Liquid Insight

Understanding FX vol using PCA

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Global

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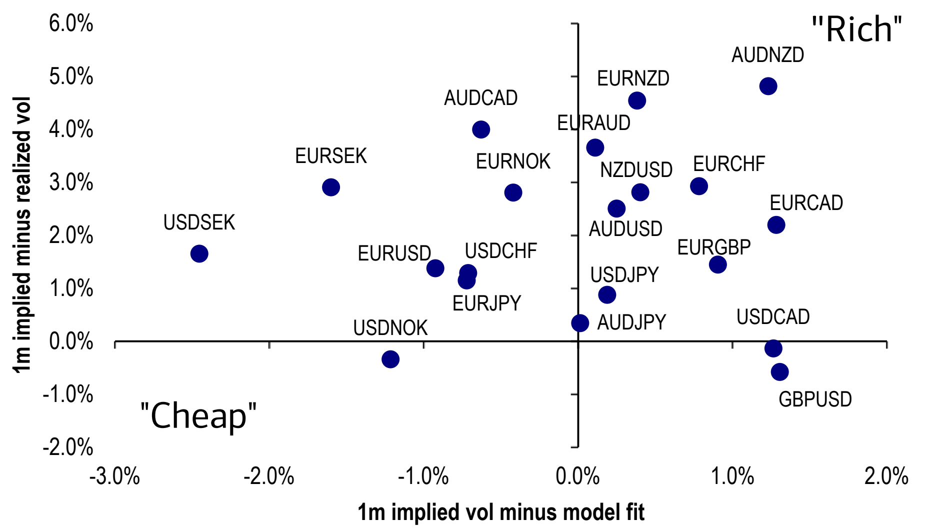
Key takeaways

- A three-factor model explains nearly 90% of the variation in G10 FX vols.
- We conceptualize the factors as global uncertainty, risk appetite, and central bank policy divergence.
- Our analysis suggests AUDNZD, EURCHF, and EURCAD vols may be overvalued, while USDNOK vol may be undervalued.

By Vadim Iaralov, Chris Xiao and Dora Xia

Chart of the day: Evaluating FX vol using PCA model



Source: BofA Merrill Lynch Global Research

Viewing FX vols through PCA lens

FX implied volatility can be valued in a variety of ways, including realized volatility comparisons, breakeven analysis, and examining cross-asset vols. We use principal component analysis (PCA) to evaluate which vols look relatively rich or cheap.

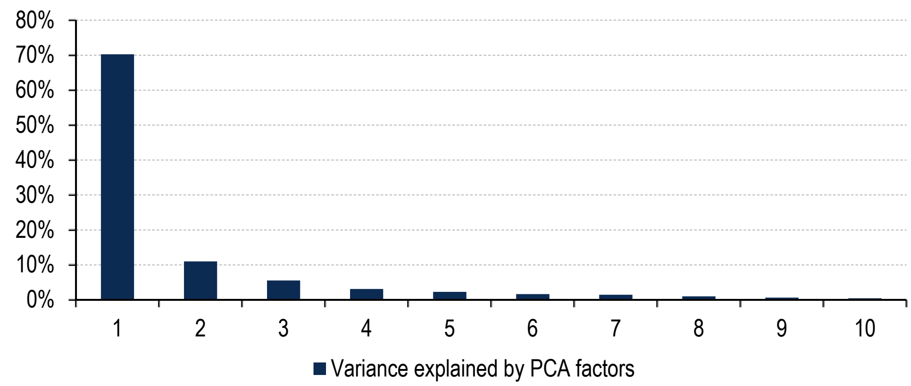
Over 87% of the variation in G10 FX one-month vols can be explained by a three-factor model. We conceptualize these factors as global uncertainty, risk appetite, and central bank policy divergence.

The PCA framework provides an additional tool for valuating implied volatilities and can be especially useful when combined with other approaches. Our analysis shows the 1m implied volatilities of AUD/NZD, EUR/CAD, EUR/CHF may be overvalued, while USD/NOK may be slightly undervalued. For the 3m tenor we observe GBP crosses have a significant premium priced in for the EU referendum, while CAD/NOK 3m vol is cheap.

Breaking FX vol into components

A PCA analysis of all 45 G10 FX 1m vols reveals a majority of the variance can be attributed to a few common factors. Indeed, the first three factors explain over 87% of the variance in implied vols, with the first factor alone accounting for 70% (Chart 1). This result is consistent with the empirical observation that currency vols tend to move together as a baseline and pairs only diverge occasionally. Similarly, three factors explain over 90% of the variation in 3m implied vols.

