Deutsche Bank
Markets Research

Global | Cross-Discipline

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Volatility Cross Asset Note

Capturing Dissensus With Carry in Uncentered Markets

Carry trades draw attention as non-taper starts pushing aside "risk on, risk off"

- Leaving the short-term risks aside, in terms levels of the underlying assets and their vol, we have made a round trip relative to the early summer. However, the positioning has been cleared substantially and the correlations repriced completely. The primary effect of almost-taper may have been snapping the risk on, risk off correlation pattern.
- We believe that the market will gradually turn back to carry trades. Although from a mark to market point of view, selling downside in risky assets could produce short-term discomfort, the market could remain calm as the government shutdown is actually taking the steam out of data with their delay further attenuating their relevance.

Carry trades as risk on, risk off subsides: views from each asset class

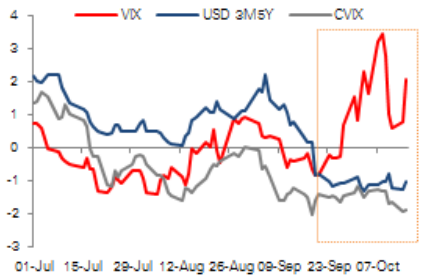
- **Rates:** The rates view remains consistent with continued headwinds for labor market and expectations for trend growth with low inflation and accommodative monetary policy. Forwards are expected to steepen with green/blue sector leading the way in a rally. The appeal on long-term steepeners could be further enhanced through path dependence. We recommend: **Buy 2Y 2s/10s curve cap subject to 2s < 1.65% at expiry, offer 23c, a 44% discount to vanilla at 41c.** The conditioning enhances the already favorable roll-down of the 2s/10s slope. The 2Y2Y forwards roll down almost 90bp in the first year, ensuring that the barrier is already in the money after three months.
- **Equities:** The SPX options market has been more affected by the DC drama than other markets, leaving SPX options currently carrying poorly as realized vol has been calm. For a rebound, we suggest bullish risk reversals: **Sell 1M 97.5% put to buy a 1M 102.5% call for a 50bp credit.**
- **FX:** FX vols have attracted significant attention after the drop of recent weeks. Any significant fiscal or monetary development in the US will prompt major USD moves, but absence will be costly for most options structures. We favor structures that are less exposed to spot variance: **buy a 3m3m AUD/USD forward vol agreement for 10.15%.**
- **Commodities:** Precious metals are transitioning into safe-haven status in light of current market uncertainty. Similar periods in the recent past have been followed by high volatility as positions shift. We favor owning volatility in the 2-3 month part of the curve.

Data book observations: no clear MST center, but watch the butterflies

- The Minimum Spanning Tree lacks a clear center; in fact, it shows multiple centers and significant fragmentation, which is in tune with the observations regarding the effect of monetary policy on the markets.
- Butterfly (or convexity) ratios look particularly low in the DXY, S&P and Nikkei, making them candidates for tail protection through options.

Prices are indicative and as of 15-Oct. The maximum downside on the long cap trade is the premium at inception, the maximum loss in the risk reversal trade is theoretically unlimited, and the maximum loss in the FVA trade is the vega exposure multiplied by a vol drop to zero.

Figure 1: Equity vols have repriced, but not the rest (vol moves, rolling 3-month z-score)



CVIX: 3M volume-weighted average of G10 USD/FX implied vols. USD 3M5Y is the USD 3M into 5Y IRS swaption vol. Source: Deutsche Bank

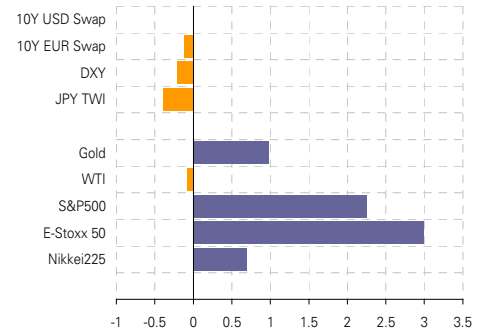
Market overview

	Spot				3M implied volatility(%)			3M realised volatility(%)		
	Current	1W chg	1M chg	1Y chg	Current	1W chg	1M chg	Current	1W chg	1M chg
10Y USD Swap*	2.76	-0.8	-11.2	47.9	8.1	0.0	-1.2	7.8	-0.3	-1.8
10Y EUR Swap*	2.15	-0.1	-7.0	21.2	6.1	-0.1	-0.9	5.8	-0.1	-0.8
DXY	80.34	0.7	-1.9	0.6	6.2	-0.2	-0.4	5.6	-0.6	-1.6
JPY TWI	114.72	-0.8	1.1	-24.1	9.9	-0.4	-1.3	9.8	0.0	-1.3
Gold	1266	-3.9	-9.2	-34.4	22.1	1.0	0.7	22.1	1.0	0.4
WTI	102.02	-1.8	-5.3	13.3	19.8	-0.1	-1.9	19.4	-0.6	-1.2
S&P500	1703.20	0.7	0.8	16.0	15.8	2.3	3.1	10.5	0.8	-0.9
E-Stoxx 50	2974.28	1.6	3.8	18.6	20.0	3.0	2.9	13.4	0.6	-4.5
Nikkei225	14404.74	2.7	1.4	51.6	25.9	0.7	2.4	24.4	-0.3	-2.7

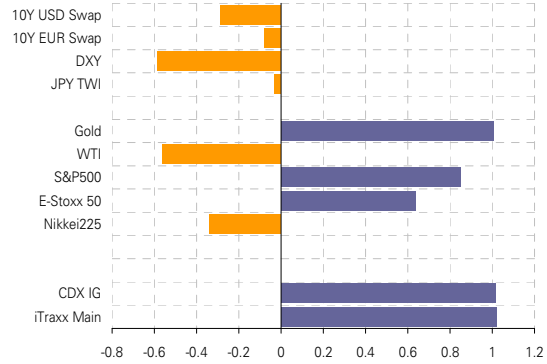
** Implied vol=Price Implied Vol (see appendix)*

	Spread			
		Current	1W chg	1M chg
CDX IG	76.69	46.53	1.02	3.35
iTraxx Main	92.59	45.39	1.02	-1.68

1W change in 3M impllied volatility (%)



1W change in 3M realized volatility (%)

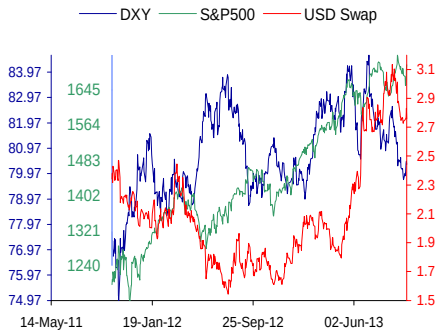


Spot historical correlation matrix (underlying assets - log changes*)

	10Y USD Swap	10Y EUR Swap	DXY	JPY TWI	Gold	WTI	S&P 500	E-Stoxx 50	Nikkei 225
10Y USD Swap		79	15	-34	-8	22	14	13	16
10Y EUR Swap	40		-9	-30	-4	14	5	11	1
DXY	24	46		-15	-37	-6	-13	-22	26
JPY TWI	-40	-43	9		5	-12	-32	-25	-67
Gold	15	-11	-44	-41		29	11	19	-21
WTI	-14	8	4	41	-2		43	34	19
S&P500	-8	33	-6	-49	-15	19		70	47
E-Stoxx 50	25	25	-10	-45	7	13	65		33
Nikkei225	-1	11	7	-67	18	-28	44	23	

* Upper triangle: 1M, daily changes. Lower triangle: 1Y, weekly changes. Outright changes for IRS (See appendix for colouring)

Spot: DXY, 10Y USD Swap, S&P 500

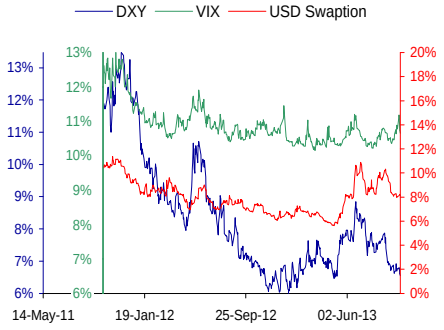


3m Implied Vol historical correlation matrix (underlying assets - changes*)

	10Y USD Swap	10Y EUR Swap	DXY	JPY TWI	Gold	WTI	S&P 500	E-Stoxx 50	Nikkei 225
10Y USD Swap		66	36	27	19	12	15	22	18
10Y EUR Swap	23		36	44	17	15	28	33	20
DXY	36	-12		41	23	29	52	52	24
JPY TWI	-26	2	33		6	6	25	41	41
Gold	11	16	26	17		43	29	21	-1
WTI	13	-29	1	2	26		52	49	3
S&P500	-8	-13	24	34	17	34		71	25
E-Stoxx 50	-20	-21	20	47	45	47	77		29
Nikkei225	-18	3	-35	22	1	14	-30	-3	

* Upper triangle: 1M, daily changes. Lower triangle: 1Y, weekly changes. Outright changes for IRS (See appendix for colouring)

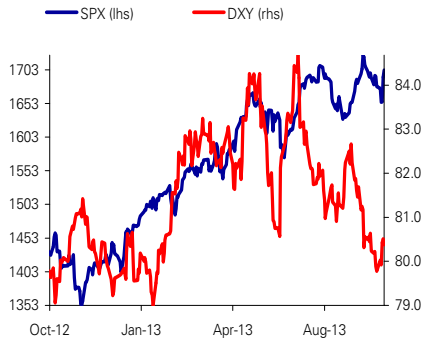
Implied Vol: DXY, 3M10Y USD Swaption, VIX



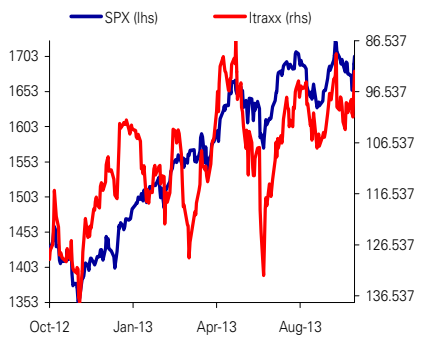
Main movers	-2y	2y History	Last	Max	Min
Spot = NOK TWI	110.40		103.68	114.63	103.67
Spot = USD/BRL	1.76		2.19	2.45	1.69
3M imp. vol. = EEM	0.39		0.25	0.44	0.15
3M imp. vol. = SPX	0.29		0.16	0.32	0.12
3M hist. vol. = NZD TWI	0.10		0.09	0.11	0.06
3M vol risk prm. = NKY	0.00		-0.07	0.06	-0.13
12M-3M vol. slope = GBP 10Y	0.05		0.04	0.06	0.03
1M correlation = JPY TWI-DXY	0.07		0.09	0.83	-0.71
1M correlation = WTI-JPY TWI	-0.01		0.39	0.41	-0.75

