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Relative Value on Curve vs. Butterfly Trades

INVESTMENT STRATEGIES: NO. 22

- • We show that slope spreads at the front end of the yield curve are highly correlated to fly spreads at the long end of the curve and vice-versa

- • We argue that highly correlated slope/fly spreads can be interpreted as rival trades reflecting the same underlying view

- • We show that rival curve and butterfly trades are often priced inconsistently, giving rise to relative value opportunities

- • We illustrate the framework by looking for an efficient way of expressing a steepening view on the EUR swap curve

- • We believe a EUR 2/5y bear-steepening view can currently be efficiently expressed via the EUR 5/10/15y conditional fly via payers

Finding trading rules that can be applied to a wide spectrum of market conditions is an ambitious goal. As trade ideas usually originate from investors looking to express macro views in the marketplace, the selection process is very much a subjective task. The probability of making money on a specific trade depends on both the investor's view proving to be correct as well as the performance of the trade proving to be effectively consistent with that view.

In this note we suggest a framework to assess the relative merit of different curve trades, which helps in the trades selection process. We first look at highly correlated spreads on the EUR swap curve, interpreting them as rival trades expressing the same view on the curve. Building on this relationship, we then rank the different trades on the basis of their yield cushion. The results of the analysis show that, despite the high degree of correlation, rival trades are often priced inconsistently in the rates market, thus creating trading opportunities. We conclude that this 'relative value' approach to trades selection can be used to efficiently express specific views in the fixed-income market as well as to find 'pure' relative value trades.

In the following we discuss this method of analysis, examining in particular the possibility of replacing EUR slope trades with more efficient EUR fly trades, relying on the historical tight slope/convexity relationship on the swap curve. More specifically, we focus on the high correlation existing between the 2/5y and the 5/10y curve spreads relative to the 5/10/15y and the 2/3/5y fly spreads respectively (in the following, the fly spreads are all specified as the body minus half the wings and are 50:50 risk weighted).

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Comparing the slope and the convexity of the EUR yield curve

Both sophisticated models fitting the yield curve and simple regression analyses indicate that the slope and the convexity of the yield curve share common drivers, the most important being the level of rates (for an in depth discussion of curve models see "*Fitting the Euro swap curve*" European Rates, April 7, 2006). This explains the high degree of slope/ convexity correlation observed historically. A steepening of the yield curve is usually associated with the 'hump' of the curve moving towards longer maturities and hence with the long end becoming more convex. In the same way, the flattening of the yield curve usually calls for increasing convexity at the short end. This empirical evidence can be demonstrated by comparing the 2/5y curve to the 5/10/15y and the 5/10y curve to the 2/3/5y fly. In both cases, the slope/convexity relationship looks tight and stable over time. Putting it differently, long end butterflies are related to front end slopes and vice-versa.

Considering the past 10-year history, we find that the 2/5y curve is 94% **positively correlated** to the 5/10/15y fly spread (chart 1). The more the 2/5y curve steepens, the more the hump moves towards longer maturities. The 10-year sector becomes the pivotal point of the yield curve, with 10-year yields rising faster than the combination of 5-year and 15-year yields. Vice-versa, with the 2/5y curve flattening, the 5/10/15y curvature tends to become less pronounced. As can be expected, regressing the 5/10/15y fly on the 2/5y curve gives a very good fit, with a beta of +0.24 and a standard error of 3bp.