Chart 1: Over 87% G10 FX vol variance is explained by 3 factors



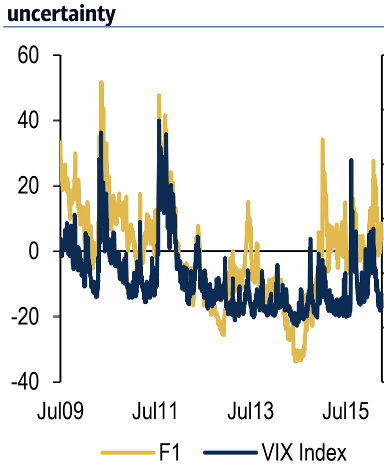
Source: BofA Merrill Lynch Global Research

Interpreting the key driving factors

While PCA factors are unobservable and cannot be fully captured by any single macro variable, we find it worthwhile to search for highly correlated proxies to gain greater intuition on the drivers of FX vol.

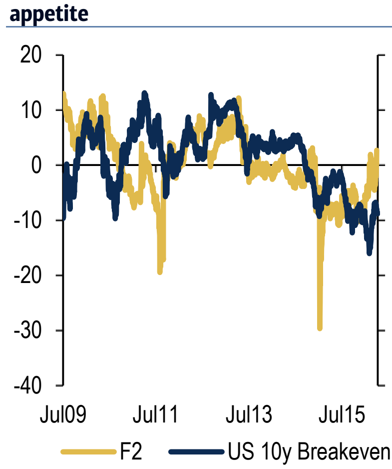
We find the first factor has a 77% correlation with the VIX index (Chart 2). We conceptualize the first factor as representing global uncertainty. The intuitive interpretation is that the premium for currency volatility increases when there is greater overall uncertainty in global financial markets. The second factor is correlated with US inflation breakevens (Chart 3). While it is not an ideal proxy, we think this can be interpreted as risk appetite. When investors are more risk-averse, options command greater insurance premium. Finally, the third factor is 60% correlated with central bank policy divergence (Chart 4), which we think has contributed greatly to the rise in FX volatility over the past three years. In practice, active central banks make for greater investor speculation, driving option premiums higher.

Chart 2: First factor correlated with global uncertainty



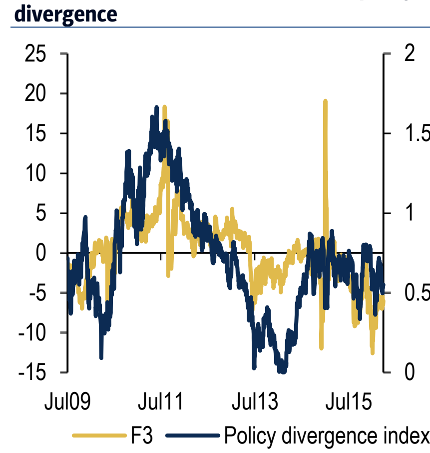
Source: BofA Merrill Lynch Global Research

Chart 3: Second factor correlated with risk appetite



Source: BofA Merrill Lynch Global Research

Chart 4: Third factor correlated with policy divergence



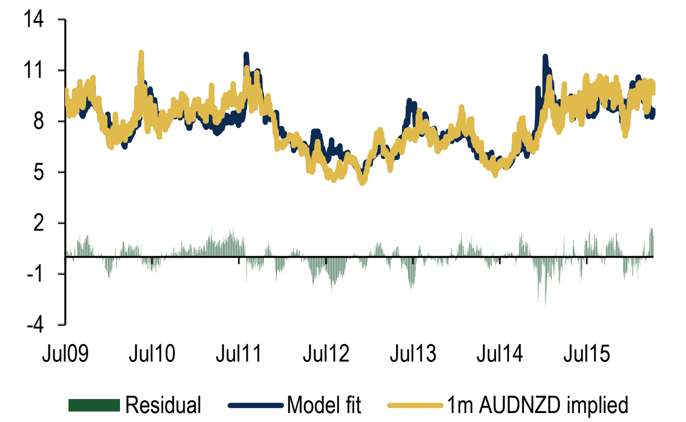
Source: BofA Merrill Lynch Global Research
The absolute deviation of 5 year EU-US spread from its 20y avg

