Completed 03 Feb 2017 04:39 PM EST
Disseminated 03 Feb 2017 05:09 PM EST

J.P.Morgan

North America Fixed Income Strategy
03 February 2017

An option by any other name

Sourcing cheap convexity in the long end of the curve

- Owing to convexity differentials between tenors, PVBP-weighed curve trades have an options-like payoff profile under large moves in rates.
- Returns in the very long end are particularly exposed to this effect. For example, the vast majority of P/L variance for 30s/50s flatteners over the past ten years is attributable to convexity effects.
- We introduce a relative value framework for comparing these exposures to alternative sources of convexity, particularly swaptions.
- We find that the yield curve is frequently a cheaper source of long gamma risk, especially in risk-off events.
- An empirical backtest suggests that forward curve flatteners (e.g., 25Yx5Y versus 20Yx5Y) are a more attractive and cheaper source of this exposure than 30s/50s and similar structures.
- This is consistent with a pick-up in activity in this sector over the past few years.

US Fixed Income Strategy

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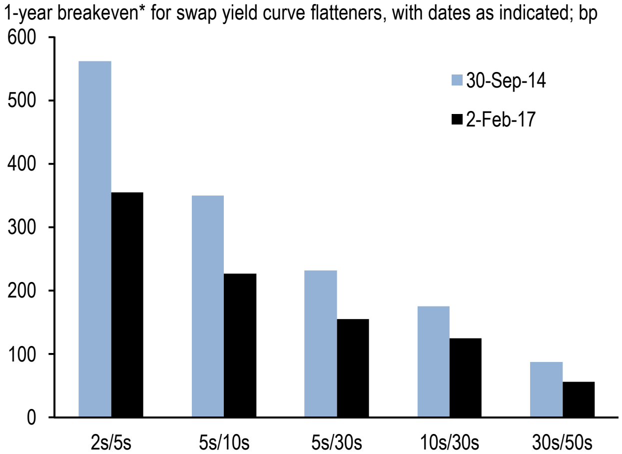
Introduction

When seeking out exposure to convexity in interest rate markets, the tendency is to focus on options, either explicitly (e.g., swaptions or options on Treasury futures) or embedded in other products (e.g., mortgages and callable bonds). **However, though often overlooked, the yield curve in principle provides another mechanism for sourcing gamma risk**. This arises from convexity differentials between swaps of differing maturity, which introduces options-type payoffs under large moves in rates. For example, consider a 5s/30s flattener exposure under a large and sustained parallel shift in the curve: as rates rise, receive-fixed positions in the longer tenor (which is losing money) will lose dollar duration more quickly than the pay-fixed position in the shorter leg (which is making money), resulting in a positive P/L—and vice versa in a rally. **In this way, flattening exposures on the curve have a positively convex payoff under large enough moves in rates**.

Exhibit 1: The flatness and stability of the long end makes this sector much more appealing for constructing convex payoffs via forward curve flatteners…

1-year breakeven* for swap yield curve flatteners, with dates as indicated; bp



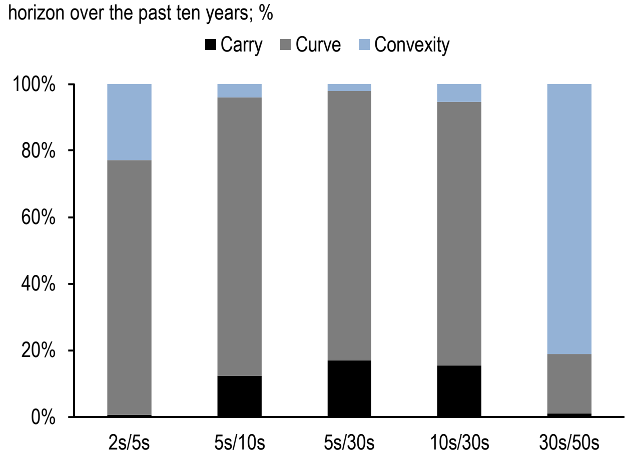
* Minimum parallel shift in the swap yield curve to break even on a 1-year forward flattener held to spot—i.e., to offset the carry cost.

