

# Volatility Watch

IR Strategy Denmark, 04 March 2015

The ECB is on tomorrow with little chance of new policy measures but a sound hope for details on the QE that will start within the next 8 days. After the Greek situation alternated daily with progress and regress in February, a higher degree of calmness has hit the market. Vols reflect this and have come back down over the past month for gamma in particular, but we remain elevated above the depressed levels from H2 2014. *We find gamma rich/neutral overall, and the same with vega.*

Vol on 1Y tails have gone off the grid – few, if any quote skews on it. Under almost all distributional assumptions the implied chance of sub-zero 1y swaps in 1 year is substantial and above 40% if the distribution actually was normal. This is interesting: If you sell a 1y1y (vs. 3s) receiver swaption for 10.5bps, your break-even is -10bps on the 1y swap rate in a year. Without further cuts from the ECB, this looks hard to attain.

So sell that, or alternatively pound on the following. 0% floors have been and are embedded in a lot of structure products and bonds. These are almost always on each coupon payment, and not in a swaption like format. Consequently, there's a demand/supply gap between the pricing of otm floors and otm receiver swaptions: *1x5 0% floor vs. 6s trades at around 35bps. Sell that and buy 1y4y rec swaption at 0.25% (today's 4y spot is 0.20%) for zero cost.* This wedge trade covers the same payment dates and buys a cheap correlation that has been distorted by the demand/supply above.

On the immediate horizon (before the ECB begins buying), *we like buying 1m30y against 6m30y on the long-end uncertainty, where 1m30y vol has cheapened 25bpVols since mid-January.*

## 1. Vol surface – bpVol change, z.scores in brackets

|     | 1Y          | 2Y          | 5Y          | 7Y          | 10Y         | 20Y        | 30Y        |
|-----|-------------|-------------|-------------|-------------|-------------|------------|------------|
| 1M  | -8.1 (-0.1) | -6.4 (-0.3) | -6.4 (-2.4) | -8.9 (-2)   | 10.2 (-1.3) | -8 (-0.3)  | -6.2 (0.2) |
| 3M  | -0.8 (0.9)  | -0.8 (0.7)  | -4.5 (-1.7) | -3.8 (-1.3) | -3.3 (-0.4) | -0.7 (0.6) | 1.6 (1)    |
| 6M  | 0.7 (1.3)   | 0.6 (1.2)   | -1.9 (-0.9) | -1.5 (-0.1) | 1.1 (0.9)   | 1.4 (1.3)  | 3.7 (1.5)  |
| 1Y  | 0.8 (1.6)   | 0.2 (1.5)   | 0 (0.1)     | 0.6 (0.6)   | 3.7 (1.8)   | 3.4 (1.7)  | 4.5 (1.8)  |
| 2Y  | 0.9 (1.6)   | 0.4 (1.5)   | 0.8 (-0.2)  | 1.2 (0.2)   | 2.2 (1)     | 2.5 (1.6)  | 3 (1.7)    |
| 3Y  | 0.7 (1)     | 0.7 (0.1)   | 1.6 (-0.4)  | 1.1 (-0.3)  | 1 (0.4)     | 1.5 (1.4)  | 1.7 (1.6)  |
| 5Y  | 1.3 (-0.7)  | 1 (-0.6)    | 0.5 (-0.8)  | 0.2 (-0.8)  | -0.2 (-0.5) | 0 (0.5)    | 0.8 (1.5)  |
| 7Y  | 0.5 (-0.9)  | 0.1 (-0.6)  | 1 (-0.4)    | 0.5 (-0.4)  | -0.2 (-0.5) | 0.2 (0.2)  | 0.9 (1.2)  |
| 10Y | 0.1 (-0.8)  | 0.7 (0.4)   | 1.3 (0.6)   | 0.6 (0.2)   | -0.8 (-0.4) | -0.3 (0.1) | 0.3 (0.9)  |
| 20Y | 1 (0.5)     | 1.2 (1.4)   | 2.1 (1.7)   | 1.6 (1.4)   | 0.5 (0.4)   | 1.3 (1.5)  | 1.8 (1.6)  |
| 30Y | 2.2 (1.4)   | 2.2 (2)     | 2.3 (2)     | 2 (1.8)     | 1.6 (1.4)   | 2.2 (2)    | 2.4 (1.9)  |