Cross Asset Moves - Historical Perspective

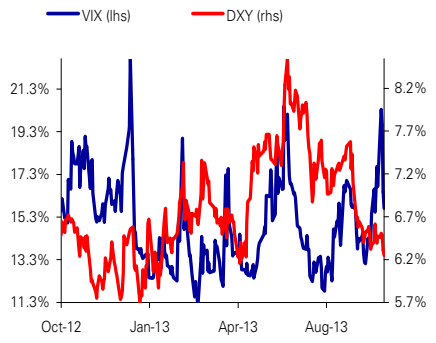
Spot - S&P500 vs DXY



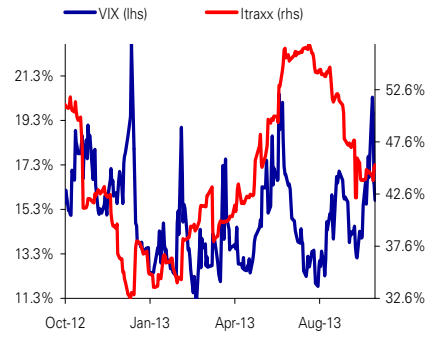
Spot - S&P500vs iTraxx Main



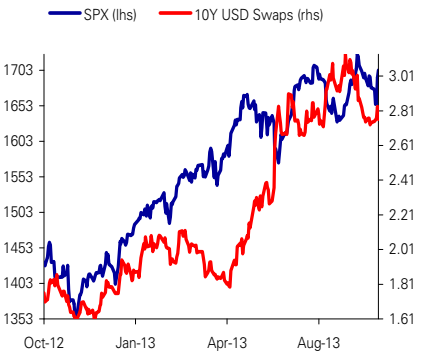
3m Vols - VIX vs DXY Implied



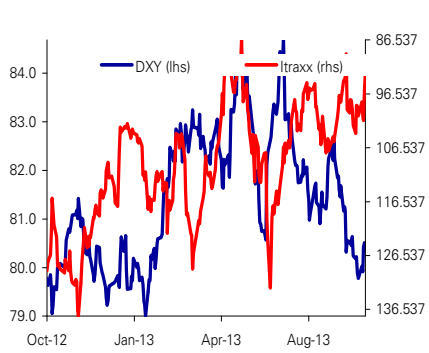
3M Vols - VIX vs Realized iTraxx Main



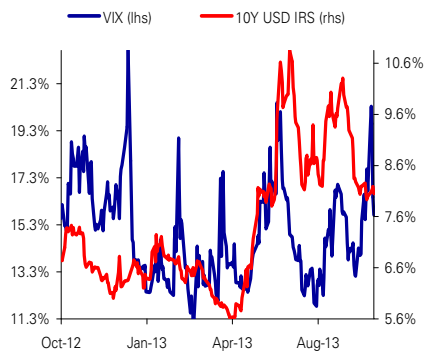
Spot - S&P500 vs 10Y USD Swaps



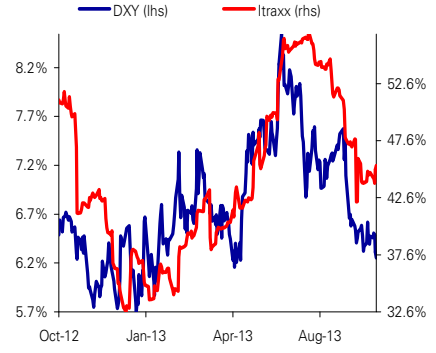
Spot - DXY vs iTraxx Main



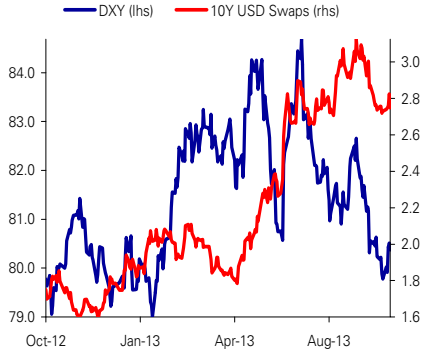
3m Vols - VIX vs 10Y USD IRS Implied



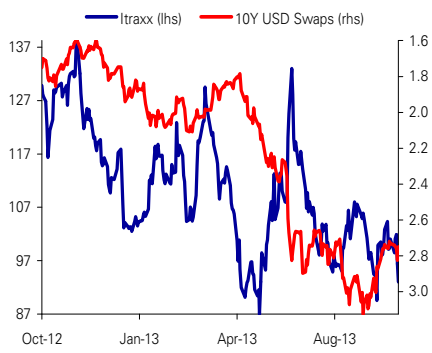
3M Vols - DXY Implied vs Realized iTraxx Main



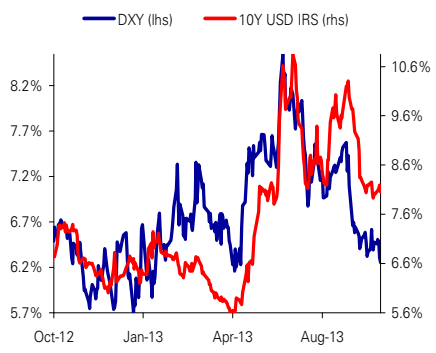
Spot - DXY vs 10Y USD Swaps



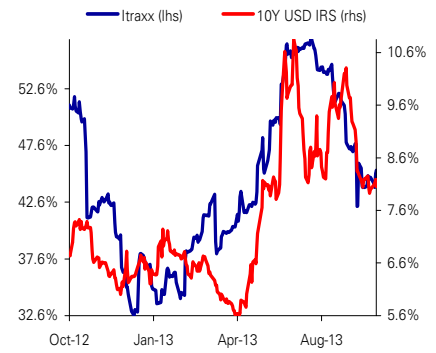
Spot - iTraxx Main vs 10Y USD Swaps



3m Implied Vols - DXY vs 10Y USD IRS



3M Vols - iTraxx Main Realized vs 10Y USD IRS Implied

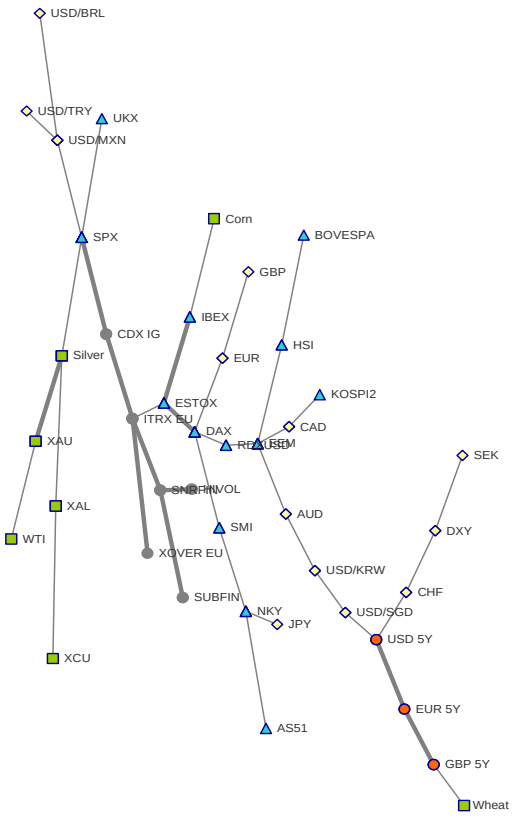


* Itraxx Realized vol=Stdev. Of daily log-changes in spread

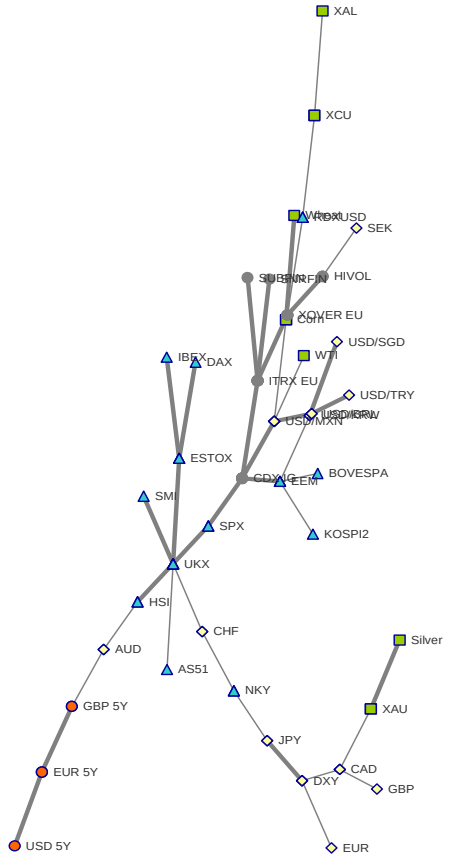
Correlations - Spot

Minimum Spanning Tree : See Appendix. Thick Lines: Absolute Corr > 80%

2-month correlation



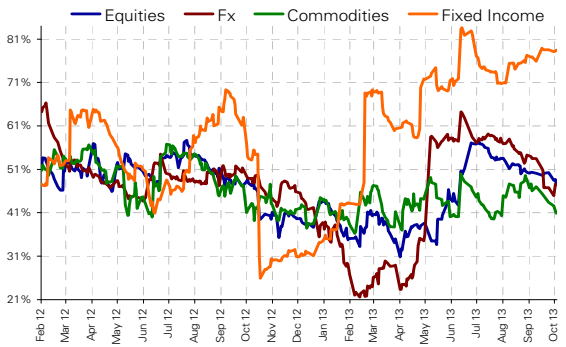
2-month correlation, 2 month ago



1M Cross-asset correlations on the move (spot) - top, bottom (2Y history)

	Asset1 (X axis)	Asset2 (Y axis)	
Top 1	HSCEI	EUR TWI	0.18 0.80 0.73 -0.21
Top 2	DXY	EUR 2Y	-0.79 -0.81
Top 3	XAL	GBP 2Y	0.15 -0.56 0.66
Top 4	DXY	EUR 5Y	-0.85 -0.87 0.70
Bottom 1	EEM	CAD TWI	0.63 0.86 -0.25
Bottom 2	EUR TWI	EUR 2Y	0.86 -0.48
Bottom 3	EUR TWI	EUR 5Y	0.89 -0.54
Bottom 4	HSI	CAD TWI	0.73 -0.25

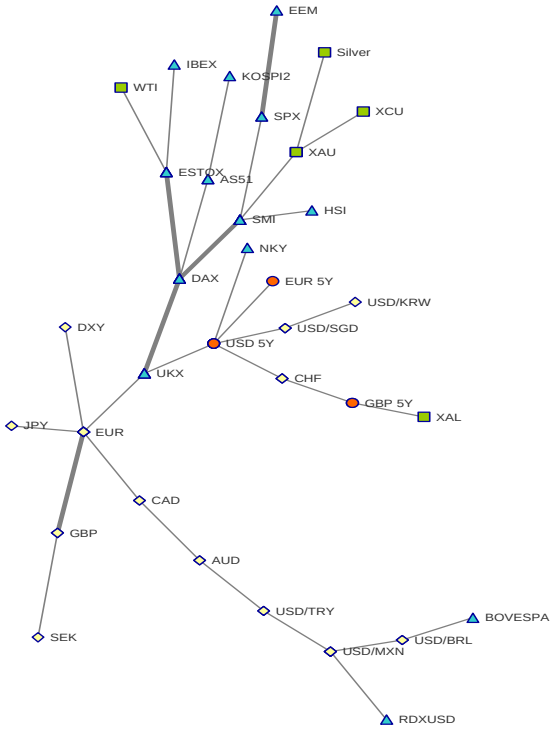
Average spot correlation per basket (see Appendix for details)



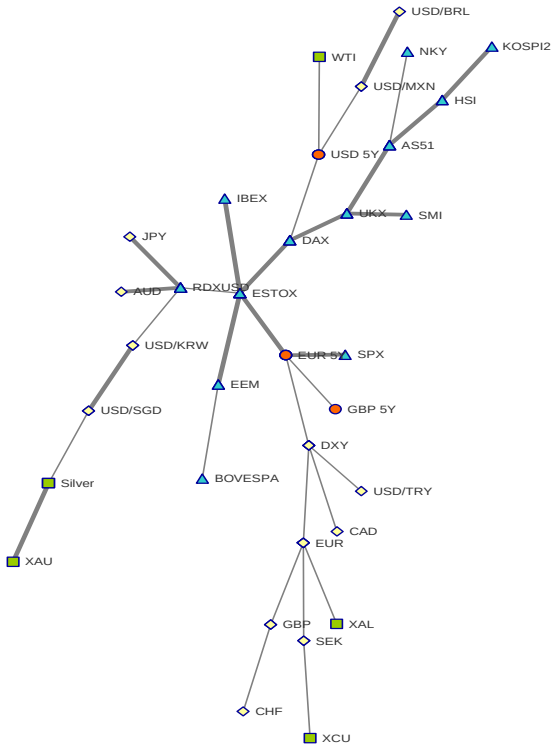
Correlations - Implied Volatility

Minimum Spanning Tree : See Appendix. Thick Lines: Absolute Corr > 80%

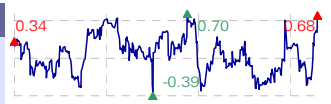
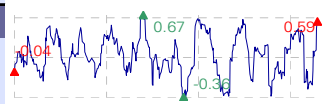
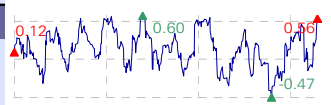
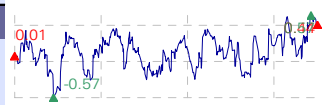
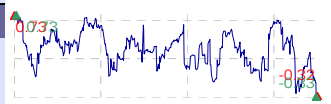
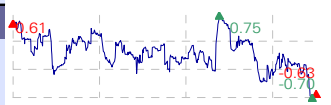
2-month correlation



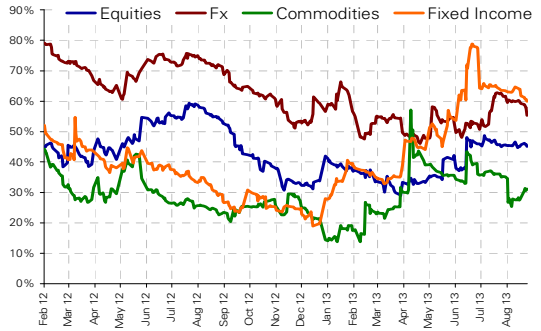
2-month correlation, 2 month ago



1M Cross-asset correlations on the move (Implied Vol) - top, bottom (2Y history)