Source: J.P. Morgan

Even so, at the risk of sounding glib, there is no free lunch. **Similar to the premium paid for a long options position, flatteners typically carry negatively**. As a result, though the payoff profile of gamma-adjusted curve positions are similarly shaped, the much lower carry costs at the long end make breakeven moves in rates much more achievable. For example, in **Exhibit 1**, we consider the parallel shifts required to breakeven for a number of curve pairs spanning a wide range of tenors. The results demonstrate that P/L on 10s/30s and especially 30s/50s flatteners are much more likely to be profitable absent volatility in the curve itself. Further, these breakevens in general have come down as carry has been extracted from USD rates in the years since the taper tantrum of 2013. That said, since the curve itself can be volatile, it is also important to consider the relative contribution of changes in slope, carry, and convexity to the P/L on these trades over a longer horizon. **The results confirm that gamma exposure is best sourced in the very long end, where shifts in rates are more frequently parallel and carry costs lower, leading to the vast majority of the variance in P/L on flatteners being attributable to convexity returns (Exhibit 2)**.

Exhibit 2: …and partly as a result a much higher fraction of the variance in P/L for 30s/50s trades is explained by convexity effects than shorter maturity curve exposures

Fraction of the variance in P/L* for curve trades by pair held over a 1-year horizon over the past ten years; %



* P/L calculated for 1-year forward flatteners initiated daily and held to spot. Carry is based on the *ex-ante* difference between spot and forward, curve is the change in the spot curve over the trade horizon, and convexity is the remainder versus total trade P/L.

Source: J.P. Morgan

Given this backdrop, the question then becomes one of relative value. In other words, we require a framework for deciding whether long-end flatteners are a cheap or rich source of gamma compared to other instruments—particularly options. **In this piece we introduce a methodology for doing so, and specifically compare long-end flatteners to swaption straddles to decide which is the better source of long gamma exposure**.

A relative value framework

The first step in evaluating relative value is estimating the probability of the range of potential outcomes. To do so, we start with the payoff profile of a given curve

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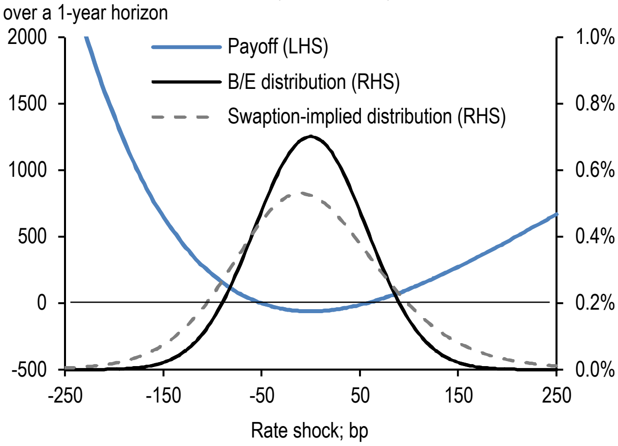
position, and calculate the expected payoff given an assumption around the terminal distribution of moves in rates over a given horizon.

To estimate those probabilities, we first turn to the options markets, where an implied distribution can be extracted from ATMF and OTM pricing for each expiry. This is then multiplied with the payoff profile of an aged flattener at fixed coupon—primarily to incorporate carry costs—to estimate an expected return. Since, as discussed above, these trades tend to be located in longer-dated swaps, we use 1Yx30Y swaptions for a 1-year horizon and assuming parallel shifts in rates.

Alternatively, we can solve for the implied volatility priced into the long end of the yield curve. This can be accomplished by making a specific assumption for the terminal distribution of rates—in our case a normal distribution, again with parallel shifts in the curve—and solving for zero expected payoff over a given horizon. In other words, we are estimating the level of normal daily volatility in rates that is sufficient to offset the carry costs on a given curve trade.

