RESPONDING TO CHANGE

Purnur Schneider and **Christopher Cruden** at Insch Capital Management in Lugano, Switzerland, use the Black-Litterman model to test strategies designed to work in changing market conditions

Early in the millennium, active currency management was perhaps a little easier. Remember the days when carry and purchasing power parity (PPP) were the main rival strategies and trend was a cool alternative, as a combination of the two?

Then the financial crisis and the credit crunch changed the game. Choppy markets and a roller-coaster of bumps in investor risk appetite decimated the performance of naive strategies of either kind. While sophisticated strategies that perform can still be found, there is no consensus over the profitability of simple trading rules.

Other markets may have found consensus strategies, such as the Markowitz market portfolio in equity investing (suboptimal, both in theory and practice, but popular for its tractability), and extrapolating past returns in the guise of expectations (a poor strategy in most cases; see the bond market for an excellent illustration).

A good indicator of the FX environment can be gleaned from the performance of a family of DB naive strategies' indexes (formerly RBS indexes). In figure 1, one can get an inkling of the succession of risk tolerance regimes and their impact on the FX market during the past five to six years. As the financial crisis deepened, elevated risk expectations proved beneficial for volatility strategies and shattering for carry (DB G10 Carry Index, see box, overleaf).

When volatility started to fall, both these indexes' performances reversed. Recently, volatility in FX has fallen to almost pre-crisis levels, despite the financial crisis not being completely over yet, so plain carry may have a chance – but who can tell that volatility may not spike again?

Since the start of 2007, none of the naive strategies have performed satisfactorily, except for brief periods. Sophisticated and large investors may find ways to extract information from market prices and events or collect arbitrage returns. Where simple strategies fail, what can the un-sophisticated investor do, absent computing power and analyst manpower? Is there an easy shortcut to a satisfactory trading strategy? In the following, we illustrate the application of a possible solution – the Black-Litterman model, which combines a naive strategy with an investor's private views – and test it with real forex market data.

Black-Litterman model

The Black-Litterman allocation model generates a portfolio by starting from a set of neutral weights (therefore called baseline portfolio) and tilting it in the direction of the investor's views. The size of the tilt depends on the investor's conviction. In its original form, the model updates the prior expectations resulting from an equilibrium market model with the investor's private views obtained from a proprietary model.

In the Black-Litterman portfolio, the weight of an asset is higher than its analogue in the baseline portfolio if the investor is more bullish than the market on that particular asset, and vice versa. In addition, the weight increment is higher as the investor's confidence in the view, also called the view strength, grows.

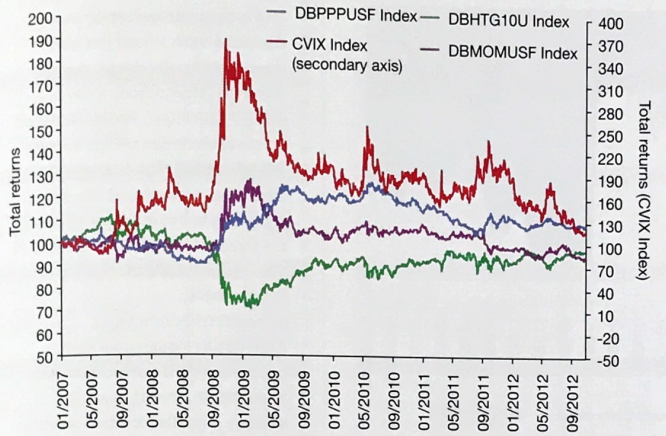
We start by specifying the baseline model and calculating prior baseline expectations. Then we construct private views and the investor's confidence in the views (strength). Finally, we update the baseline expectations with the private views tempered by their strength.

A. Baseline portfolio

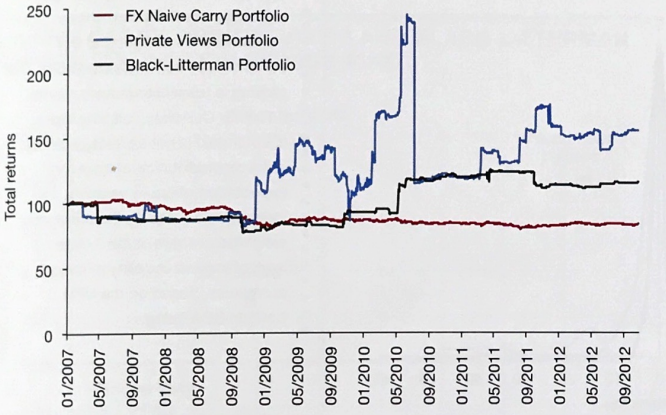
In the following, we shall apply the model to the G-7 FX market. We do not make use of a market portfolio of G-7 currencies.