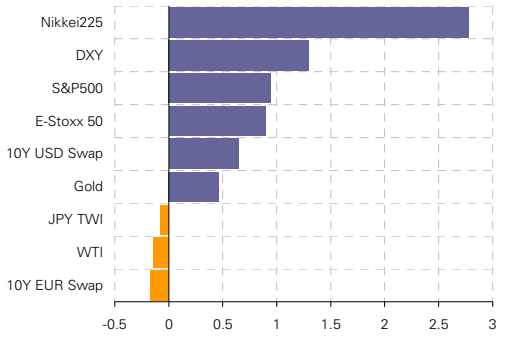
	Asset1 (X axis)	Asset2 (Y axis)	
Top 1	KOSPI2	SEK TWI	
Top 2	HSI	WTI	
Top 3	HSCEI	WTI	
Top 4	XAU	USD 5Y	
Bottom 1	USD/TRY	XCU	
Bottom 2	NZD TWI	XAL	
Bottom 3	USD/MXN	XAL	
Bottom 4	NZD TWI	XCU	

Average 3m Implied Vol correlation per basket (see Appendix for details)

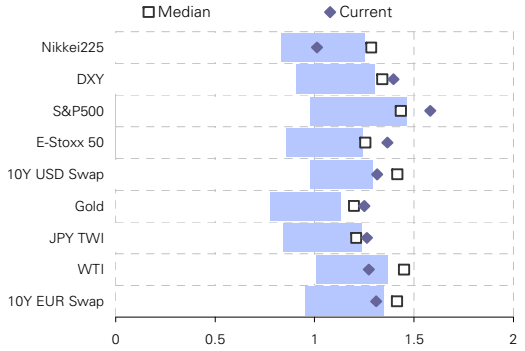


Volatility risk premium and Volatlity Spreads

3m Volatility risk premium Z-score(2Y Sample)



3m IV-RV Ratio 2Y (current, 10%-ile, median, 90%-ile)

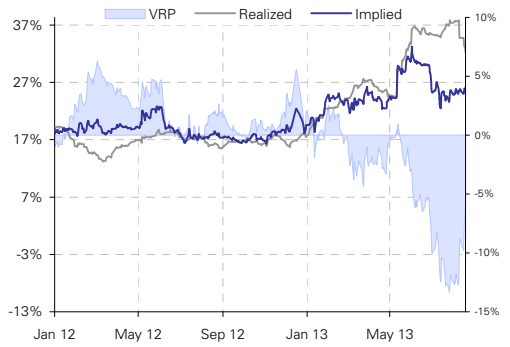


Implied Volatility Spreads

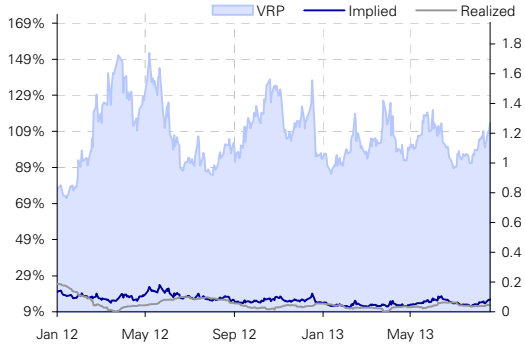
	USD Swap	EUR Swap	DXY	JPY TWI	Gold	WTI	S&P 500	E-Stoxx 50	Nikkei 225
10Y USD Swap		2	2	-2	-11	-11	-8	-11	-13
10Y EUR Swap	-2		0	-4	-13	-13	-10	-13	-15
DXY	-2	0		-4	-13	-12	-9	-13	-15
JPY TWI	2	4	4		-9	-8	-5	-9	-11
Gold	12	14	14	9		0	3	0	-2
WTI	15	17	17	13	3		3	-1	-3
S&P500	6	8	8	4	-5	-9		-4	-6
E-Stoxx 50	10	13	13	8	-1	-5	4		-2
Nikkei225	16	19	18	14	5	1	10	6	

* Outright changes for UST. Upper triangle: 3M. Lower triangle: 1Y. Spread=Row - Column

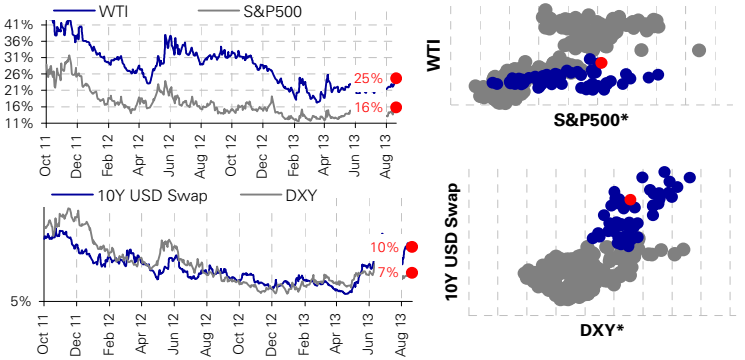
Highest Z-score Volatility risk premium-Nikkei225



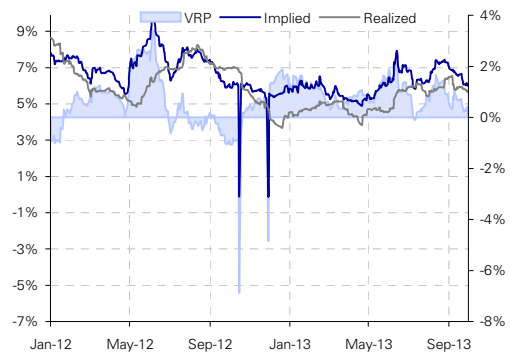
Highest Risk premium (IV/RV Ratio) - S&P500



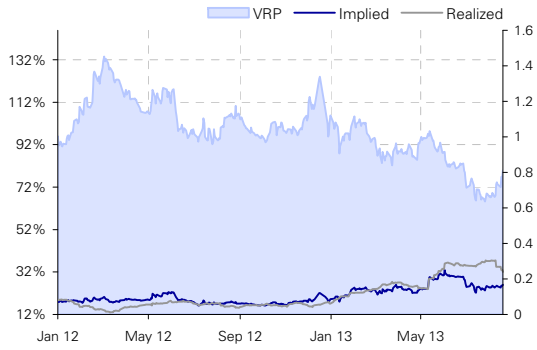
Cross-asset implied vol spreads on the move (3m expiry)



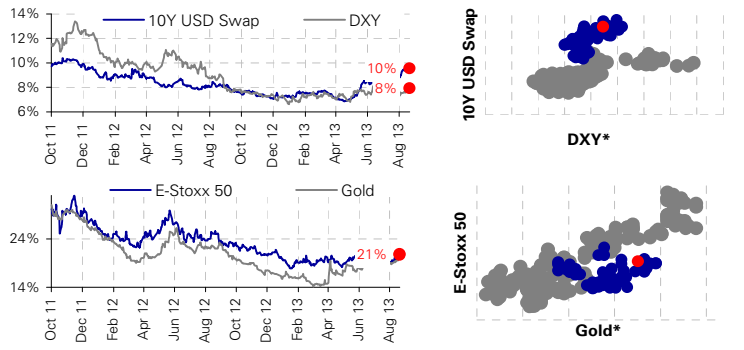
Lowest Z-score Volatility risk premium-10Y EUR Swap



Lowest Risk premium (IV/RV Ratio) - Nikkei225



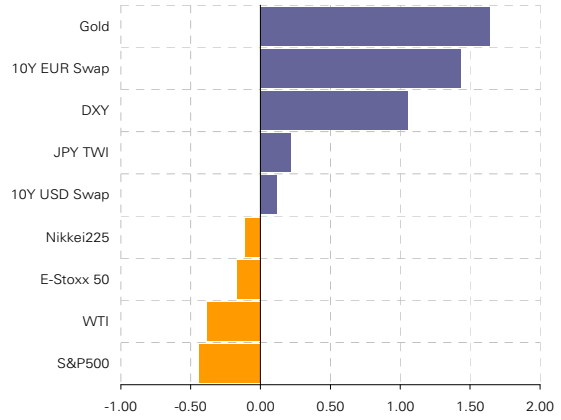
Cross-asset implied vol spreads on the move (1Y expiry)



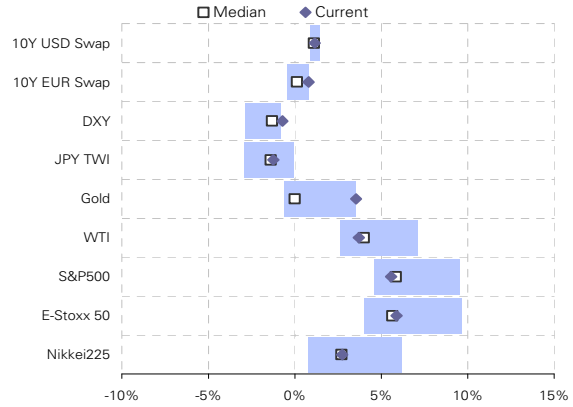
* *Last:Red, past Last 3M: blue, past last 2Y: grey*

Risk Reversals and Skew

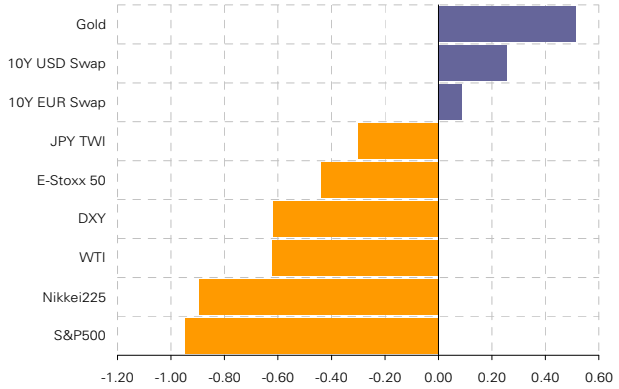
3M Risk Reversals (25P-25C) Z-score(2Y Sample)



3M Risk Reversals (25P-25C)-(current, 2Y 10%-ile, median, 90%-ile)



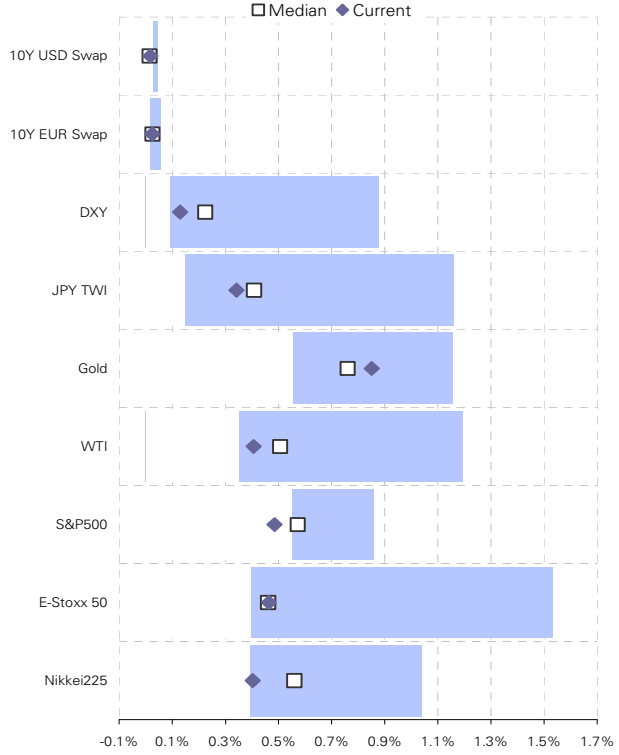
3M Butterfly Ratio: [25P + 25C] / 2 - ATM z-score(2Y Sample)



3M Highest Z-score Risk Reversal(25P-25C)-Gold

Highest current 3M risk reversal (25P - 25C) - E-Stoxx 50

3M Butterfly Ratio: [25P + 25C] / 2 - ATM (current, 2Y 10%-ile, median, 90%-ile)

