Cross Asset Hedging

Policy uncertainty leaves Rates & Gold vol elevated, Credit & FX hedges offer value

Asset Allocation

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Global

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Cross asset vols decline post the G20 meeting

The continued dovish stance of global central banks and an improvement in trade-war rhetoric following the G20 led to a global risk asset relief rally and cross asset volatilities resetting lower. Most notably, Global Equity & FX vol and Credit CDS spreads have fallen back to their 1st decile since 2007 (Table 1).

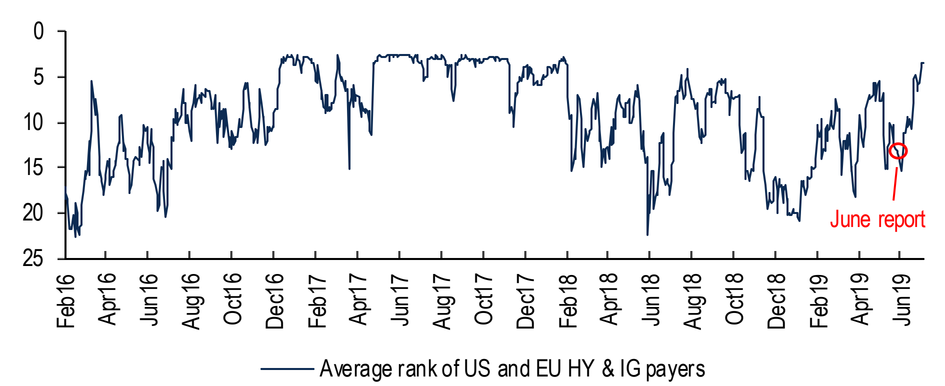
Short dated gold vols elevated; 1y+ tenors offer value

Despite commodity vols falling last month (led by crude oil vol), short term gold vol spiked in the recent gold rally to 1400. As we noted last month, FX and gold were the last cheap perceived "safe-haven" hedges even as rates vol reacted to rising macro risk. With short-dated vols elevated, we see value in owning laggard long-dated gold vol as a hedge (12m ATMf vol in its 12th 10y percentile vs 28th percentile for 3m).

Credit and FX hedges most underpricing tail risk

Accounting for 4 of the top 5 hedges, Credit hedges (IG and HY payers in the US and EU) have shot to the top of our cheapest hedges screen (Chart 1) – up from the middle of the table in our last report. The last time credit hedges screened this well was during Q217. FX hedges also continue to rank well in our screen: EURUSD puts rank the most attractive hedge while Commodity-linked FX pairs are not far behind.

Chart 1: Credit hedges are dominating the top of our cheapest hedges screen (as last seen in 2017)



Source: BofA Merrill Lynch Global Research. Data: 2-Feb-16 to 3-Jul-19

Table 1: X-asset vols & credit spreads

	Cur. level	1M chg.	%-ile
Global Equity Vol	12.4%	-3.6%	4%
Global FX Vol	5.9%	-0.6%	3%
Commodity Vol	20.8%	-2.1%	30%
Global Rates Vol (bp)	51.6	0.1	19%
US IG Credit (bp)	51.9	-18.6	7%
US HY Credit (bp)	315.6	-77.8	4%
iTraxx EU Main (bp)	49.2	-22.7	5%
iTraxx EU Xover (bp)	239.3	-71.7	4%

Equity Vol: SPX, SX5E, UKX, NKY & HSI 3M ATM vol
FX Vol: USDJPY, EURUSD & GBPUSD 3M ATM vol
Commodity Vol: Crude Oil, Gold & Copper 3M ATM vol
Rates Vol: ML Swaption 3M Vol Index US & EUR
Source: BofA Merrill Lynch Global Research. Data as of 3-Jul-19. %-iles are based on data since May-07. *Change since 31-May-19.

EFA puts continue to have proxy hedging value

Since expanding our universe of potential proxy hedging candidates, EFA puts (Global developed market ex-N. American equities) have consistently screened highly for hedging the S&P500 and world equities (MXWO). Once again this is the case (Chart 7 and Chart 4) and they now screen as attractive hedges for EM equity exposure as well (Chart 11). Other notable proxy hedges include: Topix puts for the Nikkei (Chart 13) and credit payers (particularly CDX HY) for HY Credit (Chart 14).

Timestamp: 07 July 2019 02:25PM EDT

Cross-asset tail hedging

Identifying value in puts across asset classes

Chart 2 shows crash returns of different assets during historical tail events per unit of current OTM option implied volatility. We measure tail events by the 10 largest 3M drops since Jan-06 (see Finding cheap hedges: the framework for how we algorithmically identify these events). Ranked by the average, the screen shows that the hedges which are most underpricing historical tail events are: **EURUSD puts,** and **IG payers** in the EU and US:

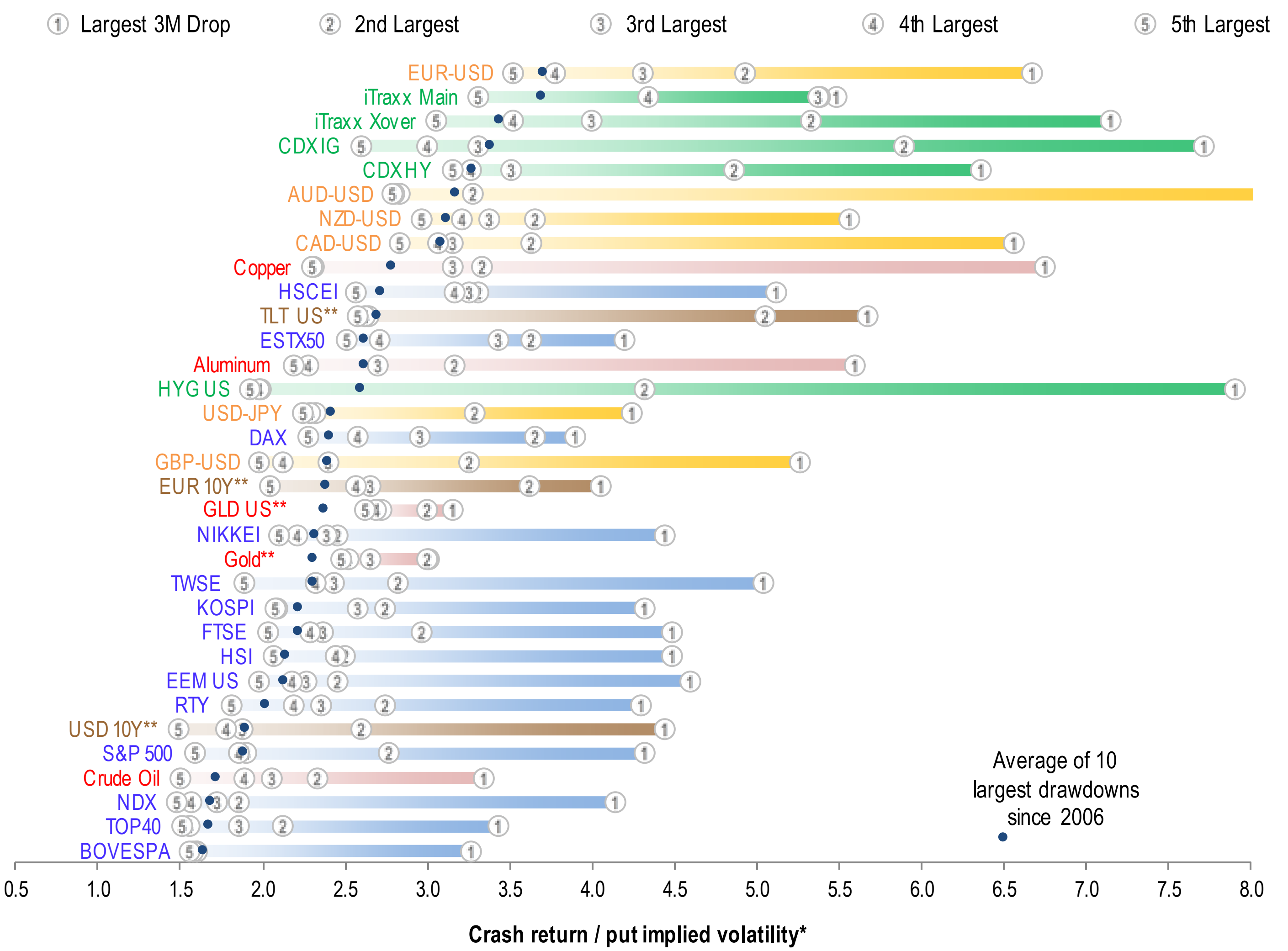
- **EURUSD** puts remain cheap and indeed are now the cheapest cross-asset hedge in our screen. Other FX hedges (**AUDUSD**, **NZDUSD** & **CASUSD**) continue to screen highly – notably these currency pairs have historically been commodity-linked.

- **Credit hedges** saw a large increase in efficacy with European and US credit payers (both IG and HY) representing 4 of the top 5 hedges in our screen

- As we highlighted last report, FX and gold were the last "safe-haven" assets to react to rising macro risks. After gold's sharp rally through 1400 and its rise in vol (Table 2), **Gold** calls are now screening much lower than last month

Chart 2: Cross-asset tail hedging screen: EUR-USD puts are currently most underpricing tail risk based on history

For an explanation of how to interpret this chart see Finding cheap hedges: the framework.



Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *3M 25% delta put volatility for each asset, see Finding cheap hedges: the framework for more details on the methodology behind this diagram. **3M 25% delta call volatility (receiver premia) for TLT US, Gold and GLD US (USD & EUR 10Y rates). Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

As a reference, Table 2 shows the largest drops (unless stated otherwise) within 3M in each asset class between '06 and '19, ranked in the same order as the assets in Chart 2.

