The Road to Profitability is Paved with Volatility-Adjusted Carry

US Interest Rate Strategy

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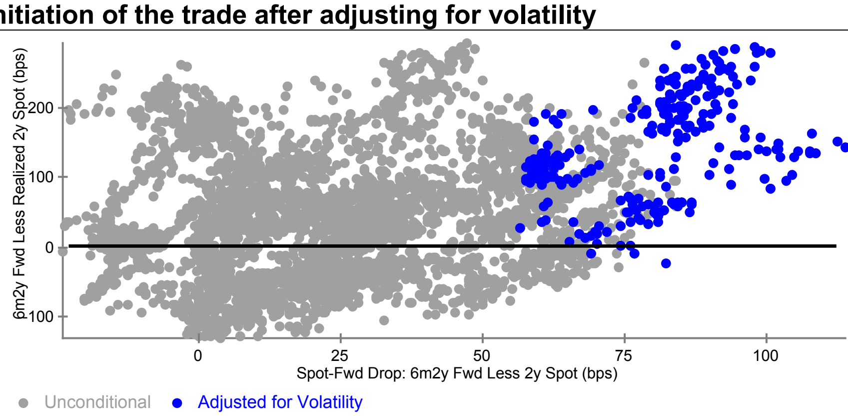
- When evaluating trades within a carry/rolldown framework, we strongly recommend that investors factor into their analysis market levels of volatility.
- Since investors earn the full carry/rolldown in a scenario that assumes an unchanged reference yield curve, investors are implicitly short volatility in positive carry/rolldown swap trades.
- Contrary to the widely held belief that positive carry drives profitability, we find no correlation between terminal P&L and carry at the initiation of the trade. However, we find that elevated levels of positive carry adjusted for market volatility are a consistent indicator of future profitability.
- Under current market conditions, carry and rolldown are most elevated at the front end of the yield curve.
- After accounting for levels of market volatility, we favor receiving outright in 6-month forward-starting 2-year swaps.
- Carry and rolldown are most elevated for the 5s30s and 2s10s steepeners across the spectrum of curve trades and are also at the high end of their historical range.
- After accounting for market levels of volatility, we favor establishing 1-year forward-starting steepeners in 5s30s. We also favor 1-year forward 2s10s steepeners but will wait for better entry levels
- These trades should be suitable for investors who believe that the Fed will fail to deliver on the implied hikes priced into the curve resulting in the forwards failing to get realized.

Exhibit 1: Terminal P&L to six-month horizon on receiving in a 6-month forward 2-year swap is correlated to carry/rolldown at the initiation of the trade after adjusting for volatility



Source: Credit Suisse Locus

The Road to Profitability Is Paved with Volatility-Adjusted Carry

When evaluating the attractiveness of any swaps trade (outright, curve, or fly), carry and roll are important factors to consider in the analysis. Carry and rolldown reflect the potential return on a swaps position assuming an unchanged scenario for a reference yield curve (for example, the par swap curve or the forward swap curve) over some given fixed horizon.

- Specifically, "carry" is the portion of the expected return that is attributed to the net income earned between the various payments that are received and paid out to the horizon date.
- "Roll-down" is the portion of the expected return that is attributed to the capital gains/losses on the swaps positions if the reference curve remains unchanged and the trade simply ages, resulting in an MTM at a lower swap yield.

Positive carry should be adjusted for market levels of volatility to determine whether investors are being adequately compensated for implicit short vol exposure

While carry and roll reflect only the potential return that investors earn for a very specific "unchanged" scenario for a reference yield curve and not the actual realized return in the presence of yield curve volatility, they are still useful measures in judging the attractiveness (positive carry and roll) or punitiveness (negative carry and roll) of various swaps trades. Since trades that carry positively and have positive rolldown are implicitly short volatility, we show later in this report, they should be compared relative to market levels of volatility in order to evaluate whether investors are being adequately compensated for selling volatility albeit implicitly. Trades based on the carry/rolldown framework are assumed to be static positions held to a fixed horizon (although they need not be due to forced unwinds and adverse MTM). In contrast, the trading of short-term dislocations in risk premia of market spreads needs to be managed more dynamically based on the strength of the dislocation from fair value and is beyond the scope of this report. However, it is worthwhile to note that in both frameworks, investors are implicitly selling the tails of some underlying distribution and are implicitly short volatility.

Below we review the carry and roll calculations for both spot and forward starting swaps, swap curves, and swap flys. Additionally, we recommend several preferred measures used to determine the optimal points in swaps space from a carry-and-roll perspective. Most of this analysis can be done on Locus, the Credit Suisse online analytics platform. (Please contact your Credit Suisse sales representative to gain access to Locus.)

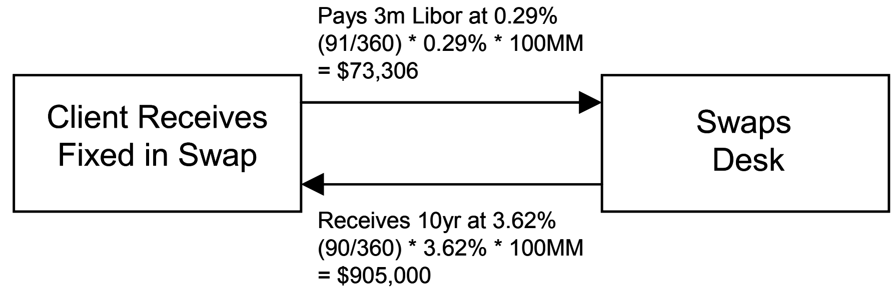
Spot-Starting Swaps

Income carry is the net interest payment earned on a spot swap

The expected total return on a spot-starting swap is comprised of the net fixed versus floating payments earned (income carry) and changes in the valuation of the swap when rates remain unchanged (rolldown). Because by definition the NPV of a swap is zero only when the forwards are realized, an unchanged rate scenario that fails to follow the forwards would always result in changes in the swap's valuation.