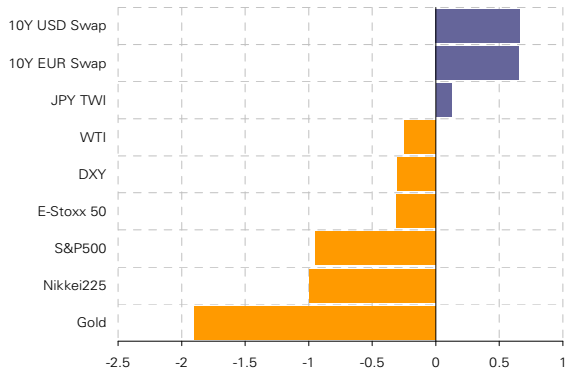


3M Lowest Z-score Risk Reversal(25P-25C)-S&P500

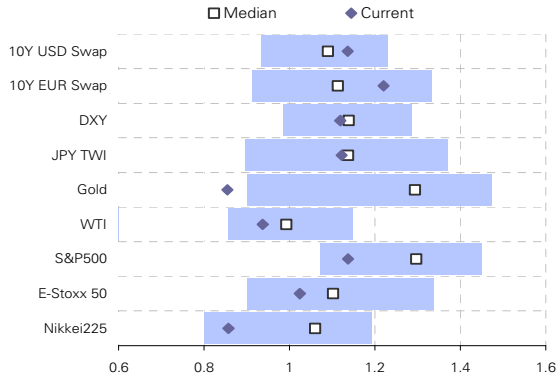
Lowest current 3M risk reversal (25P - 25C) - JPY TWI

Volatility Slope and Carry

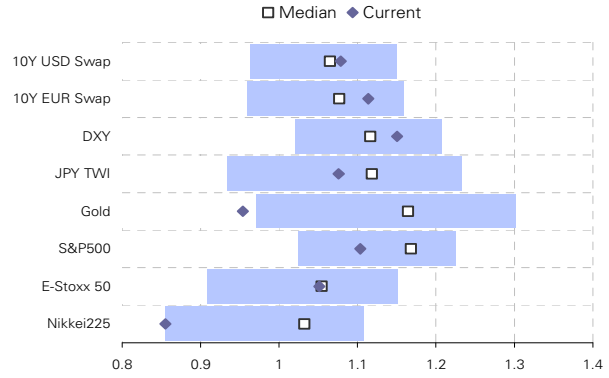
1Y (-) 1M implied volatility spread Z-score



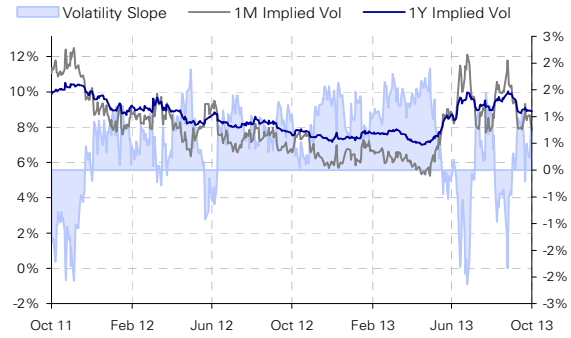
1Y/1M implied vol ratio (current,1Y 10%-ile, median, 90%-ile)



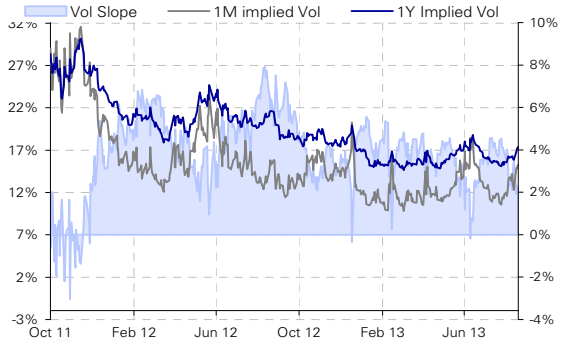
6M6M forward vol / 6M spot vol



Highest Zscore 1Y (-) 1M volatility spread-10Y USD Swap

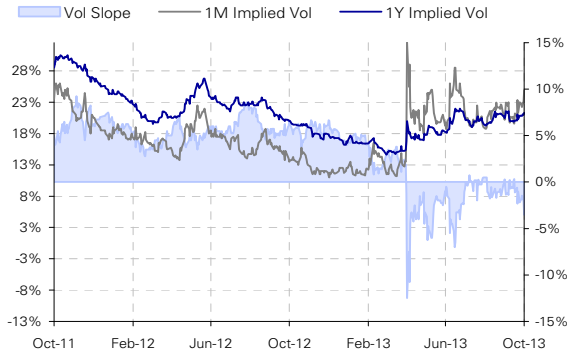


Highest 1Y (-) 1M volatility spread-S&P500

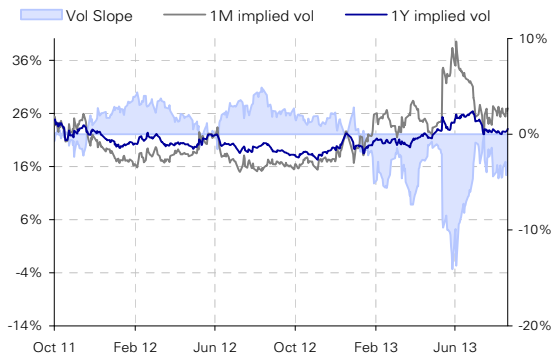


Highest 6M6M forward vol / 6M spot vol -DXY

Lowest Zscore 1Y (-) 1M volatility spread-Gold



Lowest 1Y (-) 1M volatility spread-Nikkei225

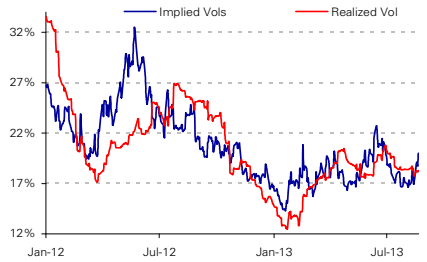


Lowest 6M6M forward vol / 6M spot vol -Nikkei225

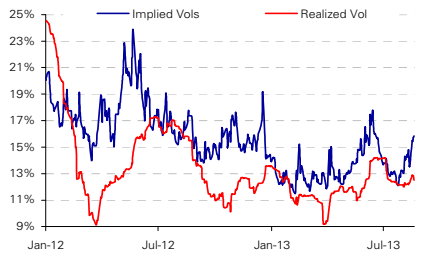
Equities

SPX		Implied Volatility			
	Spot	*1M*	*3M*	*6M*	*1Y*
Last level	1703	15.2	15.8	16.5	17.3
Previous close	1693	15.1	15.7	16.3	17.2
1Y maximum	1726	20.2	19.2	19.8	21.6
1Y minimum	1353	9.8	11.5	13.1	14.6
Z-score	**1.8**	**-0.1**	**-0.3**	**-0.4**	**-0.6**
Percentile rank	**99%**	62%	51%	40%	32%
		1M	*3M*	*6M*	*1Y*
Close-close actual volatility		12.7	10.5	12.4	12.0
Z-score		**-0.1**	**-0.9**	**-0.5**	**-0.9**
Percentile rank		54%	8%	48%	22%
5D change in close-close actual vol		3.3	1.0	0.4	0.3
Z-score		**1.6**	**1.3**	**1.4**	**1.7**
Percentile rank		**95%**	**93%**	**95%**	**98%**
		1M	*3M*	*6M*	*1Y*
Volatlity risk premium		3.8	3.3	4.6	5.4
Z-score		**0.7**	**0.5**	**0.9**	**2.0**
Percentile rank		76%	71%	**85%**	**98%**
		1M	*3M*	*6M*	*1Y*
25D risk reversal (25C-25P)		-5.1	-5.6	-5.7	-6.0
Z-score		**0.0**	**0.4**	**0.7**	**0.9**
Percentile rank		34%	56%	68%	71%
		1M	*3M*	*6M*	*1Y*
25D butterfly		0.5	0.6	0.6	0.8
Z-score		**-0.5**	**-1.0**	**-1.0**	**-0.2**
Percentile rank		30%	17%	16%	33%
		1M	*3M*	*6M*	*1Y*
Implied daily market move		0.95%	0.98%	1.02%	1.07%

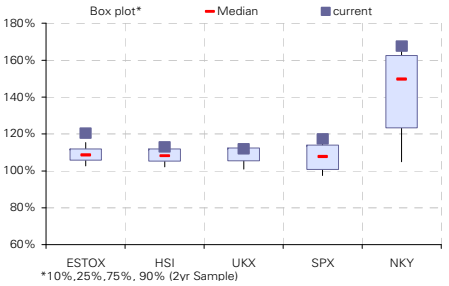
3M Implied Volatility : E-Stoxx 50



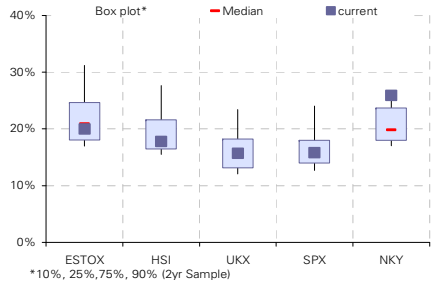
3M Implied Volatility : SPX



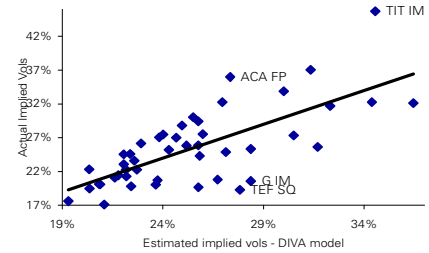
1Y Price History(rebased 100% 1Y ago)



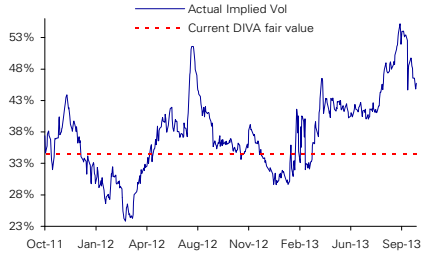
3M ATM Implied Volatility



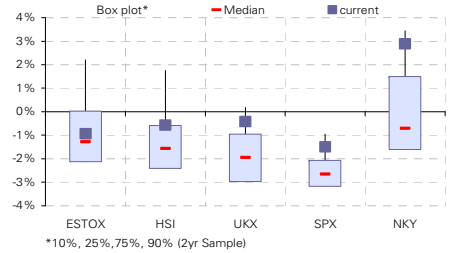
3M implied vol vs DIVA Estimated implied vols



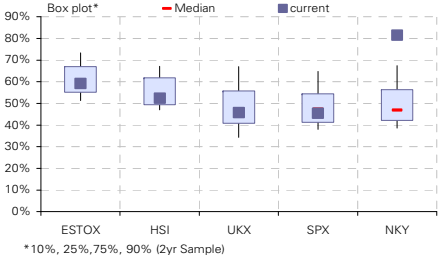
Top Deviation: Rank 1 : TIT IM Equity



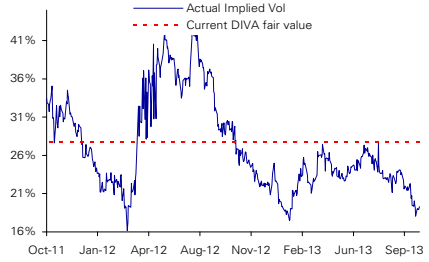
ATM IV Term Structure: 3M-12M



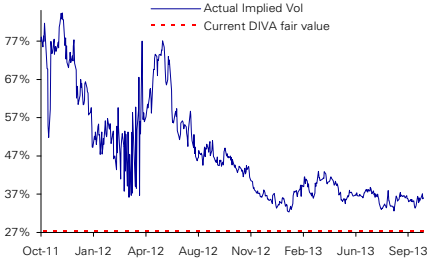
3M Implied Correlation



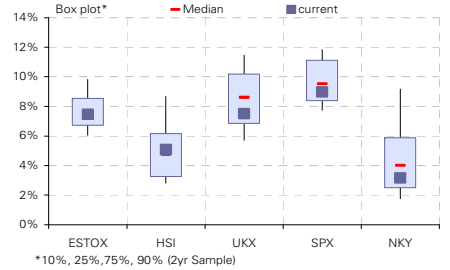
Top Deviation: Rank 3 : TEF SQ Equity



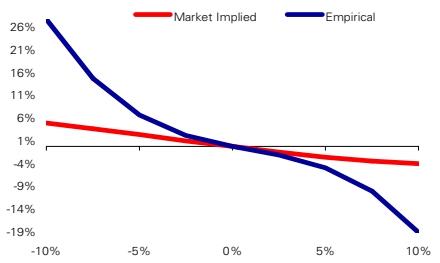
Top Deviation: Rank 2 : ACA FP Equity



3M 90%-110% IV skew



Volatility-Spot Relationship : SPX*

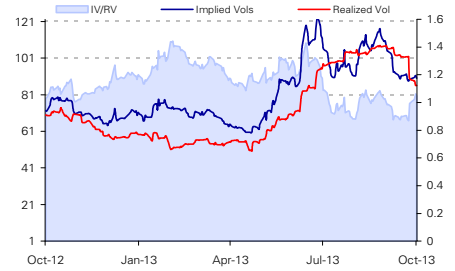


* Y-axis: 1-day change in ATMF volatility. X-axis: 1-day change in spot. See appendix