Table 2: 10 largest 3M drawdowns across asset classes since Jan-06

Asset Name	Asset Category	10 Largest 3M drawdowns					3Mth 25 Delta Vol*	Vol Change†
EUR-USD	Currency	-17% (Oct-08) -8% (Jan-12)	-13% (Mar-15) -7% (Jul-12)	-11% (Jun-10) -7% (Oct-14)	-10% (Mar-09) -7% (Dec-16)	-9% (Feb-10) -7% (Nov-15)	5.1%	-0.3%
iTraxx Main	Credit	-4% (Sep-11) -2% (Mar-09)	-4% (Mar-08) -2% (Nov-11)	-4% (Dec-08) -2% (Feb-16)	-3% (May-12) -2% (Aug-07)	-2% (Jun-10) -1% (Jun-13)	52.4%	-8.8%
iTraxx Xover	Credit	-17% (Dec-08) -6% (Feb-16)	-12% (Sep-11) -6% (Nov-11)	-9% (Mar-08) -5% (May-12)	-8% (Aug-07) -4% (Mar-09)	-7% (Jun-10) -4% (Jun-13)	39.4%	-10.7%
CDX IG	Credit	-5% (Dec-08) -2% (Jun-10)	-4% (Mar-08) -2% (Aug-07)	-2% (Mar-09) -2% (Feb-16)	-2% (Jul-08) -2% (Jun-12)	-2% (Oct-11) -1% (Nov-07)	51.1%	-8.4%
CDX HY	Credit	-18% (Dec-08) -8% (Jul-07)	-14% (Mar-09) -7% (May-10)	-10% (Oct-11) -7% (Nov-11)	-9% (Oct-09) -6% (Feb-10)	-9% (Mar-08) -5% (Jun-09)	38.9%	-7.1%
AUD-USD	Currency	-31% (Oct-08) -10% (Oct-08)	-12% (Jul-13) -9% (Aug-07)	-11% (May-10) -9% (Sep-15)	-11% (Feb-15) -8% (May-12)	-10% (Sep-11) -8% (Nov-11)	7.5%	-0.5%
NZD-USD	Currency	-22% (Nov-08) -11% (Oct-11)	-14% (Mar-09) -10% (Oct-14)	-13% (Jul-15) -10% (Aug-08)	-13% (Aug-07) -9% (May-12)	-12% (Apr-06) -9% (Jun-13)	7.9%	-0.3%
CAD-USD	Currency	-18% (Oct-08) -8% (Jul-15)	-10% (Feb-15) -6% (Mar-09)	-9% (Jan-16) -6% (Aug-08)	-8% (Oct-11) -6% (Jan-14)	-8% (Dec-07) -6% (May-10)	5.5%	-0.1%
Copper	Commodity	-56% (Dec-08) -19% (Dec-07)	-28% (Jan-07) -17% (Jun-06)	-26% (Oct-11) -16% (Feb-15)	-19% (Jun-10) -16% (Jan-16)	-19% (Aug-15) -15% (Jul-18)	16.3%	-2.8%
HSCEI	Hong Kong Equity	-46% (Oct-08) -21% (Mar-08)	-30% (Sep-15) -21% (Jan-09)	-30% (Jan-08) -17% (May-12)	-29% (Oct-11) -15% (Jun-06)	-23% (Jan-16) -15% (Jun-13)	17.7%	-3.5%
TLT US**	T-Bills	30% (Dec-08) 10% (Jul-16)	27% (Sep-11) 10% (Feb-16)	14% (Jan-15) 8% (Sep-07)	14% (Jun-12) 8% (Jan-19)	14% (Jul-10) 8% (Aug-10)	10.5%	-1.5%
ESTX50	European Equity	-29% (Nov-08) -15% (Sep-15)	-25% (Sep-11) -14% (May-12)	-24% (Mar-09) -14% (Jul-08)	-19% (Mar-08) -12% (May-10)	-17% (Feb-16) -12% (Nov-11)	13.6%	-5.0%
Aluminum	Commodity	-43% (Dec-08) -16% (Sep-08)	-24% (Jun-06) -16% (Oct-11)	-21% (Jun-10) -15% (Feb-06)	-17% (Aug-15) -15% (Sep-07)	-17% (Feb-09) -15% (Jun-12)	15.0%	-1.4%
HYG US	US Credit	-28% (Nov-08) -7% (Aug-07)	-15% (Mar-09) -5% (Jul-08)	-7% (Jan-16) -5% (Feb-10)	-7% (Aug-11) -5% (May-10)	-7% (Nov-11) -5% (Feb-08)	7.0%	-3.8%
USD-JPY	Currency	-15% (Dec-08) -8% (Jun-13)	-11% (Mar-08) -7% (May-06)	-8% (Apr-16) -7% (Sep-07)	-8% (Aug-16) -7% (Oct-09)	-8% (Sep-10) -6% (Mar-18)	7.0%	-1.1%
DAX	German Equity	-29% (Nov-08) -16% (Sep-15)	-27% (Sep-11) -13% (Dec-18)	-22% (Mar-09) -13% (Jun-12)	-19% (Mar-08) -12% (Jul-08)	-17% (Feb-16) -12% (Nov-11)	14.7%	-4.7%
GBP-USD	Currency	-19% (Nov-08) -7% (Jan-16)	-12% (Jul-16) -7% (Jul-18)	-9% (Jan-09) -6% (May-10)	-8% (Mar-10) -6% (Oct-16)	-7% (Mar-13) -6% (Oct-14)	7.2%	-1.2%
EUR 10Y**	Rates	9% (Dec-08) 4% (Aug-14)	8% (Sep-11) 4% (Jan-15)	6% (Jun-12) 4% (May-10)	5% (Aug-10) 4% (Jan-12)	4% (Feb-16) 4% (Mar-09)	0.3%	0.0%
GLD US**	Commodity	26% (May-06) 21% (Nov-09)	25% (Feb-09) 17% (Mar-16)	23% (Mar-08) 14% (Oct-10)	22% (Sep-11) 14% (Jul-06)	22% (Nov-07) 13% (Aug-13)	16.3%	5.4%
NIKKEI	Japanese Equity	-36% (Oct-08) -16% (Jun-13)	-20% (Feb-16) -16% (Jul-10)	-19% (Mar-08) -16% (Dec-18)	-18% (Mar-09) -15% (Jun-12)	-17% (Mar-11) -15% (Jun-06)	15.8%	-4.3%
Gold**	Commodity	25% (Feb-09) 20% (Nov-07)	25% (May-06) 18% (Mar-16)	22% (Sep-11) 14% (Jul-06)	21% (Mar-08) 14% (Oct-10)	21% (Nov-09) 13% (Aug-13)	16.5%	6.1%
TWSE	Taiwanese Equity	-37% (Nov-08) -13% (Oct-18)	-21% (Jul-08) -13% (Aug-07)	-18% (Jan-08) -13% (Feb-10)	-17% (Oct-11) -13% (Jun-06)	-14% (Aug-15) -12% (Jun-12)	14.4%	-2.0%
KOSPI	Korean Equity	-32% (Oct-08) -15% (Aug-07)	-20% (Aug-11) -14% (Mar-09)	-19% (Aug-08) -12% (Oct-18)	-15% (Jun-06) -11% (Aug-15)	-15% (Feb-08) -11% (May-12)	14.6%	-2.2%
FTSE	UK Equity	-27% (Oct-08) -12% (Mar-08)	-18% (Mar-09) -10% (Aug-15)	-14% (Jul-08) -9% (May-12)	-14% (Aug-11) -9% (Aug-07)	-12% (Jul-10) -9% (Jun-13)	11.9%	-3.7%
HSI	Hong Kong Equity	-38% (Oct-08) -16% (Jan-16)	-21% (Oct-11) -15% (Jul-08)	-21% (Sep-15) -11% (May-12)	-21% (Mar-08) -11% (Jun-13)	-17% (Jan-09) -11% (Feb-10)	16.5%	-3.4%
EEM US	Emerging Market Equity	-45% (Oct-08) -17% (Jan-16)	-24% (Sep-11) -15% (May-12)	-22% (Nov-08) -15% (Mar-09)	-21% (Jun-06) -14% (May-10)	-19% (Aug-15) -14% (Jan-08)	18.9%	-3.8%
RTY	US Small Cap Equity	-39% (Nov-08) -15% (Jan-08)	-25% (Mar-09) -15% (Jul-10)	-22% (Sep-11) -11% (Jun-06)	-20% (Dec-18) -11% (Aug-07)	-17% (Feb-16) -10% (Nov-11)	17.9%	-4.8%
USD 10Y**	Rates	17% (Dec-08) 5% (Jul-09)	10% (Sep-11) 5% (Jun-12)	7% (Jul-10) 5% (Jan-15)	7% (Jan-08) 5% (Sep-07)	6% (Feb-16) 5% (Mar-08)	0.6%	-0.1%
S&P 500	US Equity	-33% (Nov-08) -11% (Mar-08)	-21% (Mar-09) -11% (Jul-08)	-14% (Aug-11) -9% (Jan-16)	-14% (Dec-18) -9% (Aug-15)	-12% (Jul-10) -8% (Feb-18)	14.9%	-5.1%
Crude Oil	Commodity	-63% (Dec-08) -28% (Sep-08)	-44% (Jan-15) -25% (Nov-06)	-38% (Jan-16) -22% (Jun-12)	-35% (Dec-18) -21% (Oct-14)	-28% (Aug-15) -19% (May-10)	34.9%	-10.2%

Table 2: 10 largest 3M drawdowns across asset classes since Jan-06

Asset Name	Asset Category	10 Largest 3M drawdowns					3Mth 25 Delta Vol*	Vol Change†
NDX	US Equity	-39% (Nov-08) -13% (Feb-16)	-18% (Mar-08) -13% (Jul-06)	-16% (Dec-18) -12% (Jul-10)	-15% (Mar-09) -10% (Aug-15)	-14% (Aug-11) -10% (Nov-12)	18.5%	-6.3%
TOP40	South African Equity	-30% (Nov-08) -13% (Jun-06)	-19% (Aug-08) -12% (Aug-07)	-16% (Mar-09) -11% (Jan-16)	-14% (Oct-18) -11% (Aug-11)	-13% (Jan-08) -9% (May-10)	17.3%	-1.3%
BOVESPA	Brazilian Equity	-40% (Oct-08) -18% (Jun-06)	-19% (Jun-12) -17% (Jun-18)	-19% (Oct-08) -17% (Aug-11)	-19% (Jan-16) -15% (May-10)	-19% (Jul-13) -15% (Aug-15)	23.3%	-2.8%

Source: BofA Merrill Lynch Global Research Data: 3-Jul-19. *Note that these are the actual 3Mth 25 delta implied vols (3M 25d Receiver premiums for USD & EUR 10Y rates) and not the adjusted vols used in the analysis as described in Finding cheap hedges: the framework. **Largest 3M *gains* since Jan-06. † Percentage point change in 3Mth 25 delta vols (premia for USD and EUR rates) since 31-May-19.

Hedging benchmarks w/out liquid options

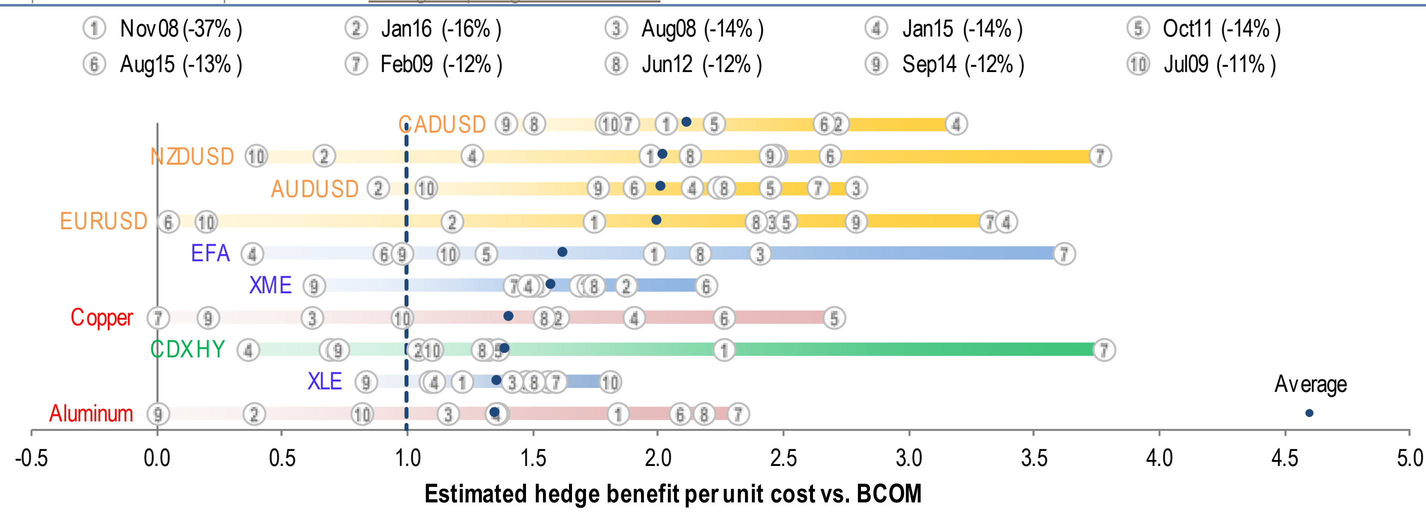
This section aims to identify the most efficient tail hedges for common constituents of broad cross asset portfolios. Importantly, the benchmarks we consider in Chart 3 to Chart 6 do not possess liquid option markets for comparison, meaning our standard proxy hedging screen is not applicable. Instead, we infer the relative efficacy of potential hedges by ranking their crash beta (as a proportion of their current implied volatility) during the 10 most severe declines of the benchmark. Whenever a proxy asset does not decline for a given sell-off in the benchmark, this hedge benefit is registered as 0, highlighting the basis risk of proxy hedging (see Method III in Finding cheap hedges: the framework for a detailed explanation). Note we use a wider universe of 70+ assets across cross asset ETFs, regional equity indices and equity sectors as opposed to the one in Table 2 when screening for proxy hedges, but only display the top 10 ranking proxies for simplicity. In addition, we now compute drawdowns (both here and in Chart 2) on total returns instead of price returns to better approximate option payouts when the forward is meaningfully dislocated from spot.