For a simple example, when an investor receives a 10-year swap fixed at 3.62% and pays floating at 3-month LIBOR 0.29% on $100MM notional, the net income carry for a three-month horizon is $831,694. See Exhibit 2.

Exhibit 2: When the 10-year rate exceeds 3-month Libor, receiving fixed in swaps is a positive carry trade



Source: Credit Suisse Locus

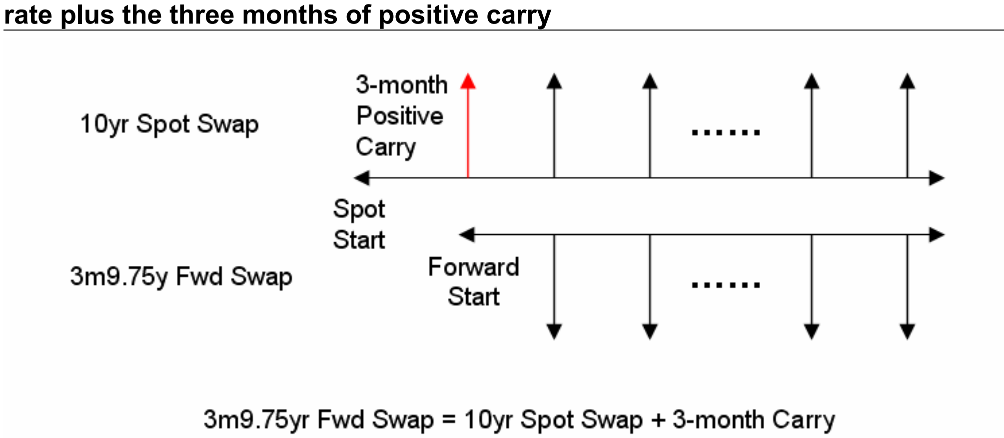
This positive carry earned for receiving fixed serves as a cushion for higher rate moves over the next three months. To determine how much rates can increase before the investor starts to lose money (mark-to-market loss exceeds the positive carry), we take the carry and divide it by the DV01 on the position ($86,254) as of the 3-month forward date. Note that the forward DV01 is used rather than the spot DV01 because we are trying to calculate the breakeven three months from now. The breakeven rate change over a three-month horizon in this case is 9.6 bps ($831,694/$86,254). In the context of an investor receiving fixed on the 10-year swap, the positive carry earned over the next three months can offset up to 9.6 bps of a sell-off. Thus, the breakeven rate level is 3.72% (3.62% + 0.096%), which is also equal to the 3-month forward 9.75 year swap rate.

The forward rate is the break-even rate at which investors are indifferent between receiving on a spot or forward basis

If the forward rate equaled the spot rate, investors can simply receive fixed on the spot-starting swap and pay fixed on the 3-month forward-starting swap with the same final maturity to earn positive carry risk-free. Thus, forward rates are just spot rates adjusted by the breakevens so that investors are indifferent between receiving in a spot-starting 10-year swap or in a 3-month forward-starting 9.75 year swap.

Put differently, the carry on a spot-starting swap can also be calculated by subtracting the spot-starting swap rate from the forward-starting swap rate with the same final maturity. The positive carry in rate terms (9.6 bps) can be calculated from the difference between the 3-month forward 9.75 year swap (3.72%) and 10-year spot (3.62%) and can be converted to dollar carry by multiplying by the DV01 of the forward-starting swap. (See Exhibit 3).

Exhibit 3: Receiving fixed in a 10-year swap will carry positively over three months and will age into a 9.75 year swap. Using arbitrage principles, today's 3-month forward 9.75-year swap rate must equal the spot-starting 10-year swap rate plus the three months of positive carry

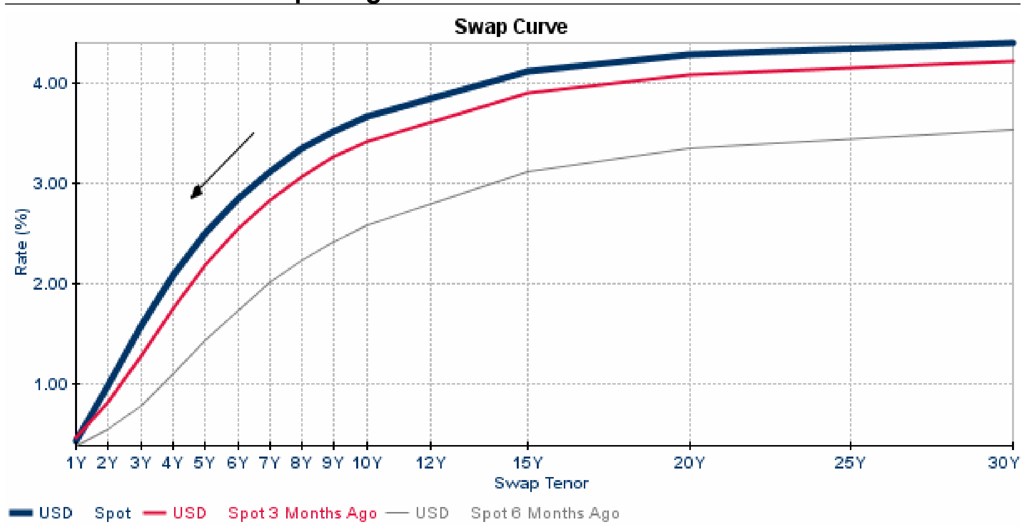


Source: Credit Suisse Locus

Rolldown on a spot-starting swap is the capital gains/losses if the par swap curve is unchanged to the horizon date

The rolldown on a spot-starting swap is the capital gains/losses the investor would achieve if the par swap curve remains unchanged to the horizon date. In the example above, the 10-year spot-starting swap at 3.62% would become a 9.75-year swap at 3.62% in three months. But because at 3.59%, the market rate for a 9.75-year swap would be assumed unchanged, the mark-to-market on the 10-year swap, which has aged by three months would change and in this case favorably (3.0 bps). The change in mark-to-market is referred to as "rolldown" because visually the aged swap is simply rolling down the rate curve. Together, the three-month carry and roll for receiving fixed in 10-year swap is 12.6 bps. (To create Exhibit 4 on Locus, please go to Rates->US Swap & Volatility Analytics and click on the Swap Curves and Roll Page under Swap RV Tools.)