Bank of America Merrill Lynch

Rich/cheap analysis using PCA

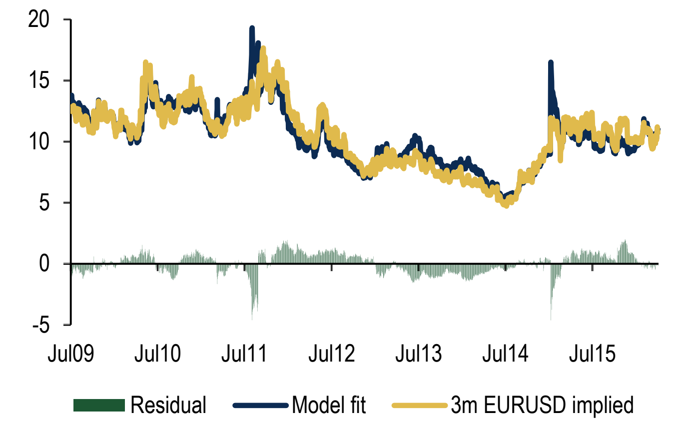
Using PCA as a framework can help identify potential dislocations in price. For example, the EURUSD model fit shows a tendency to lead implied volatility (Chart 6). The intuition behind this is that since the aforementioned PCA factors are not directly observable, the market is inefficient at adjusting prices immediately. Rather, investors and market makers may have a delayed reaction, needing to empirically observe increased realized volatility before properly adjusting their risk-premiums higher.

Chart 5: AUDNZD 1m implied vol is rich vs 3-factor model



Source: BofA Merrill Lynch Global Research

Chart 6: EURUSD 3m implied vol is fair valued vs 3-factor model



Source: BofA Merrill Lynch Global Research

Potential volatility opportunities

Our analysis suggests GBP and CAD family vol are rich, while NOK and SEK vols are cheap (Table 1). While we do not recommend trading solely on a model fit, we think it can be a useful additional tool for valuing vols when combined with other tools such as recent realized vol (Chart of the day: Evaluating FX vol using PCA model). Combining both methods suggests AUD/NZD, EUR/CHF, and EUR/GBP 1m vols are overvalued, while 1m USD/NOK is undervalued.

Table 1: GBP and CAD vols look rich while NOK and SEK vols look cheap

1m implied vol minus model fit (% vol)

	EUR/	GBP/	AUD/	NZD/	USD/	CAD/	CHF/	NOK/	SEK/
/GBP	0.91								
/AUD	0.11	0.83							
/NZD	0.38	1.28	1.23						
/USD	-0.93	1.31	0.25	0.40					
/CAD	1.28	0.94	-0.63	-0.23	1.26				
/CHF	0.78	1.80	0.05	1.13	-0.71	1.54			
/NOK	-0.42	-0.42	-1.62	-0.77	-1.22	-1.58	0.19		
/SEK	-1.60	-0.56	-1.30	-0.02	-2.45	-1.16	-0.85	-0.63	
/JPY	-0.72	1.05	0.01	0.96	0.19	0.60	-0.53	-0.45	-1.40

Source: BofA Merrill Lynch Global Research

Column labels are base currencies and row labels show quoted currencies, corresponding to all 45 G10 FX pairs.

Possible explanations for mispricing

Liquidity constraints and recency bias may contribute to temporary mispricing. NOK and SEK vol may be undervalued due to limited liquidity and greater transaction costs. At the same time, GBP and CAD may be overvalued given their recent outperformance in realized volatility which is not certain to persist.

Notable Rates and FX Research

* Global Rates & Currencies 2016 Year Ahead, 23 November 2015
* Delayed spring for the greenback, FX Quant Trader, 11 April 2016
* Looking for the next big trends, Global Rates and FX Weekly, 15 April 2016
* Uncomfortably numb, US Rates Weekly, 15 April 2016
* The end of the USD sell-off?, Liquid Cross Border Flows, 11 April 2016

Key trade ideas

Top Rates and FX trades for 2016

For rationale and details, refer to Global Rates & Currencies 2016 Year Ahead: The "Great Divorce", 23 November, 2015

Rates:

Buy US 30y TIPS, entry: 1.2%, target: 70bp, stop loss: 1.55%

Closed at 101bp (3 Mar 2016): Short USD 5y5y vs EUR 5y5y, entry: 115 bp, target: 160 bp, stop-loss: 90 bp (3 Sep 2015)

Long $100mn 6m5y ATMF UK vs $100.75mn US rates straddles, net take-in: $126K, target: +450K, stop: -$225K