Hedging commodity exposure (BCOM)

Value in proxy hedging commodity exposure continues to be dominated by commodity-linked FX hedges. CADUSD puts offer the greatest hedge benefit and also the minimal basis risk during the top 10 largest BCOM drawdowns. XME (US Metals & Mining) and XLE (US Energy) puts also offer increased hedge benefit with reduced basis risk and notably screen more reliable than Copper puts and other commodity hedges.

Chart 3: Proxy hedge screen: Bloomberg Commodity Index

For an explanation of how to interpret this chart see Finding cheap hedges: the framework.



Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates). **Hedge benefit = Proxy return / [Benchmark return X Proxy 3M 25d vol] for each proxy and each of the 10 largest drawdowns of the benchmark. These are then normalized by the median level of the Average Hedge Benefit across all proxies.

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Table 3: Top 5 ranking BCOM proxy hedges

Asset	10 largest 3M drawdowns: Nov-08	Jan-16	Aug-08	Jan-15	Oct-11	Aug-15	Feb-09	Jun-12	Sep-14	Jul-09	Average crash beta*	R2	Avg crash beta / 3M 25d Vol	Normalised by median
BCOM	-37.2%	-15.6%	-14.5%	-13.6%	-13.5%	-13.5%	-12.2%	-11.8%	-11.5%	-10.9%	1.0	-	-	-
CADUSD	-15.5%	-8.7%	-5.3%	-8.9%	-6.2%	-7.4%	-4.7%	-3.6%	-3.3%	-4.0%	0.4	82%	7.8	2.1
NZDUSD	-21.9%	-3.1%	-10.7%	-5.1%	-10.0%	-10.8%	-13.7%	-7.5%	-8.4%	-1.3%	0.6	56%	7.5	2.0
AUDUSD	-23.5%	-3.9%	-11.4%	-8.2%	-9.4%	-7.3%	-9.1%	-7.5%	-5.7%	-3.3%	0.6	82%	7.4	2.0
EURUSD	-12.5%	-3.5%	-6.8%	-8.8%	-6.5%	-0.1%	-7.8%	-5.4%	-6.2%	-0.4%	0.4	40%	7.4	2.0
EFA	-35.1%	-9.7%	-16.6%	-2.5%	-8.5%	-5.8%	-21.1%	-12.2%	-5.4%	-6.0%	0.8	66%	6.0	1.6

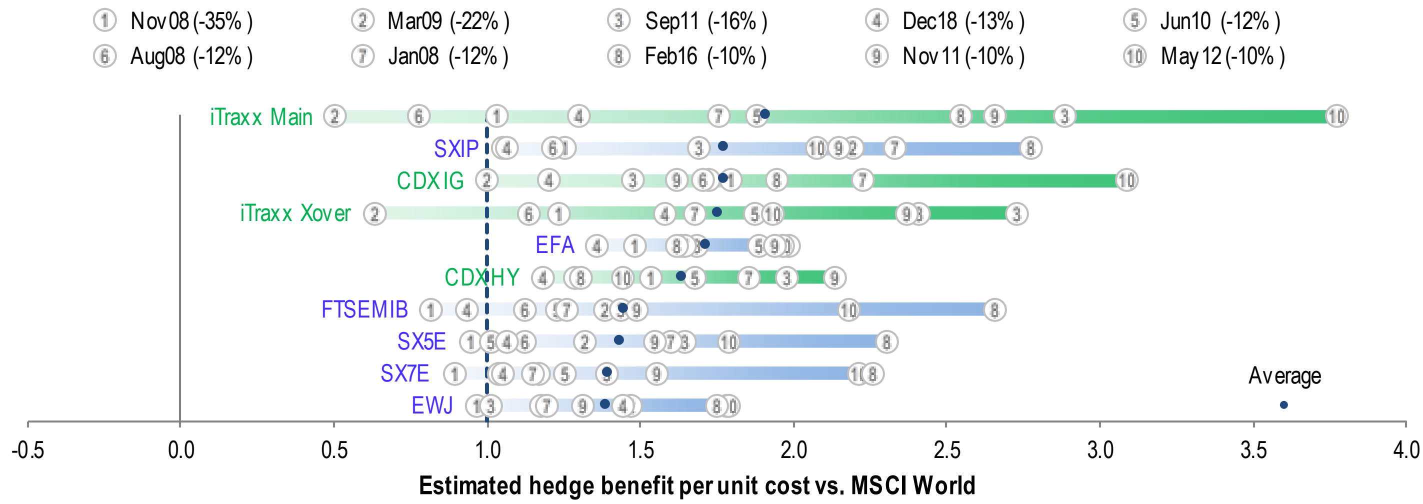
Source: BofA Merrill Lynch Global Research Data: 3-Jul-19. *Crash beta = max[0, Proxy return / Benchmark return].

Hedging global equities (MSCI World)

SXIP (European insurance) and EFA (Global DM equities ex-N. America) puts as well as CDX IG and CDX HY (US IG and HY credit) payers continue to screen as good value hedges for global equities particularly given lower basis risk than European credit hedges to global equities. Interestingly, FX hedges (which were 3 of the top 5 hedges last month) are no longer among the top 10 proxy hedges for MSCI following the outsized fall in credit vol.

Chart 4: Proxy hedge screen: MSCI World Benchmark

For an explanation of how to interpret this chart see Finding cheap hedges: the framework.



Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates). **Hedge benefit = Proxy return / [Benchmark return X Proxy 3M 25d vol] for each proxy and each of the 10 largest drawdowns of the benchmark. These are then normalized by the median level of the Average Hedge Benefit across all proxies.

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Table 4: Top 5 ranking MSCI World proxy hedges

	10 largest 3M drawdowns										Average	R2	Avg crash beta /	Normalised by
Asset	Nov-08	Mar-09	Sep-11	Dec-18	Jun-10	Aug-08	Jan-08	Feb-16	Nov-11	May-12	crash beta*		3M 25d Vol	median
MSCI World	**-35.2%**	**-21.8%**	**-16.0%**	**-13.5%**	**-12.4%**	**-12.1%**	**-11.6%**	**-10.4%**	**-9.9%**	**-9.6%**	**1.0**	**-**	**-**	**-**
iTraxx Main	-3.3%	-0.9%	-3.8%	-1.4%	-2.0%	-0.8%	-1.6%	-2.0%	-2.1%	-3.0%	0.2	8%	10.7	2.0
SXIP	-36.5%	-37.3%	-20.6%	-10.5%	-10.4%	-11.2%	-19.2%	-19.8%	-16.0%	-15.2%	1.3	66%	9.9	1.9
CDX IG	-4.8%	-1.7%	-1.8%	-1.2%	-1.6%	-1.6%	-2.0%	-1.5%	-1.2%	-2.3%	0.1	71%	9.5	1.8
iTraxx Xover	-12.7%	-3.8%	-11.7%	-5.5%	-6.6%	-3.7%	-4.9%	-6.1%	-6.2%	-5.0%	0.5	39%	9.8	1.8
EFA	-35.8%	-24.5%	-18.6%	-12.6%	-16.2%	-16.5%	-13.2%	-11.6%	-13.2%	-13.0%	1.2	96%	9.2	1.7

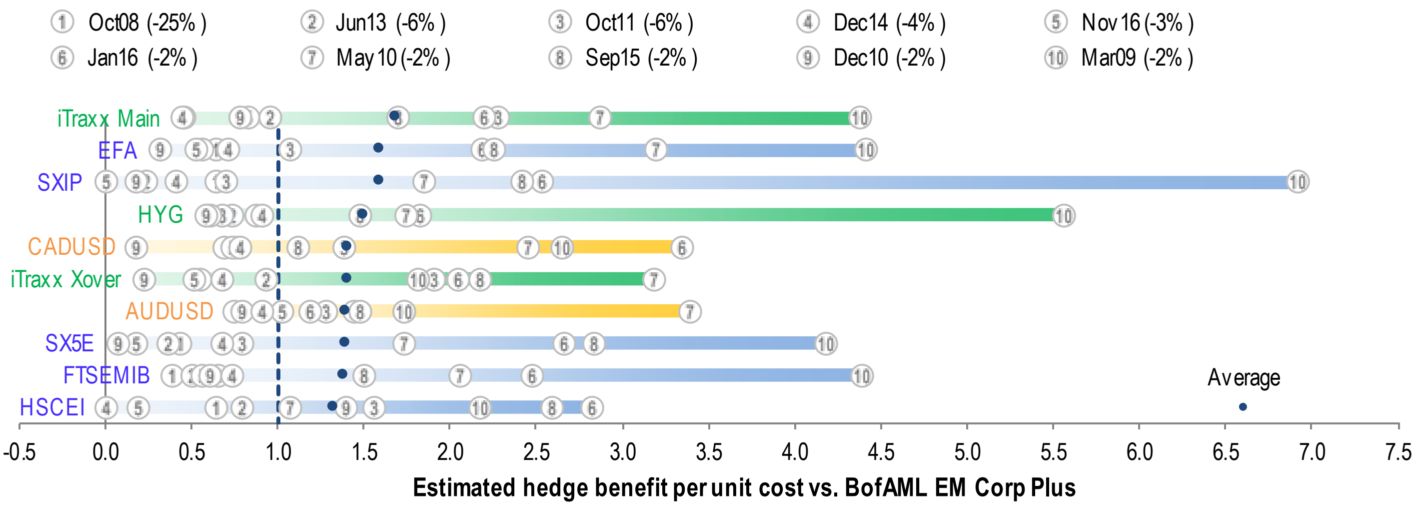
Source: BofA Merrill Lynch Global Research Data: 3-Jul-19. *Crash beta = max[0, Proxy return / Benchmark return].

Hedging EM Credit (BofAML EM Corporate Plus)

iTraxx Main (European IG credit) payers screen as the top value for proxy hedging EM corporate credit exposure. Most other candidates offering significant hedge benefit come with a great deal of basis risk (e.g. no hedge would have provided a benefit during Oct08); however, HYG and AUDUSD carry less basis risk whilst screening attractively for hedging value on average.

Chart 5: Proxy hedge screen: BofAML EM Corporate Plus Benchmark

For an explanation of how to interpret this chart see Finding cheap hedges: the framework.



Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates). **Hedge benefit = Proxy return / [Benchmark return X Proxy 3M 25d vol] for each proxy and each of the 10 largest drawdowns of the benchmark. These are then normalized by the median level of the Average Hedge Benefit across all proxies.

