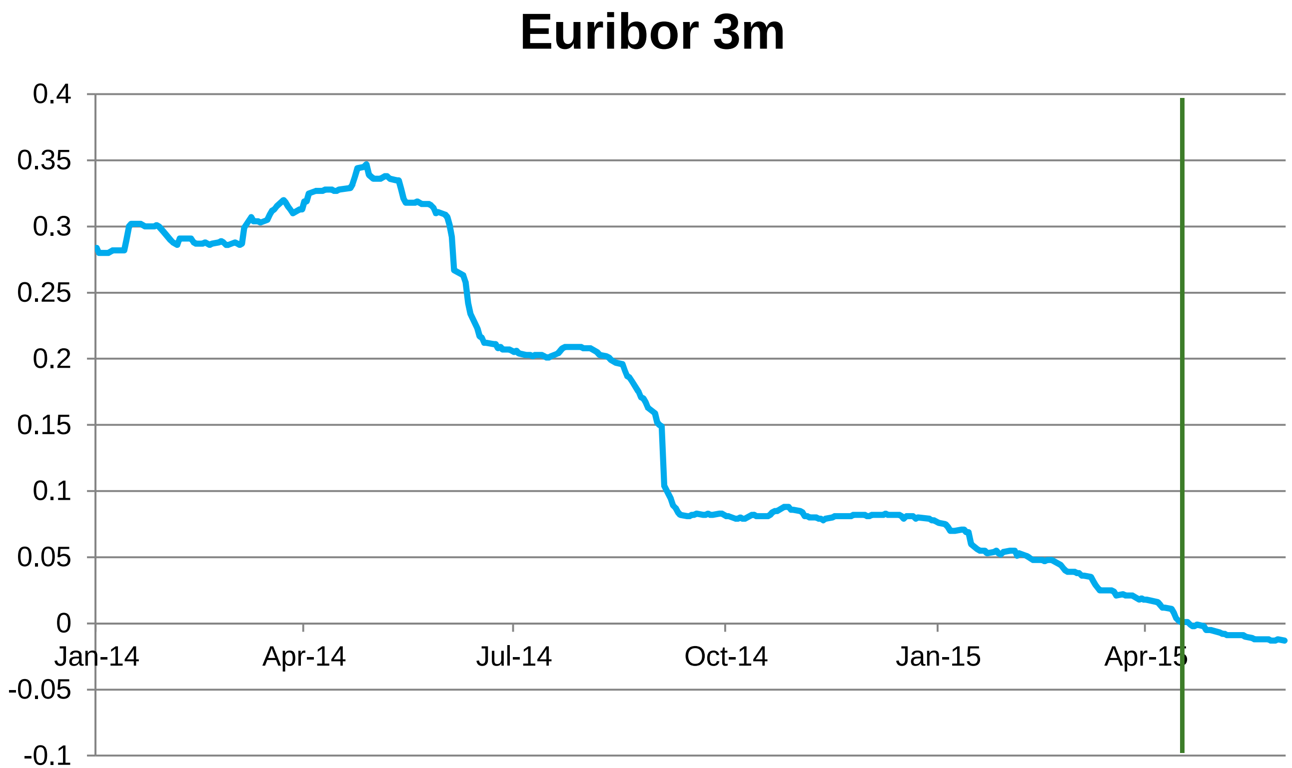
Initial market experience with negative 3-month Euribor rates

