CDX IG Perf.Chart, P&L (left), 3M 20-50 payer skew (right)



Source: Citi Research

Figure 32. CDX IG Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	723,264	38,361
Daily Volatility	29,317	4,114
Information Ratio	1.55	0.59
Max Draw down	(374,644)	(71,061)
Calmar Ratio	1.93	0.54

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

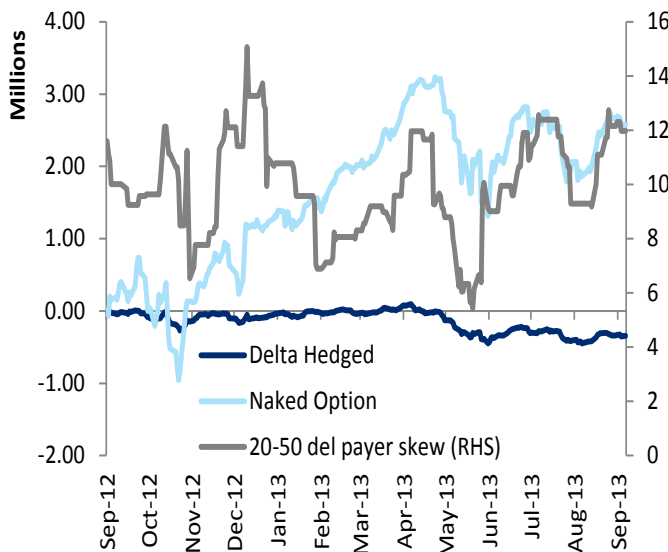
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	38,361	8,362
P&L due to gamma	(25,600)	365
P&L due to vega	52,865	8,038
Residual P&L	11,097	(41)

Bid/Ask Assumption	Option (cents)	Index (bp)
IG	2.00	0.50

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	38,361	8,362
Transaction Costs	(640,040)	(68,740)
Net Delta Hedged P&L	(601,679)	(60,378)

Source: Citi Research

Figure 33. CDX HY Perf.Chart, P&L (left), 3M 20-50 payer skew (right)



Source: Citi Research

Figure 34. CDX HY Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	2,572,850	(342,255)
Daily Volatility	145,835	22,958
Information Ratio	1.11	(0.94)
Max Draw down	(1,917,178)	(544,527)
Calmar Ratio	1.34	(0.63)

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	(342,255)	108,810
P&L due to gamma	30,597	4,948
P&L due to vega	(55,071)	71,412
Residual P&L	(317,781)	32,449

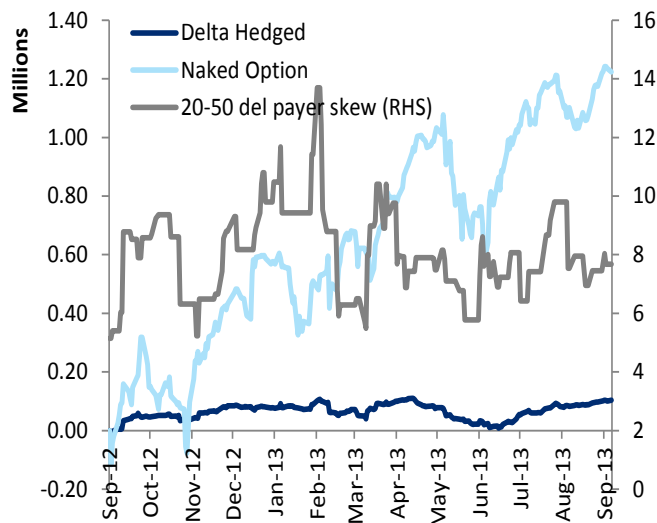
Bid/Ask Assumption	Option (cents)	Index (pt)
HY	15.00	0.25

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	(342,255)	108,810
Transaction Costs	(9,218,844)	(834,983)
Net Delta Hedged P&L	(9,561,099)	(726,174)

Source: Citi Research

⁴ 100 million face notional on each leg, in currency of underlying index.