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Table 5: Top 5 ranking BofAML EM Corporate Plus proxy hedges

Asset	10 largest 3M drawdowns										Average crash beta*	R2	Avg crash beta / 3M 25d Vol	Normalised by median
	Oct-08	Jun-13	Oct-11	Dec-14	Nov-16	Jan-16	May-10	Sep-15	Dec-10	Mar-09				
BofAML EM Corp Plus	**-24.8%**	**-6.2%**	**-5.7%**	**-3.8%**	**-2.8%**	**-2.5%**	**-2.5%**	**-2.4%**	**-2.1%**	**-1.9%**	**1.0**	**-**	**-**	**-**
iTraxx Main	-2.7%	-1.3%	-3.0%	-0.4%	-0.5%	-1.2%	-1.7%	-0.9%	-0.4%	-1.8%	0.4	33%	26.0	1.7
EFA	-30.8%	-6.6%	-11.8%	-5.2%	-2.7%	-10.4%	-15.1%	-10.5%	-1.2%	-15.9%	3.1	62%	23.7	1.6
SXIP	-36.1%	-2.9%	-8.5%	-3.1%	6.0%	-12.3%	-10.0%	-11.5%	-0.7%	-26.6%	3.3	43%	24.2	1.6
HYG	-23.0%	-4.8%	-4.1%	-3.7%	-1.8%	-4.8%	-4.6%	-3.8%	-1.3%	-11.1%	1.6	77%	22.3	1.5
CADUSD	-14.1%	-3.8%	-6.5%	-2.4%	-1.7%	-6.9%	-5.0%	-2.2%	-0.3%	-4.1%	1.2	74%	21.0	1.4

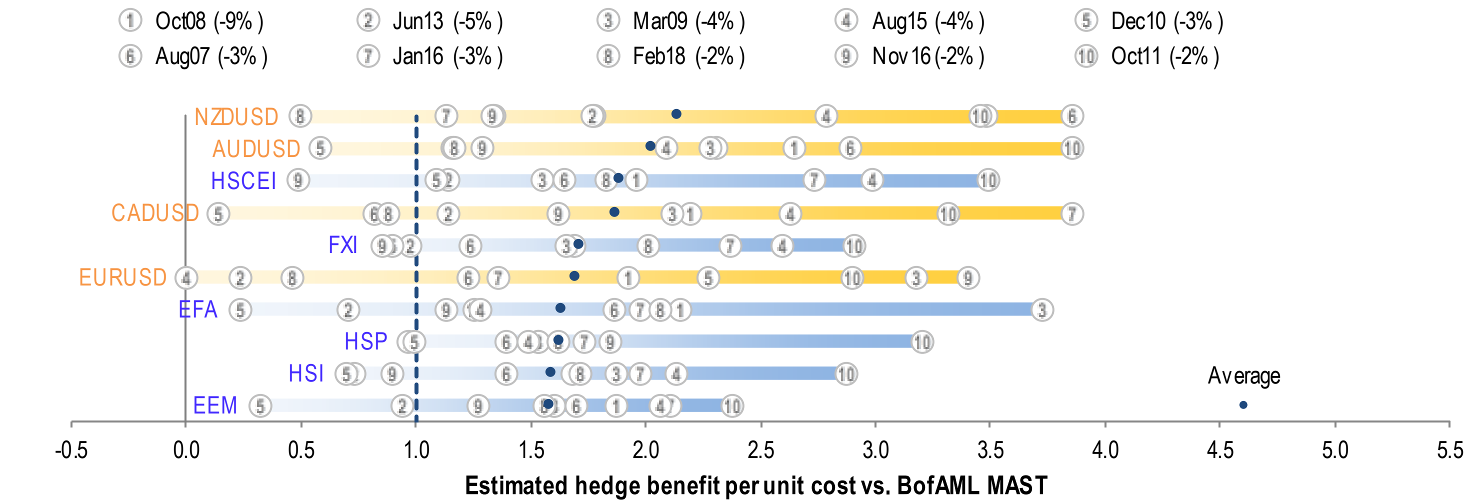
Source: BofA Merrill Lynch Global Research Data: 3-Jul-19. *Crash beta = max[0, Proxy return / Benchmark return].

Hedging a diversified multi-asset portfolio

NZDUSD and AUDUSD puts rank as the cheapest proxy hedges for popular diversified multi-asset portfolios (as represented by our BofAML MAST index). FXI (Chinese large-cap equities) puts also offer significant hedge benefit with limited basis risk.

Chart 6: Proxy hedge screen: BofAML MAST

For an explanation of how to interpret this chart see Finding cheap hedges: the framework.



Source: BofA Merrill Lynch Global Research. Data: 3-Jul -19. *Hedge benefit = Proxy return / [Benchmark return X Proxy 3M 25d vol] for each proxy and each of the 10 largest drawdowns of the benchmark. These are then normalized by the median level of the Average Hedge Benefit across all proxies.

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Table 6: Top 5 ranking BofAML MAST proxy hedges

Asset	10 largest 3M drawdowns										Average crash beta*	R2	Avg crash beta / 3M 25d Vol	Normalised by median
	Oct-08	Jun-13	Mar-09	Aug-15	Dec-10	Aug-07	Jan-16	Feb-18	Nov-16	Oct-11				
BofAML MAST	**-9.1%**	**-4.8%**	**-4.0%**	**-3.6%**	**-3.5%**	**-3.2%**	**-3.1%**	**-2.4%**	**-2.3%**	**-2.2%**	**1.0**	**-**	**-**	**-**
NZDUSD	-16.7%	-8.7%	-14.3%	-10.4%	-4.8%	-12.6%	-3.6%	-1.2%	-3.1%	-7.9%	2.2	48%	27.4	2.1
AUDUSD	-23.6%	-10.8%	-8.9%	-7.4%	-2.0%	-8.9%	-3.6%	-2.8%	-2.9%	-8.3%	2.0	81%	26.0	2.0
HSCEI	-41.7%	-12.8%	-14.6%	-25.5%	-9.0%	-12.2%	-20.3%	-10.5%	-2.6%	-18.2%	4.5	64%	24.2	1.9
CADUSD	-14.2%	-3.9%	-6.0%	-6.8%	-0.4%	-1.8%	-8.6%	-1.5%	-2.6%	-5.2%	1.3	57%	24.0	1.9
FXI	-40.2%	-12.1%	-17.2%	-24.5%	-8.2%	-10.2%	-19.3%	-12.7%	-5.1%	-16.7%	4.5	64%	22.0	1.7

Source: BofA Merrill Lynch Global Research Data: 3-Jul -19. *Crash beta = max[0, Proxy return / Benchmark return].

Lowest cost cross-asset proxy hedges

Chart 7 through Chart 14 show ratios of historical crash betas (versus a benchmark) to relative hedge costs (see Benchmark proxy hedging in Finding cheap hedges: the framework for a detailed explanation of the methodology). Whenever a proxy asset does not decline for a given sell-off in the benchmark, this hedge benefit is registered as 0, highlighting the basis risk of proxy hedging.

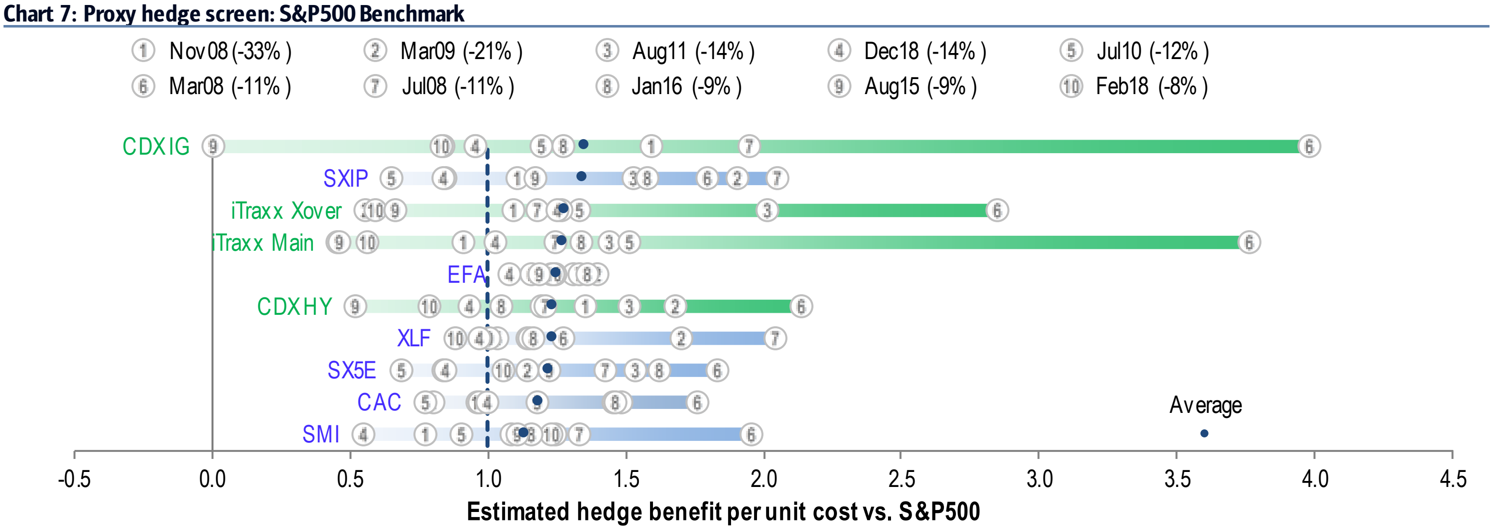
For appropriate proxy hedges, we look for:

1. **Average hedge benefit per unit cost > 1** (better value than the benchmark hedge)
2. **Closely distributed hedge benefits in past sell-offs** (consistency of proxy hedge)
3. **Min hedge benefit > 0** (low basis risk to benchmark)

Hedging US equities (S&P500)

Puts on EFA (Global developed market ex-N. American equity) look to be the best compromise between hedge value and minimal basis risk when proxy hedging the S&P500. EFA puts would have generated 25% greater hedge benefit (per unit cost) than S&P puts on average during the 10 largest sell-offs in US large-caps. Moreover, at current pricing EFA puts would have outperformed S&P puts in each of the 10 largest sell-offs. Puts on XLF (US Financials) would have also offered superior hedge benefit (to S&P puts) with little basis risk. Value in proxy hedging the S&P500 with credit payers saw a sharp rise last month as credit vols fell significantly. Whilst there was great value in US IG credit hedges during '08, there was a great deal of basis risk in the Aug15 S&P drawdown.

Chart 7: Proxy hedge screen: S&P500 Benchmark



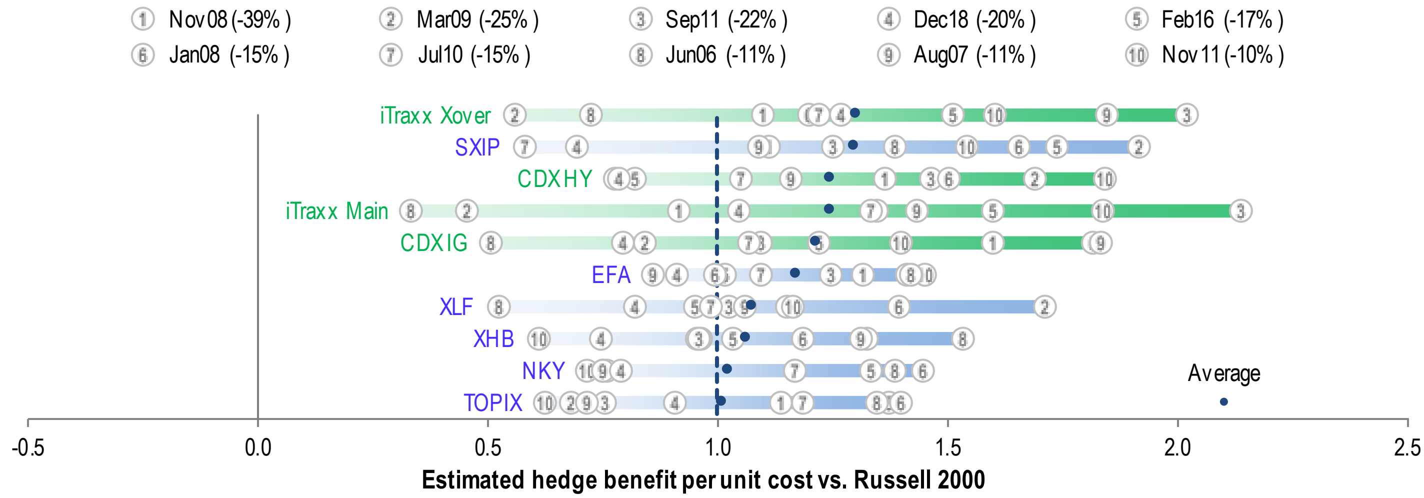
Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Hedging US small/mid-cap equities (RTY)

iTraxx Xover payers and puts on SXIP (European insurance) continue to rank as cheap proxy hedges for US small/mid-cap equities. CDX HY payers and EFA puts can also provide excess hedge benefit whilst reducing basis risk (vs higher ranking hedges).