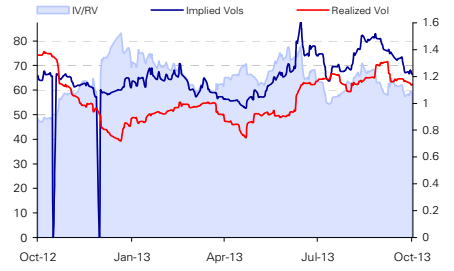
Rates

USD 10Y Swaps	Spot	3M	6M	2Y	5Y
		Normal Implied Volatility			
Last level	2.93	90	94	100	98
Previous close	2.93	91	94	100	98
1Y maximum	3.28	122	116	110	104
1Y minimum	1.69	60	66	80	86
Z-score	**1.8**	**0.2**	**0.4**	**0.7**	**0.5**
Percentile rank	**93%**	58%	63%	70%	61%
		3M	6M	2Y	5Y
Close-close actual volatility (normal vol)		87	90	93	100
Z-score		**0.6**	**0.6**	**0.5**	**-0.1**
Percentile rank		74%	74%	69%	53%
5D change in close-close actual vol		-4	-4	-4	-4
Z-score		**-1.0**	**-0.9**	**-0.9**	**-0.7**
Percentile rank		10%	12%	12%	18%
		3M	6M	2Y	5Y
Volatlity risk premium (IV/RV)		1.03	1.04	1.07	0.98
Z-score		**-0.5**	**-0.4**	**-0.3**	**-0.1**
Percentile rank		31%	37%	47%	51%
		3M	6M	2Y	5Y
25D risk reversal (25C-25P)		-13	-15	-14	-11
Z-score		**-0.2**	**-0.7**	**1.7**	**1.4**
Percentile rank		35%	24%	**98%**	**95%**
		3M	6M	2Y	5Y
25D butterfly		0.41	0.48	1.23	3.12
Z-score		**0.3**	**2.7**	**0.7**	**0.5**
Percentile rank		65%	**95%**	72%	69%
		3M	6M	2Y	5Y
Implied daily market move		5.6	5.8	6.2	6.1

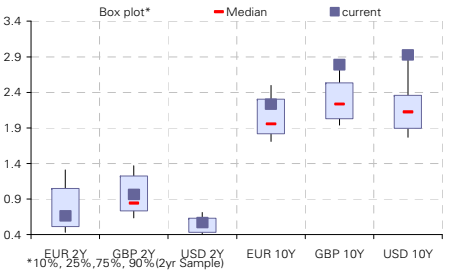
Implied Volatility : USD 3M10Y Swaptions



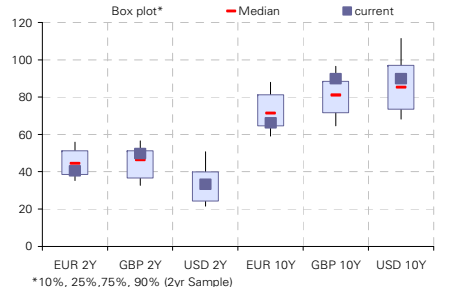
Implied Volatility : EUR 3M10Y Swaptions



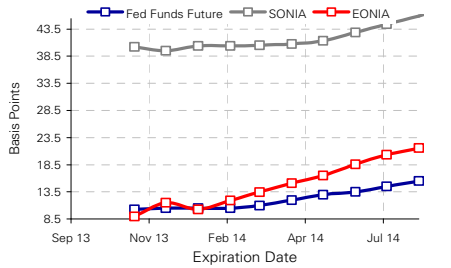
Swap rates, 1Y History



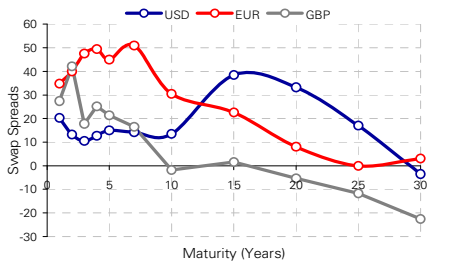
ATM Implied Volatility - 3M Expiry



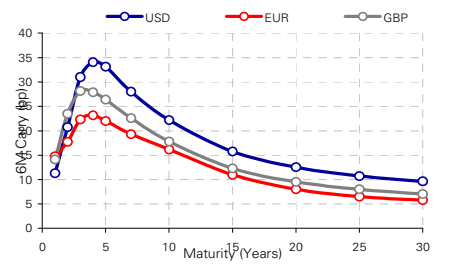
Forward Money Market Curves



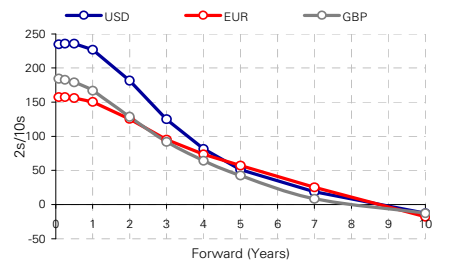
Swap Spreads



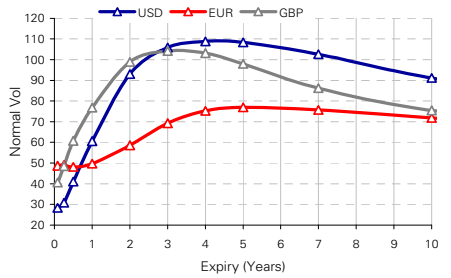
6M Carry



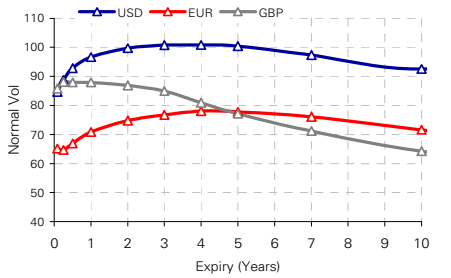
2s/10s Slope



2Y Swaptions With Different Expiry



10Y Swaptions With Different Expiry



Costless Risk Reversals

USD	3M	1Y	5Y	10Y
2Y	-25/+74	-25/+55		
5Y	-25/+43	-50/+85	-50/+62	
10Y	-50/+75	-50/+66	-100/+123	-100/+108
30Y	-100/+115	-100/+111	-100/+105	-100/+98

GBP	3M	1Y	5Y	10Y
2Y	-25/+42	-25/+47		
5Y	-25/+36	-50/+85	-50/+76	
10Y	-50/+76	-50/+66	-100/+139	-100/+141
30Y	-100/+103	-100/+113	-100/+134	-100/+139

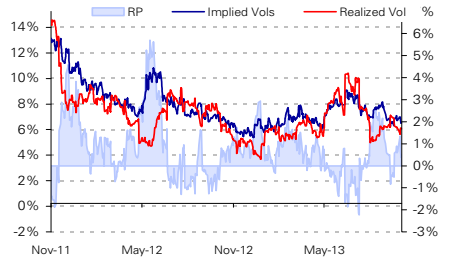
EUR	3M	1Y	5Y	10Y
2Y	-25/+46	-25/+50		
5Y	-25/+38	-50/+92	-50/+80	
10Y	-50/+79	-50/+69	-100/+147	-100/+150
30Y	-100/+108	-100/+120	-100/+143	-100/+149

Tenor	Expiry
	Receiver swaption strike (lhs) vs break-even equivalent Payer strike (rhs), both measured in bp distance from the ATM strike

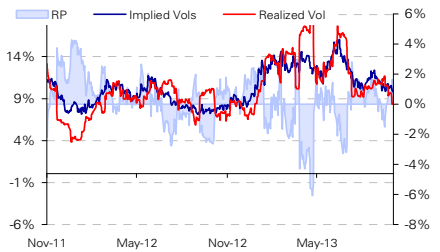
Foreign Exchange

DXY		Implied Volatility			
	Spot	*1M*	*3M*	*6M*	*1Y*
Last level	80	6.3	6.2	6.5	7.1
Previous close	80	6.3	6.3	6.7	7.1
1Y maximum	85	8.8	8.5	8.3	8.3
1Y minimum	79	5.2	5.7	6.0	6.6
Z-score	-0.8	-0.8	-1.0	-1.0	-1.0
Percentile rank	29%	18%	10%	8%	8%
		1M	*3M*	*6M*	*1Y*
Close-close actual volatility		5.8	5.6	7.1	6.3
Z-score		-0.6	-1.0	0.5	-0.7
Percentile rank		30%	15%	72%	18%
5D change in close-close actual vol		0.0	-0.5	0.1	0.0
Z-score		0.1	-1.6	0.5	0.3
Percentile rank		50%	4%	75%	61%
		1M	*3M*	*6M*	*1Y*
Volatlity risk premium		0.5	0.6	-0.6	0.8
Z-score		-0.2	0.0	-1.5	0.0
Percentile rank		44%	50%	2%	42%
		1M	*3M*	*6M*	*1Y*
25D risk reversal (25C-25P)		0.2	0.7	1.2	1.7
Z-score		-1.1	-1.1	-0.9	-0.9
Percentile rank		4%	5%	12%	12%
		1M	*3M*	*6M*	*1Y*
25D butterfly		-0.1	0.2	0.3	0.7
Z-score		-0.6	-0.6	-0.8	-0.7
Percentile rank		23%	24%	16%	23%
		1M	*3M*	*6M*	*1Y*
Implied daily market move		0.39%	0.39%	0.41%	0.44%

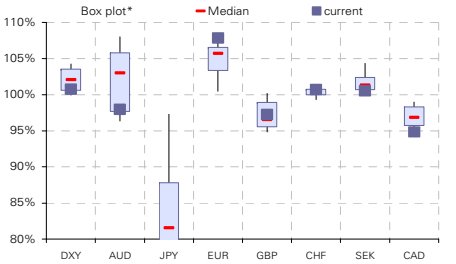
1M Implied Volatility : DXY



1M Implied Volatility : JPY TWI

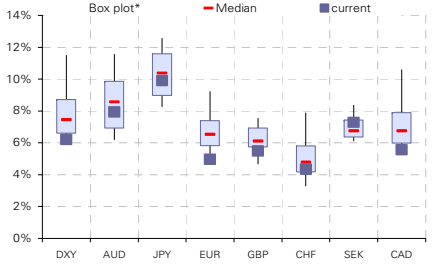


1Y Price History(rebased 100% 1Y ago)



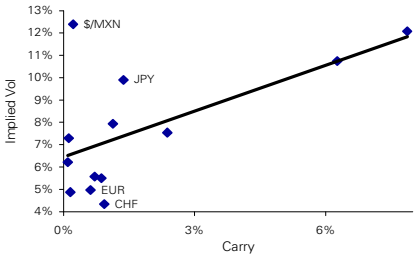
*10%. 25%.75%. 90% (2vr Sample)

3M ATM Implied Volatility

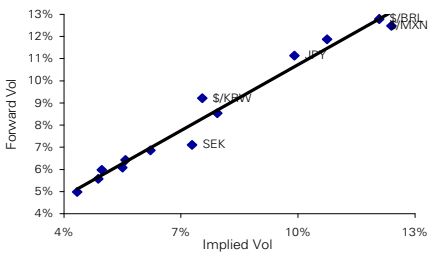


*10%, 25%,75%, 90%(2yr Sample)

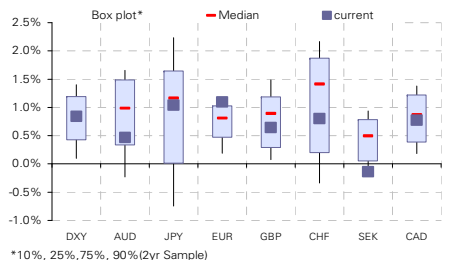
3M abs. Annualised Carry vs 3M Implied vol



3M3M Forward vol vs 3M Implied vol

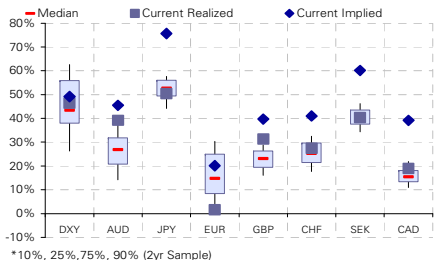


ATM IV Term Structure: 1Y - 3M



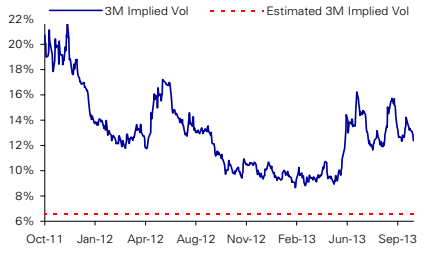
*10%, 25%,75%, 90%(2yr Sample)