Exhibit 3: The width of the breakeven distribution of terminal rates on long-end flatteners over a given horizon can differ—and is frequently narrower—than that implied by co-expiry swaptions

Payoff profile* (LHS; bp), breakeven implied distribution† (RHS; bp of notional), and swaption-implied distribution** (RHS; unitless) for a 30s/50s flattener held over a 1-year horizon



* Net P/L for a spot 30s/50s flattener under parallel shifts in rate, with coupons equal to the 1-year forward rates.

† A normal distribution of terminal rate shifts centered on zero with standard deviation fit to produce a probability-weighted payoff of zero assuming parallel shifts in rates.

** The terminal distribution of rate shifts implied by ATMF and OTM 1Yx30Y swaption pricing.

Note: All data as 1/31/17.

Source: J.P. Morgan

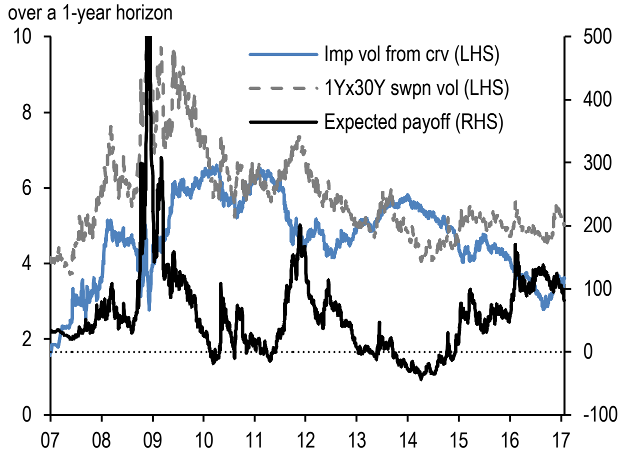
Examples of both distributions as well as the payoff profile of a 30s/50s flattener over a 1-year horizon are shown in **Exhibit 3**. **Both measures can be interpreted as a relative value signal for curve convexity trades versus swaptions**. When the expected payoff on a flattener using an implied distribution extracted from swaption pricing is positive, the curve trade is the cheaper source of long gamma exposure. The same can also be said when the level of volatility priced into the curve is less than that implied by ATMF swaptions.

Sourcing cheap gamma in long-end flatteners

Given the relative value framework described above, we turn to results for commonly traded curve pairs. Though expected payoff and implied volatility comparisons have some key differences, they are unsurprisingly highly correlated. Starting with 30s/50s, we see significant variation in the relative cheapness of this flattener as a source of gamma relative to swaptions (**Exhibit 4**). Overall, however, the curve tended to be the better source of convexity. This is particularly notable around the financial crisis of 2008, during which the implied volatility priced into the curve was relatively consistent even as vols rose dramatically. **This suggests that the relative stability of the very long end under such circumstances keeps carry costs manageable even as swaptions are very well bid, and suggests the former will outperform in a risk-off trade**.

Exhibit 4: Our framework suggests the yield curve is frequently the cheaper source of gamma, particularly in a risk-off event

Implied volatility for 30s/50s flatteners and 1Yx30Y swaptions (both in bp/day; LHS) and expected payoff for 30s/50s flatteners (bp of notional; RHS), both over a 1-year horizon



Note: For details, see Exhibit 3.

Source: J.P. Morgan

Though intuitive, our relative value framework also makes some assumptions that motivate empirical

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verification of the results. This is because our signal is premised in part on an assumption of roughly parallel moves in rates for the sector under consideration; if the curve is sufficiently volatile over the trade horizon, in principle other P/L drivers could dominate. We therefore backtest a strategy trading the curve versus swaptions using expected payoff as an *ex-ante* trading signal. When this measure is positive, we initiate a flattener and sell 1Yx30Y ATMF swaption straddles to fund the carry on the position (i.e., sized such that the initiate premium intake is equal to the carry over the same 1-year horizon); when it is negative, we do the opposite. We also need to consider other structures in the long end, particularly forward curves such as 25Y/20Yx5Y and other similar pairs, which in principle—and, it turns out, in practice—could offer cheaper access to curve gamma than vanilla 30s/50s flatteners.

