14 December 2012 │ 20 pages

Europe

Euro Rates Strategy

The Implications of Negative Deposit Rates

- **Negative rates:** Markets are now pricing in the chance of negative ECB deposit rates during the course of 2013. What does this mean for Euro rates markets? How will negative nominal rates distort the behavior of market participants? Are there clear trends and investment opportunities in a negative rates environment?

- **Money markets:** Several factors are likely to distort the trajectory of EUR money markets in the event of negative ECB deposit rates. Our view is that a structural shift into deeply negative money market rates is likely to happen only as a result of multiple shocks to the EUR market infrastructure (including regulatory shocks) rather than simply as a result of ECB action.

- **EGB portfolios:** We examine curve behavior when short rates are low or negative. Based on our analysis in other currencies, we recommend fading any sharp steepening of 2/10s as well as being long 10s vs 2s and 30s.

- **Swap markets:** Extreme curve directionality, negative swap spreads and forwards inversion can result under a particular set of conditions once interest rates approach zero and eventually become negative.

- **Option markets:** In the very near-term liquidity in options with negative strikes is likely to be low but we do not expect this to mark the start of a structural change. We expect implied volatility in the top left of the grid to remain low and payer skew to continue to be steep. We see good value in carry and roll trades in the front-end of the curve.

- **Inflation markets:** A negative deposit rate is unlikely to have much immediate impact on the structure and the valuation of euro inflation markets. The greater impact is likely to be felt by nominal yields, rather than break-even inflation spreads, with real yields following.

- **SSA:** Further ECB cuts will continue to support the front-end of curves and anchor core SSA yields in short dated sectors. Aversion of some investors to negative yielding assets is likely to prompt a degree of “stickiness” around the zero bound.

- **Demand for bonds:** We look at long-term trends in demand for risk-free assets in general and EGB in particular against the background of very low / negative interest rates and regulatory changes.

- **Trade Ideas:** A selection of strategies that are suited to navigate through the unusual negative interest rates environment.

Alessandro Tentori
+44-20-7986-9224
alessandro.tentori@citi.com

Robert Crossley
+44-20-7986-9255
robert.crossley@citi.com

Jamie Searle
+44-20-7986-9493
jamie.searle@citi.com

Peter Goves
+44-20-7986-3215
peter.goves@citi.com

Nishay Patel
+44-20-7986-1007
nishay.patel@citi.com

The Implications of Negative Deposit Rates

We're in uncharted territory having left conventional monetary policy responses far behind as events in Europe and the global financial system have overtaken everything else. That, together with the rarity of negative short-term rates, circumscribes extensive analysis and support of anything, but tentative conclusions. Nevertheless, looking at the experience of Denmark, Japan, and Germany together with theoretical arguments and practical intuition does yield some interesting results, and provides some pointers of how to approach a further fall in front end yields if you believe that is going to happen.

Money Markets

Markets are pricing in a chance of negative deposit rates in 2013

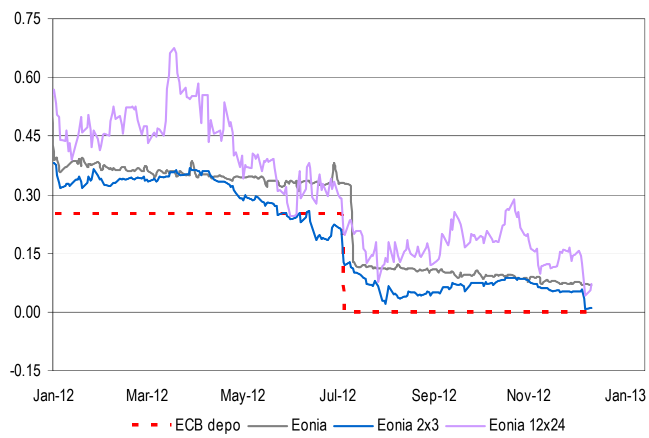
Following Mr Draghi's comments about negative rates on ECB's deposit facility during the Dec-12 Q&A session ("*We briefly touched upon the complexities that such a measure would involve and possible unintended consequences, but we didn't elaborate any further*"), the Eonia curve has shifted towards pricing in a reasonable chance of negative rates over the course of 2013. On Monday 10 December, the Aug-13 meeting was worth around -3bp, which implies – assuming unchanged fixing spreads – an 8bp decline in deposit rates, i.e. a 32% probability of having the deposit facility rate at -0.25%. The probability of negative rates has now receded a bit, mainly as a result of Mr Praet's comments ("*must be careful with negative rates*", Figure 1).

Figure 1. ECB expectations for 2013

Meeting	Reserve Period		Eonia 10 Dec	Eonia live	Prob
10-Jan-13	16-Jan-13	12-Feb-13	0.05	0.06	
07-Feb-13	13-Feb-13	12-Mar-13	0.01	0.04	9%
07-Mar-13	13-Mar-13	09-Apr-13	-0.01	0.02	15%
04-Apr-13	10-Apr-13	07-May-13	-0.02	0.01	20%
02-May-13	08-May-13	11-Jun-13	-0.02	0.01	20%
06-Jun-13	12-Jun-13	09-Jul-13	-0.01	0.00	21%
04-Jul-13	10-Jul-13	06-Aug-13	-0.02	0.00	23%
01-Aug-13	07-Aug-13	10-Sep-13	-0.03	0.00	22%
05-Sep-13	11-Sep-13	08-Oct-13	-0.02	0.01	19%
02-Oct-13	09-Oct-13	12-Nov-13	-0.02	0.01	19%
07-Nov-13	13-Nov-13	10-Dec-13	-0.01	0.01	20%
05-Dec-13	11-Dec-13	14-Jan-14	0.00	0.02	15%

Source: ECB, Citi Research

Figure 2. Compression in money market rates in 2012



Source: Citi Research

Money market rates have converged towards 0% this year, with the main move taking place between April and August on the back of a spike in sovereign risk premia and the associated discussion about negative interest rates. For example, Eonia 12x24 dropped by 60bp during this period (currently around 0.09%, Figure 2).

Factors distorting money markets…

While the initial reaction post-Dec ECB has been vehement, money markets' trajectory in 2013 is less obvious given several possible distortions:

Early repayment of LTRO liquidity

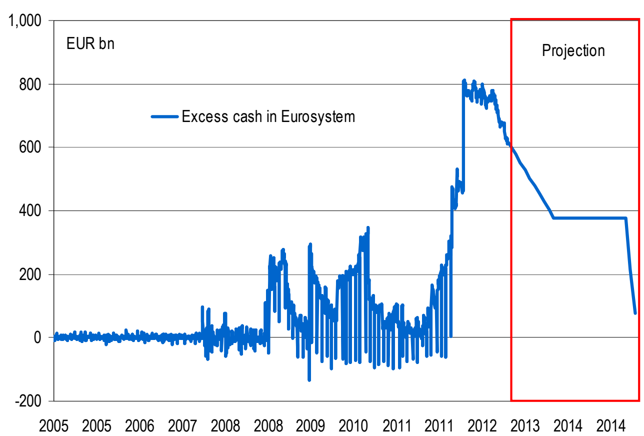
- **LTRO repayment options:** Both 3y LTRO have embedded early repayment options with first exercise on 30 January 2013 and 27 February 2013, respectively. Under "normal" money market conditions, the consensus is probably around EUR 200/250bn to be repaid early. In Figure 3, we model excess liquidity over the coming three years assuming a smooth early repayment process (the option can be exercised on any MRO settlement date following the initial date) as well no further 3y or longer LTRO prior to the final repayment date. The situation could change dramatically in a negative rates environment, though. Let's assume

the ECB is a -0.25% depo and caps current accounts (or charges a penalty rate on excess reserves). Especially under improving sovereign market conditions, MFI would be tempted to repay amounts in excess of so called "speculative liquidity" (as compared to "structural liquidity"). Why? Because banks would have limited incentive to deposit at the ECB at -0.25% or pay a penalty on excess reserves. Moreover, why would banks lend to each other at negative repo rates if they can repay the LTRO excess (and assuming no premium on Level 1 collateral)? This is not only an argument against structurally negative GC and Eonia rates, but also a technical issue for the ECB. Again, assume the depo rate at -0.25%, the refi rate at +0.50% and an unexpectedly large exercise of the repayment options. In this scenario, the rate cut would risk being perceived as a tightening of monetary conditions as Eonia fixings would become very volatile or even start drifting higher as the ECB drains excess cash from the system!