Chart 8: Proxy hedge screen: RTY Benchmark



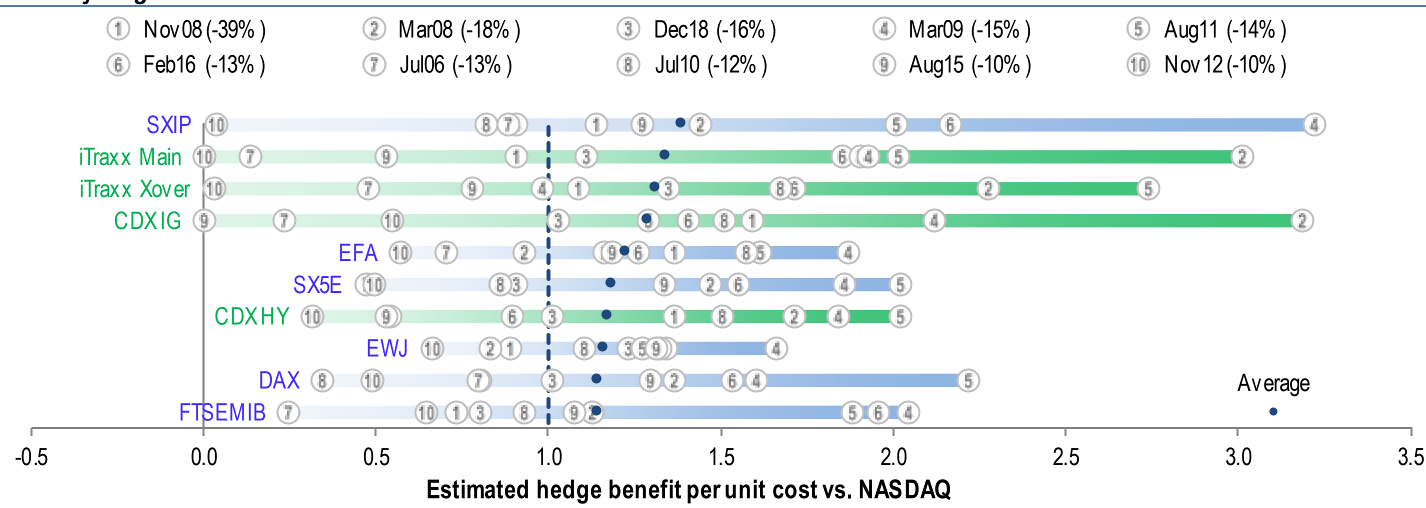
Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Hedging US Tech (NDX)

US Tech puts continue to screen as one of the most expensive hedges in Chart 2 potentially making proxy hedging cost-effective. Indeed, SXIP puts and Credit payers offer better value than NDX puts at current pricing but all come with significant basis risk (as we saw in Nov12). EFA (Global developed market ex-N. American equity), ESTX50 and EWJ (Japan equity) puts however come with relatively less basis risk.

Chart 9: Proxy hedge screen: NDX Benchmark



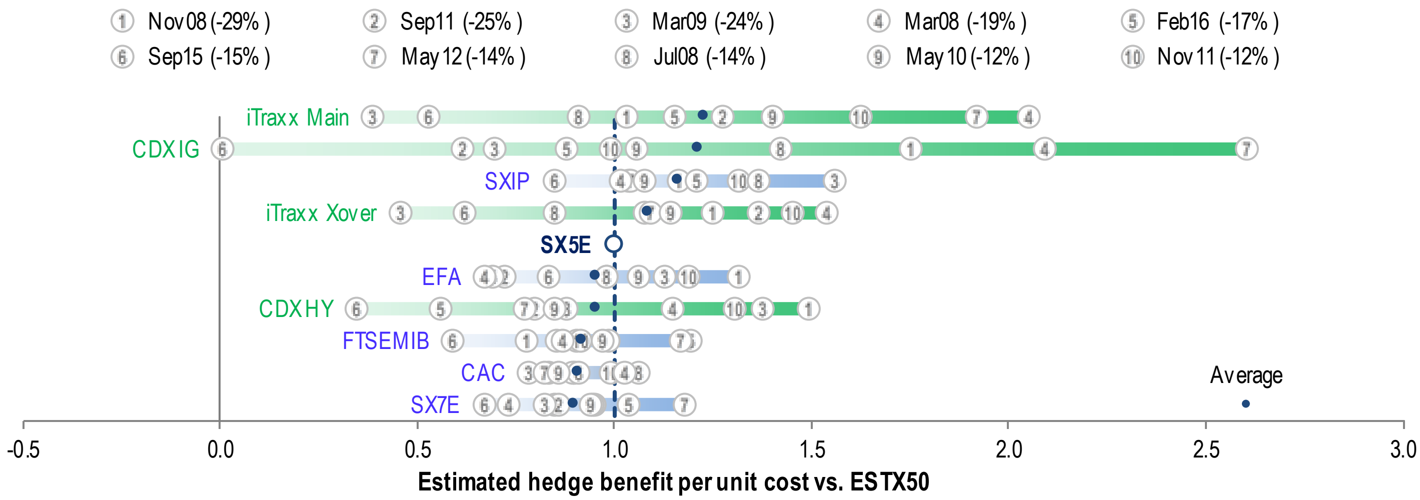
Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Hedging European equities (Euro STOXX 50)

iTraxx Main and CDX IG payers now rank as the top value proxy hedges for the ESTX50. However, SXIP (European insurance) still screens as a better proxy hedge for European equity exposure given limited basis risk.

Chart 10: Proxy hedge screen: ESTX50 Benchmark



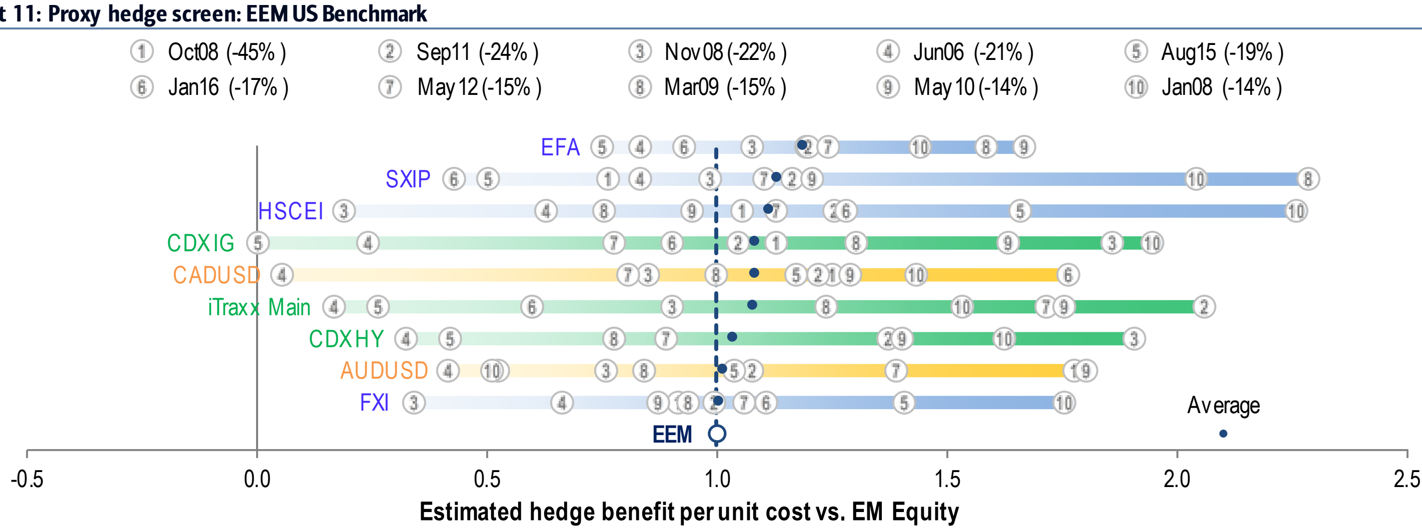
Source: BofA Merrill Lynch Global Research. Data: 3-Jul -19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Hedging Emerging market equity exposure (EEM)

As opposed to last month, equity puts now screen cheaper than currency puts as candidates for proxy hedging EM equity exposure. Puts on EFA screen as the cheapest proxy hedge and have the least basis risk amongst the top 10 candidates in the screen.

Chart 11: Proxy hedge screen: EEM US Benchmark



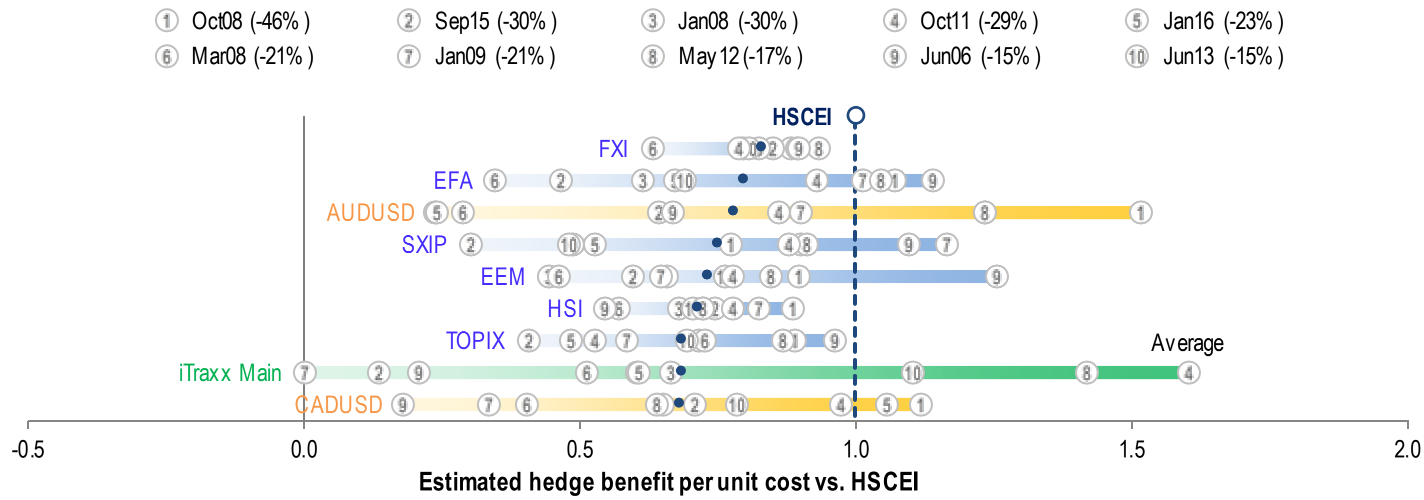
Source: BofA Merrill Lynch Global Research. Data: 3-Jul -19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Hedging Chinese equities (HSCEI)

HSCEI puts screen as the cheapest equity hedge in our universe despite ongoing US-China trade risks (Chart 2). Consequently, proxy hedging is currently inefficient.

Chart 12: Proxy hedge screen: HSCEI Benchmark

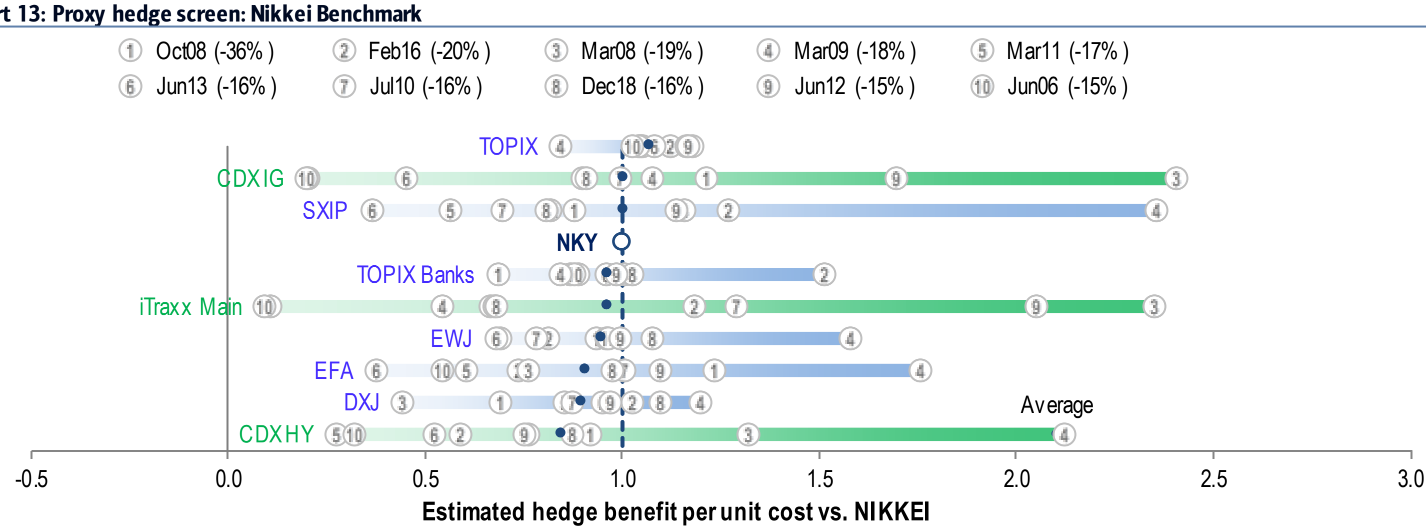


Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).
Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Hedging Japanese equities (Nikkei)

Offering 7% better value than Nikkei puts and generating greater hedge benefit in 9 of the 10 largest Nikkei sell-offs, Topix puts continue to screen well for proxy hedging the Nikkei.