Z-Score value significant if absolute value > 1.96

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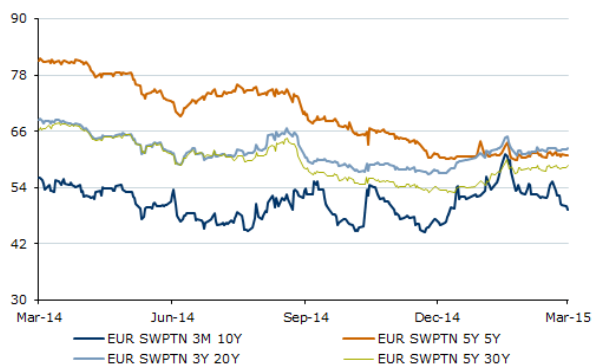
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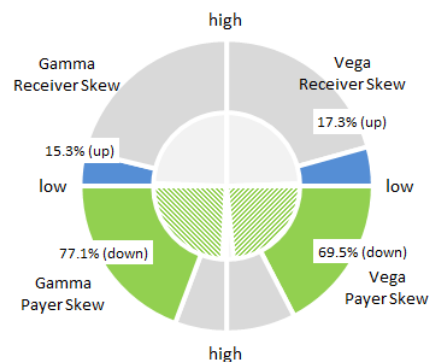
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| At a glance      |              |
|------------------|--------------|
| Gamma            | Rich/Neutral |
|                  | Neutral      |
| 1y10y (fwd prm)  | 439 (411)    |
| Vega             | Rich/Neutral |
|                  | Rich/Neutral |
| 10y10y (fwd prm) | 1554 (1565)  |
| PCA (rich/cheap) | 2Y30Y/5Y5Y   |

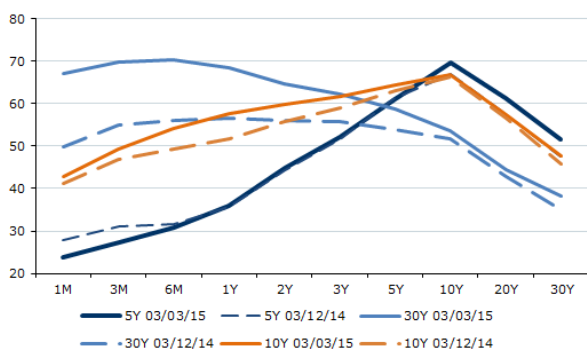
### 2. Implied bpVol development over the past year



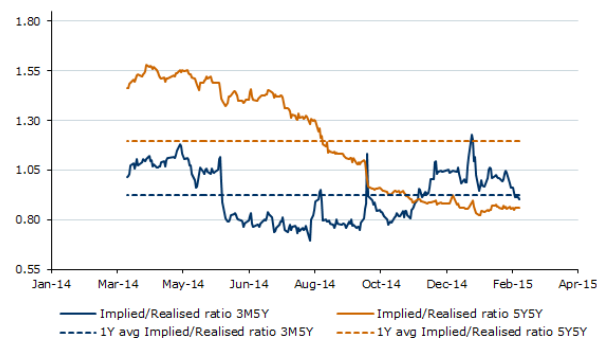
### 3. Skew overview (current skew vs. last year)



### 4. bpVol term structures – Current & 3Ms ago



### 5. Implied/Realized bpVol ratios



### 6. Vol surface (bpVol)

|     | 1Y   | 2Y   | 5Y   | 7Y   | 10Y  | 20Y  | 30Y  |
|-----|------|------|------|------|------|------|------|
| 1M  | 21.0 | 20.0 | 23.7 | 31.5 | 42.9 | 60.5 | 67.1 |
| 3M  | 24.2 | 23.0 | 27.2 | 36.0 | 49.3 | 64.2 | 69.8 |
| 6M  | 24.2 | 24.2 | 30.8 | 40.7 | 54.2 | 66.3 | 70.3 |
| 1Y  | 25.7 | 27.1 | 35.9 | 44.8 | 57.5 | 65.7 | 68.5 |
| 2Y  | 31.1 | 35.5 | 44.8 | 51.4 | 59.7 | 63.5 | 64.5 |
| 3Y  | 39.4 | 44.6 | 52.1 | 56.3 | 61.7 | 62.5 | 62.1 |
| 5Y  | 54.0 | 58.2 | 61.0 | 62.7 | 64.4 | 60.9 | 58.6 |
| 7Y  | 62.1 | 65.5 | 66.2 | 66.1 | 66.0 | 59.8 | 55.9 |
| 10Y | 66.8 | 70.7 | 69.6 | 68.7 | 66.9 | 58.4 | 53.6 |
| 20Y | 59.2 | 62.2 | 61.4 | 59.9 | 57.3 | 48.4 | 44.4 |
| 30Y | 50.8 | 54.1 | 51.5 | 49.9 | 47.6 | 40.3 | 38.3 |