Pricing distortions due to reduced liquidity

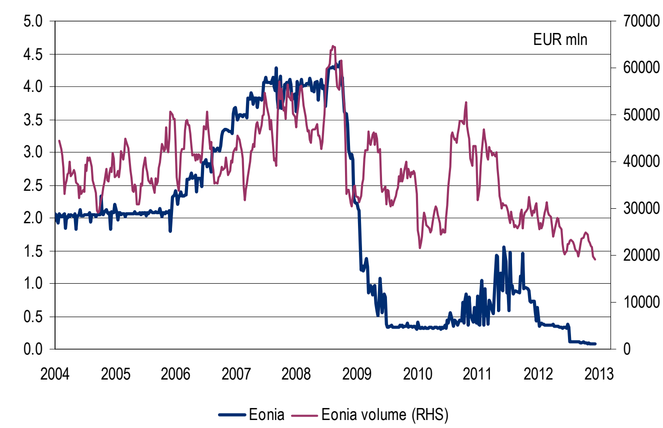
- **Decline in market liquidity/volumes:** Negative deposit rates and the uncertainty about banks' behavior in such an unusual operational environment are likely to further reduce trading volumes and overall money market liquidity. In its 2012 Money Market Survey[1], the ECB has reported that overall turnover contracted by 14% yoy in Q2, while OIS (-50%) and IRS (-16%) activity is even weaker. Daily Eonia volumes have continued to decline also in the second half of 2012 and are now down approximately 26% from June (Figure 4).

Figure 3. Excess liquidity and repayment options



Source: Citi Research

Figure 4. Declining Eonia volumes



Source: EBA, Citi Research

Chances of fixing below 0%?

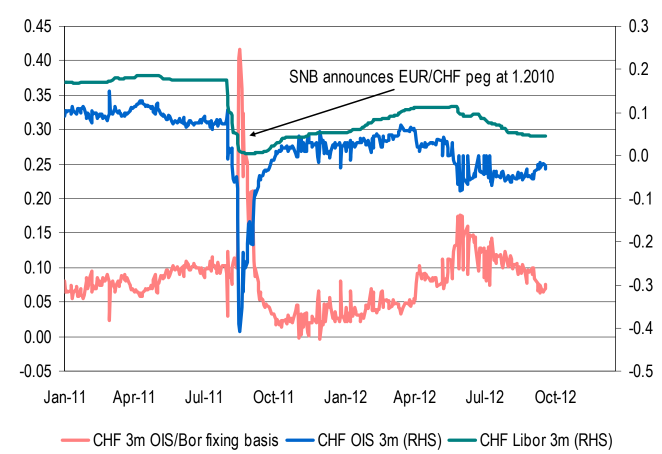
- **"Stickiness" around zero:** Negative ECB deposit rates are by no means a sufficient condition for all money market rates to fall below zero. Depending on regulatory aspects, liquidity constraints, market fundamentals as well as balance sheet conditions, we argue that some rates could show a persistent stickiness to trade above zero, while other rates may indeed fall into negative territory. One recent example is Switzerland, where prior to introduction of the currency peg in the summer of 2011, the market was speculating on the introduction of negative rates on SNB deposits. As a result, CHF 3m OIS fixings briefly collapsed as low as -0.4%, while CHF 3m Libor never fixed below zero (2m Libor did). The related sharp widening in CHF basis (Figure 5) was pure mechanical and had little or nothing to do with risk aversion and/or a liquidity crunch.

[1] http://www.ecb.europa.eu/press/pr/date/2012/html/pr120928.en.html

Derivatives market regulation

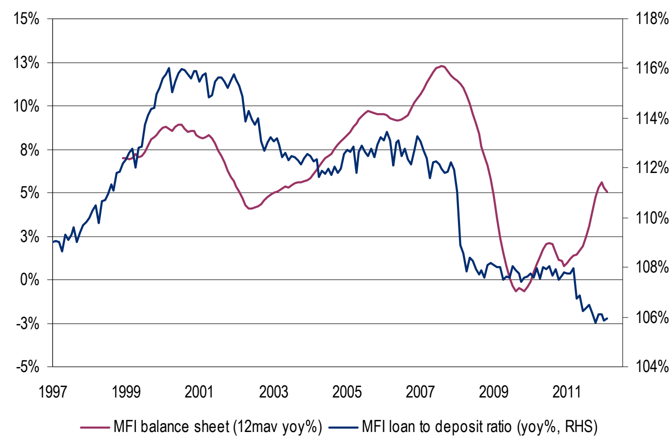
- **Collateral risk:** In addition to the implementation of both Basle and Solvency regulation, the proposed central counterparty clearing for OTC derivatives (initially to be enforced by the end of 2012) is also going to affect the value of high-quality assets for collateral purposes. The BIS[2] has estimated that the additional initial margin requirement for G14 dealers and non-dealers (IRS and CDS combined) could exceed USD 1 trillion, if we computed VARs on the basis of crisis levels of volatility. This number reduces to around USD 720bn under a less extreme volatility assumption. It goes without saying that CCP for OTC derivatives will translate into increased pressure for low-haircut collateral, i.e. mainly short-term bonds issued by high-grade sovereigns. This could structurally affect ASW-spreads to the Eonia curve (i.e. banks would lend at negative repo rates to secure scarce collateral for CCP operations). Furthermore, regulation is likely to bias the transmission mechanism of monetary policy, as banks pile into zero-RWA at the expense of more risky lending activity (Figure 6). This particular issue has been highlighted also by the ECB in the context of long-term distortions in financial intermediation in Japan[3]

Figure 5. The SNB experience in 2011



Source: Citi Research

Figure 6. MFI balance sheets and lending



Source: ECB, Citi Research

Multiple shocks are needed to push money markets structurally into negative territory

In a nutshell, there are several factors that will distort the trajectory of EUR money market rates in the event of negative ECB deposit rates. Our view is that a structural shift into deeply negative money market rates is likely to happen only as a result of multiple shocks to the EUR market infrastructure (including regulatory shocks) rather than simply as a result of ECB action. We are not convinced this is in the best interest of the ECB, other Eurozone official bodies or specific liquidity-providers like money market funds.