3M avg correlation (basket with a common currency)

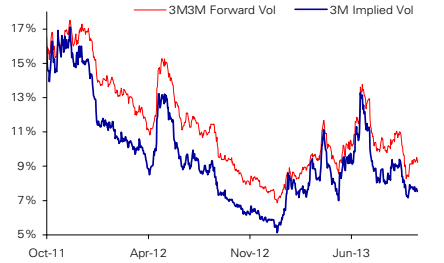


*10%, 25%,75%, 90% (2yr Sample)

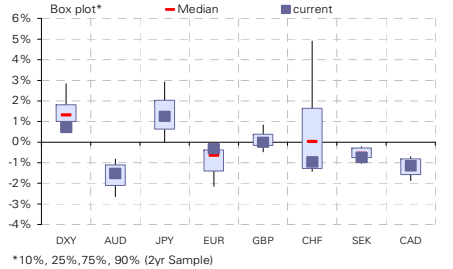
Top Deviation 3M Carry vs 3M vols: $/MXN



Top Deviation 3M3M vs 3M vols: $/KRW

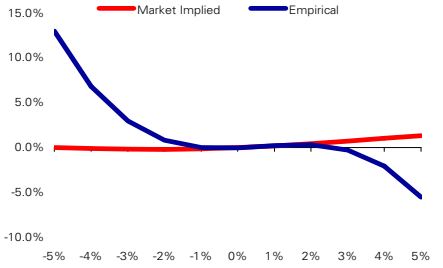


3M Risk Reversals (25C-25P)



*10%, 25%,75%, 90% (2yr Sample)

Volatility-Spot Relationship : DXY*

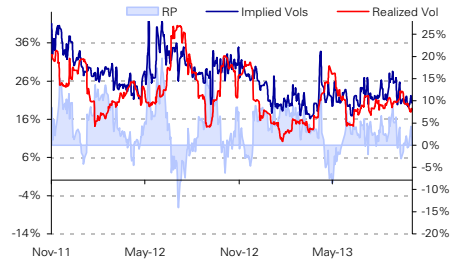


* Y-axis: 1-day change in ATMF volatility. X-axis: 1-day change in spot. See appendix

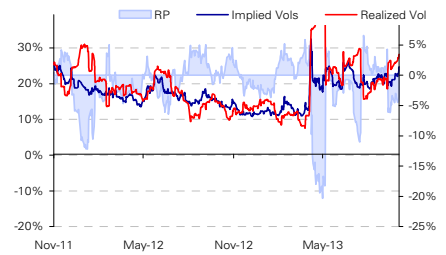
Commodities

WTI		Implied Volatility			
	Spot	*1M*	*3M*	*6M*	*1Y*
Last level	102	20.2	19.8	19.7	19.0
Previous close	103	20.6	19.8	19.7	18.9
1Y maximum	111	34.8	33.0	33.1	30.3
1Y minimum	84	16.1	17.3	18.4	18.3
Z-score	**0.8**	**-1.1**	**-1.3**	**-1.4**	**-1.5**
Percentile rank	75%	13%	5%	2%	4%
		1M	*3M*	*6M*	*1Y*
Close-close actual volatility		18.4	19.4	20.7	20.0
Z-score		**-0.6**	**-0.8**	**-0.7**	**-2.0**
Percentile rank		27%	19%	30%	0%
5D change in close-close actual vol		-1.2	-0.5	0.1	-0.8
Z-score		**-0.3**	**-0.3**	**0.3**	**-2.1**
Percentile rank		31%	26%	66%	3%
		1M	*3M*	*6M*	*1Y*
Volatlity risk premium		1.8	0.4	-1.0	-1.0
Z-score		**-0.4**	**-1.1**	**-1.3**	**0.0**
Percentile rank		31%	13%	4%	64%
		1M	*3M*	*6M*	*1Y*
25D risk reversal (25C-25P)		-3.2	-3.7	-4.3	-5.1
Z-score		**-0.1**	**0.4**	**0.8**	**1.2**
Percentile rank		39%	61%	78%	**90%**
		1M	*3M*	*6M*	*1Y*
25D butterfly		0.6	0.5	0.5	0.4
Z-score		**0.1**	**-0.6**	**-0.7**	**-0.8**
Percentile rank		57%	32%	28%	21%
		1M	*3M*	*6M*	*1Y*
Implied daily market move		1.25%	1.22%	1.22%	1.18%

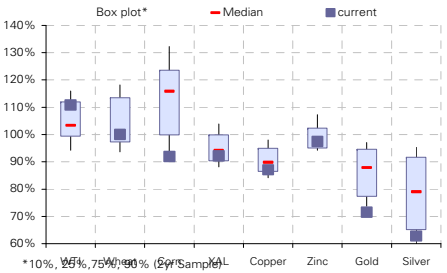
1M Implied Volatility : WTI



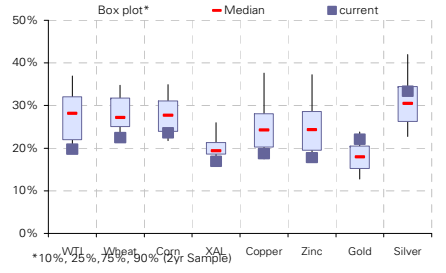
1M Implied Volatility : XAU



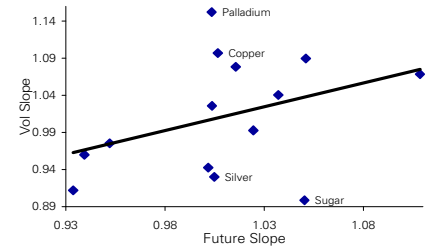
1Y Price History(rebased 100% 1Y ago)



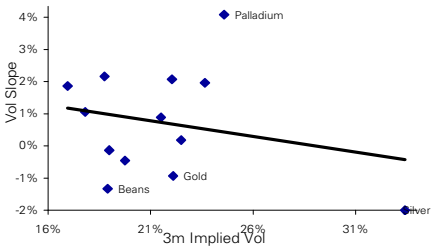
3M ATM Implied Volatility



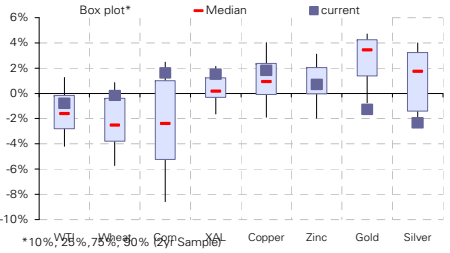
Vol Slope (1Y/3M) vs Future Slope (1Y/3M)



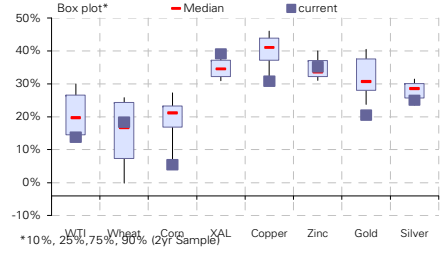
Vol Slope (12M-3M) vs 3M Implied vol



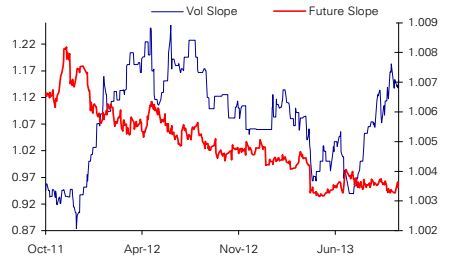
ATM IV Term Structure: 12M-3M



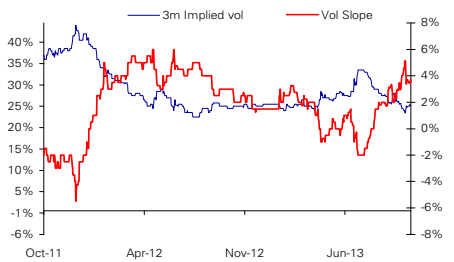
3M avg corr (basket with a common commodity)



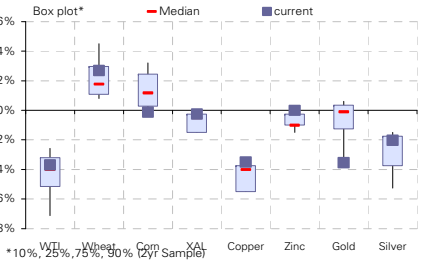
Top Deviation (Vol Slope vs Future Slope): Palladium



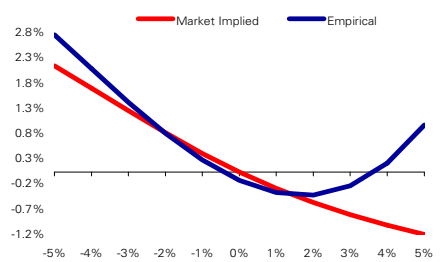
Top Deviation (Vol Slope vs 3M implied vol): Palladium



3M Risk Reversals (25C-25P)



Volatility-Spot Relationship : WTI*



* Y-axis: 1-day change in ATMF volatility. X-axis: 1-day change in spot. See appendix

Appendix – Reading the Cross Asset Monitor

Asset markets are increasingly connected, and most money managers can no longer afford concentrating on a single asset class. By giving a thorough review of price action across the globe, our new Cross Asset Monitor shows how today's key themes are affecting the different asset classes. It answers questions such as

- Which asset class is responding more quickly to recent developments, and which one is lagging?
- How are options markets reacting to developments in the spot markets?
- Which assets are most inter-twined and what are their common drivers?

In the front page we highlight the most interesting points in the current monitor, focusing on the charts that best reflect the current environment.

Page 1 provides a snapshot of global markets. we show levels, changes and correlations in the main indices, assets and implied vols. Pivotal assets are plotted historically for FX, equities and interest rates and we also present a special section on "main movers"; that is, the assets which have moved the most over the past month for each category of interest.

Pages 2 and 3 look at spot and implied vol correlations from the unique angle of the minimum spanning tree (MST). MSTs link assets to one another based on correlation strength, therefore highlighting hubs where one asset exerts great influence on a group of assets (see the separate section below). The MSTs are followed by our diversification indices; these measure how connected the assets are within a given asset class, or which asset classes are more diversified, evaluated according to a ratio of volatilities (see separate section below). The most interesting correlations on the move are also highlighted.

Pages 4, 5 and 6 cover the most important elements of the volatility surface: levels, smile and term structure. We compare vol risk premium across different asset classes and highlight the most significant discrepancies based on a z-score metric. A similar analysis is done for risk reversals and the term structure, where we also highlight opportunities with volatility carry (the distance between forward-starting implied vols and spot-starting vols).

Finally, we dedicate each of the subsequent pages to a given asset class. These contain information of interest to both specialists and non-specialists, with some of the details highlighted below.

Technical terms and expressions

25-delta risk reversals: the risk reversal is a measure of the relative cheapness of calls relative to puts. A 25-delta risk reversal measures the spread between the implied volatility of the 25-delta call and that of the 25-delta put in the same underlying asset and maturity.

Absolute skew (p.11): Absolute skew measures the difference between the price of a CDS index and its "fair value" based on the weighted average price of the underlying components. The higher the difference, the cheaper (or wider) is the index versus its individual constituents. The skew is expressed as a running spread in basis points.

Basket correlation (p.9 and 10): these are analogous to the broad correlation baskets in p.2 and p.3, and measure the average correlation between time series with a common asset. In FX, it is the average correlation between the crosses in a TWI with one common cross (the JPY basket has USD/JPY, EUR/JPY, AUD/JPY and so on). In commodities, it is the average correlation of all commodities relative to a common one.

CDS index skew (p. 11): this is the difference between the traded spread of the CDS index and its fair value computed using spreads of its single name constituents; a positive (negative) value of the skew indicates that CDS index protection is overbought (oversold) with respect to its single name constituents.

CDS index spread dispersion (p. 11): these measures show how bunched together or dispersed single name spreads of a CDS index are. We show two measures for each index - central dispersion and right tail dispersion. Central dispersion shows how far apart single names are from the median spread name of the index portfolio; the higher the value of the measure, the greater is the dispersion in the portfolio. Right tail dispersion aims to capture the wide spread names in the portfolio. It is high when there are a number of names with significantly higher spread than the portfolio median spread.