Exhibit 4: Rolldown has increased sharply at the front end of the yield curve on the back of recent steepening

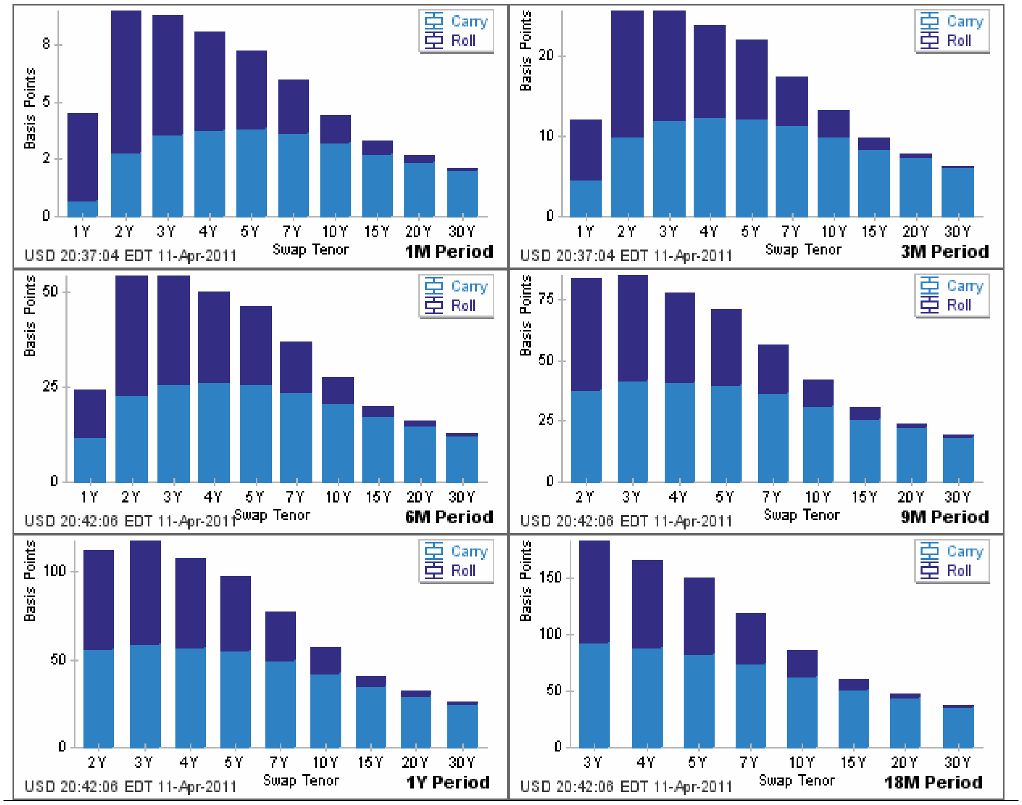


Source: Credit Suisse Locus

Zero volatility return assuming the par swap curve remains unchanged is the just the sum of carry and rolldown

Exhibit 5 highlights carry and rolldown over different time horizons for various spot-starting swaps from a receiving fixed perspective. (These can be generated by going to the Rates->US Swap and Volatility Analytics tools on Locus and then clicking on the Carry and Roll page under Swap RV Tools.) Note that receiving front-end rates (other than very short rates such as one-year swaps) offers the most attractive carry and rolldown. Rolldown makes up a big part of the zero volatility returns for front-end swaps, but it is insignificant for 30-year swaps. This speaks directly to the steepness in the front end of the curve, which is pricing for aggressive Fed tightening beyond 2011. The attractive rolldowns on two- and three-year swaps represent the potential returns that investors can earn for receiving fixed if front-end par rates remain unchanged in a zero-volatility environment.

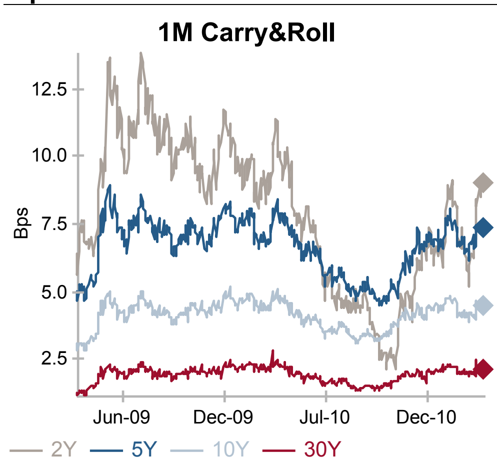
Exhibit 5: Rolldown (dark shading) represents the largest component of a zero-volatility return at the front end while carry (light shading) represents the largest component of a zero volatility return at the back end



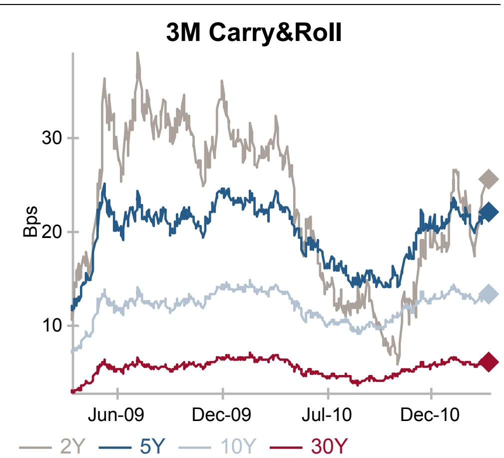
Source: Credit Suisse Locus

Historical time series (Exhibit 6) show that carry and rolldown on two-year swaps have only recently exceeded the carry and rolldown on five-year swaps when the market started to price for aggressive Fed tightening on the back of less-dovish Fed rhetoric and FOMC minutes. (The time series in Exhibit 6 can be generated by double clicking on cells in the carry and roll table found on Rates->Swap and Volatility Analytics-> Swap RV Tools-> Carry and Roll page on Locus.)