[2] http://www.bis.org/publ/work373.pdf

[3] http://www.ecb.europa.eu/pub/pdf/mobu/mb201205en.pdf

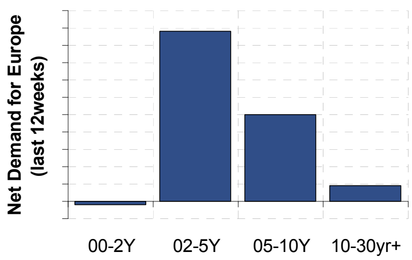
EGB Portfolios

Do lower rates mean flatter curves?

One of the features of the new financial landscape is the extremely low level of front end yields. This has important implications for investor behaviour. Actual negative yields may preclude certain participants from buying, e.g., central banks, and represent a cost for buyers wishing to safely deposit their money. So whether out of necessity or choice, money is encouraged to move towards positive returns.

Intuitively you'd expect very low or negative front end rates to cause flattening as investors are forced to move out on the curve for yield. And the flow data appears to be consistent with this: over the last 3 months since Draghi's game changing "*whatever it takes*" statement, buying of European government bonds has been clearly concentrated in the 2-5y sector (Figure 7).

Figure 7. Demand for European government bonds has been concentrated in the 2-5y sector over the last 3 months[4]



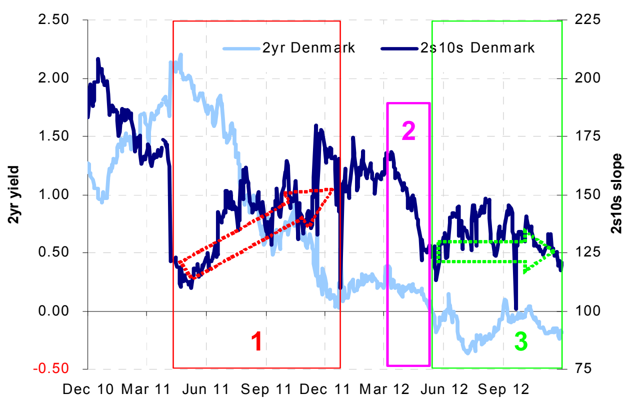
Source: Citi Research

However, when you look at what happened in Denmark and Germany as 2y rates approached and then went through zero, in reality things are not that simple.

Three phases are clearly evident on German and Danish curves:

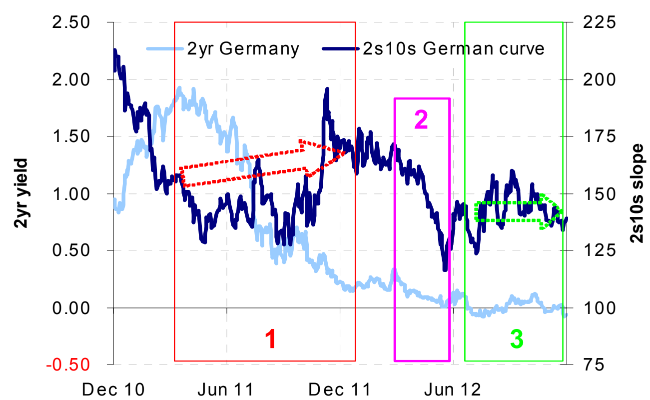
1. As front end rates fell, this drove 2/10s steeper.
2. Flattening did occur, but only when short rates had their second, and slower, leg down, to test zero.
3. Once rates went negative, 2/10s pretty much went sideways.

Figure 8. Phases of behaviour of 2/10s in Denmark as short rates breach zero



Source: Citi Research

Figure 9. Phases of behaviour of 2s10s in Germany as short rates approach and breach zero



Source: Citi Research

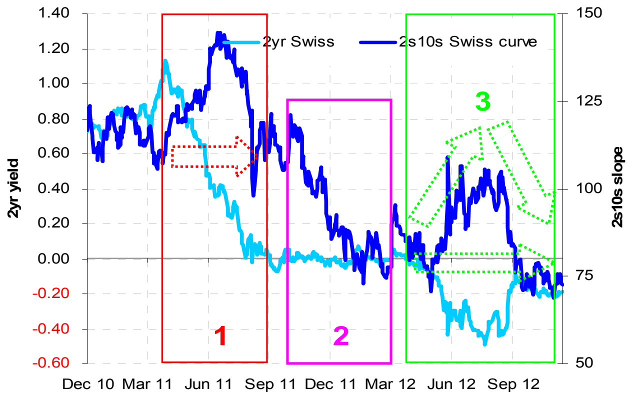
The dynamics of the Swiss curve in detail

There were similarities in the behavior of the Swiss curve (Figure 10), but there was more volatility in the first and third phases. In Switzerland, in phase 1 there was the characteristic steepening, but this was unwound before short rates bottomed out rather than in phase 2.

There was the usual flattening in phase 2 but this occurred while short rates were stable around zero rather than falling. And when short end yields did go decisively negative in phase 3 the curve steepened, but then re-flattened, to end up largely unchanged.

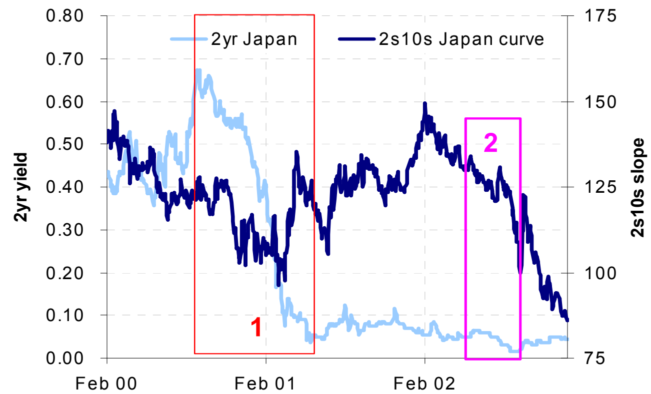
[4] Based on electronically executed Citi customer trades.

Figure 10. Phases of behaviour of 2/10s in Switzerland as short rates fell, consolidated, and then went through zero.



Source: Citi Research

Figure 11. Phases of behaviour of 2/10s in Japan as short rates approach zero

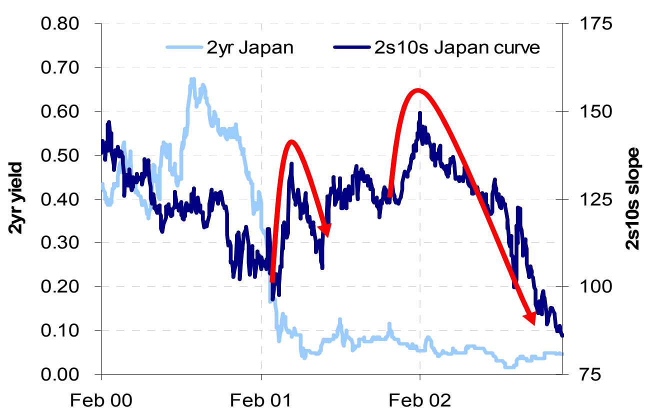


Source: Citi Research

Japan is the other obvious comparison. Back in 2000/2001, like Switzerland in 2011, 10s kept pace with the fall in front end yields over phase 1, but then in Japan 2y yields never really went much lower. However, when they did head towards zero the curve responded by flattening.