European fin./sov. systemic risk shorts (p. 11): these are the most optimum names to buy protection on in single name CDS form against further spikes in European systemic risk. The names are chosen as per our PCA-based methodology discussed in *Hedging in Binary European Financial Markets*

(*Credit Market Insights - European Systemic Risk Remains High,* published 8 July 2011 and available at https://gm.db.com/QCStrategy). The names chosen are typically high beta names that are trading relatively tight in the CDS market. Note that we highlight names with a CDS spread of 1,000bp or lower.

Correlation baskets (p.2, p.3): we measure the average exponential correlation between key assets in a common asset class. The constituents are given equal weights, and are as follows:

- *Equities*: S&P 500, Eurostoxx 50, Nikkei 225, DAX 30, SMI, IBEX, HSI, HSCEI, KOSPI 200, ASX 200, RDX, MSCI EM, BOVESPA.
- *Rates*: 2, 5 and 10-year USD, EUR and GBP interest rate swaps.
- *Foreign exchange*: USD vs EUR, JPY, GBP, AUD, CAD, CHF, NOK and SEK.
- *Commodities*: WTI, Brent, Aluminium, Copper, Gold and Silver.

DIVA (p.7): The Deusche Bank Implied Volatility Analyzer. This model evaluates richness and cheapness of European stocks relative to key fundamental drivers: CDS spreads, realised vol, daily volume, absolute returns and earnings dispersion. It identifies value through a cross-sectional regression of major European stocks against this set of explanatory variables. In our equities page, we highlight the stocks that are most out-of-line with the DIVA fair value and plot their ATM volatility over time. For more details on DIVA, please refer to "Searching For Value In Implied Volatility", 08 September 2008.

Equity implied correlation (p.7): This is a measure of the average implied correlation between constituents in an equity index. The implied correlations are captured through different sources of implied volatility. For more details, see "Trading Dispersion", 14 May 2007.

Implied vol references: while the skew data is standardized according to the deltas, the central vol reference diverges according the convention in each asset class. In foreign exchange and precious metals, we use delta-neutral implied vols. In other commodities and rates, we use ATMF vols. Finally, in equities, we use ATMS volatility.

Rates volatility: "normal" vs "price" vols (p.1,3, 4 and 8): We show interest rate vols in 2 distinct forms. Page 8 shows normal implied volatilities of interest rates, annualized and in basis point units, following the interest rate market convention. This measure is then compared to the realised volatility of swap rate changes. To make them more easily comparable, we convert the interest rate normal vol to volatility on the underlying swap present value, derived through multiplying the normal volatility by the swap DV01. This makes rates vol directly comparable with the volatility of other asset classes, which generally referred as "price" volatility.

Volatility-to-spot relationship (p.7, 9, 10): This measures the 1-day change in 3-month implied volatility (Y-axis) associated with a 1-day change in spot (X-axis), evaluated through 2 measures. The first is what's implied by the volatility smile using a "sticky-strike" calculation. The second applies a polynomial fit to a scatterplot of historical changes in implied vol versus changes in spot. This chart is a powerful tool to evaluate differences in implied versus empirical skew - or in other words, how sensitive the options market expects implied vols to be relative to spot, compared to how sensitive it's been in the past.

Volatility risk premium: the distance between implied and realised volatility. The lookback window used to estimate realised volatility is the same as the tenor of the implied vol. We typically evaluate the ratio between the two when comparing risk premium across different asset classes, though we also use the outright spread in some of the later pages of the report (clearly specified).

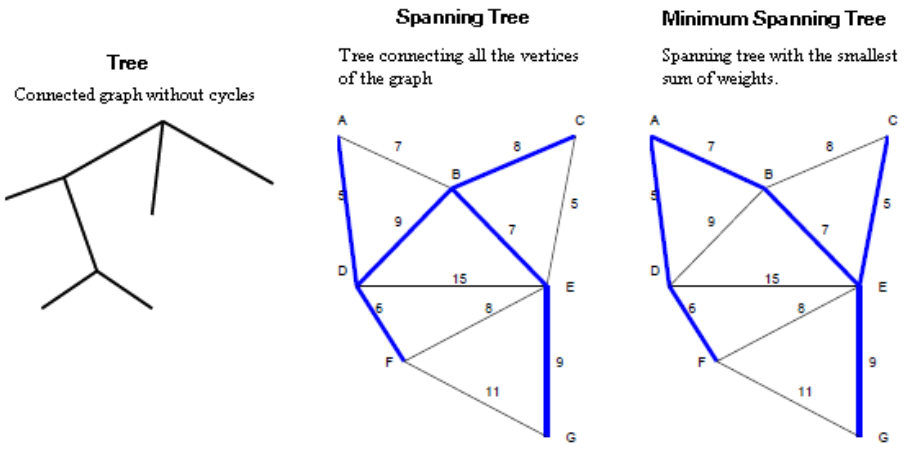
Z-score: the z-score is a measure that evaluates where a variable stands relative to its history. It standardizes any time series by calculating the distance between the current observation and the sample average, divided by its standard deviation. While the probabilistic interpretation of Z-score readings is only accurate for normally-distributed variables, it is still effective in comparing non-Gaussian data with different magnitudes.

The Minimum Spanning Tree (MST) Concept

The minimum spanning tree is a tool from graph theory that is widely used in industrial engineering. With finance data, the MST objectively highlights causality between assets, visualized through the clustering of variables with one common link.

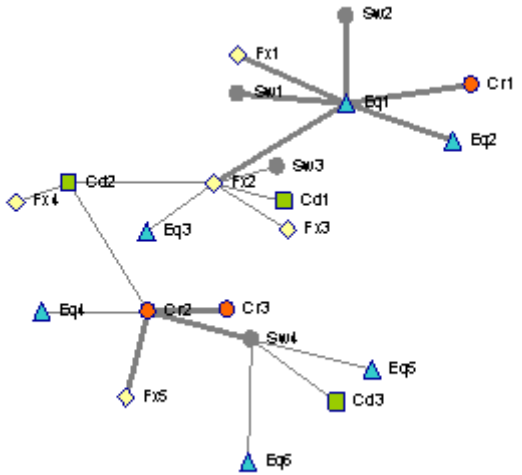
A *tree* is an undirected and connected graph without cycles. A *spanning tree* is a tree that connects all the vertices of the graph. The *minimum spanning tree* is the spanning tree with smallest weight amongst all possible spanning trees in the same graph. As we defined "weight" to be $1-corr^2$, our MSTs connect the most strongly correlated vertices.

Figure 2: Building a minimum spanning tree



Source: Deutsche Bank

Figure 3: MST given a few distinct drivers



Source: Deutsche Bank

Different techniques can be used to build the minimum spanning tree. We apply a modified version of Kruskal's algorithm[1], keeping the branch lengths constant for better visualization. But while branch distances don't change, we modify their width to reflect stronger (thicker) and weaker (thinner) correlation.

We demonstrate the interpretation through 3 examples below:

<u>High correlation within certain a category of assets, low correlation elsewhere</u>:

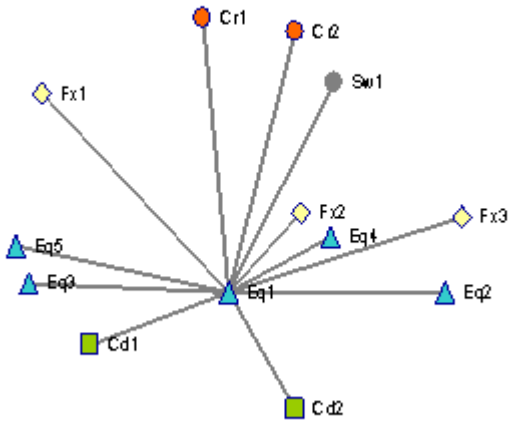
This MST portrays the environment where a few themes drive the price action of the entire set, leading to regional concentration. In this example, each hub is defined according to a common driving theme, and the asset at the centre most clearly incorporates that theme. As is the usually the case, the hubs are not necessarily specific to one asset class.

<u>Strongly correlated assets, likely with a common driver:</u>

This MST represents an environment where a common driver affects most assets. The effects of such driver crystalise more clearly in one pivotal asset, which then acts as reference for the others. An example would be when risk aversion is the sole driver of global markets, and shifts in investor appetite get more quickly (and most clearly) reflected in the S&P 500. Other assets then become more strongly correlated to this pivotal asset than to one another. In practice, the presence of one unique theme in markets typically leads to more linear structures, albeit united by a common driver in the middle. See the subsequent charts for more detail.

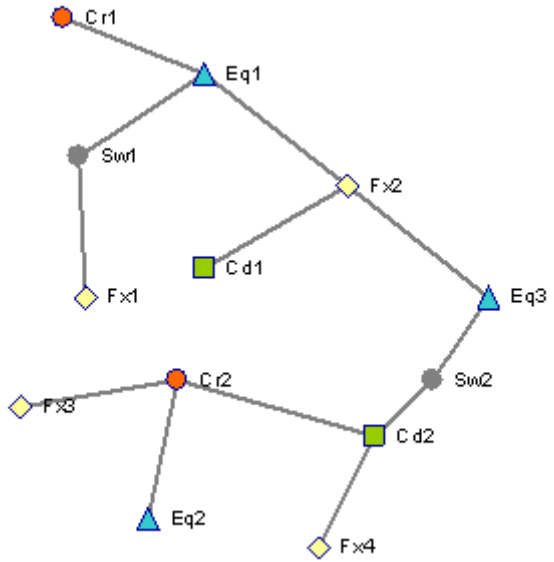
[1] Joseph. B. Kruskal: "On the Shortest Spanning Subtree of a Graph and the Traveling Salesman Problem", *Proceedings of the American Mathematical Society*, Vol 7, No. 1 (Feb, 1956)

Figure 4: MST given one distinct driver



Source: Deutsche Bank

Figure 5: MST given no distinct driver



Source: Deutsche Bank

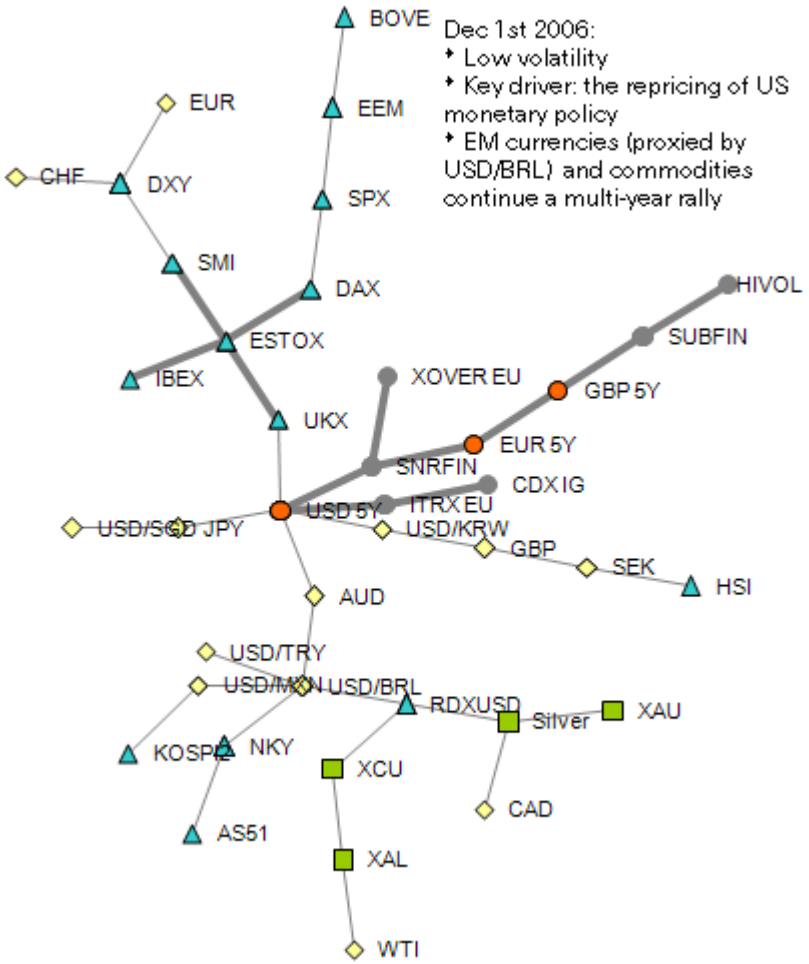
Low correlations in general:

This example shows a lack of clear drivers of the set, reflected in the absence of significant regional hubs. With little commonality, the dependency structure is vague and therefore one cannot say what the common driver is. This is analogous to situations where idiosyncratic factors are far more influential in the price action than common market factors.