Exhibit 6: The front end now has the largest zero volatility return as the market reprices for a more restrictive Fed



Source: Credit Suisse Locus



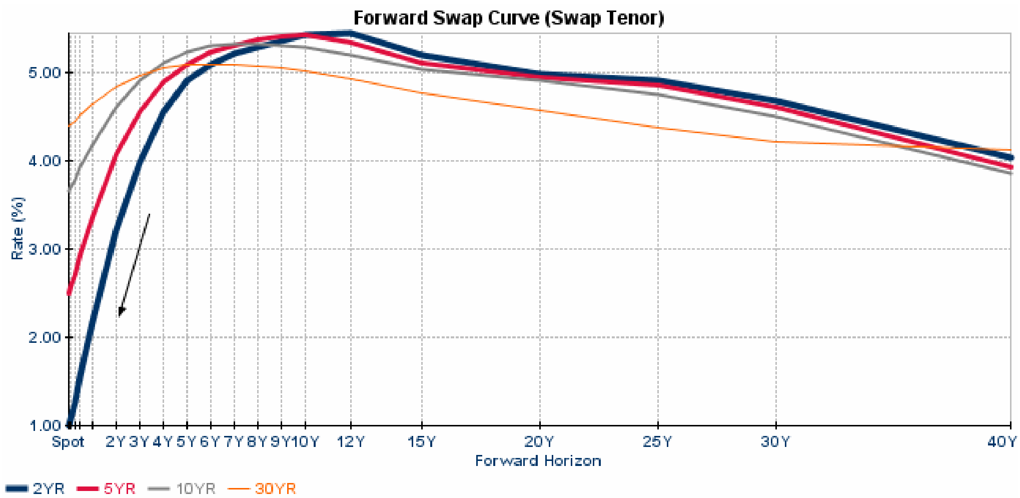
Source: Credit Suisse Locus

Forward-Starting Swaps

Zero volatility return assuming the forward curve remains unchanged is due to capital gains/losses alone since there is no exchange of interest payments

Unlike spot-starting swaps, no actual interest payments are exchanged in forward-starting swaps. Thus the expected total return on a forward-starting swap is comprised entirely of the capital gains/losses on the swaps assuming rolldown along the forward curve with none due to income carry. Investors think of rolldown for forward-starting swaps in terms of forward/spot "drop." Assuming an "unchanged" scenario to a horizon date, a forward-starting swap would simply become closer to a spot-starting swap as it ages, or rolls down from the forward to spot (the drop). Note the difference in the zero-volatility assumption for a spot-starting versus forward-starting swap; the former assumes an unchanged par swap curve, the latter an unchanged forward curve for a fixed underlying swap tenor.

Exhibit 7: Rolldown to spot along the forward curve is the greatest for two-year tenors



Source: Credit Suisse Locus

In an upward-sloping par swap curve environment, the forward-spot drop initially increases as the forward settlement date increases but eventually starts decreasing (see Exhibit 7). (To create this chart on Locus, go to Rates->US Swap & Volatility Analytics and click on the Swap Curves and Roll Page under Swap RV Tools.) To compare the rolldown to spot across varying forward settlement dates and underlying tenors, use the average monthly rolldown instead, which is simply the drop to spot divided by the number of forward-starting months.

Average monthly spot-forward rolldown is the highest over short settlement dates on short tenors due to the steepness of the front end of the par swap curve

Currently, the six-month forward-starting 10-year swap rate is 3.89% versus the spot 10-year swap rate of 3.62%. The average monthly spot-forward rolldown is simply the forward rate less the spot rate divided by the number of forward months, or approximately 4.44 bps per month = (3.89%-3.62%)/6. The grid below in Exhibit 8 shows that the six-month forward settlement offers the highest average monthly spot-forward rolldown on the 10-year tail. Across the entire forward rate surface (thinking of forward settlement dates and underlying swap tenors as the two dimensions of the surface) however, the highest average spot-forward rolldown is found on shorter forward settlement dates on short tenors. This grid can be generated on Locus by going to the Rates->US Swap & Volatility Analytics and clicking on the Forward and Volatility Grids page under Volatility RV Tools. Then select the "Average Roll Down per Month (bps)" field in the drop-down menu. The time series in Exhibit 9 can be generated by double clicking on a cell in this grid.

Note that the spot-forward rolldown for the forward curve and rolldown for the par swap curve are closely related concepts

As a technical aside, for a forward curve on a fixed underlying tenor, the spot-forward rolldown initially increases (see Exhibit 7) reflecting the steep yield pick at the front end of the par swap curve per unit extension of DV01; put differently, the rolldown at the front end of the par swap curve (See Exhibit 4) is the steepest. For the same reason, the forward curve for a fixed underlying tenor eventually slopes downward as in Exhibit 7; the yield pick-up per unit extension of DV01 declines at a rapid rate as the rolldown contribution progressively declines beyond the 10-year maturity of the par swap curve (see Exhibit 5).