In the same way, the 5/10y curve is 94% **negatively correlated** to the 2/3/5y fly spread (chart 2). Historically, a flattening in the 5/10y curve corresponds to the hump shifting towards shorter maturities, thus cheapening the 3-year sector versus the combination of 2-year and 5-year yields. Vice-versa, with the 5/10y curve steepening, the level of the 2/3/5y fly tends to decline. Again, regressing the 2/3/5y fly on the 5/10y curve, gives a beta of -0.20 and a standard error of 1.5bp (the case of the 5/10y curve vs. 2/3/5y fly is discussed in the last paragraph).
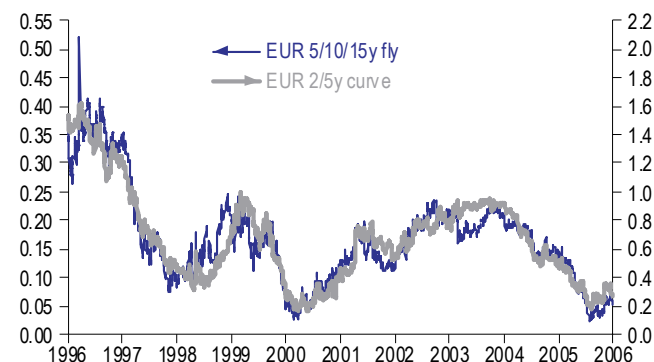
2/5y steepener or buy the 5/10/15y fly?

Consider an investor looking to express a 2/5y curve steepening view. The relationship described above suggests the investor can look for an alternative, highly correlated butterfly trade as a potential replacement to the outright 2/5 steepener trade. Provided that the two spreads show high

correlation, the investor will in fact be fairly indifferent between the rival trades, as they will *a-priori* both look consistent with his view. We have shown that the 2/5y curve shows high positive correlation with the 5/10/15y fly spread, which therefore could be bought by the investor as an alternative trade expressing the same view.
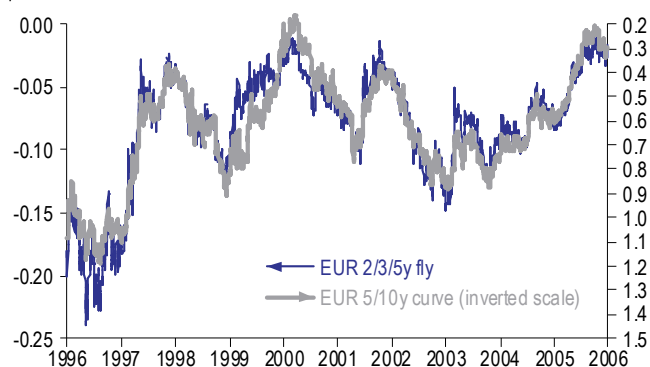
How do we select between the two strategies? In the following we suggest one simple approach to ranking highly correlated trades, by looking at a measure of yield cushion. The larger the yield cushion, the better the trade. In particular, when trades are expressed on an outright basis, we assume that the yield cushion results from their relative rate slide. When trades are expressed on a conditional basis, the yield cushion arises from the combination of the relative rate slide and the relative spread in implied volatility. Intuitively, as the yield cushion is connected to the passage of time, it is conceptually similar to a measure of carry.

Chart 1. 5/10/15y fly 94% positively correlated to 2/5y curve

Source: JPMorgan

Chart 2. 2/3/5y fly 94% negatively correlated to 5/10y curve

Source: JPMorgan

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From time to time additional relative value opportunities may arise from the slope/butterfly relationships moving out of line. We assess the relevance of the dislocations by means of analysing the residuals estimated from running the regressions in charts 1 & 2.

Comparing the outright trades

Assuming unchanged spot curve, the yield cushion of an outright position over a certain period of time is given by its rate slide (note that we calculate the slide as the mere difference between the spot and the forward spread). When comparing two correlated trades, the investor will thus prefer the trade offering the largest positive slide. Since the amount of slide is usually proportional to the amount of risk implied by the trade, a trade offering better slide will also generally entail a higher level of risk. However, as the two trades may involve a significantly different amount of risk, the absolute level of the slide will represent a biased measure of the merit of the trade. As the risk of a trade can be approximated by its volatility, adjusting the slide for the level of volatility allows obtaining comparable measures of yield cushion.