Figure 35. iTraxx Main Perf.Chart, P&L (left), 3M payer skew (right)



Source: Citi Research

Figure 36. iTraxx Main Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	1,223,121	103,715
Daily Volatility	44,631	5,820
Information Ratio	1.73	1.12
Max Draw down	(506,314)	(101,400)
Calmar Ratio	2.42	1.02

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

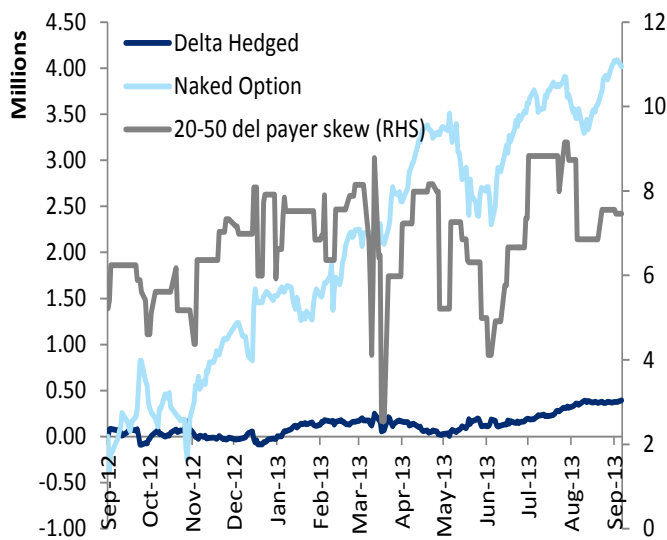
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	103,715	21,097
P&L due to gamma	4,762	11,621
P&L due to vega	37,076	6,085
Residual P&L	61,877	3,392

Bid/Ask Assumption	Option (cents)	Index (bp)
MAIN	2.00	1.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	103,715	21,097
Transaction Costs	(768,766)	(77,411)
Net Delta Hedged P&L	(665,051)	(56,313)

Source: Citi Research

Figure 37. iTraxx Xover Perf.Chart, P&L (left), 3M payer skew (right)



Source: Citi Research

Figure 38. iTraxx Xover Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	4,018,712	393,335
Daily Volatility	123,881	27,411
Information Ratio	2.04	0.90
Max Draw down	(1,202,926)	(249,744)
Calmar Ratio	3.34	1.57

Information Ratio = (Avg P&L)/(P&L Vol), annualized
Calmar Ratio = Total P&L / Max Draw down

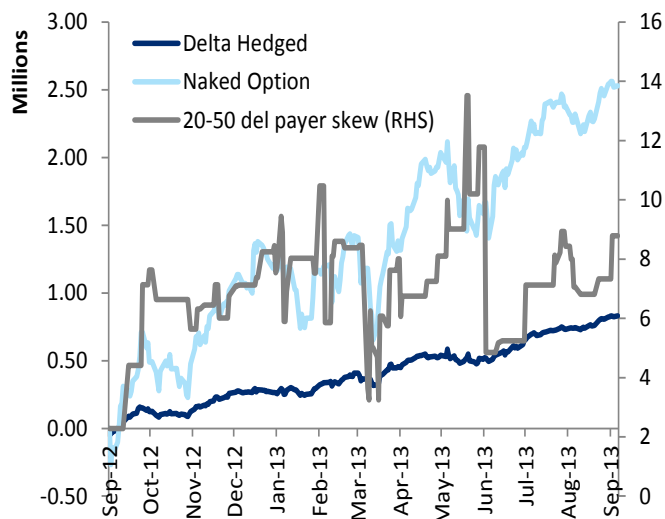
P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	393,335	47,632
P&L due to gamma	(91,968)	12,043
P&L due to vega	42,338	13,140
Residual P&L	442,965	22,449

Bid/Ask Assumption	Option (cents)	Index (bp)
XO	12.00	3.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	393,335	47,632
Transaction Costs	(3,762,986)	(407,934)
Net Delta Hedged P&L	(3,369,651)	(360,303)

Source: Citi Research

Figure 39. iTraxx FinSnr Perf.Chart, P&L (left), 3M payer skew (right)



Source: Citi Research

Figure 40. iTraxx FinSnr Performance Statistics

Statistics (past 1 year)	Naked Option	Hedged Daily
Gross Total P&L	2,529,016	831,166
Daily Volatility	88,857	15,578
Information Ratio	1.79	3.36
Max Draw down	(782,386)	(110,017)
Calmar Ratio	3.23	7.55

Information Ratio = (Avg P&L)/(P&L Vol), annualized

Calmar Ratio = Total P&L / Max Draw down

P&L Breakdown	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	831,166	86,442
P&L due to gamma	(3,028)	20,436
P&L due to vega	205,257	23,471
Residual P&L	628,937	42,535

Bid/Ask Assumption	Option (cents)	Index (bp)
SNRFIN	7.00	3.00

Net of Transaction Costs	Last 1 Year	Last 1 Month
Gross Delta Hedged P&L	831,166	86,442
Transaction Costs	(2,576,506)	(266,488)
Net Delta Hedged P&L	(1,745,340)	(180,045)

Source: Citi Research

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Appendix A-1

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