"Recently, volatility in FX has fallen to almost pre-crisis levels, despite the financial crisis not being completely over yet, so plain carry may have a chance – but who can tell that volatility may not spike again?"

1. NAIVE SYSTEMATIC DB STRATEGIES –TOTAL RETURNS



2. BLACK-LITTERMAN PORTFOLIO VERSUS NAIVE CARRY



Instead, we will use as baseline portfolio a naive carry strategy, whereby the investor buys long a currency pair if it is associated to a positive interest rate differential. For example, if the key interest rate in AUD is 4.5% and in CHF it is 2.0%, the investor will allocate a portion of its trading portfolio to the AUD/CHF pair, that is, long AUD and short CHF. In the naive model, the proportions allocated to each currency pair are equivalent.

The advantage of this baseline portfolio is its simplicity and ease of construction. Besides, in "normal" times, such a portfolio may even perform, as empiricists have shown. However, in times of turmoil, the currencies used for funding carry trades quickly become "safe havens" and carry profits reverse. Returning to the DB G10 Carry Index in figure 1, we see that the index lost about 30% in the bleak autumn of 2008. While it has performed relatively well since 2009, there is no guarantee that bad times will not occur again (just consider the ongoing euro crisis and the possibility of a black swan event).

Entering private views in the portfolio through a Black-Litterman model may shield the investor from ruin or substantial drawdowns in such eventuality.

Our naive portfolio is a buy and hold allocation beginning in 2007 and carried until October 26, 2012. According to the average sovereign interest rates at the beginning of 2007, such a portfolio would have allocated equal parts to the following 17 currency pairs: AUD/JPY, AUD/CHF, AUD/EUR, AUD/CAD, GBP/EUR, GBP/CAD, GBP/CHF, GBP/JPY, USD/EUR, EUR/JPY, EUR/CHF, EUR/CAD, CAD/JPY, USD/CHF, USD/JPY, USD/CAD and CHF/JPY. Interest rate differentials have changed since then, but our baseline strategy does not take the changes into account.

Given the naive weights and the observable covariance matrix of the currency pairs held in the portfolio, the implied or reverse return expectations of the naive investor can be calculated. We will call these baseline or prior expectations.

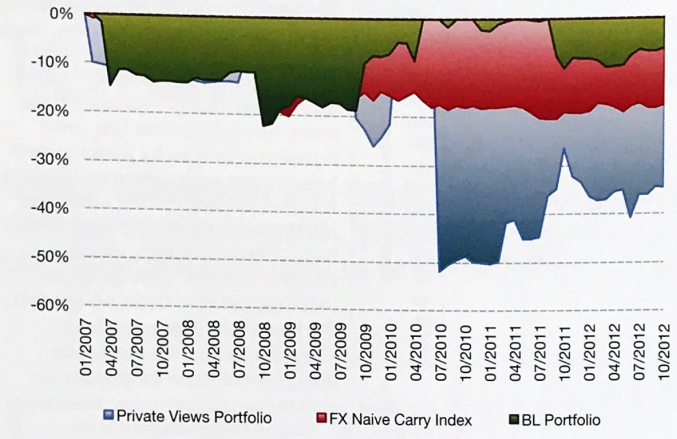
B. Private views

The original Black-Litterman model provides no guidance in setting the private views. These views may come from anywhere: media, analyst forecasts or factor models. We prefer the latter. First, because we are adept at systematic trading. Second, because econometric estimations produce not only expected values (views), but also standard errors of estimates (view strengths).