Going back to our example, the 3-month slide on a 2/5y curve steepening position is currently worth 4.4bp, compared to the 0.3bp slide from buying the 5/10/15y fly. Therefore, the yield cushion of the steepener trade looks much better in absolute terms. Because the 2/5y spread has been historically more volatile than the fly, we need to adjust the slide for the relatively different risk of the two trades. As previously discussed, regressing the 2/5y curve on the 5/10/15y fly, gives an estimated beta of 0.24, indicating that, on average, the fly is four times less volatile than the 2/5y curve. Adjusting for the estimated beta, the risk-adjusted slide increases to 1.2bp. In the end, the yield cushion of the 2/5y curve still looks higher and, given the high correlation

of the two trades, the 2/5y curve outright steepening still looks preferable to buying the fly.

Comparing the conditional trades

The same trades can be analysed in the swaptions market, with the relative spread in implied volatility representing an additional element of differentiation. When considering two highly correlated spreads, their relative implied volatility can in fact be expected to reflect their almost identical historical directionality. In our example, given the high positive slope/concavity correlation, the 2/5y implied volatility spread can thus be expected to almost equal the 5/10/15y implied volatility spread, once adjusted for the estimated beta. Quite surprisingly, this is not the case at current market levels.

Considering swaptions expiring in three months, the 2/5y implied volatility spread is currently trading at 0.38bp/day, while the 5/10/15y implied volatility spread is 0.07bp/day **negative** – equivalent to beta-adjusted -0.29bp/day. Therefore, from a pure volatility perspective, buying the 5/10/15y implied vol spread looks significantly cheaper than buying the 2/5y implied vol spread.

The issue can also be addressed from a different angle. With 5-year rates expected to be 0.38bp/day more volatile than 2-year rates over the next three months, the options market is in fact pricing the 2/5y curve to steepen in a sell-off (and flatten in a rally). On the other hand, it is discounting 10-year rates to outperform wings in a sell-off, as implied volatility on 10-year rates is lower than the combination of 5-year and 15-year rates volatility. Interestingly, the options market valuation of the two trades contrasts with the high positive correlation illustrated in chart 1. According to current implied volatility levels, with yields rising, the 2/5y curve should steepen and the fly spread should decline, which would be

Chart 3. 3-month rate slide
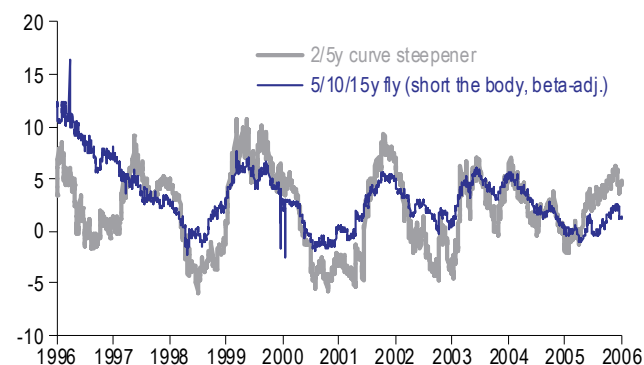
Source: JPMorgan

Chart 4. 3-month rate slide

Source: JPMorgan

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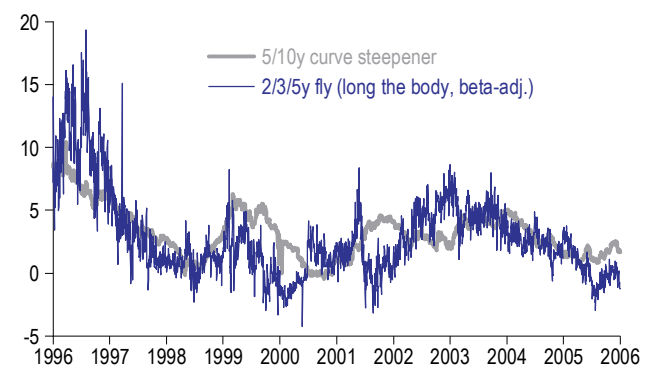
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clearly in contrast with the two spreads positive correlation. Swap option volatilities are effectively discounting the two spreads to be negatively correlated over the next three months.