Chart 13: Proxy hedge screen: Nikkei Benchmark

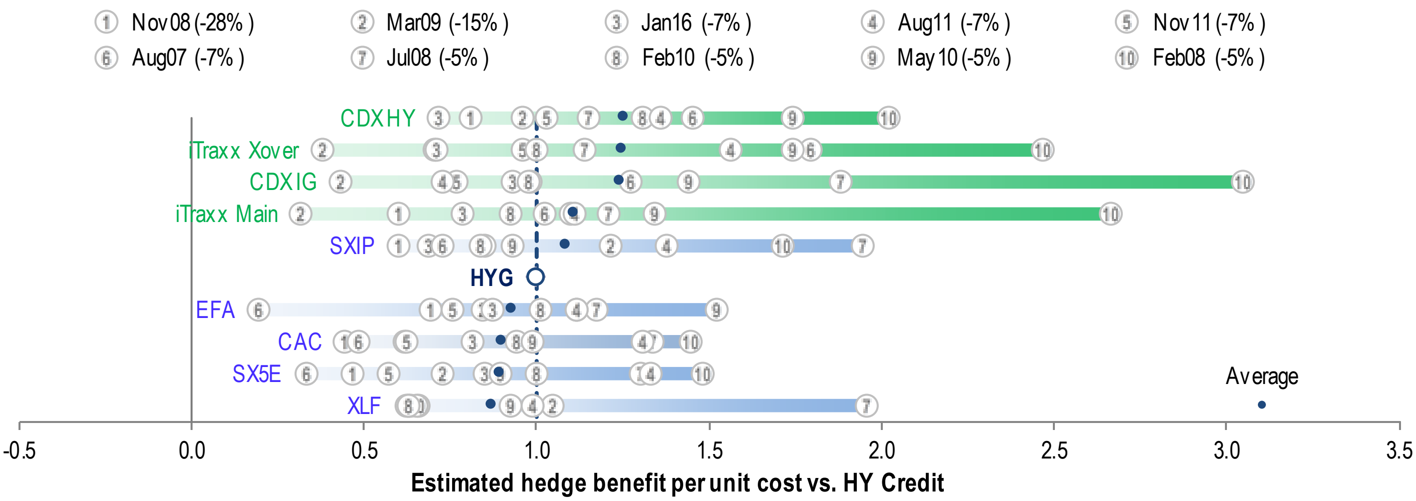


Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).
Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Hedging HY Credit

HYG puts have cheapened significantly more than other assets over the month making proxy hedging less desirable than previously. Credit hedges (US and European, HY and IG payers) rank as better value than HYG puts. Unsurprisingly, CDX HY payers offer the least basis risk when proxy hedging HY credit.

Chart 14: Proxy hedge screen: HY Credit Benchmark



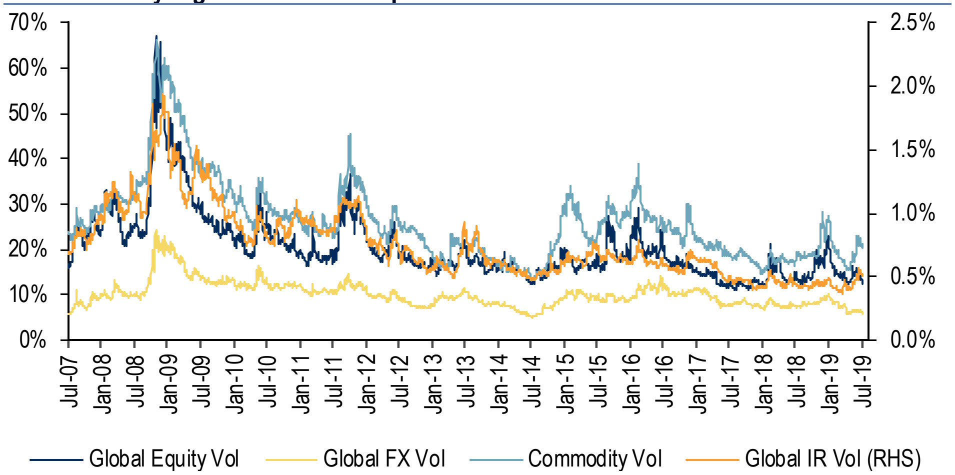
Source: BofA Merrill Lynch Global Research. Data: 3-Jul-19. *Call volatility (Receiver premia) used for TLT US, Gold and GLD US (EUR & USD 10Y rates).

Note: This screen is not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions.

Global cross-asset volatility trends

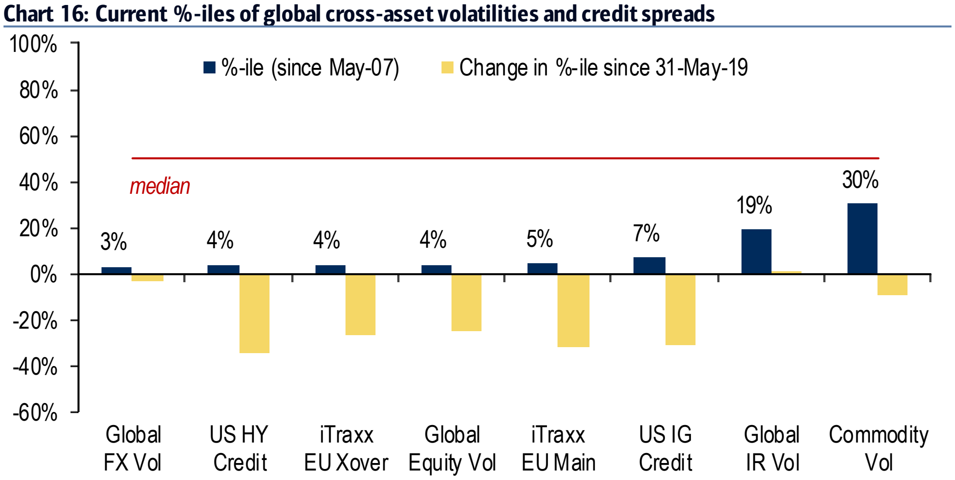
- Cross-asset risk reduced over the month led by 3 vol point falls in both commodity and equity volatility (Chart 15). FX vol also ground lower, down to its 3rd 12y percentile, while rates vol remained flat on the month (Chart 16).
- Credit spreads saw the largest fall in percentile level last month, with both IG and HY CDS spreads in the US and Europe falling to their first deciles (since '07). Indeed the only asset class with more depressed risk is FX (Chart 16).

Chart 15: History of global cross-asset implied volatilities



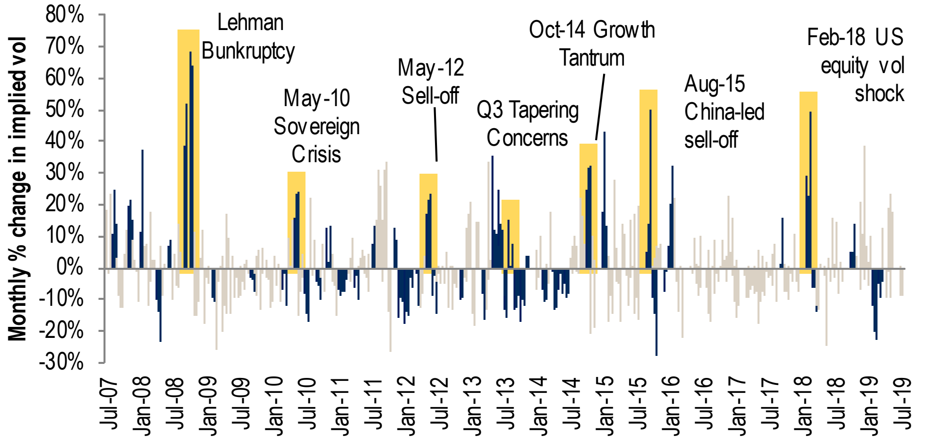
Source: BofA Merrill Lynch Global Research (data from 1-Jun-07 to 3-Jul -19). 3M ATM implied vols on Equities (S&P500, ESTX50, FTSE 100, Nikkei 225, HSI), Interest Rates (Europe and US), FX (EUR/USD, USD/JPY, GBP/USD) and Commodities (Crude Oil, Gold and Copper).

Chart 16: Current %-iles of global cross-asset volatilities and credit spreads



Source: BofA Merrill Lynch Global Research (data as of 3-Jul -19). 3M ATM implied vols on Equities (S&P500, ESTX50, FTSE 100, Nikkei 225, HSI), Interest Rates (Europe and US), FX (EUR/USD, USD/JPY, GBP/USD) and Commodities (Crude Oil, Gold and Copper).

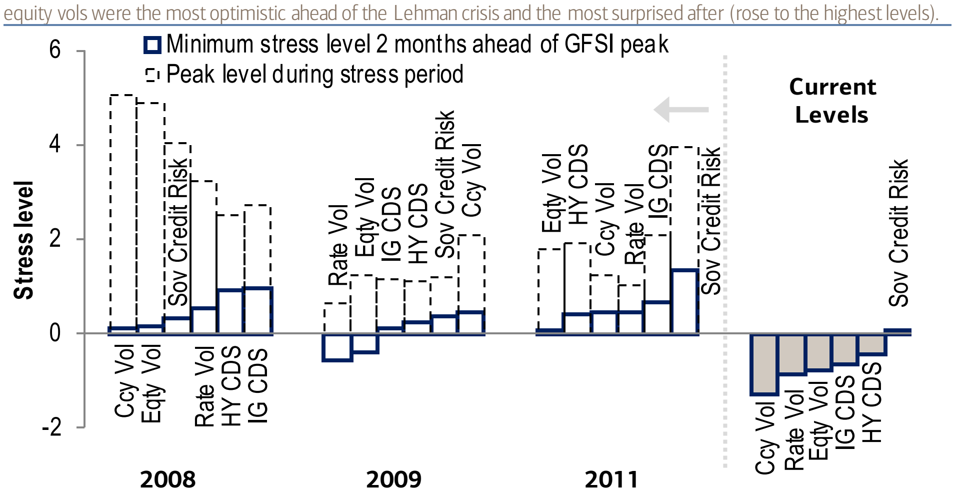
Chart 17: Month-on-month changes in cross-asset volatility, blue bars show when there is high correlation in asset volatility (i.e. all move in the same direction)



Source: BofA Merrill Lynch Global Research. Monthly data from 1-Jul-07 to 3-Jul -19.
Monthly % Change in 3M ATM implied volatilities on: Interest Rates (Europe and US), FX (EUR/USD, USD/JPY, GBP/USD), Commodities (Crude Oil, Gold and Copper) and Equities (S&P500, ESTX50, FTSE 100, Nikkei 225, HSI).