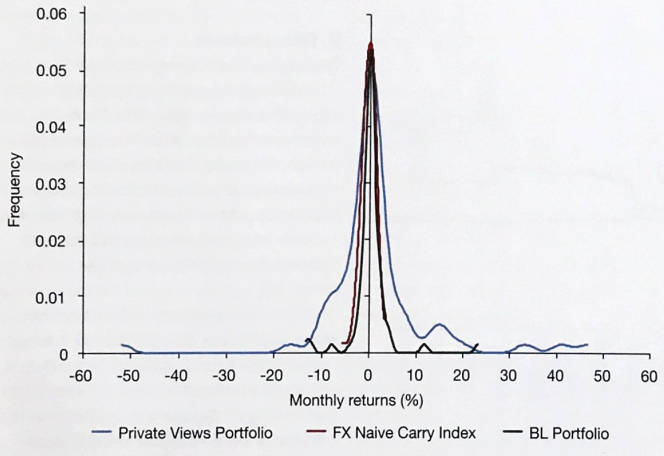
To keep things simple, our factor model uses a single factor the past 22 working days' returns series in each currency pair. The private views consist of extrapolations of the daily rolling 22-day average and they have a confidence matrix attached in the form of the standard error of the 22-day average estimates. In our example, the views on a currency pair are independent from the views on other currency pairs, but this assumption can be relaxed.

A mean-variance investor having full confidence in this view would allocate the portfolio entirely according to the views, the risk aversion (which we infer from the realised returns of the baseline portfolio, assuming the expectations are realised) and the covariance matrix between the currency pairs.

3. DRAWDOWNS



4. KERNEL DISTRIBUTION



C. Updated returns and BL portfolio

Both portfolios obtained at A and B result in unacceptable return patterns (for any sane investor). As shown in figure 2, the baseline portfolio accumulates losses, while a portfolio built solely from the private views is extremely volatile. One is too naive, while the other ignores the degree of uncertainty contained in the views. Luckily, an improved allocation can be achieved by combining the views with the baseline model while taking into account the views' strength.

The Black-Litterman asset allocation model uses the Bayesian approach to infer the assets' expected returns. The inference starts with a prior belief, embedded, here, in the naive allocation (originally, the prior beliefs were market equilibrium returns). Additional information is derived from the private views and used along with the prior beliefs to infer the posterior distribution of expected returns. We may also call these expected returns posterior views.

The posterior views are in the form of updated expected returns and an updated covariance matrix. These are used in conjunction in order to construct optimal portfolio weights, using a Markowitz mean-variance optimisation.

Black-Litterman model results

We have tested the procedure using the methodology outlined in the paper *Global Portfolio Optimization* by F Black and R Litterman and in the *Investments* book by F Bodie, A Kane and AJ Markus. A number of

HOW THE INDEXES ARE CONSTRUCTED

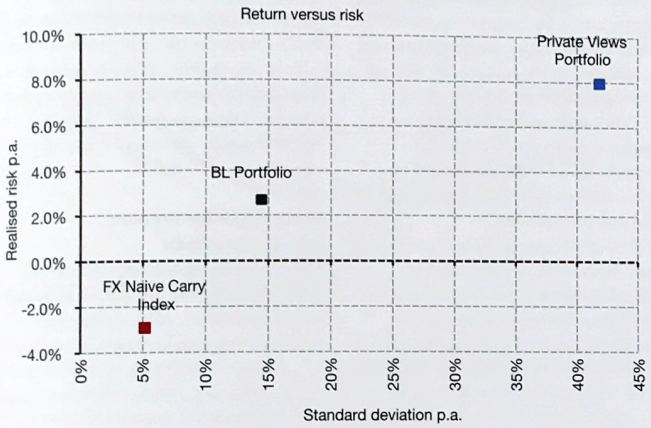
The indexes proposed by the Deutsche Bank Index team are constructed in the following ways:

- The DB G10 Valuation Index (DBPPPUSF Index) trades long/short on the extreme departures from the PPP prediction. The strategy buys the three most undervalued currencies according to this measure, and sells the three most overvalued currencies. The exposures are reassessed every three months.
- The DB G10 Carry Index (DBHTG10U Index) ranks each quarter the G-10 currencies by their three-month interest rates. The strategy buys the top-three yielding currencies and sells the bottom-three yielding currencies.
- The DB G10 Momentum Index (DBMOMUSF Index) ranks currencies by their 12-month changes in spot exchange rates. The top-three performers are bought and the bottom-three currencies are sold. The ranking is reassessed every month.
- The DB Currency Volatility Index (CVIX Index) is not a strategy *per se*, but a representation of investors' expectation of future volatility. The index is calculated as the arithmetic weighted average of the 3-month level of implied volatility of major currencies, based on the 4PM London BBA fixing.