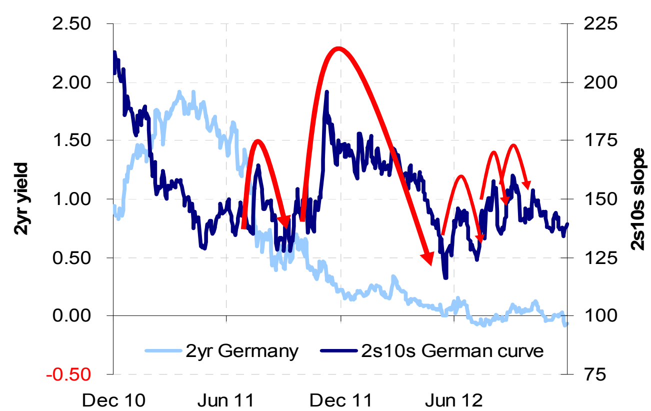
Overall, when you look at the four charts above, they do suggest that when short rates are very low, any quick steepening moves contain the seeds of their own reversal, and should be faded – e.g., Figure 12 and Figure 13 below. As you would expect, steepening is difficult to sustain when short rates are so low.

Figure 12. Flattening follows sharp steepening when short rates low



Source: Citi Research

Figure 13. Flattening follows sharp steepening when short rates low

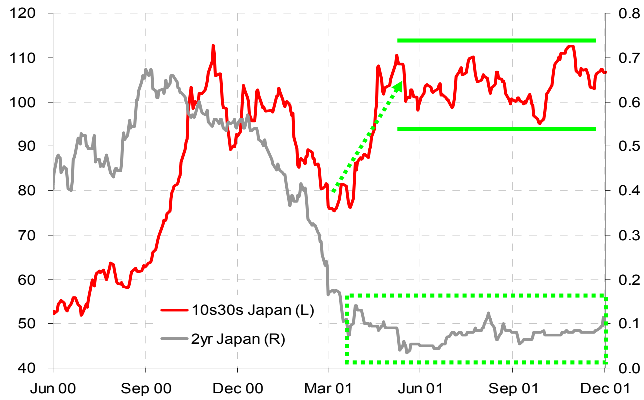


Source: Citi Research

Consistent 10/30s steepening

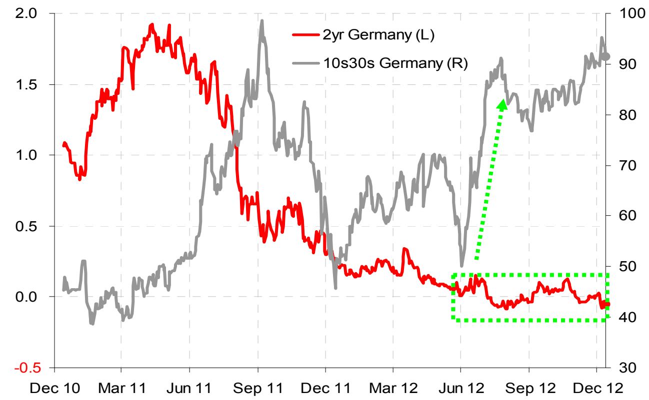
Once short rates are around their perceived lower bound, any flattening in 10/30s has been limited. In both Japan (Figure 14, below left) and Germany (Figure 15, below right), once short rates approached their lower bound, 10s30s steepened sharply, followed by either range-trading or a drift higher.

Figure 14. 10/30s steepening followed by range-trading in Japan



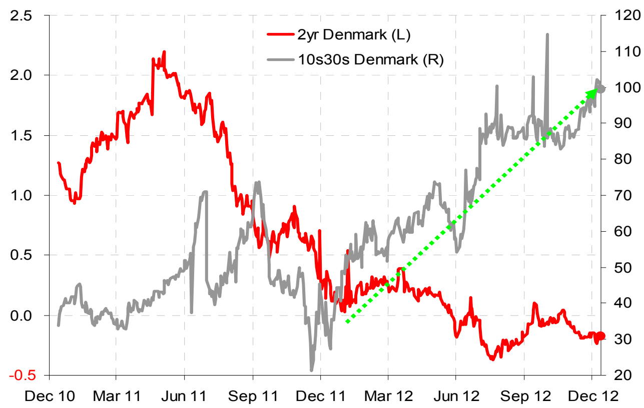
Source: Citi Research

Figure 15. 10/30s steepening followed by drift higher in Germany



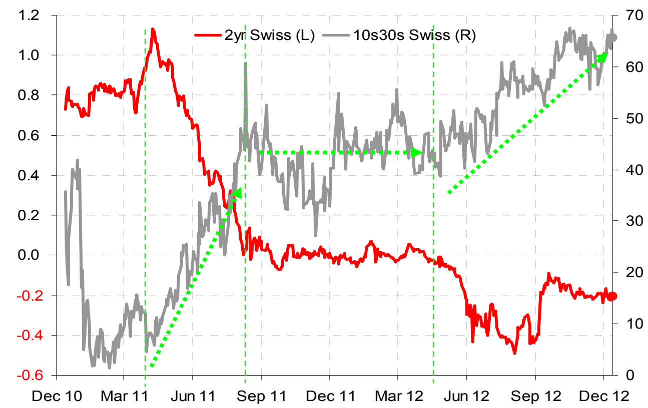
Source: Citi Research

Figure 16. Strong 10/30s steepening in Denmark from end of initial main fall in short rates to very low levels



Source: Citi Research

Figure 17. Further steepening of 10/30s in Switzerland when 2y rates fell decisively through zero



Source: Citi Research

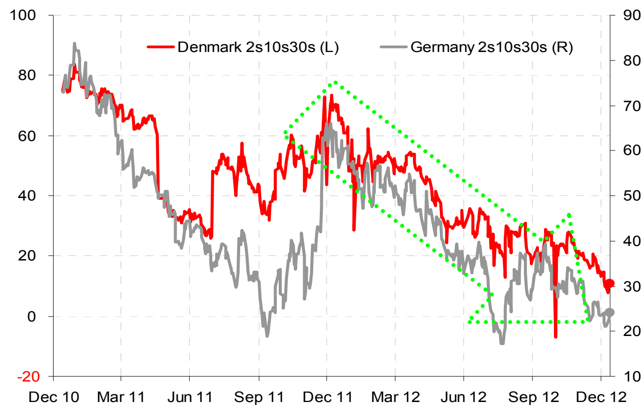
In Denmark (Figure 16 above, left), 10/30s has only steepened while 2y rates have been close to zero or negative. In Switzerland (Figure 17 above, right), 10s30s drifted sideways while short rates bounced around zero, (following the sharp steepening as 2yr rates plummeted). But once short rates took their second leg lower through zero, 10s30s embarked on its second steepening leg, which has been impervious to short rates moving higher again.

10s outperforms the wings when short rates are very low/falling

So with 10/30s consistently struggling to flatten when rates are low, and history pointing to fading steepening in 2/10s, the obvious trade to look at is some flavour of 2/10/30s. Denmark and Germany are shown in Figure 18 below, left.