Our minimum spanning trees at different points in time

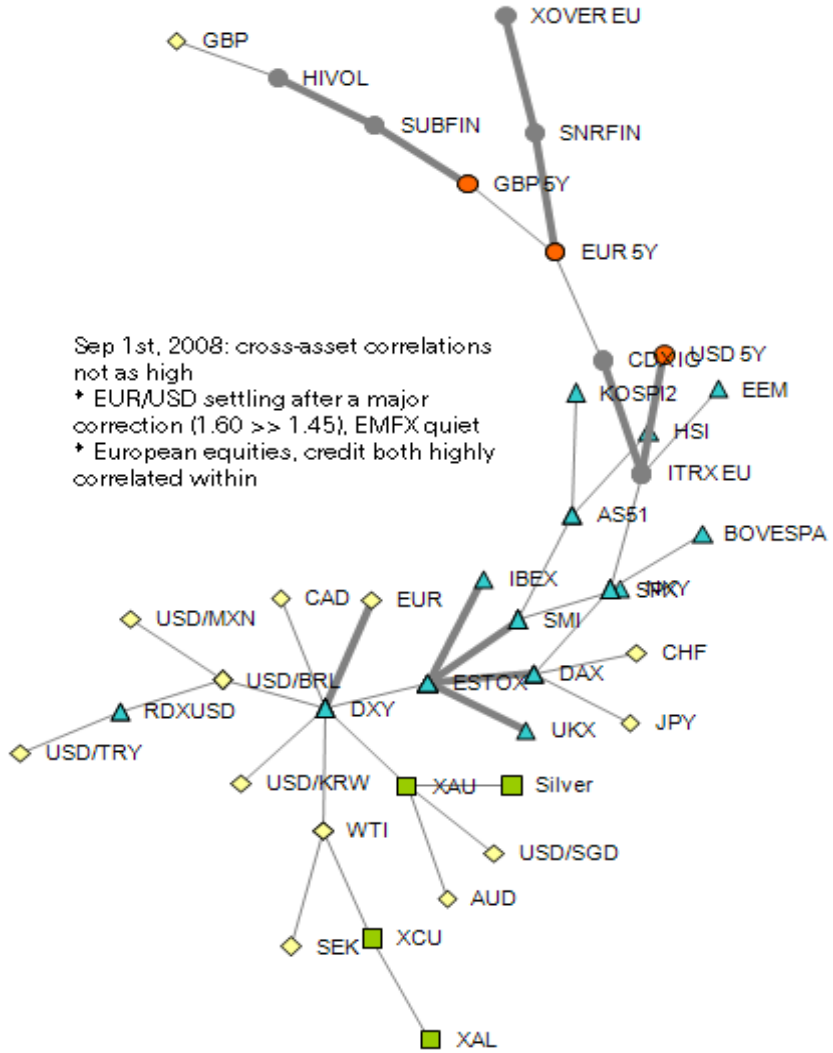
As further guidance on how MSTs graphically represent environments, the charts below show MST snapshots of the world during different market conditions. We focused on distinct periods such as market shocks and low vol regimes.

Figure 6: MST snapshot on Dec 1st 2006 (Nov + Dec'06 data)



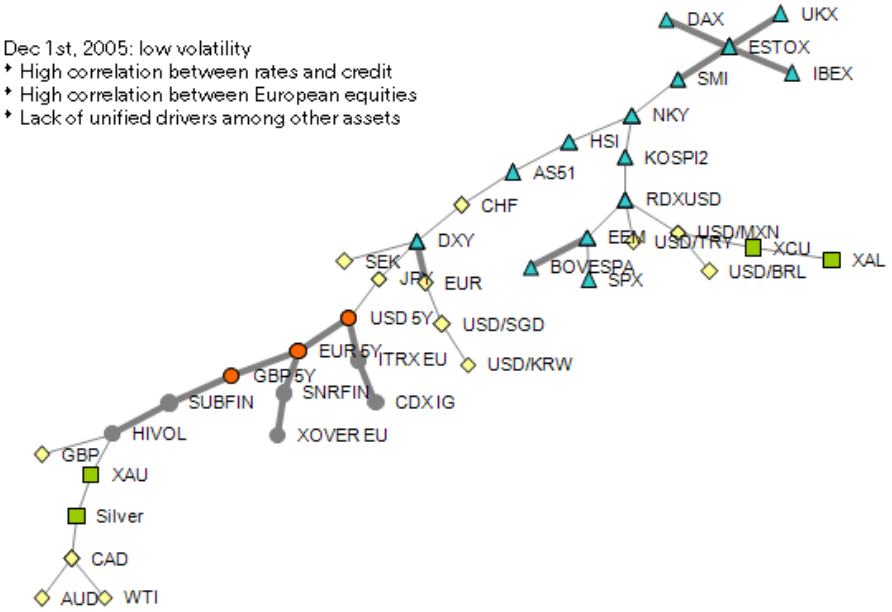
Source: Deutsche Bank

Figure 7: MST snapshot on Sep 1st 2008 (Jul + Aug'08 data)



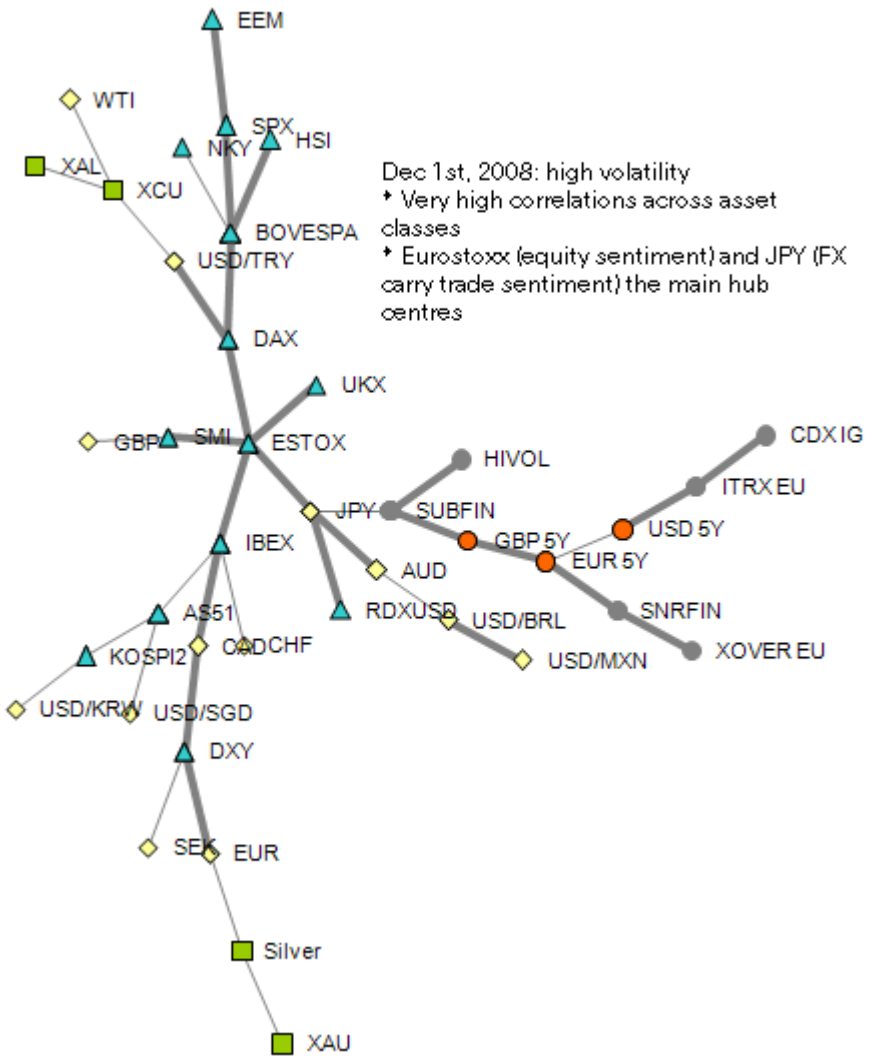
Source: Deutsche Bank

Figure 8: MST snapshot on Dec 1st 2005 (Nov + Dec'05 data)



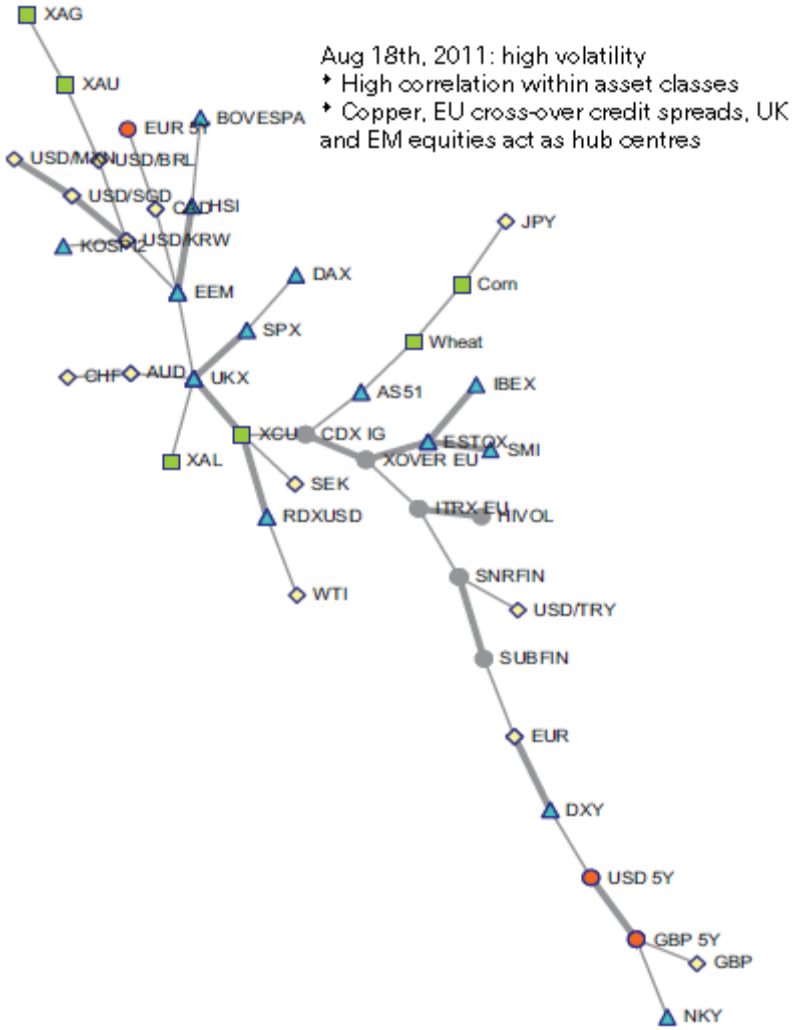
Source: Deutsche Bank

Figure 9: MST snapshot on Dec 1st 2008 (Oct + Nov'08 data)



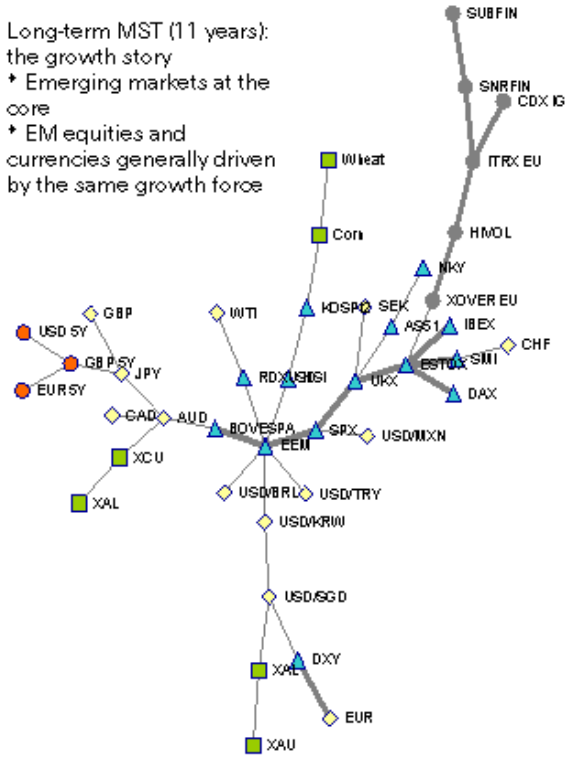
Source: Deutsche Bank

Figure 10: MST snapshot on Aug 18th 2011 (Jun - Aug'11 data)



Source: Deutsche Bank

Figure 11: Long-term MST snapshot 11 years of daily data



Source: Deutsche Bank

Source for all charts and tables in this report: Deutsche Bank Global Markets Research.

2012 Credit outlook:
https://gm.db.com/global_credit/pages/strategy/CrMrktinsight_biweekly/1539094/grcm2011prod024308_web.pdf

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https://ger.gm.cib.intranet.db.com/ger/document/pdf/GDPBD00000202165.pdf

Appendix 1

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