RANKING

Strategy	Ranking	Avg ranking
BL Portfolio	1	1.82
Private Views Portfolio	2	1.94
FX Naive Carry Index	3	2.24
Compounded average return p.a.		
BL Portfolio	2	2.70%
Private Views Portfolio	1	7.96%
FX Naive Carry Index	3	-2.93%
Cumulative return		
BL Portfolio	2	16.79%
Private Views Portfolio	1	56.31%
FX Naive Carry Index	3	-15.95%
One-year holding period return		
BL Portfolio	2	6.01%
Private Views Portfolio	1	14.34%
FX Naive Carry Index	3	-3.49%
Standard deviation p.a.		
BL Portfolio	2	14.47%
Private Views Portfolio	3	41.84%
FX Naive Carry Index	1	5.23%
One-year holding period std. dev.		
BL Portfolio	2	3.71%
Private Views Portfolio	3	11.62%
FX Naive Carry Index	1	1.49%
Return/risk ratio		
BL Portfolio	2	0.19
Private Views Portfolio	1	0.19
FX Naive Carry Index	3	-0.56
One-year holding period return/risk		
BL Portfolio	1	1.62
Private Views Portfolio	2	1.23
FX Naive Carry Index	3	-2.34
Average return positive months		
BL Portfolio	2	2.36%
Private Views Portfolio	1	7.39%
FX Naive Carry Index	3	1.00%
Average return negative months		
BL Portfolio	2	-1.53%
Private Views Portfolio	3	-4.95%
FX Naive Carry Index	1	-1.34%
Skewness		
BL Portfolio	1	1.76
Private Views Portfolio	2	0.33
FX Naive Carry Index	3	-0.50
Excess kurtosis		
BL Portfolio	3	15.50
Private Views Portfolio	2	8.90
FX Naive Carry Index	1	1.36
Best month return		
BL Portfolio	2	23.25%
Private Views Portfolio	1	46.64%
FX Naive Carry Index	3	3.25%
Worst month return		
BL Portfolio	2	-13.25%
Private Views Portfolio	3	-51.84%
FX Naive Carry Index	1	-5.54%
Historical VAR (5%)		
BL Portfolio	1	-1.47%
Private Views Portfolio	3	-7.84%
FX Naive Carry Index	2	-2.01%
Compounded return p.a. / VAR		
BL Portfolio	1	1.84
Private Views Portfolio	2	1.01
FX Naive Carry Index	3	-1.46
Largest drawdown		
BL Portfolio	2	-22.31%
Private Views Portfolio	3	-51.84%
FX Naive Carry Index	1	-20.45%
Compounded return p.a. / largest DD		
BL Portfolio	2	0.12
Private Views Portfolio	1	0.15
FX Naive Carry Index	3	-0.14

5. NAÏVE CARRY, PRIVATE VIEWS AND BLACK-LITTERMAN PORTFOLIOS, RETURN VERSUS RISK



other papers such as TM Idzorek's *A Step-By-Step Guide to the Black-Litterman Model"* were of great help in understanding the Black-Litterman methodology as well.

We find that the portfolio obtained by applying the Black-Litterman procedure outperforms both the baseline portfolio and the private views portfolio on average for a number of criteria, displayed in the table above. Drawdowns are significantly improved both in size and duration, as displayed in figure 3. The Kernel distribution of returns in figure 4 shows the Black-Litterman portfolio distribution of returns has volatility comparable with that of the baseline portfolio, and significantly lower than that of the private views portfolio.

In figure 5, it becomes even more obvious that the Black-Litterman portfolio outperforms the other two portfolios. In fact, it acts as a diversified portfolio made of the two strategies – naive and private views. The crucial improvement respective to other diversified portfolio constructions is that in the Black-Litterman portfolio each period's weightings are determined by the strength of the private views.

The results are not excellent but satisfactory, considering the fact we started from a very naive baseline portfolio and a very basic rule for constructing the private views. The results can be improved by refining these views. Nevertheless, we find there is great value in applying the Black-Litterman model to reduce the calamitous effect of misguided private views.

Christopher Cruden established Insch Capital Management SA in Switzerland during 2004. He has been involved in the alternative investment industry for more than 30 years. Purnur Schneider joined Insch as an Associate Director in 2011 and is responsible for the company's security and market research notes and commentary, quantitative and qualitative analysis of investment products, performance reviews, internal and client reports

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