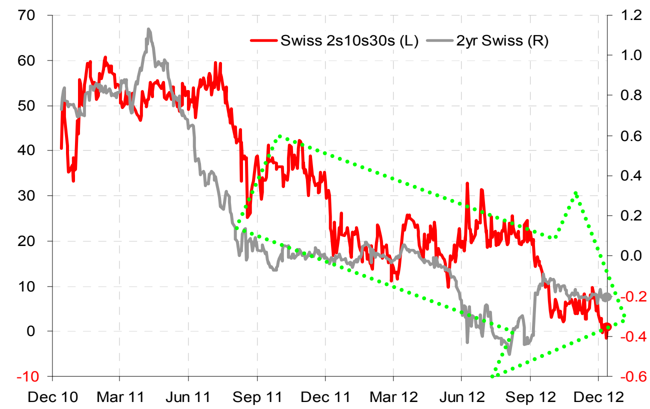
In the case of Switzerland (Figure 19, below, right), when short rates went decisively through zero, 10s did underperform briefly, but this was contained and was followed by flattening to new lows as 2yr rates first became less negative, and then went sideways.

Figure 18. 2/10/30s in Denmark and Germany showing the outperformance of 10s when short rates are bouncing around their lows/straying into negative territory



Source: Citi Research

Figure 19. 2/10/30s in Switzerland showing the outperformance of 10s when short rates are bouncing around zero and subsequently



Source: Citi Research

Fade any sharp steepening of 2/10s

Be long 10s vs 2s and 30s

In conclusion, low or falling short rates don't reliably translate into 2/10s flattening. Negative short rates don't automatically drive flattening either, but they do militate against sustained steepening. With short rates low or negative, history suggests fading swift steepening moves in 2/10s. That is obviously another way of saying that while the beta may vary, sell-offs in 10s tend to be limited when front end yields are so low - because front end yields are so low for a reason. But it would be a surprise if the reality was anything different really.

Be careful of positioning for structural 10/30s flattening

Further out on the curve, structural 10s30s flatteners appear to be swimming against the tide when short rates are so low, and especially if you think there is a danger of short rates falling further. This doesn't rule out opportunistic flattening trades, but the (admittedly restricted) historical comparisons point to being long 10s vs 2s and the long end from a structural perspective.

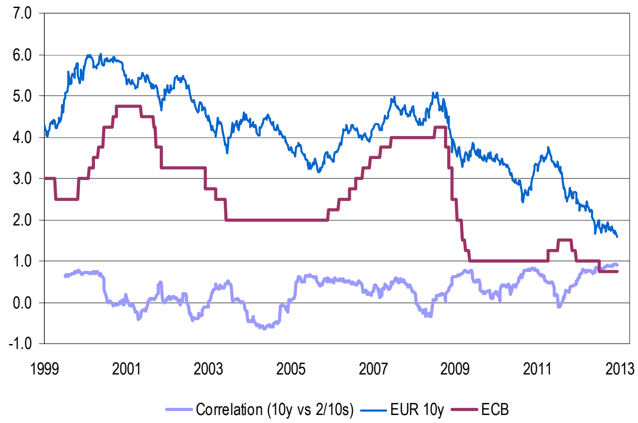
Swap Markets

We have three topics on our agenda when discussing the impact of zero nominal rates on the swap market:

Calibrating rates model with a symmetrical distribution around zero could be conceptually challenging

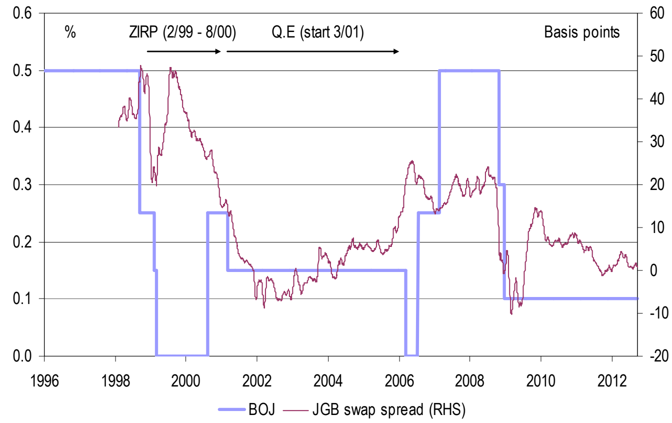
- **Curve directionality:** Once policy is at its nominal bound, all the dynamics of the yield curve can be explained by the variation of higher maturity rates. Curve directionality has been typical for the EUR curve in the aftermath of the 2008 crisis, as the ECB has collapsed the main refinancing rate to 1% (Eonia trading close to the deposit facility due to excess liquidity conditions). In Figure 20, we can see how the average level of correlation between 10y rates and the 2/10s curve has drifted higher ever since 2009. By removing the concept of a 0% floor, one could say that the shape of the curve should again be determined by both front-end and long-end rates, i.e. lower levels of yield curve correlation. However, given the Swiss experience (no negative Libor fixing past 2 months), we think that such a flip in curve correlation will be anticipated by a rather prolonged period of very high directionality with 10y rates. It would take a complete removal of the stigma of negative rates in order for the yield curve to behave symmetrically with rates above and below zero, i.e. interest rate models would have to be calibrated with a symmetric probability distributions centered on 0%. We think most market participants would find this a challenging concept.

Figure 20. Yield curve correlation and monetary policy regime



Source: Citi Research

Figure 21. The experience with the BoJ and JGB ASW



Source: Citi Research

In the absence of credit risk, liquidity is the main driver of swap spreads

- **ASW spreads:** In a world without credit risk, swap spreads reflect exclusively liquidity premia and demand/supply parameters. We've been in this special environment between 2004 and 2006 when global policy was providing ample liquidity and Bund spreads were trading in a narrow 5/25bp range with extremely limited volatility. Similarly, the combination of BoJ's zero-rate environment and non-standard policy measures has managed to push JGB swap spreads into negative territory for some time in several occasions (Figure 21). As far as swap spreads in the euro area are concerned, we need to deal with the additional complexity of significant flight-to-quality premia embedded into the German yield curve. Furthermore, regulation could introduce a persistent premium for high grade collateral, thus structurally affecting the shape of the ASW-term structure for AAA or near-AAA sovereign issuers.

Forward swaps can trade negative even with positive spot rates

- **Forward inversion:** Under a stress scenario of aggressive bull-flattening of the yield curve, there are certain points of the forwards space which might trade into negative territory even though spot rates might still be above zero (Figure 22). Negative forward rates do not necessarily imply a string of negative Euribor fixings in the future, they just result from a special configuration of rate levels and curve shape. As discussed in the section on options, this may have important technical consequences on model-based pricing. On the other hand, the level of negative convexity risk in EUR exotic books is nowhere near 2008 level, thus preventing positive-feedback loops between vol, rates and the yield curve. Furthermore, issuers may be tempted to pay very low forwards (or sell low strike receivers) in order to increase funding efficiency, thus flooring the level of long-dated swaps. Looking back, forwards like EUR 20y10y have dropped to 1.30% in Dec-08 and 1.65% in Jun-12, while JPY 20y10y managed to stay above 1.50% in Jun-03 as well as Q4 2008 (power dual distortion).