Chart 18: Min 2 months ahead of historical stress peaks, including current levels

The chart illustrates why it is useful to consider the relative pricing of options across asset classes to hedge against tail events: option markets often underestimate the severity of market shocks, and to different degrees. In 2008, currency and equity vols were the most optimistic ahead of the Lehman crisis and the most surprised after (rose to the highest levels).



Source: BofA Merrill Lynch Global Research (data as of 3-Jul -19). Z-scores calculated using data since 2001 (where available) as per the GFSI methodology.

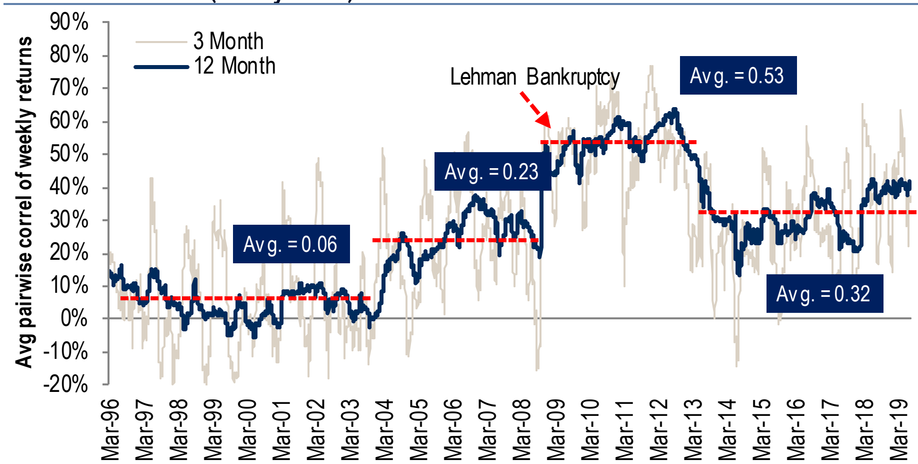
Global cross-asset correlation trends

- At 42%, 12M cross asset correlation remains somewhat above the average level over the last 6y (of 32%).

Historically there have been 3 distinct cross asset correlation regimes since 1995. Interestingly, we see a broadly upward trend since Oct-03, well before the Lehman bankruptcy in Sep-08. This is related to the liquidity driven crush in asset risk-premia that helped drive investment leverage higher.

Long-term correlation established a new regime since 3Q13, similar to the '03 to '08 correlation environment.

Chart 19: Cross-asset (weekly return) correlation trends



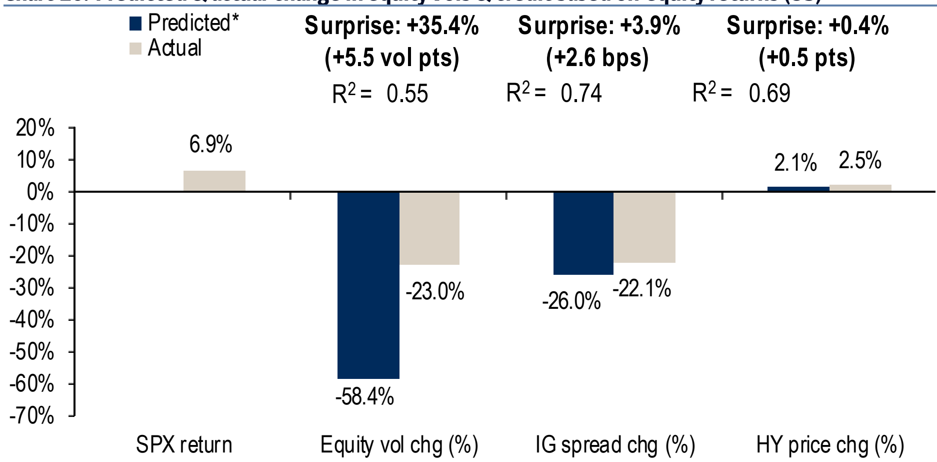
Source: BofA Merrill Lynch Global Research. Daily data from 1-Mar-96 to 3-Jul -19.
3M/1Y average pairwise correlation between the weekly returns of the Dollar Index (DXY, inverted), S&P Goldman Sachs Commodity Index (SPGSCITR), MSCI All Country World Index (MXWD) and the BofA Merrill Lynch US High Yield Master II Index (H0A0 Index).

Macro trends in equity vs credit markets

- US equity volatility once again moved notably less than expected following the 6.9% rally in the S&P500. Credit spreads however contracted in line with expectations (in part explaining good value in credit hedges currently).
- Similar dynamics can be noted for market stress measures in Europe following the ESTX50's 6.2% rally last month.

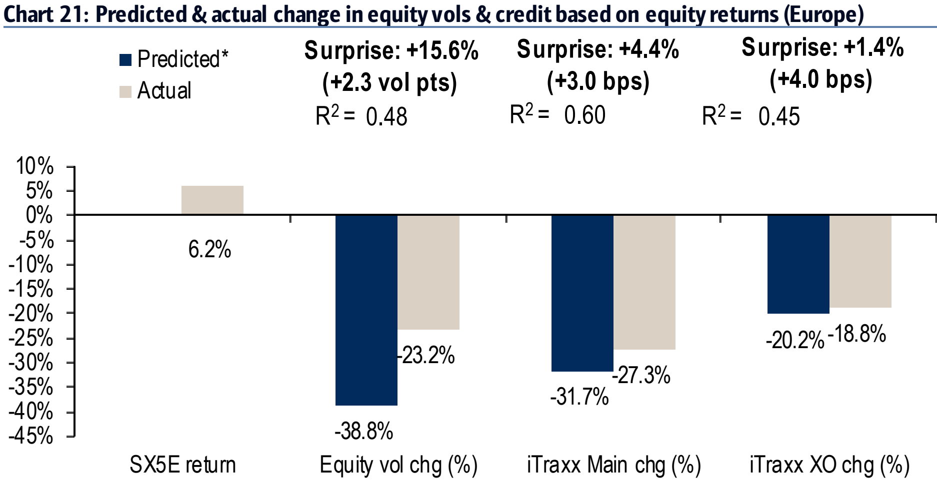
If equities decline, we expect the cost of hedging in the equity derivative and credit derivative markets to rise (and vice-versa for a rise in equities). Based on this relation, we regress historical changes in equity vol and CDS spreads against equity returns. The **bar charts below illustrate how the derivatives markets behaved in the past month relative to expectations** based on this regression.

Chart 20: Predicted & actual change in equity vols & credit based on equity returns (US)



Source: BofA Merrill Lynch Global Research. * Predicted 1-month change based on orthogonal regressions of i) changes in 3M ATM S&P500 vol, (bottom chart: ESTX50 vol), ii) Markit CDX North America Investment Grade CDS spread (bottom chart: iTraxx Crossover) and iii) Markit CDX North America High Yield CDS price index (bottom chart: iTraxx Main CDS) against S&P500 changes (bottom chart: ESTX50 changes), using 3 years of monthly data. Regression data is from 7-Jul-16 to 1-Jul-19. Actual 1-month data from 31-May-19 to 3-Jul-19.

Chart 21: Predicted & actual change in equity vols & credit based on equity returns (Europe)



Source: BofA Merrill Lynch Global Research. * Predicted 1-month change based on orthogonal regressions of i) changes in 3M ATM S&P500 vol, (bottom chart: ESTX50 vol), ii) Markit CDX North America Investment Grade CDS spread (bottom chart: iTraxx Crossover) and iii) Markit CDX North America High Yield CDS price index (bottom chart: iTraxx Main CDS) against S&P500 changes (bottom chart: ESTX50 changes), using 3 years of monthly data. Regression data is from 7-Jul-16 to 1-Jul-19. Actual 1-month data from 31-May-19 to 3-Jul-19.

Finding cheap hedges: the framework

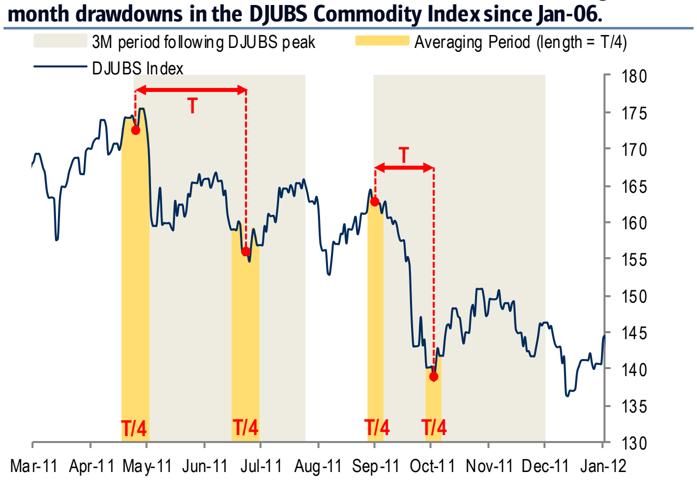
Method I: Cross asset tail hedging

Our cross asset tail hedging screen compares current put option costs to the magnitude of historical tail events in order to determine which options are most underpricing tail risk.

Interpreting the cross asset TH screen:

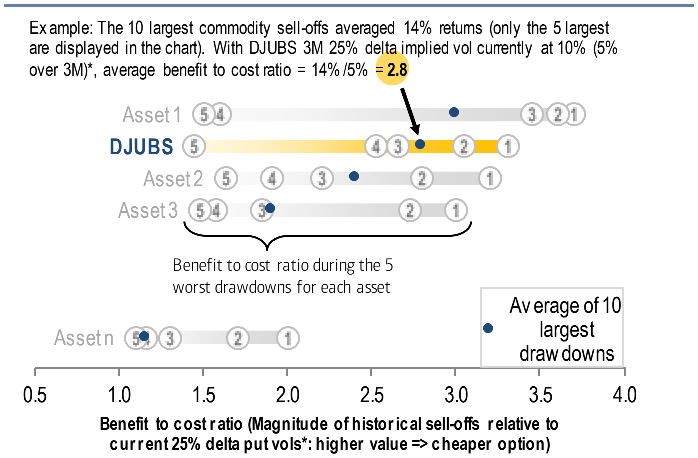
- Readings further to the right represent assets that are most underpricing historical tail events today
- An asset with a benefit-to-cost ratio of 2 indicates its options are half the price of an asset with a ratio of 1, assuming their historical tail returns were similar
- Looking across asset classes we perform a cost-benefit analysis comparing the cost of buying out-of-the-money put options to the magnitude of historical tail events, without consideration of hedging benchmarks. Assuming historical tail events represent the potential magnitude of future sell-offs, we look for options that are most underpricing downside risk.
- **Tail hedge benefit:** is measured by the magnitude of the 10 largest drawdowns occurring over non-overlapping 3-month periods since Jan-06 (Chart 22).
- **Hedging cost:** is measured by the current implied vol of 25 delta put options (*see footnote of Chart 23). We use out-of-the-money options as we are comparing their pricing of large downside risks. Equal delta options allow for easy comparison across assets.
- **High benefit / low cost:** The best value hedge is cheap to enter relative to its expected payoff in a tail event. The x-axis in the right-hand chart below maps out this ratio for past events and includes the average payout relative to today's put costs. Assets with points far to the right are most underpricing historical downside risks and hence represent best value.

Chart 22: This chart shows the 9th (Jul-11) and 3rd (Oct-11) largest 3-month drawdowns in the DJUBS Commodity Index since Jan-06.



Source: BofA Merrill Lynch Global Research. Put volatilities used here are for illustration and do not necessarily reflect current costs. Once a drawdown is identified to be within the top 10, the entire period shaded in grey is removed from the time series before identifying the next biggest drawdown.

Chart 23: This is a schematic illustrating how we calculate the benefit-to-cost ratio for each asset.



Source: BofA Merrill Lynch Global Research. *We make a slight adjustment to 25% delta vols in order to make the ratio of same delta vols equal to the ratio of option prices for two assets. This adjustment increases the volatility of high vol assets relative to lower vol assets (eg vol of credit spreads versus vol of currencies). Importantly, the adjustment is not dependent on the relative forward levels. Please ask us for more details.