MMCG Frankfurt – June 17th 2015

Executive Summary

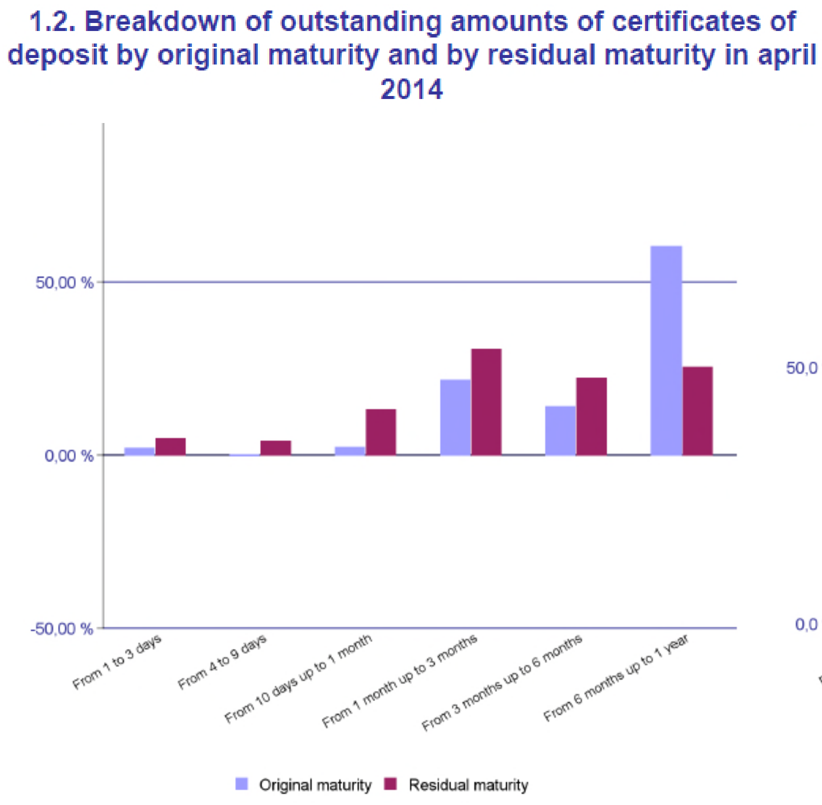
- 3m Euribor path
- French CD market
- Euro zone cash market
- e-MID Electronic platform
- 3m Euribor and 3m Repo Rate
- 3m Euribor and relative stickiness
- Basis Swaps behaviour
- Interest Rate Options Pricing Model
- Open Issues

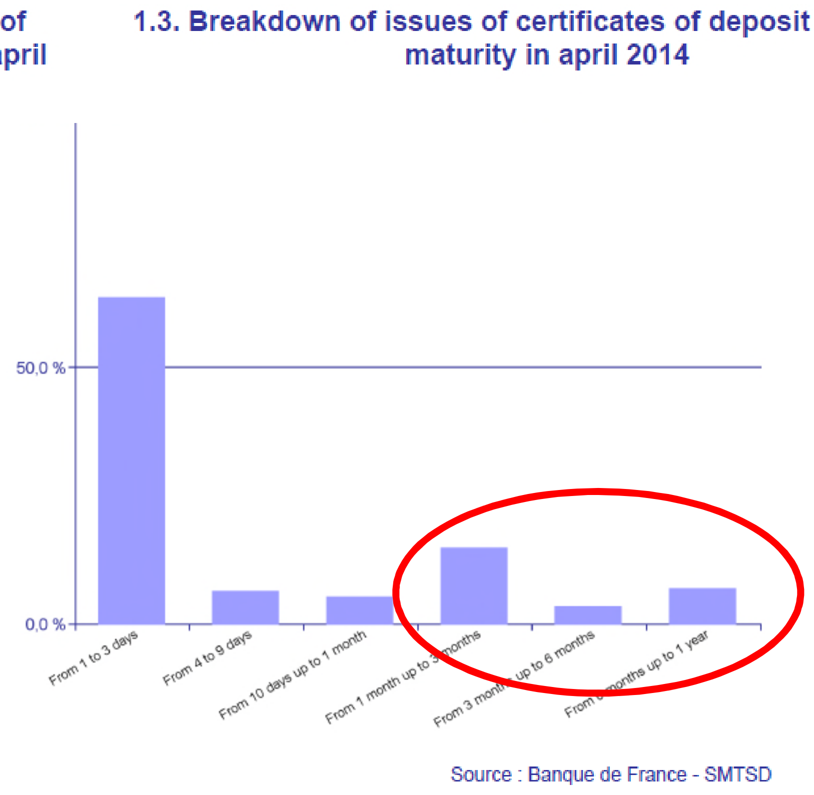
3m Euribor 1 year graph



- 3m Euribor fixing has turned negative for the first time on April 21 st 2015.
- Shorter Euribor rates turned negative at an earlier stage, as a consequence of Central Bank's negative Deposity Facility Rate (1w and 2w Euribor on Sept 5 th 2014, 1m onMarch 11 th 2015).

