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The rise of multi-currency options

In this article, Adrian Campbell-Smith (RBS Currency Options Trading) and Ben Hamdani (RBS Currency Structuring) examine the realm of multi-currency options and explain some of the reasons behind their increasing popularity

Multi-currency options and structures have been integrated into currency markets for quite some time. For years they have been a key part of the retail and investor product scene, but this year – more so than ever before – has seen an increasing number of asset managers using such options to express leveraged views.

Think back a couple of months to the topic everyone was talking about, namely EUR weakness. Not EUR weakness specifically against the USD, AUD or BRL, but EUR weakness, full stop. Expressing this through a vanilla EUR put/AUD call, for example, would have not only been a more expensive route to take, but would also have proved a poorer match to the underlying strategy based on a correlated EUR move lower. Instead, the view lent itself perfectly to a multi-currency worst-of option.

From late January 2010, implied volatilities began to fall steadily across all asset classes. Figure 1 illustrates six-month implied volatility in EURUSD, USDJPY, AUDUSD and USDBRL. Front-end volatilities came under even greater pressure, with realised volatility being tempered by predominantly one-way, trending markets.

Traders faced a dilemma. On one hand, implied volatility was approaching post-Lehman lows, yet on the other hand there seemed to be no end in sight to this trend. Certainly, there were reasons to be nervous (including European periphery, UK elections, occasionally faltering economic data), yet the market was content to save these concerns for another day. Few desks wanted to sell options at these levels, but even fewer wanted to buy – leverage had to be found elsewhere.

1 Six-month implied volatility (at-the-money)

Source: RBS

A rich vein of new strategies has emerged in the multi-currency, or correlation, space. Taking positions in derivatives whose payoffs are determined by the behaviour of several currency pairs at once has opened a wealth of interesting opportunities for traders.

Correlation is a measure of the dependence between two random variables, and is commonly represented by the familiar Pearson correlation coefficient, which takes values from +100% (a perfect positive linear relationship between the variables) through zero (independence) to -100% (a perfect negative linear relationship). In the foreign exchange world, the random variables in question are the percentage changes in currency pairs. Since there are markets in virtually every currency pair, including all crosses, foreign exchange is fertile ground for trading correlations.

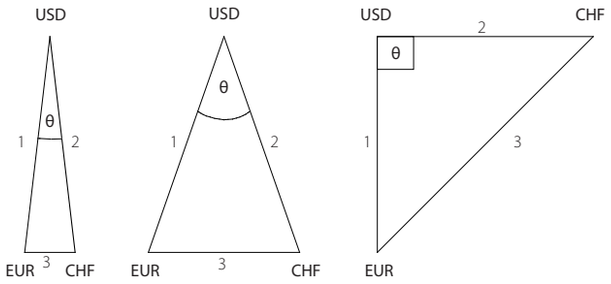
Consider the following simple cross:

$$EURCHF = EURUSD \times USDCHF$$

Imagine that EURCHF is permanently pegged and can never move. Trivial arbitrage arguments require EURUSD and USDCHF to move in opposite directions: when EURUSD strengthens by 1%, USDCHF will weaken by 1%, and vice versa. In this example, EURUSD and USDCHF are perfectly negatively correlated (correlation = -100%). In practice, of course, EURCHF is relatively free to move, but we can nevertheless observe the realised correlation between EURUSD and USDCHF, measuring it through high-frequency tick data or daily changes, and on scales of a few days to a few months or even years. This is in direct analogy with familiar analysis of realised or historic volatility.

Again, as with volatility, we can measure implied correlation, which is the market's expectation of future correlation, and can be derived by studying the implied volatilities of the currency pairs involved. If we return to the EURCHF example above, and let EURCHF move a very small amount around its peg, then its volatility will be virtually zero. In this case EURUSD and USDCHF are virtually perfectly anti-correlated and their implied volatilities must be virtually equal. We can visualise this with an 'implied volatility triangle' (see figure 2), with a currency at each vertex and each side's length in proportion to the implied volatility of the pair. The correlation between EURUSD and USDCHF is related to the angle in the triangle: near perfect anti-correlation is depicted in figure 2a and, as we gradually increase the implied volatility for EURCHF, the other pairs become gradually less perfectly anti-correlated (figure 2b). EURUSD and USDCHF are independent, i.e. have a correlation of zero, when the triangle is right-angled (figure 2c).