Figure 22. Extreme scenarios for EUR forward rates

	EUR swaps (spot)								
	1y	2y	5y	10y	15y	20y	30y	40y	50y
Live	0.29	0.33	0.77	1.59	2.04	2.19	2.26	2.35	2.42
	0.28	0.31	0.72	1.49	1.92	2.05	2.10	2.18	2.24
	0.27	0.29	0.67	1.39	1.80	1.91	1.94	2.01	2.06
	0.26	0.27	0.62	1.29	1.68	1.77	1.78	1.84	1.88
	0.25	0.25	0.57	1.19	1.56	1.63	1.62	1.67	1.70
	0.24	0.23	0.52	1.09	1.44	1.49	1.46	1.50	1.52
	0.23	0.21	0.47	0.99	1.32	1.35	1.30	1.33	1.34
Shifted	0.22	0.19	0.42	0.89	1.20	1.21	1.14	1.16	1.16
	0.21	0.17	0.37	0.79	1.08	1.07	0.98	0.99	0.98
	0.20	0.15	0.32	0.69	0.96	0.93	0.82	0.82	0.80
	0.19	0.13	0.27	0.59	0.84	0.79	0.66	0.65	0.62
	0.18	0.11	0.22	0.49	0.72	0.65	0.50	0.48	0.44
	0.17	0.09	0.17	0.39	0.60	0.51	0.34	0.31	0.26
	0.16	0.07	0.12	0.29	0.48	0.37	0.18	0.14	0.08

	Swap curve							
	1/2s	2/5s	2/10s	5/10s	5/30s	10/30s	20/30s	30/50s
Live	0.04	0.44	1.26	0.82	1.49	0.67	0.07	0.17
	0.03	0.41	1.18	0.77	1.38	0.61	0.05	0.15
	0.02	0.38	1.10	0.72	1.27	0.55	0.03	0.13
	0.01	0.35	1.02	0.67	1.16	0.49	0.01	0.11
	0.00	0.32	0.94	0.62	1.05	0.43	-0.01	0.09
	-0.01	0.29	0.86	0.57	0.94	0.37	-0.03	0.07
	-0.02	0.26	0.78	0.52	0.83	0.31	-0.05	0.05
Shifted	-0.03	0.23	0.70	0.47	0.72	0.25	-0.07	0.03
	-0.04	0.20	0.62	0.42	0.61	0.19	-0.09	0.01
	-0.05	0.17	0.54	0.37	0.50	0.13	-0.11	-0.01
	-0.06	0.14	0.46	0.32	0.39	0.07	-0.13	-0.03
	-0.07	0.11	0.38	0.27	0.28	0.01	-0.15	-0.05
	-0.08	0.08	0.30	0.22	0.17	-0.05	-0.17	-0.07
	-0.09	0.05	0.22	0.17	0.06	-0.11	-0.19	-0.09

	EUR forward swaps						
	1y1y	5y5y	10y10y	15y15y	20y10y	20y20y	30y20y
Live	0.36	2.47	2.96	2.57	2.45	2.60	2.89
	0.33	2.26	2.61	2.27	2.19	2.30	2.46
	0.30	2.11	2.43	2.07	1.99	2.10	2.25
	0.27	1.96	2.25	1.87	1.79	1.90	2.04
	0.24	1.81	2.07	1.67	1.59	1.70	1.83
	0.21	1.66	1.89	1.47	1.39	1.50	1.62
	0.18	1.51	1.71	1.27	1.19	1.30	1.41
Shifted	0.15	1.36	1.53	1.07	0.99	1.10	1.20
	0.12	1.21	1.35	0.87	0.79	0.90	0.99
	0.09	1.06	1.17	0.67	0.59	0.70	0.78
	0.06	0.91	0.99	0.47	0.39	0.50	0.57
	0.03	0.76	0.81	0.27	0.19	0.30	0.36
	0.00	0.61	0.63	0.07	-0.01	0.10	0.15
	-0.03	0.46	0.45	-0.13	-0.21	-0.10	-0.06

Source: Citi Research

Options Markets

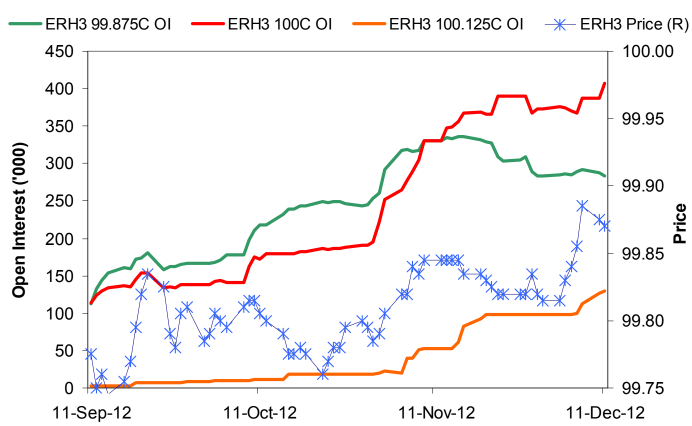
ECB policy has spurred interest in demand for protection against even lower rates

Low policy rates and the introduction of non-standard measures by the ECB have been one of the main drivers behind negative yields for a number of assets such as 2yr Germany. With 3m Euribor fixing at 18bps and the likelihood of the ECB cutting the deposit rate to -0.25% in 2013 there has been some interest by investors to take advantage of the prospect of lower rates. For example, 100-strike Euribor calls, OTM receivers with negative strikes or 0% floors.

Listed Euribor options

Strategies involving 99 to 100 strikes on March expiry ERH3 have been hugely popular in recent months (e.g. 87/par/12 call flies, par/12/25/37 call condors or combinations such as buying 87C and selling par calls and 50 puts). Above all, the outcome of lower Euribor rates has resulted in a surge in the open interest of 99.875–100 strike call options (Figure 23).

Figure 23. Open interest for selected strikes call options on March Expiry ERH3 has surged



Source: Citi Research

Model risk at negative strikes

Facilitating demand for OTM receivers with a negative strike can prove to be a problem when using traditional interest rate option valuation models. We explore some of the limitations of these models below.

Black-Scholes model vs smiles and skews

Under the original Black/Scholes model the volatility (of an underlying asset) is presumed to be constant. However, in practice options with different strikes require different volatilities to match their market prices thus volatility is generally not a constant but is dependent on the strike.

Local volatility models vs observed market behaviour

As market participants (particularly dealers) usually have large exposures across a wide range of strikes handling market skews and smiles correctly is vital. To handle volatility smiles and skews, a local volatility model was developed by Dupire and Derman/Kani.

The *local volatility model* predicts that the market smile and skew will move in the opposite direction to the price of the underlying asset. This is generally opposite to what is observed in the market place (where smiles and skews move in the same direction as asset prices) resulting in unstable hedges. Furthermore, the delta and vega risk hedges derived from the local volatility model often perform worse than the hedges derived by the original Black/Scholes model.

The SABR Model vs negative strikes

To resolve this issue, the *SABR model* was developed. In short, the SABR model is a stochastic volatility model in which the asset price and the volatility are correlated. Moreover, the model captures the correct dynamics of the smile resulting in stable hedges. The valuation of negative strike options (e.g. OTM receivers in the short-end) poses a problem for the traditional SABR model as it cannot typically facilitate these requirements. This is essentially due to the assumption that the distribution of returns is lognormal (i.e. has positive rates) and so when the strike is 0 or below the model can fail[5]. In order to overcome this issue a number of dealers have begun to implement proprietary models or even a variation of the SABR model (such as a displaced SABR model that involves shifting rates a few percentage points higher in order to overcome the issue of negative rates).

Implications for liquidity

In the *very near-term* liquidity in options with negative strikes could prove to be challenging for two reasons: (1) it is likely that a number of market participants are in the process of implementing new valuation models and (2) with year-end approaching liquidity in a number of interest rate products can prove to be fairly limited. We stress that this is more likely to be a temporary issue as opposed to the start of a structural change.