Trending toward low/negative rates: French CDs as of April 2014

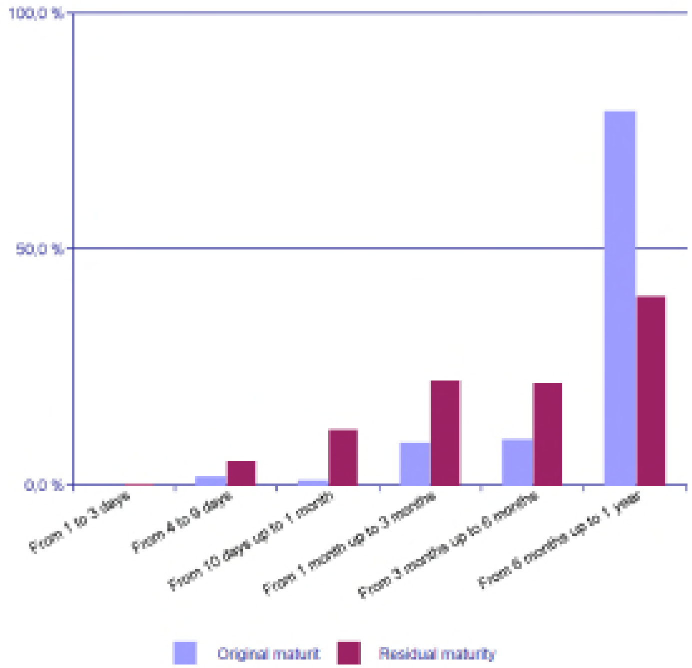




- Average Original Maturity of Outstanding Amount: 255 days
- Average Original Maturity of Issues: 43 days

Trending toward low/negative rates: French CDs in April 2015

1.2. Breakdown of outstanding amounts of certificates of deposit by original maturity and by residual maturity in april 2015



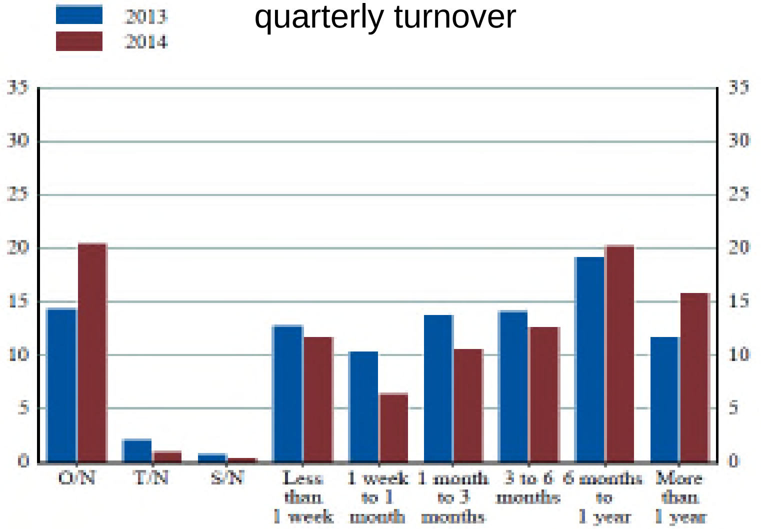
1.3. Breakdown of issues of certificates of deposit by original maturity in april 2015

Source : Banque de France - SMTSD

- Average Original Maturity of Outstanding Amount: 308 days
- Average Original Maturity of Issues: 120 days
- As rates have been moving down, large investors have lengthen their credit limits (i.e. the tenor of their assets) in order to achieve positive returns and/ or avoid negative rates.
- 3m Euribor negative fixing, *per se*, does not have a significant impact.