### 7. Implied/Realised values

|                             | 2Y   | 5Y   | 10Y  | 30Y  |
|-----------------------------|------|------|------|------|
| Implied (daily bp)          |      |      |      |      |
| 1m                          | 1.29 | 1.48 | 2.68 | 4.22 |
| 3m                          | 1.51 | 1.70 | 3.09 | 4.39 |
| 6m                          | 1.63 | 1.96 | 3.42 | 4.44 |
| Past 6M realised (daily bp) |      |      |      |      |
| spot                        | 0.77 | 1.93 | 2.83 | 3.69 |
| 1m                          | 0.88 | 1.79 | 2.87 | 3.70 |
| 3m                          | 0.96 | 1.89 | 2.94 | 3.73 |
| 6m                          | 1.04 | 2.03 | 3.04 | 3.77 |
| Implied/Realised            |      |      |      |      |
| 1m                          | 1.46 | 0.82 | 0.93 | 1.14 |
| 3m                          | 1.57 | 0.90 | 1.05 | 1.18 |
| 6m                          | 1.57 | 0.97 | 1.13 | 1.18 |

### 8. PCA – Relative Value (Vega grid only)

|     | 2Y    | 5Y    | 7Y    | 10Y   | 20Y   | 30Y  |
|-----|-------|-------|-------|-------|-------|------|
| 2Y  | 2.06  | 0.24  | 0.01  | 0.38  | 1.88  | 2.99 |
| 3Y  | 0.80  | -0.16 | -0.46 | -0.40 | 0.93  | 1.98 |
| 5Y  | -1.02 | -2.07 | -1.93 | -1.69 | -0.47 | 1.05 |
| 7Y  | -1.36 | -1.07 | -1.29 | -1.61 | -0.63 | 0.73 |
| 10Y | -0.45 | -0.18 | -0.74 | -1.74 | -0.84 | 0.36 |
| 20Y | 0.62  | 1.07  | 0.48  | -0.52 | 0.72  | 1.50 |
| 30Y | 1.99  | 1.56  | 1.21  | 0.75  | 1.72  | 2.59 |

## Appendix: Calculation details and model description

### General:

Calculations are based on data from Nordea Markets. All quotes are end of day quotes, sampled on the trading day preceding the publication date. Volatilities are always normalized volatilities (bp vols).

### 1. Vol surface

The vol surface on page 1 contains changes in bpVol over the past month. The Z-scores in parentheses are based on levels of bpVol over the past 6 months. Current bpVol grid is given in chart 6.

### 3. Skew overview

The pie chart illustrates the current magnitude of the skews (outer circle) and the magnitude two weeks ago (inner circle) relative to the magnitudes over the previous year. The values given are percentiles. Thus, a value of say 75% for a given skew indicates that 75% of the previous year's skews are below the current skew. The skews are calculated as  $(\text{impvol}(\text{atm}-50\text{bp}) - \text{impvol}(\text{atm}))$  for the receiver skew and  $(\text{impvol}(\text{atm}+50\text{bp}) - \text{impvol}(\text{atm}))$  for the payer skew. Here again, "impvol" is understood to be in terms of bp vol. The movement in the skew, relative to 1 month ago, is shown as "up", "down" or "unchanged". The gamma option is 6M10Y and the vega option is 5Y5Y.

### 4. Vol term structures

Current atm vol term structures along with those 3 months ago for 5Y, 10Y, and 30Y tails are shown. Increasing forward periods on the x-axis.

### 5 & 7. Implied vs. Realised vol

Implied is given as the product of the Black implied volatility and the atmf rate. Realized volatilities are estimated on daily differences of the underlying, based on data from the past six months.

### 8. PCA – Relative Value

The PCA Relative Value model is designed to detect temporary correlative patterns that differ from historical correlative patterns. It is applied to the historical correlation matrix of the bpVol of all swaptions, using a large data sample window spanning from 2005 to 2015. Each swaption in the grid is evaluated relative to all other swaptions. This is done by comparing each swaption movements with the movements of the market as a whole, with the latter being represented as the movements in the principal components. This gives an expression of value relative to the rest of the volatility grid. Those values, in bpVol terms, are shown in the table. A swaption that has endured movements that are relatively less (more) than what the PCA prescribes will be cheap (rich). This evaluation is based on the last 6 months of bpVol data.

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