Exhibit 5: Backtesting a trading rule based on our relative value framework suggests that it is more reliable when applied to longer-dated forwards

Performance of 25Y/20Yx5Y and 30s/50s flatteners versus 1Yx30Y ATMF swaption straddles over a 1-year horizon for trades initiated after Jan-2009

Statistic	25Y/20Yx5Y	30s/50s
% cheap curve gamma	100%	70%
Hit Rate	86%	56%
Avg PnL; bp of notional	11.4	10.4
Carry; bp of notional	1.1	-100.6
25th/75th pct P/L; bp of notional	4 / 19	-43 / 75
5th/95th pct P/L; bp of notional	-10 / 33	-140 / 128

Note: We size the option premium to the carry as of trade initiation assuming a 1-year horizon and calculate the payoff on the curve flattener including convexity effects. When carry is negative we sell ATMF straddles, and when it is positive we buy. % cheap curve gamma refers to positive *ex-ante* expected payoff on the flattener using the swaption-implied distribution; when this is negative we reverse both directions of both trades. Trades are initiated daily.

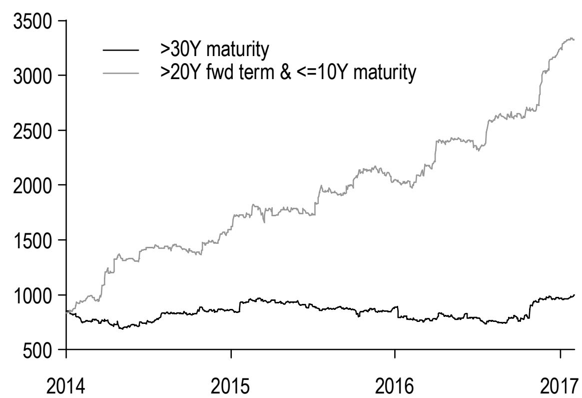
Source: J.P. Morgan

We therefore perform an empirical backtest employing a simple trading rule, the results of which are summarized in **Exhibit 5**. Specifically, we initiate flatteners when the curve is cheap using our relative value framework, and fund the carry by selling 1Yx30Y ATMF swaption straddles. **The first and most important conclusion is that, generally speaking, the distribution of returns validates our relative value framework, with positive P/L and a high hit rate since early-2009**. **Further, the forwards appear to be a more attractive way to source long-end convexity, given lower carry costs—not infrequently positive in fact—with both more consistent and significant cheapness versus swaptions**.

More anecdotally, this conclusion is consistent with recent trends in trading activity. Though SDR data are only available for the past few years, they show a material increase in the quantity of long-dated swaps, particularly in forward space. This is coincident with a rise in the expected payoff of such trades using the swaption-implied distribution—in other words, activity has picked up as the curve has looked like an increasingly cheap source of long gamma risk. **Further, the duration-adjusted flows clearly favor the forward curve flatteners rather than spot, which is consistent with the above finding of more consistent cheapness and better performance of our relative value measure (Exhibit 6)**.

Exhibit 6: The cheapening of forward flatteners as a source of gamma and greater reliability of relative value frameworks is consistent with the sizeable increase in activity in these trades

Rolling 1-year average daily trading volume in long-dated swaps in both spot and forward space; $mn of 10-year equivalents



Note: Based on SDR trade reporting, and therefore subject to regulatory caps on reported size.

Source: J.P. Morgan, DTCC

Conclusion

In summary, we find that convexity returns are a significant driver of P/L in very long-end flatteners. We also introduce a relative value framework comparing these exposures to other source of long gamma risk, particularly swaptions. **The results suggest that the curve is often a cheaper source of convexity, particularly in a risk-off event**. Specifically, we find that forward curve flatteners (e.g., 25Yx5Y versus 20Yx5Y) more frequently trade cheap, and with better relative value than 30s/50s. Though liquidity in this sector can be a constraint, we recommend adding exposure when possible.

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