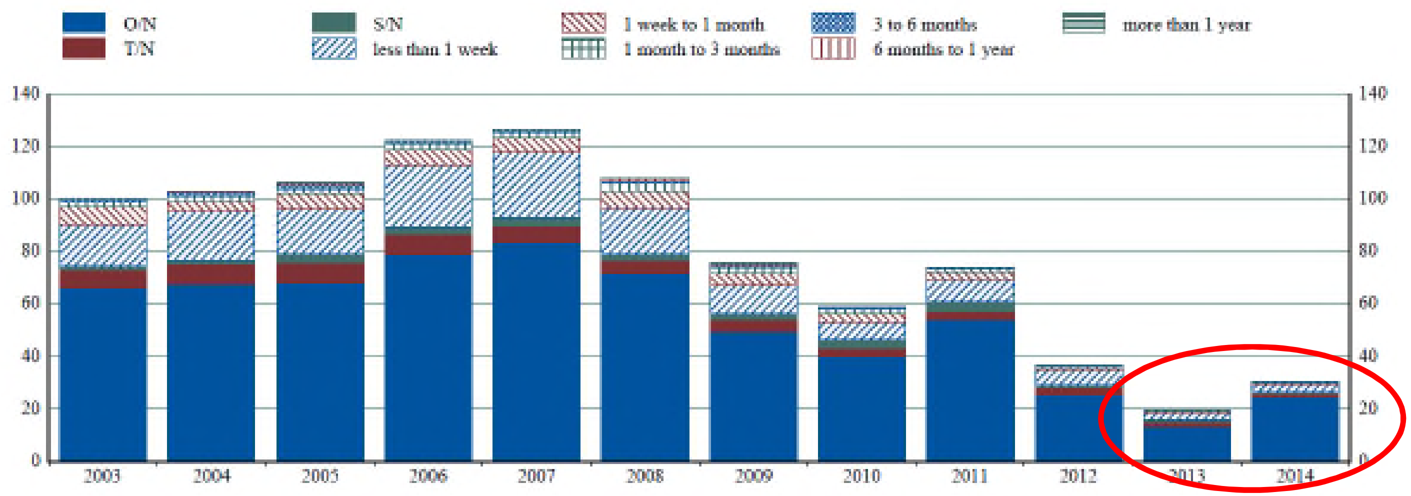
Interbank deposit market

Maturity weighted breakdown of cumulative quarterly turnover



- At aggregate Euro zone level unsecured cash borrowing gently recovers.
- Future 2015 Survey may show some further improvement.