Method II: Benchmark proxy hedging

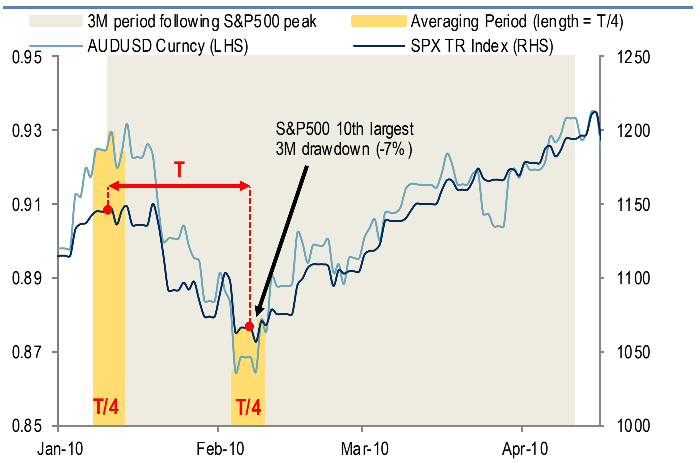
Interpreting the BPH screen:

- A reading > 1 indicates better value in the proxy put option vs. the benchmark
- Small variations along the x-axis mean the proxy has good tracking to the benchmark during large sell-offs
- All readings > 1 indicates the proxy has consistently been a better hedge at current pricing

For investors looking to hedge risk in a specific underlying benchmark, including equity, credit, commodity or currency, it is not only important to consider the cheapest options across asset classes, but also how the proxy asset correlates with the benchmark during times of stress. In severe risk-off events, asset correlations tend to 1 and proxy hedging can become attractive. Proxy hedging does not often work for small declines in benchmark assets due to the basis risk between asset classes.

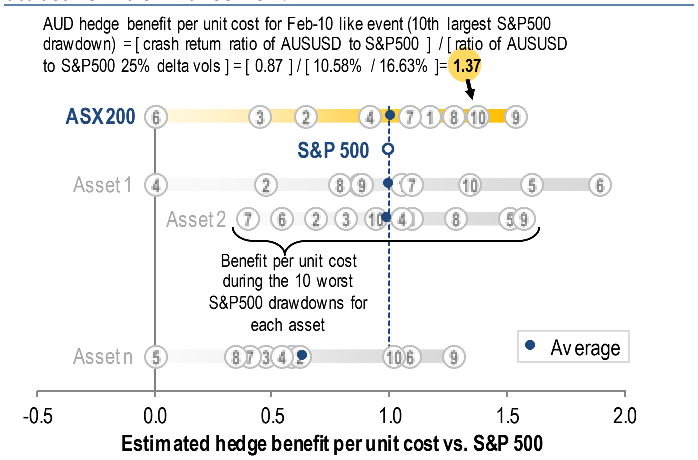
- Here, we identify options on proxy assets that our analysis shows can help hedge against declines in various benchmark assets, bearing in mind the trade-off between cost savings and tracking risk of the proxy asset.
- Proxy hedge benefit: We calculate how much proxy assets have fallen during the largest sell-offs in a benchmark asset (eg. S&P500, US HY Credit). "Crash betas" are computed based on the decline in the proxy and benchmark assets, respectively since Jan-05. For example, Chart 24 illustrates how the AUDUSD moved during the S&P500 sell-off in Feb-10.
- Relative hedge cost: The current ratio of 3M 25% delta put option implied volatility for the proxy vs. the benchmark.
- High benefit / low cost: Chart 25 summarizes how much the proxy asset declined during benchmark sell-offs relative to current option costs. A reading above 1 is desirable and means that proxy hedging would offer better value than put options on the benchmark, assuming relative asset performance is similar to the past during severe tail events.

Chart 24: S&P500 peak-to-trough return in the Feb-10 sell-off was -6.9%. AUDUSD fell by 6.0% over the same period.



Source: BofA Merrill Lynch Global Research. Average prices around the start and end points of the sell-off are used in order to allow for tracking and timing risk as well as removing noise.

Chart 25: Even though the S&P500 decline was larger, AUDUSD puts can be sufficiently cheaper than S&P500 puts to make AUDUSD puts more attractive in a similar sell-off.



Source: BofA Merrill Lynch Global Research. Put volatilities used here are for illustration and do not necessarily reflect current costs. *We make a slight adjustment to 25% delta vols in order to make the ratio of same delta vols equal to the ratio of option prices for two assets. This adjustment increases the volatility of high vol assets relative to lower vol assets (eg vol of credit spreads versus vol of currencies). Importantly, the adjustment is not dependent on the relative forward levels.

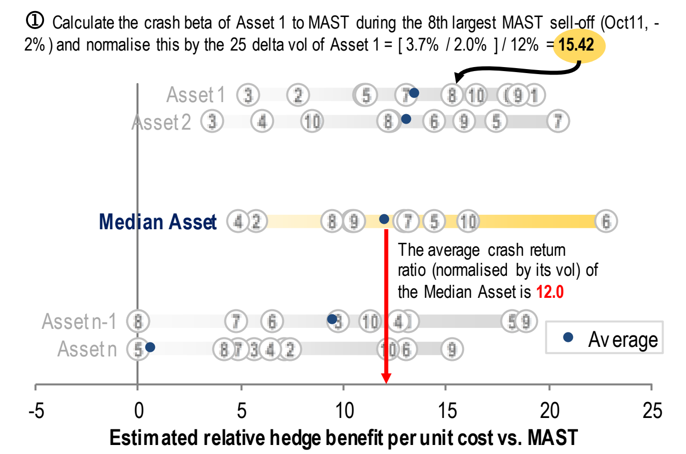
Method III: Hedging benchmarks w/out liquid options

If the benchmark does not have liquid options the best we can aim for is a relative ranking of potential proxy hedges, based on:

- The current cost of each proxy hedge (measured by their 3M 25 delta vols)
- The performance of each proxy hedge during the 10 largest historical drawdowns of the benchmark (measured by their crash beta)

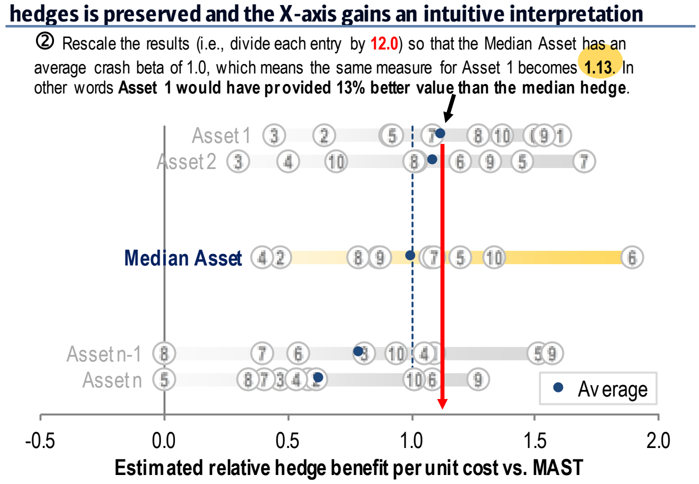
The interpretation is similar to the Benchmark Proxy Hedging case, with one important distinction: A reading of X>1 in Chart 27 means the proxy would have offered X times more hedge benefit per unit cost than the average benefit afforded by the median (i.e., middle ranking) asset in our screen.

Chart 26: The proxy hedges in our screen are ranked according to their average crash beta during the 10 largest BofAML MAST drawdowns since 2006 after being normalized by their respective 3M 25 delta vol



Source: BofA Merrill Lynch Global Research.

Chart 27: As a second step we rescale the results of Chart 26 by the average hedge benefit of the median asset. The ranking of the proxy hedges is preserved and the X-axis gains an intuitive interpretation



Source: BofA Merrill Lynch Global Research.

BofAML Ticker	Bloomberg ticker	Company name	Price
XOERF	XESX GY	EURO STOXX 50	EUR 36.795
HYG	HYG US	iShares iBoxx $ HYC	US$ 86.27
TLT	TLT US	iShares-Barclays 20+	US$ 123.87
EEM	EEM US	iShares-Emg Mkt	US$ 44.06
RSX	RSX US	MKT VECT - Russia	US$ 20.96
GLD	GLD US	SPDR Gold Trust	US$ 122.11

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Disclosures

Important Disclosures

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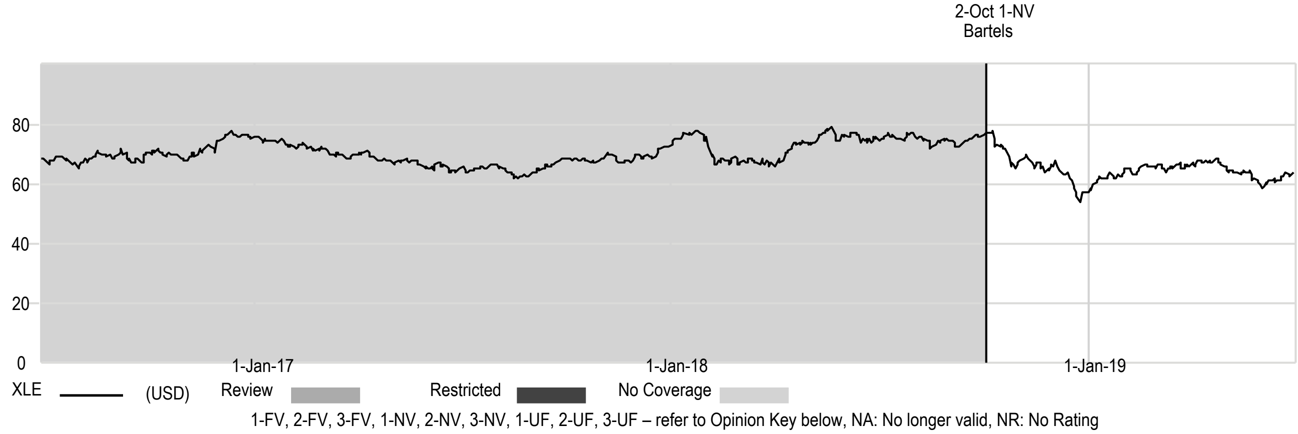
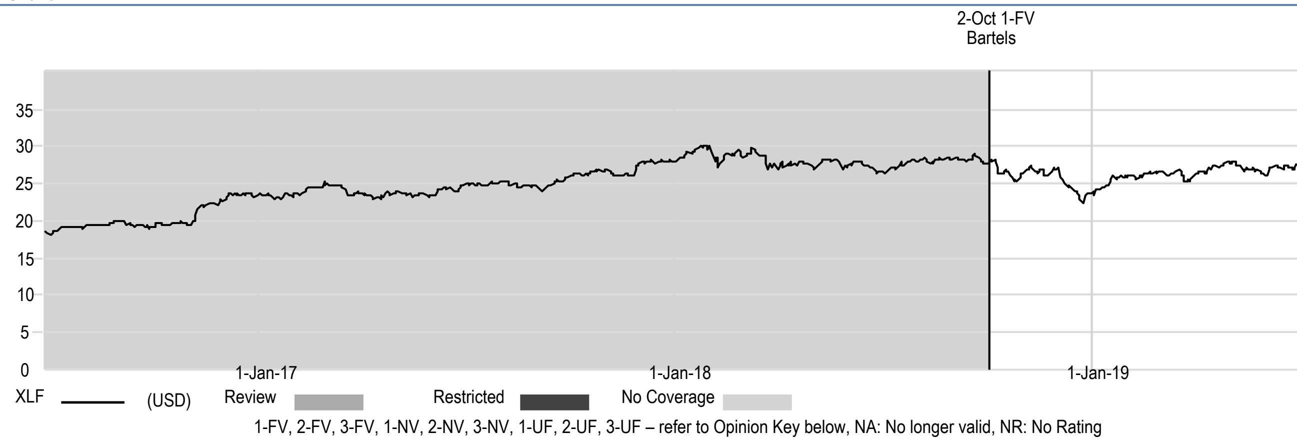


XLF Price Chart



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