Sell 3y Fannie Mae debt vs Treasuries, entry: 6bp, stop: 2bp, target: 20bp

Closed at 11bp - Long 12m Treasury bills vs OIS, entry: 1bp, target: -10bp, stop: 7bp

FX:

Buy USD/CNH 6m forward outright, entry: 6.5260, stop: 6.40

Closed at 0% - Buy EUR/USD 3m 1.10 call with a 16 Dec 1.1050 window KO, cost: 0.55% EUR (spot: 1.0690)

Buy 1y EUR/USD<1.00, USD/JPY<120 dual digital, cost: 7.0% USD (spot: 1.0690, 122.80)

Closed at 902 (10 Mar 2016): Buy AUD/KRW, entry: 832, target: 920, stop: 859 (revised from 790)

Sell TRY/JPY, entry: 43.40, target: 36.15, stop: 45.25

Closed at 8.27: Sell USD/NOK spot 8.685, target: 8.27, stop-loss: 8.60 (revised from 9.00)

Existing open trades

Rates:

Long Nov-2020 ACGB, current: 2.13%; target: 1.90%; stop-loss: 2.25%(21 Mar 2016)

Receive 2y1y AUD swap, current: 2.23%, target: 1.90%, stop loss: 2.35% (C&R: 6bp)(21 Mar 2016)

*Tighter financial conditions will weigh on AU rates over time. Positioning is less constrained for lower front-end rates. We target lower yields for Nov-2020 bonds and 2Y1Y swaps that will benefit from better carry.

OATei 2018/2027 flattener; entry: 78.5bp, target: 40bp; stop-loss: 100bp (11 Mar 2016)

* We see ECB developments favoring real yield curve flatteners in four ways. A fifth support is near- and longer-term carry.

1y2y Spain-Germany spread compression trade, enter: 80bp, target: 60bp, stop-loss: 95bp(2 Mar 2016)

* With the disappointing European inflation data, a generalized easing of monetary policy tools with focus is being concentrated on QE, TLTROs and communication instead of a big depo cut. This may not be enough to accommodate current pricing and so we see risks skewed for a selloff in the front-end, favoring a spread compression trade.

Buy €100mn 3m7y ATM/ATM+25bp payer spread (enter: €510K, max payout: 3.4:1)

* Driven by ECB disappointment this week, the 3m7y has an attractive payout ratio vs other expiries/other long tails.

Buy 3-year 3.5% ZC RPI inflation caps, entry: 26.0c (21 Oct 2015)

*Sterling vulnerability due to the UK's large current account deficit makes being long inflation volatility attractive. Pairing this trade with a long-standing recommendation to be short 30-year UK breakevens is an attractive way to finance it.

Buy 1y2y receiver ladders: Buy $200mn of 1y2y ATMF receivers, sell $200mn of 1y2y ATMF-20bp receivers, and sell $200mn of 1y2y ATMF-40bp receivers. Entry: -$90K. Target: $700K, stop-loss: -$350K(1 Oct 2015)

* The trade monetizes the richness of vols to rates and should be profitable in a wide range of Fed scenarios.

Short USD 5y5y vs EUR 5y5y, entry: 115 bp, target: 160 bp, stop-loss: 90 bp(3 Sep 2015)

* Poor performance of bond markets in the equity rout point to the presence of a price insensitive seller in fixed income. Selling pressure from foreign central banks should put less upward pressure on euro area bond yields relative to the US, given the ECB's asymmetric response function.

Own 2y2y BE vs 3s-5s nominal curve flatteners, target: 25bp, stop loss: 15bp (10 Aug 2015)

* Eventually we see one of two scenarios: 1) Forward BEs are wrong and the Fed's expectations of inflation gradually returning to target are realized. 2) Or forward breakevens are right, in which case we are staring at 1.5% PCE even two years out. In this scenario, the 3s-5s curve will probably be much flatter given that hike expectations and terminal rates will get revised lower.

FX:

Buy 3m EURCHF 1.08/1.03 put spread for 0.76% Eur (7.75/8.05 ag 10.45 vols off 1.0930 spot)(1 Apr 2016)

* EUR is underpricing Brexit and that shorting Euro was a cheaper way to express such a view via options. CHF tends to perform strongly when risk become more localized.

Buy EUR/USD 6m 1.00/1.20 strangle for 155 usd pips (off 1.1020 spot, DF two-way vols 12.1/12.3) (29 Feb 2016)

*Owning low delta EURUSD strangles may be an effective and cheap double hedge in the scenario that either the US enters a recession or the European debt crisis resurfaces.

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