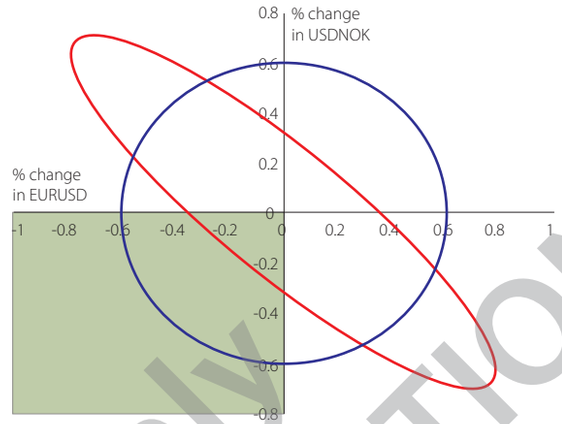
2 Implied volatility triangles



Side 1 = EURUSD implied volatility
Side 2 = USDCHF implied volatility
Side 3 = EURCHF implied volatility
Cos θ = USDEUR/USDCHF implied correlation

Source: RBS

3 The effect of correlation on expected returns from a dual digital option



The blue circle represents the locus of expected returns if EURUSD and USDNOK are independent, and we expect the dual digital to pay out one-quarter of the time (green-shaded region). However, with a strong negative correlation, the expected returns lie inside the red ellipse and the fraction of occasions the dual digital pays out is significantly reduced.

Source: RBS

Traders can bet directly on the divergence between implied and realised correlation by using a correlation swap. This instrument's floating leg is the realised correlation between the daily returns of two currency pairs during the life of the trade (typically three to 12 months), while its fixed leg is set to ensure the swap is zero-premium and is therefore determined by the implied correlation. Since the correlation coefficient has to be between ±100%, the potential profit and loss on a correlation swap are bounded but, as with any zero-premium structure or swap, the investor can both make and lose money on the trade.

As with any market variable, supply and demand effects can strain or distort the pricing of implied correlation. Contracts that couple directional forex bets with plays on implied correlation itself have proven popular in recent months. These contracts include dual digitals, worst-of options and basket options. In contrast to the correlation swap, these contracts do not have explicit sensitivity to realised correlation, but nevertheless implied correlation plays a crucial role in their characteristics and pricing.

Dual digital – this is the multi-currency-pair generalisation of a European digital option; the buyer receives a fixed rebate if two currency pairs are above or below pre-defined target levels at expiry. For example, consider a three-month dual digital that pays out if, at expiry, EURUSD and USDNOK are both lower than spot at inception. This would cost an upfront premium of around USD 10%–11%, compared with roughly USD 50% for either of the single-currency pair European digitals. This large discount is simply because the implied correlation between EURUSD and USDNOK is strongly negative (-70% or so), meaning that the expected distribution of joint returns is strongly skewed toward EURUSD and USDNOK moving in opposite directions (figure 3) and hence not paying out at expiry.

Worst-of option – this is the multi-currency-pair generalisation of a plain vanilla European option; the buyer receives the payout of the worst-performing of several (normally two or three) vanilla options. Vanilla options have more in-built leverage than European digitals because spot has to move significantly beyond the strike to generate significant value. It should therefore come as no surprise that the discounts can be even more eye-catching for worst-of options compared with dual digitals. For the example above, an at-the-money-spot struck worst-of EUR put/USD call and USD put/NOK call would cost approximately USD 0.25%, compared with the two vanillas, which would cost around USD 2.5% each. This discount represents a staggering 90%, leveraging the fact that this option buys EURUSD/USDNOK correlation at -70%.

Returning to strategies benefiting from generalised EUR weakness, it should be evident that a worst-of EUR put versus a basket of other currencies expresses the leveraged view very neatly.

The attainable discounts have led some traders to employ pure worst-of carry strategies. For example, if we shift the strikes on the EURUSD/USDNOK example above to both be 3% in-the-money-spot, the option would cost approximately USD 0.9%. Assuming unchanged spot at expiry, the option would hold an intrinsic value of 3%, or 3.33 times the initial premium outlay. It is clear then why such options proved attractive against a backdrop of falling volatilities – constructed in this way, the embedded cross-currency correlations result in a significantly reduced net vega exposure when compared to vanilla options.

Recognising the growing importance of this suite of products, RBS has built advanced tools to seek out the most favourable currency and strike combinations, thereby providing its clients optimised risk profiles. Advanced risk-management tools have also been implemented to assist RBS with managing the resultant exposures, which in turn enables the bank to perform its role as one of the leading partners in this space. Correlation is an area that the bank views as crucial to the future of the currency options business, and is therefore an area to which it continues to devote significant resources.

RBS™
The Royal Bank of Scotland

Chris Leuschke
Global Head of Foreign Exchange Sales
E: chris.leuschke@rbs.com
T: +44 (0)20 7085 7807

Richard Summerbell
Global Head of Foreign Exchange Structuring
E: richard.summerbell@rbs.com
T: +65 65 188 188

www.rbs.com