We quantify the risk-adjusted vol pick-up on the conditional fly as being positive and worth 1.8bp, whereas it is 2.4bp negative on the bear-steepener (chart 5). The rate slide and the volatility components can be added together forming the total yield cushion of the two conditional trades. The 3-month yield cushion on the conditional fly is worth 2.4bp, resulting from 0.6bp positive rate slide (i.e. the rate slide multiplied by the delta of the ATM options), and 1.8bp positive volatility pick-up. On the other hand, the 2/5y bear-steepener is showing 0.3bp negative yield cushion (2.2bp rate slide plus -2.5bp implied vol pick-up).

In contrast to the results from comparing the outright trades in the previous paragraph, the analysis of the conditional trades indicates that the 5/10/15y fly is offering better entry levels than the 2/5y bear-steepening (chart 7). As we first pointed out in the April 12 issue of Rate Derivatives Flash "*EUR 5/10/15y fly attractive in a sell-off*", we conclude that the 2/5y curve bear-steepening position can therefore be more efficiently expressed by buying the conditional fly (struck with payer options).

One caveat from combining the rate slide and the volatility pick-up into a single figure is that they may not be regarded as comparable measures. While the rate slide represents an uncertain figure – depending on the changes in the shape of the yield curve over a certain period – the implied volatility spread reflects the current ATM option prices differential, which is a certain credit/debit upfront.

Assessing the dislocated residuals

The residuals of the regression between competing spreads may represent an additional factor of interest when comparing rival trades. Given the high level of correlation, any significant divergence in the relative trajectory of the two spreads can be expected to be short-lived and can thus be interpreted as a relative value opportunity. In general, the faster the dislocated residuals are expected to mean-revert, the larger the potential return. In the same vein we adjusted the slide for the risk of the position, the speed of mean-reversion has to be considered in assessing the potential return from the dislocated residuals.

Chart 5. Implied vol spread on 3-month options
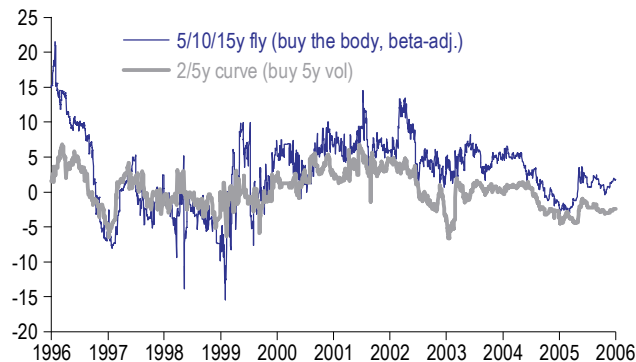
Source: JPMorgan

Chart 6. Implied vol spread on 3-month options
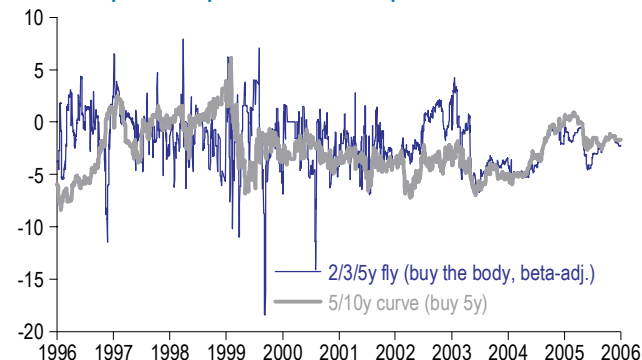
Source: JPMorgan