Implications for the top-left corner

The rally in short-end EUR forward swap rates during 2012 has resulted in lower realized volatility and lower (normalized) implied volatility. Looking ahead the removal of a zero bound on the deposit rate is likely to put further downward pressure on implied volatility for shorter dated tenors and expiries as front-end swap rates remain low.

Carry and roll trades in the front-end of the curve are likely to remain popular

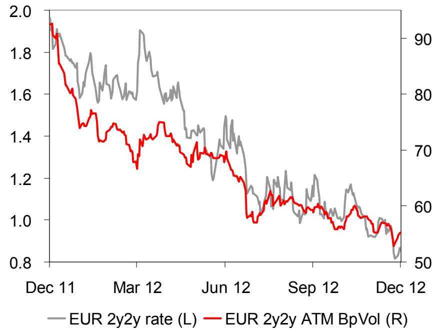
Low implied volatility in the top left of the vol grid and the prospect of short-end swap rates rallying further are likely to result in carry trades remaining popular (Figure 24). More specifically using swaptions to express long duration positions in EUR 3y2y and 3y1y swaptions look attractive – e.g. the initial cost of buying ATM receivers is essentially offset by the 1yr roll-down on the underlying. Suggested strategies can be found on p41 of European Rates Weekly - 2013 Outlook.

Impact on the skew

Demand for hedging against break-out of lower rates whilst volatility is low is likely to keep payer skew steep. As can be shown in Figure 25 and Figure 26 below, bpvol for OTM payers has increased over the last few years as rates have fallen.

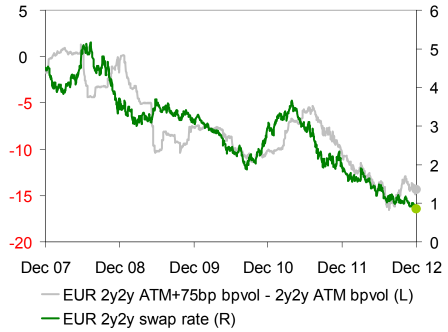
[5] due to the asymptote of $y = \ln(x)$ if the β parameter is set to 1 (log normal process)

Figure 24. EUR 2y2y ATM bpvol has fallen as the 2y2y rate has rallied…



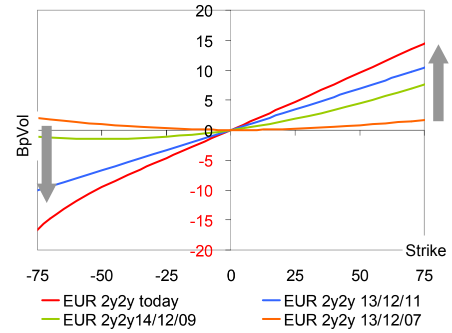
Source: Citi Research

Figure 25. …in addition 2y2y ATM+75 bpvol has increased more than ATM bpvol



Source: Citi Research

Figure 26. Skew has steepened sharply as rates have rallied



Source: Citi Research

Inflation Markets

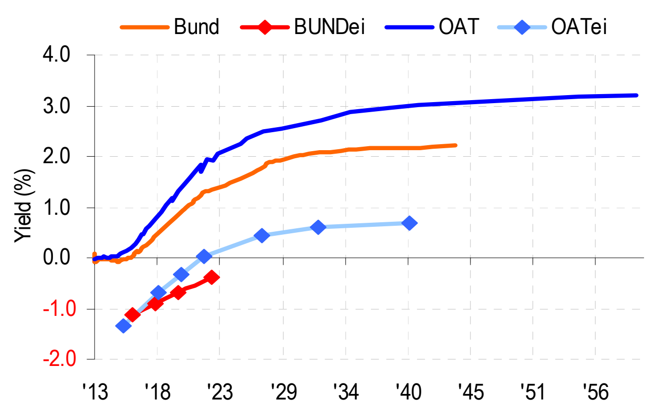
Little change in inflation expectations

A negative deposit rate is unlikely to have much immediate impact on the euro inflation market. Inflation expectations may rise a little, to reflect the additional policy accommodation (and possible impact on the euro), but we very much doubt it would have a material impact given the backdrop of severe economic weakness.

Real yields could be pushed even lower

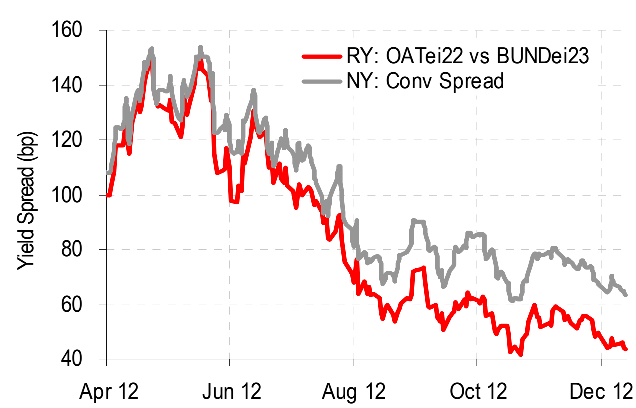
The greater impact is likely to be felt by nominal yields, rather than break-even inflation spreads, with real yields following. Front-end real yields are already deep into negative territory while 2-5y break-evens are in the region of 1.4%-1.6%. If nominal yields move lower, and assuming inflation expectations are relatively stable, then the main impact would be to push real yields even lower (Figure 27). The euro inflation market is long used to negative real yields. For example, in Germany, Bundei16 (currently -1.12%) has traded with a negative real yield since mid-2011. Further out the curve, Bundei23 (currently -0.39%) has also traded with a negative real yield since it was first issued in March.

Figure 27. Euro real yields are deep into negative territory



Source: Citi Research, Bloomberg.

Figure 28. France vs Germany in real yield & nominal yield Space



Source: Citi Research, Bloomberg.

France-Germany spread could face renewed narrowing pressure

For France too, real yields are extremely low. OATei22 currently trades with a real yield of just 0.06%. One potentially important impact from a negative deposit rate would be if it sparks a new 'yield grab' phase. The cut in the deposit rate to 0% in the summer sparked a significant narrowing of spreads to Germany, with France

being a major beneficiary. This could put further narrowing pressure on, for example, the 44bp yield spread between OATei22 and Bundei23.

However, it also worth noting that 10y France-Germany spreads (in both nominal and real yields) are already close to the tight-ends of the recent trading ranges. The potential for further tightening looks somewhat limited from here, especially in real yield space (Figure 28).

SSA

An easing of monetary policy by the ECB earlier in 2012 was but one stimulus behind the "grab for yield" dynamic and the consequent significant rally in core SSA spreads. We detailed this theme in our note, *Why we like the European SSA market in a low yield environment* and with further cuts in ECB refi and deposit rates likely in 2013, we think this will be an important theme in the months ahead – especially as investors are left scrambling to generate returns in a very low yield environment.

Yield enhancement via SSA

Together with many short-end core EMU rates moving towards zero, uncertainty regarding the euro area is unlikely to dissipate any time soon. We continue to believe the European SSA market is a good candidate for yield enhancing strategies given its credit quality and reasonable secondary market liquidity.