Exhibit 8: The highest average monthly spot-forward roll down is over short settlement dates on short underlying tenors

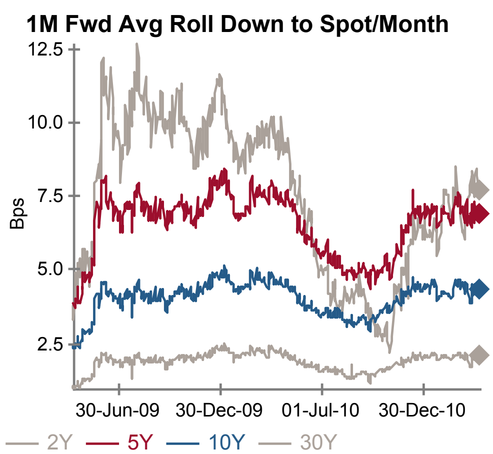
	Swap1YR	2YR	3YR	4YR	5YR	6YR	7YR	8YR	9YR	10YR	15YR	20YR	30YR
Spot													
1M	4.04	8.39	8.17	7.29	6.92	6.24	5.62	5.18	4.52	4.28	3.14	2.54	2.04
3M	5.36	8.65	8.40	7.80	7.13	6.39	5.73	5.17	4.72	4.40	3.21	2.58	2.07
6M	6.85	9.19	8.75	7.97	7.24	6.45	5.79	5.21	4.77	4.44	3.23	2.60	2.08
1Y	9.11	9.77	8.94	8.05	7.22	6.40	5.73	5.18	4.72	4.40	3.19	2.59	2.06
2Y	9.80	9.34	8.36	7.44	6.57	5.80	5.18	4.69	4.30	3.99	2.87	2.33	1.85
3Y	8.98	8.37	7.43	6.53	5.74	5.06	4.52	4.10	3.77	3.50	2.48	2.02	1.60
4Y	8.13	7.45	6.53	5.71	5.00	4.41	3.95	3.59	3.29	3.05	2.14	1.74	1.37
5Y	7.25	6.54	5.70	4.96	4.34	3.84	3.44	3.13	2.86	2.64	1.83	1.48	1.16
7Y	5.64	5.04	4.38	3.83	3.36	2.98	2.66	2.41	2.18	1.99	1.36	1.09	0.83
10Y	4.15	3.72	3.23	2.81	2.45	2.14	1.89	1.68	1.51	1.36	0.91	0.73	0.53
15Y	2.68	2.35	2.00	1.70	1.46	1.25	1.09	0.96	0.85	0.77	0.49	0.36	0.21
20Y	1.90	1.67	1.42	1.20	1.02	0.88	0.76	0.66	0.59	0.52	0.30	0.20	0.07

USD Avg Roll Down per month (bps)

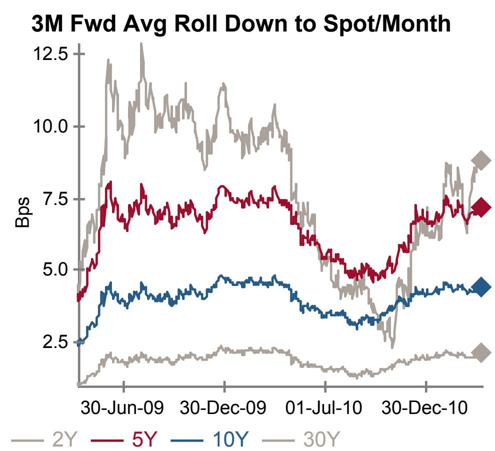
-3 s.d. Z-Score 3 s.d.

Source: Credit Suisse Locus

Exhibit 9: Average monthly rolldown is the greatest for short forward settlement on two-year tenors as the market repriced for sooner Fed tightenings



Source: Credit Suisse Locus



Source: Credit Suisse

Curve Trades

Carry/roll for trades with multiple legs is equal to the net carry/roll of the individual underlying swaps based on their risk weightings

Calculating carry and roll for swap trades with multiple legs simply requires netting the carry and roll of the individual underlying swaps based on their risk weightings. For example, carry and roll for an equal DV01 weighted 2s10s curve steepener is equal to carry and roll on the receive 2-year fixed swap plus carry and roll on the pay 10-year fixed swap (which is equal to the negative carry and roll on the receive 10-year fixed swap). This makes intuitive sense because for a 2s10s curve steepener, the investor is long a 2-year swap and short a 10-year swap. The one-month carry and roll for a 2s10s steepener (4.18 bps) shown in Exhibit 10 is consistent with the netting of one-month carry and roll of the individual swaps (9 bps – 4.82 bps). (Go to Rates->Swap and Volatility Analytics-> Swap RV Tools and click on the Carry and Roll page to generate this table on Locus.)The overwhelming positive carry and roll for nearly all the steepeners conversely suggests that carry and roll on curve flatteners are equally as punitive. The negative carry on the flatteners is consistent with the breakeven flattening that is already being priced by the market, especially for the back end of the curve. For example, the market is currently pricing for 6.25 bps of flattening in 5s30s over the next three months, as reflected in its carry. Thus an investor holding a 5s30s flattener needs the curve to flatten by more than 6.25 bps to be profitable on the trade.

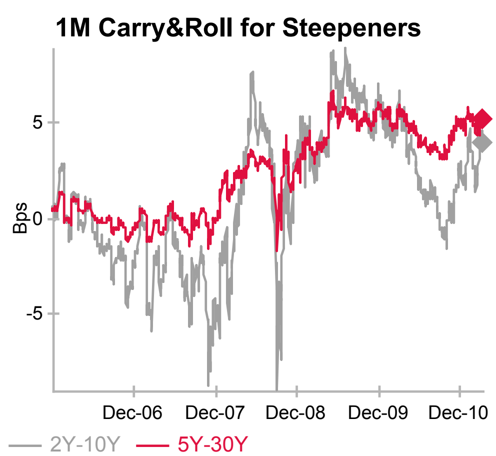
The amount of negative carry associated with the flatteners right now makes it difficult to hold curve flatteners as medium-term structural trades. Although we believe flatteners will ultimately be the right trade, timing will be critical to avoid the negative carry cost. For investors who are looking to put on flatteners immediately, 2s5s is the part of the curve that offers the least negative carry.