Chart 7. 3-month total yield cushion on the conditional trades

Source: JPMorgan

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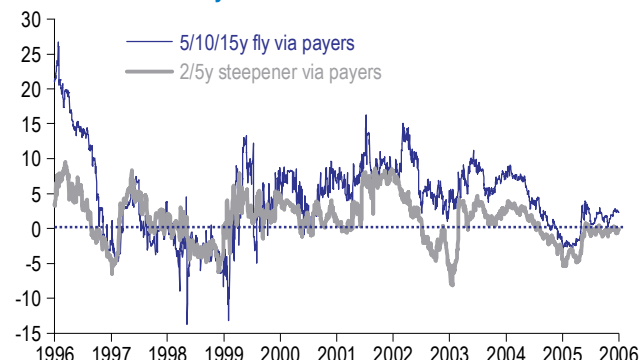
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In our example, Chart 9 shows the residuals from regressing the 5/10/15y fly on the 2/5y curve. With the hypothetical investor looking to enter a 2/5y steepening, the 5/10/15y fly seems to offer better entry levels, with the dislocation being equal to some 6bp (2/5y curve equivalent). The average mean-reverting period of the regression's residuals is one month (albeit occasionally they have diverged for a few consecutive months). Consistently with the one month mean-reversion, the relative yield cushion over one month should be considered.

Whether the dislocated residuals have to be included in the computation of the yield cushion is debatable. The rate slide and the dislocated residuals clearly have a different origin, the latter being a pure statistical measure of relative value. However, they do also share important characteristics, as the return from both of them is undetermined, depending on how the shape of the yield curve changes over a given period.

EUR 5/10y steepener or sell the 2/3/5y fly?

We apply the same analytical approach to the 5/10y curve relative to the 2/3/5 fly, which provides further interesting results. As shown in chart 2, the two spreads are 94% negatively correlated, meaning that in case an investor is looking to enter a 5/10y steepener, he might instead consider receiving the belly of the 2/3/5y fly. Considering the outright trades, the 3-month rate slide on the 5/10y steepening is 1.7bp positive, while the risk-adjusted slide on the fly is 1.2bp negative (chart 4). Given the high negative correlation of the two spreads, the 5/10y outright steepening trade looks preferable to selling the fly. Expressing the trades via options does not significantly change the results we got from the comparison of the outright trades. The level of the implied volatility spreads does not look appreciably different, consistent with the high correlation of the 2/3/5y fly and the 5/10y curve (chart 6). Finally, the residuals estimated from the 2/3/5y fly vs. 5/10y curve regression do not look significantly dislocated and can thus be ignored (chart 10). In the end, the analysis suggests that selling the 2/3/5y fly does not seem to offer a valid alternative to the 5/10y steepener trade.

Chart 8. 3-month total yield cushion on the conditional trades

2/3/5y fly via receivers
5/10y steepener via receivers
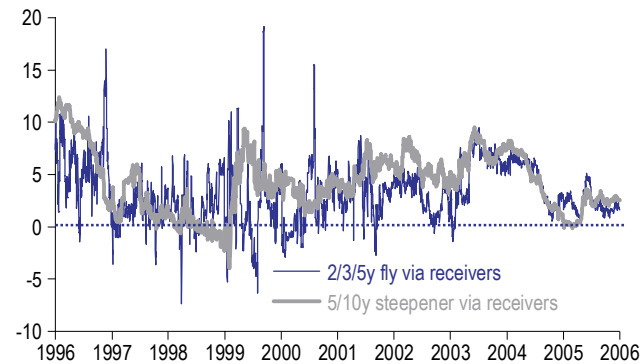
Source: JPMorgan

Chart 9. 5/10/15y fly vs. 2/5y curve

Residuals

Source: JPMorgan

Chart 10. 2/3/5y fly vs. 5/10y curve

Residuals

Source: JPMorgan

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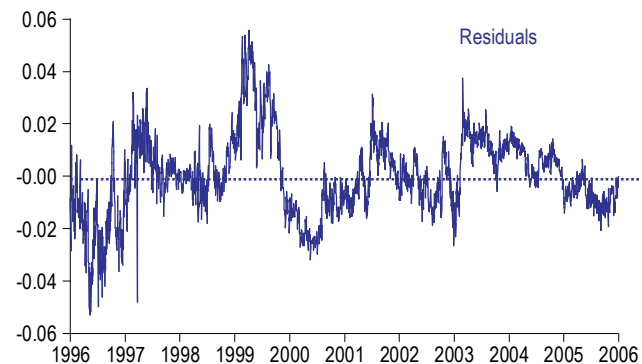
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