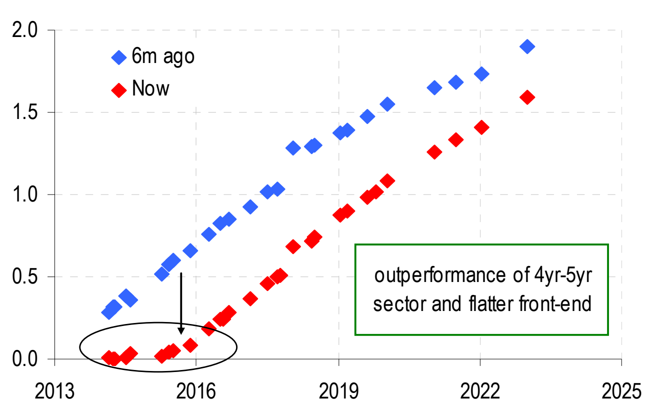
Evidence of how the SSA sector responds when policy rates continue to be cut suggests the following:

- Bull-fattening in the very front end of yield curves (Figure 29)
- Similar outperformance of 4yr-5yr sector in spread curves (Figure 30)

Stickiness at zero and extension trades

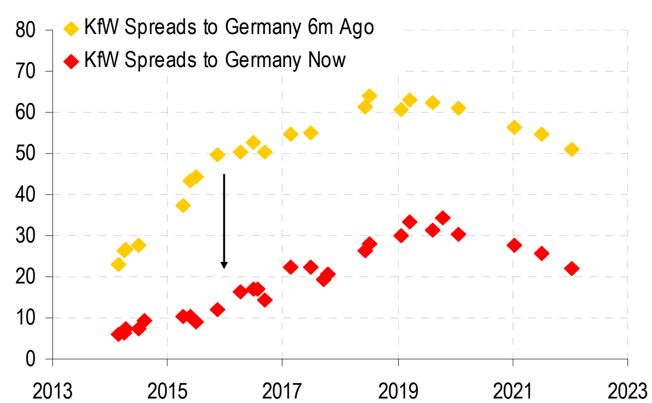
Part of this dynamic is likely to reflect investors' aversion to negative yielding assets (such as from central banks for example). This helps explain the "roll up" effect as yields tend towards a seemingly zero bound in the very front end. We expect this "stickiness" at zero is likely to persist even as ECB deposit rates go negative. More broadly, extension trades (and relative value in general on core curves) will continue to be an important and popular trading strategy in 2013. We also continue to advocate moving up in quality as yields and spreads compress among core SSA issuers (*European Rates Weekly - 2013 Outlook*).

Figure 29. KfW yield curve moves



Source: Citi Research

Figure 30. EIB Spreads to Germany



Source: Citi Research

Demand for Bonds

Bond demand is more difficult to analyze than bond supply

While analyzing the future supply of government bonds is a straightforward exercise, estimating demand trajectories and structural change in bond portfolios is not easy. Recent research papers have tried to aggregate the huge amount of fragmented information about government bond holdings and investment patterns[6], but the lack of real-time data makes the analysis of bond demand a very hard enterprise. Negative interest rates undoubtedly add complexity to the analysis.

Apart from the usual factors affecting the demand for government bonds, there are two additional key aspects to discuss:

Lower credit rating imply further reduction in the pool of safe assets

- **Demand for risk-free assets:** The pool of assets that specific types of investors can buy is shrinking as a result of the sovereign crisis that has hit the euro area and the related wave of deterioration in credit ratings. The IMF estimates that USD 9 trillion (16% of total) will be removed from the global pool of "safe assets" by 2016[7]. A negative yield environment reduces this pool further, since money market funds and central banks may face mandatory restrictions from purchasing government bonds that erode their equity/reserve base.

Additional demand for high-grade assets from regulation

- **Demand for regulatory assets:** In addition to the potential collateral squeeze due to introduction of centralized clearing of OTC derivatives (discussed above), a complete transition to Basel3 would require banks to demand up to USD 4 trillion[8] of high-quality liquid assets (HQLA) in order to meet their liquidity cover ratios (LCR).

Figure 31. Citi EGB demand estimation model

	AUM		Market parameters					
Investor type	USD bn	EUR bn	Trend growth (10y sample)	%Govt bonds	%EUR assets	EGB portfolio (EUR bn)	Trend demand (EUR bn)	AAA demand (EUR bn)
Investment fund global (Ex Euro)	14,560	11,243	3%	15%	10%	169	5	4
Investment funds (Euro)	6,286	8,140	3%	20%	70%	1140	34	21
Pension funds global (ex Euro)	8,064	6,227	3%	30%	5%	93	3	2
Insco & Pension Funds (Euro)	9,350	7,220	3%	10%	75%	542	16	10
Insurance global (Ex Euro)	24,600	18,996	3%	20%	20%	760	23	18
SWF	5,150	3,977	5%	5%	20%	40	2	1
HF	2,230	1,722	5%	2%	25%	9	0	0
Central banks	10,500	8,108	8%	50%	15%	608	49	36
Eurozone MFI (EGB holdings)	2,040	1,575	9%	100%	100%	1575	142	85
Private wealth	30,000	23,166	3%	10%	15%	347	10	6
Total (EUR bn)	112,780	87,088				5,282	284	183

Source: ECB, IMF, BIS, Wikipedia, EFAMA, EBA, SWF Institute, Citi Research

What can we say about trends in the global demand for EGB?

To put the IMF/BIS numbers into the context of negative interest rates, we estimate the global demand for EGB (Figure 31). We create a sample of global assets under management and estimate the percentage of EUR-denominated government bonds using information from various sources. Furthermore, we estimate the increase in AUM over the past ten years ("trend growth") and imply global 2013 demand for EGB. Despite the obvious inaccuracy that results from such an extensive global data aggregation, the exercise serves as a benchmark for trends in global EGB

[6] http://www.imf.org/external/pubs/ft/wp/2012/wp12284.pdf
[7] http://www.imf.org/external/pubs/ft/gfsr/2012/01/pdf/c3.pdf (Summary)
[8] http://www.imf.org/external/pubs/ft/gfsr/2012/01/pdf/c3.pdf (Box 3.4.)

demand and highlights an imbalance between trend demand and net EGB supply in 2010 and 2011. Also, trend demand for AAA or near-AAA EGB is estimated around EUR 180bn and compares to projected net AAA-supply of 130/140bn for 2013.

New investors, negative yields and regulation will alter future trends in EGB demand

Note that our exercise does not take into account the additional demand resulting from regulatory changes (which is likely to be significant) or the emergence of new players on the investor landscape. For example, the SNB and Asian investors have been a strong source of demand for French government debt in 2012. In 2013, the ESM will be the new player having total investable fund of EUR 64bn in paid-in capital. Neither do we model changes in demand resulting from bonds trading at negative yield, which could skew the behavior of both end investors and issuers.

Trade Ideas

Based on our analysis, these are trades to have in case the ECB decided to lower its deposit rate into negative territory:

- Receive EUR 3y1y @1.08% (target 0.5%).
- Buy Bunds vs 2s and 30s @25bp (target -25bp)
- Sell Schatz/OIS @-11bp (target 0bp), if you believe in the "stickiness" hypothesis or in an inversion of forward-Eonias. Otherwise, in an environment of diminishing sovereign credit risk, sell Bund spreads -27bp (target -10bp).
- Buy EUR 3y2y ATM receiver (or sell EUR 3y2y ATM payer).
- Sell OATei22 vs Bundei23 on a break-even inflation basis on the expectation that a negative deposit rate would put greater narrowing pressure on the nominal yield spread than the real yield spread.
- Buy EIB 3y vs Bunds @16bp (target 5bp).

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Notes

Appendix A-1

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