Exhibit 10: 5s30s steepeners present the most attractive positive carry and roll

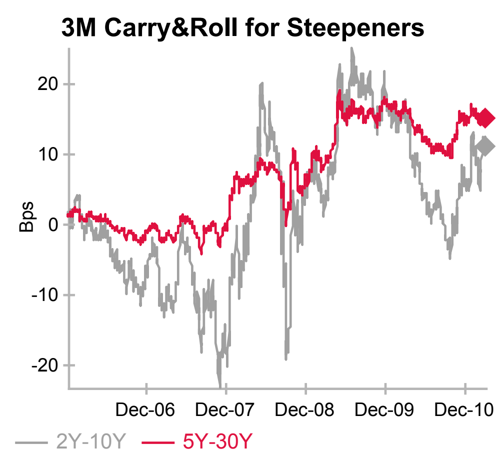
Curve	Spread (bps)	1M			3M			6M			9M		
		Carry	Roll	C+R	Carry	Roll	C+R	Carry	Roll	C+R	Carry	Roll	C+R
1s2s	51.57	-2.10	-2.29	-4.39	-5.09	-8.57	-13.66	-10.49	-19.06	-29.55	-	-	-
2s5s	147.77	-1.19	2.32	1.13	-2.49	5.18	2.69	-3.69	9.62	5.93	-3.17	11.49	8.32
3s5s	90.66	-0.33	1.40	1.08	-0.48	3.48	3.00	-0.21	7.55	7.34	0.97	11.62	12.59
2s10s	265.59	-0.65	4.59	3.95	-0.60	11.66	11.06	0.76	22.77	23.53	4.57	31.60	36.17
3s10s	208.48	0.22	3.68	3.90	1.42	9.96	11.37	4.24	20.70	24.94	8.71	31.73	40.44
5s10s	117.82	0.54	2.27	2.82	1.90	6.48	8.37	4.45	13.15	17.59	7.74	20.11	27.85
5s30s	192.40	1.83	3.36	5.19	5.73	9.50	15.23	12.48	19.59	32.06	20.40	30.16	50.56
10s30s	74.58	1.29	1.08	2.37	3.83	3.03	6.86	8.03	6.44	14.47	12.66	10.05	22.71
20s30s	12.04	0.40	0.16	0.56	1.19	0.38	1.56	2.45	0.79	3.23	3.80	1.21	5.02

Source: Credit Suisse Locus

Exhibit 11: Carry and roll is at the high end of its historical range over the past five years for steepeners



Source: Credit Suisse Locus



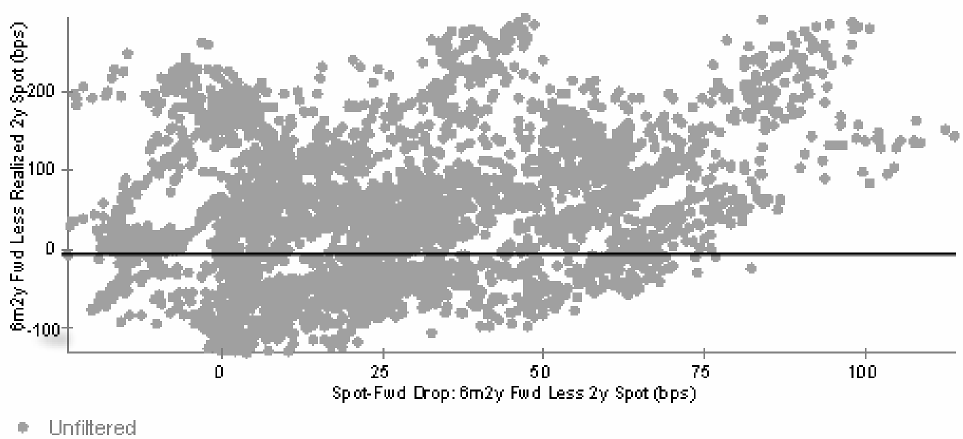
Source: Credit Suisse

Volatility-Adjusted Carry and Roll

As we have noted previously, carry and roll represent only the potential return for a very specific unchanged par swap rate scenario and often not the actual realized return in the presence of yield-curve volatility. Historically, carry and roll have generally not been fully realized because the par swap rate curve almost never stays unchanged.

Looking at receiving fixed on a 6m2y forward swap as an example, the scatter plot below shows the historical three-month rolldown (x-axis: 6m2y forward less 2y spot drop) against the historical realized P&L (y-axis: 6m2y forward less realized 2y spot rate in the subsequent six months). The scatter plot clearly shows no correlation between the expected returns and the realized returns. Additionally, the market generally understated the magnitude of the returns, i.e., the range of zero-volatility returns (spot-forward drop) is much smaller than the range of realized returns.

Exhibit 12: Terminal P&L on receiving in a 6-month forward 2-year swap is uncorrelated to the spot-forward drop at initiation of the trade



Source: Credit Suisse Locus

Adjusting carry/roll for volatility increases the likelihood of carry/roll being earned over time

Because carry and roll represent the expected return for an unchanged par swap rate scenario, intuitively it is more likely that they will be realized in a low volatility environment. Thus rather than looking at carry and roll as a standalone measure, we recommend adjusting it for volatility to take into account the likelihood of carry and roll actually being earned over the defined time horizon. For two swaps that offer the same carry and roll, investors should prefer the one that is likely to be less volatile and has a higher chance of capturing the positive carry and roll.

Our preferred measure of volatility-adjusted carry/roll is a ratio of the forward-spot rolldown in upfront dollar terms, (forward – spot) * forward DV01, divided by the upfront premium for a receiver that expires on the same forward settlement date of the swap. Embedded in the upfront premium is the current level of implied volatility. Exhibit 13 shows the volatility-adjusted rolldown ratios across all forward settlement dates and swap tenors. This grid can also be generated on Locus by going to by going to the Rates->US Swap & Volatility Analytics and clicking on the Forward and Volatility Grids page under Volatility RV Tools. Then select the “Payoff Ratio” field in the drop-down menu.

Exhibit 13: The payoff ratio represents the upfront spot-forward drop as a fraction of the receiver swaption premium

	1yr	2yr	3yr	5yr	7yr	10yr	15yr	20yr	30yr
1m(fwd)	0.90	0.96	0.78	0.58	0.50	0.39	0.31	0.26	0.21
3m	1.74	1.61	1.37	0.99	0.81	0.65	0.51	0.42	0.35
6m	2.12	2.01	1.76	1.36	1.11	0.88	0.69	0.57	0.48
1yr	2.68	2.60	2.34	1.88	1.52	1.20	0.93	0.78	0.65
2yr	3.41	3.25	2.94	2.37	1.90	1.51	1.16	0.98	0.81
3yr	3.80	3.59	3.23	2.55	2.05	1.63	1.25	1.06	0.87
5yr	4.14	3.77	3.33	2.59	2.09	1.65	1.24	1.05	0.86
7yr	4.06	3.65	3.21	2.51	2.03	1.56	1.16	0.98	0.78
10yr	3.92	3.53	3.11	2.41	1.89	1.41	1.02	0.86	0.65
15yr	3.56	3.18	2.75	2.06	1.56	1.12	0.78	0.60	0.37

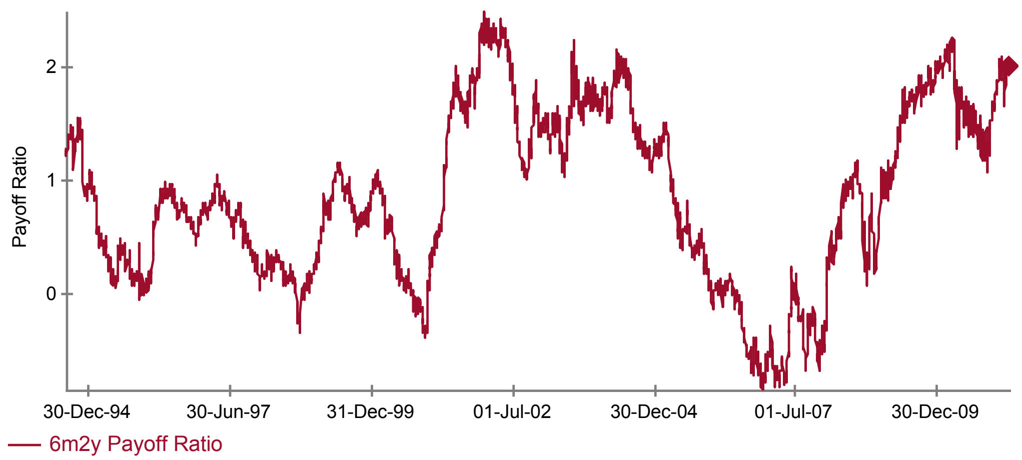
Payoff Ratio — Lower / Neutral / Higher

Source: Credit Suisse Locus

Volatility has not increased commensurately with recent curve steepening at the front end

Going back to our example of receiving fixed on a 6m2y forward swap, we see in the grid above that currently the forward-spot rolldown in dollar term is about 2x the cost of a 6m2y receiver. Even though implied volatility on 6m2y has been increasing recently, which would increase the cost of the receiver swaption, the ratio is actually at the high end of its recent range largely due to the steepening of the forward curve and increasing spot – forward rolldown. Put differently, levels of volatility have not increased commensurately with the recent steepening at the front end.

Exhibit 14: The payoff ratio in the 6m2y sector is at the high end of its historical range (payoff ratio equals upfront rolldown /receiver premium)

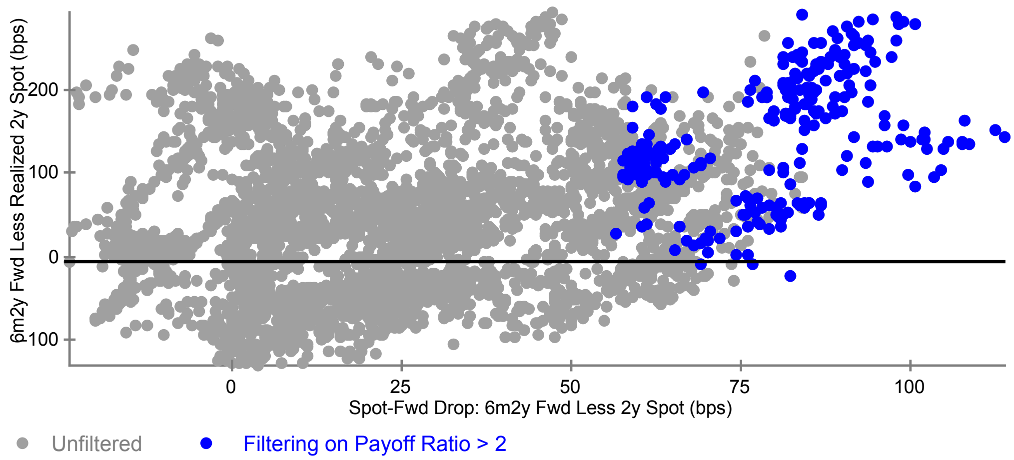


Source: Credit Suisse Locus

Historically, when this payoff ratio is greater than 2.0, receiving fixed in a 6m2y swap has resulted in positive realized returns on all occasions. The filtered result in Exhibit 15 greatly contrasts the unfiltered result from earlier, suggesting that the current steepness in the front end of the curve more than compensates for the level of market volatility. Although historical performance does not guarantee future returns, results from filtering based on the payoff ratio exceeding 2.0 suggest that carry and rolldown can be useful measures in determining value across the curve if investors account for market volatility.

Note that filtering on high levels of the spot-forward drop alone, for example greater than 50 bps, would not be effective in separating potentially winning trades from losing trades.

Exhibit 15: Filtering on the payoff ratio exceeding 2.0 (i.e., curve too steep relative to volatility), favors receiving outright in 6m2y



Source: Credit Suisse Locus

Similarly, we adjust the spot-forward rolldown for market levels of volatility to swap curve trades. Specifically, we look at the 1-year forward-starting 2s10s steepener, which rolls positively down to spot. Historically, the terminal P&L on a 1-year forward 2s10s swap curve steepener has been uncorrelated to the spot-forward drop at the initiation of the trade (grey dots in the scatter plot below). But after adjusting for market volatility, the profitability of positive carrying steepeners increases significantly.

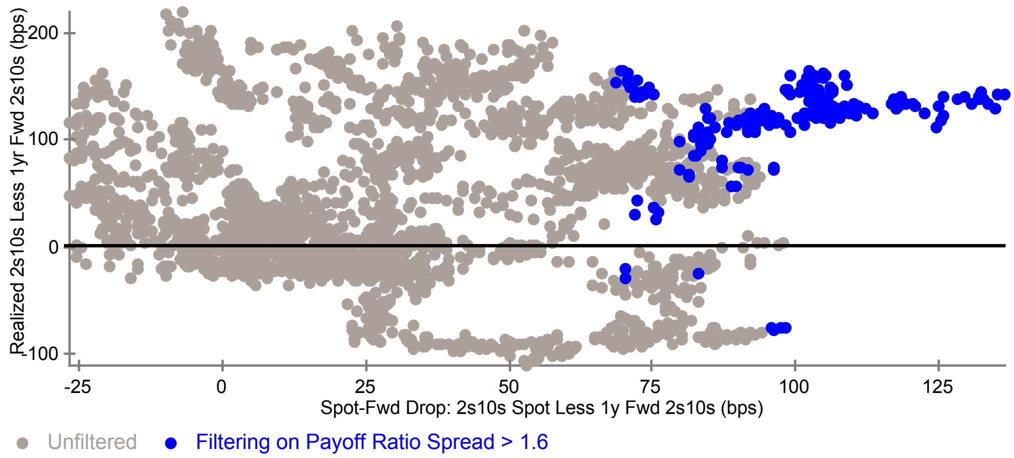
Because the implied curve volatility market is less liquid, we used the spread between the payoff ratios on the individual legs of the trade as a filtering indicator. Historically, when the spread in the payoff ratio between 1y2y and 1y10y is greater than 1.6 (currently it is 1.3), 1-year forward 2s10s steepeners have resulted in positive realized returns most of the time (blue dots in the scatter plot below), sharply improving the potential profitability on the trade and strongly suggesting a steepening bias. The last time the spread in the payoff ratio was above 1.6 was in April 2010 and we look to approach that threshold before establishing the 1-year forward 2s10s steepener.

Exhibit 16: The spread in payoff ratio between 1y2y and 1y10y is currently near the upper end of its historical range

Source: Credit Suisse Locus

Again note that filtering on elevated levels of spot-forward drop alone is not effective in separating profitable from losing outcomes. (Setting the filter on a spot-forward drop that is too high excludes multiple profitable outcomes; setting it too low includes frequent losses .)

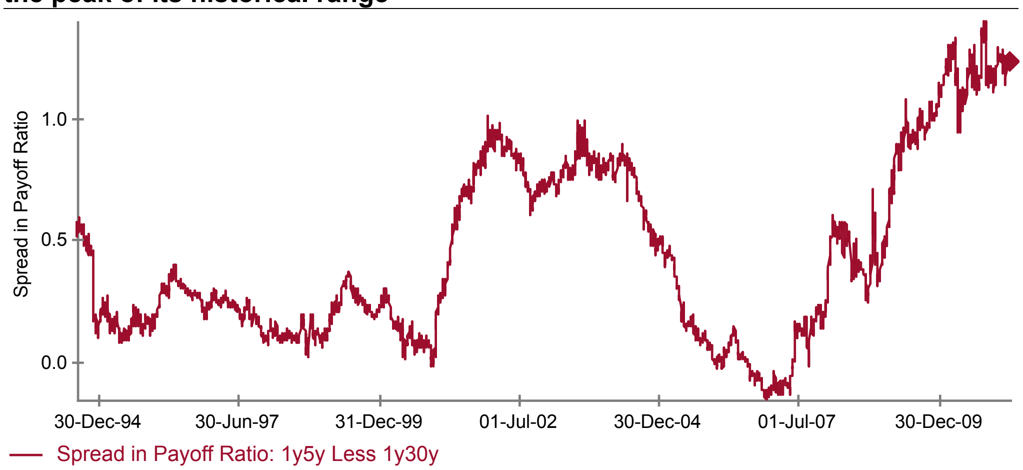
Exhibit 17: Conditional on the payoff ratio spread exceeding 1.6 favors curve steepeners in 1-year forward 2s10s



Source: Credit Suisse Locus

The same analysis when applied to a 1-year forward-starting 5s30s steepeners leads to similar results. Historically, when the spread in payoff ratio between 1y5y and 1y30y is greater than 1.0 (it is currently 1.2), 1-year forward 5s30s steepeners have resulted in positive realized returns on all occasions (blue dots in the scatter plot below).

Exhibit 18: The spread in payoff ratio between 1y5y and 1y30y is currently near the peak of its historical range



Source: Credit Suisse Locus

Exhibit 19: Filtering on the payoff ratio spread exceeding 1.0 favors curve steepeners in 1-year forward 5s30s

Source: Credit Suisse Locus

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