Cumulative quarterly turnover in unsecured cash borrowing

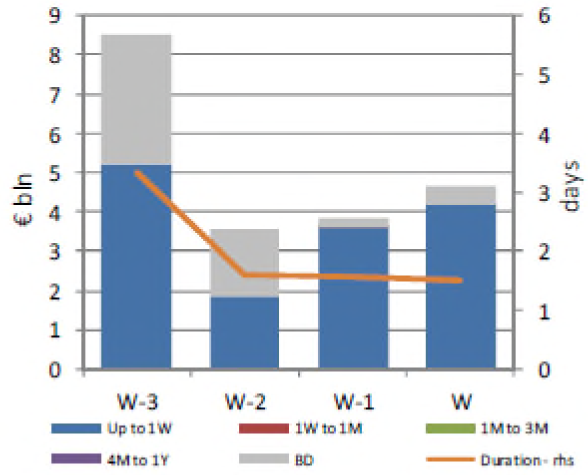


Source: ECB Money Market Survey Oct 2014

Interbank deposit market

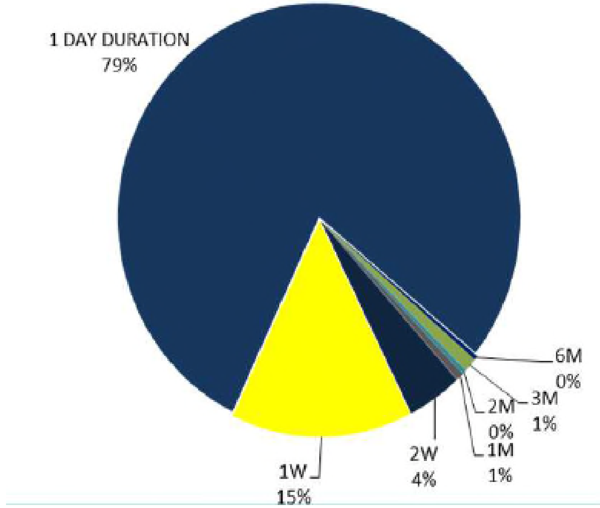
December 2013

e-MID Euro deposit maturity weighted breakdown



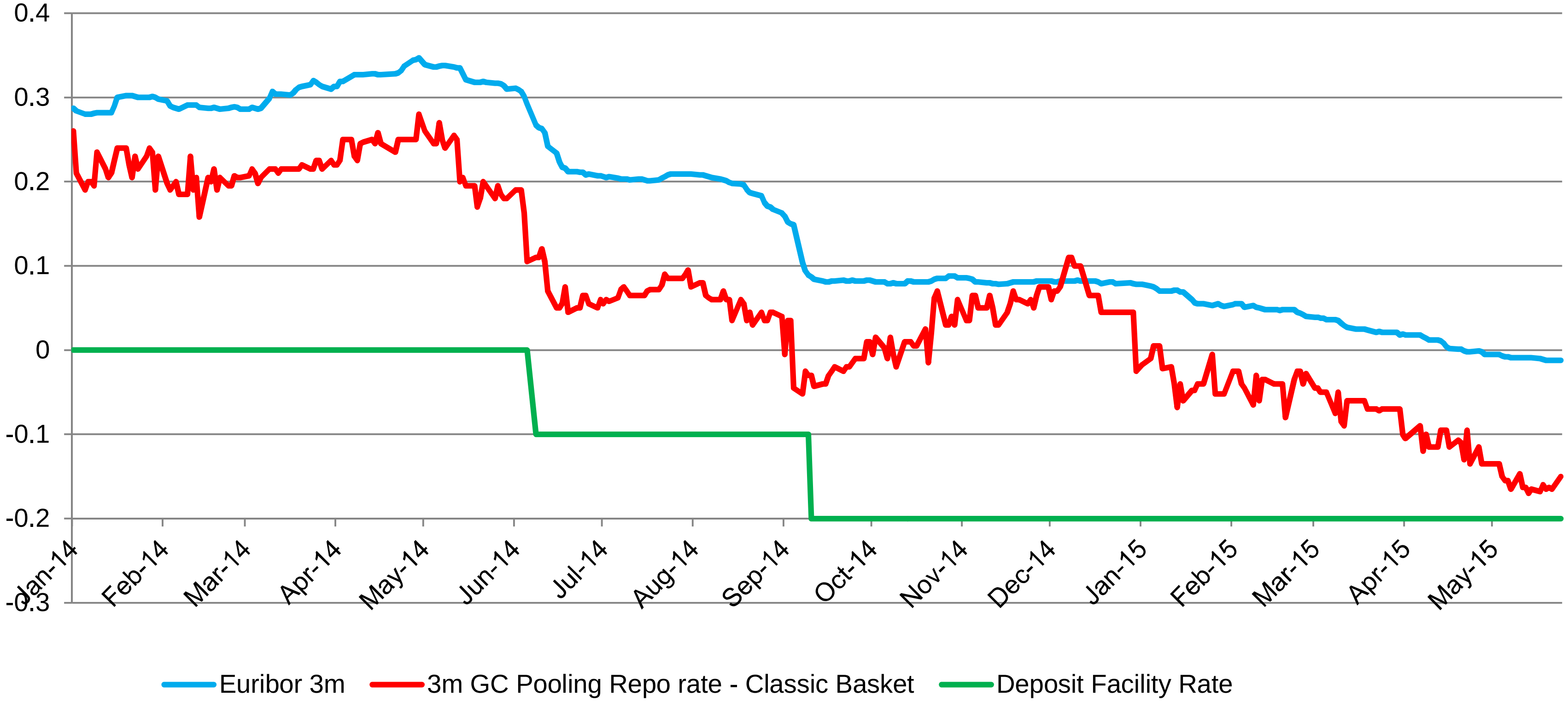
May 2015

e-MID Euro deposit maturity breakdown



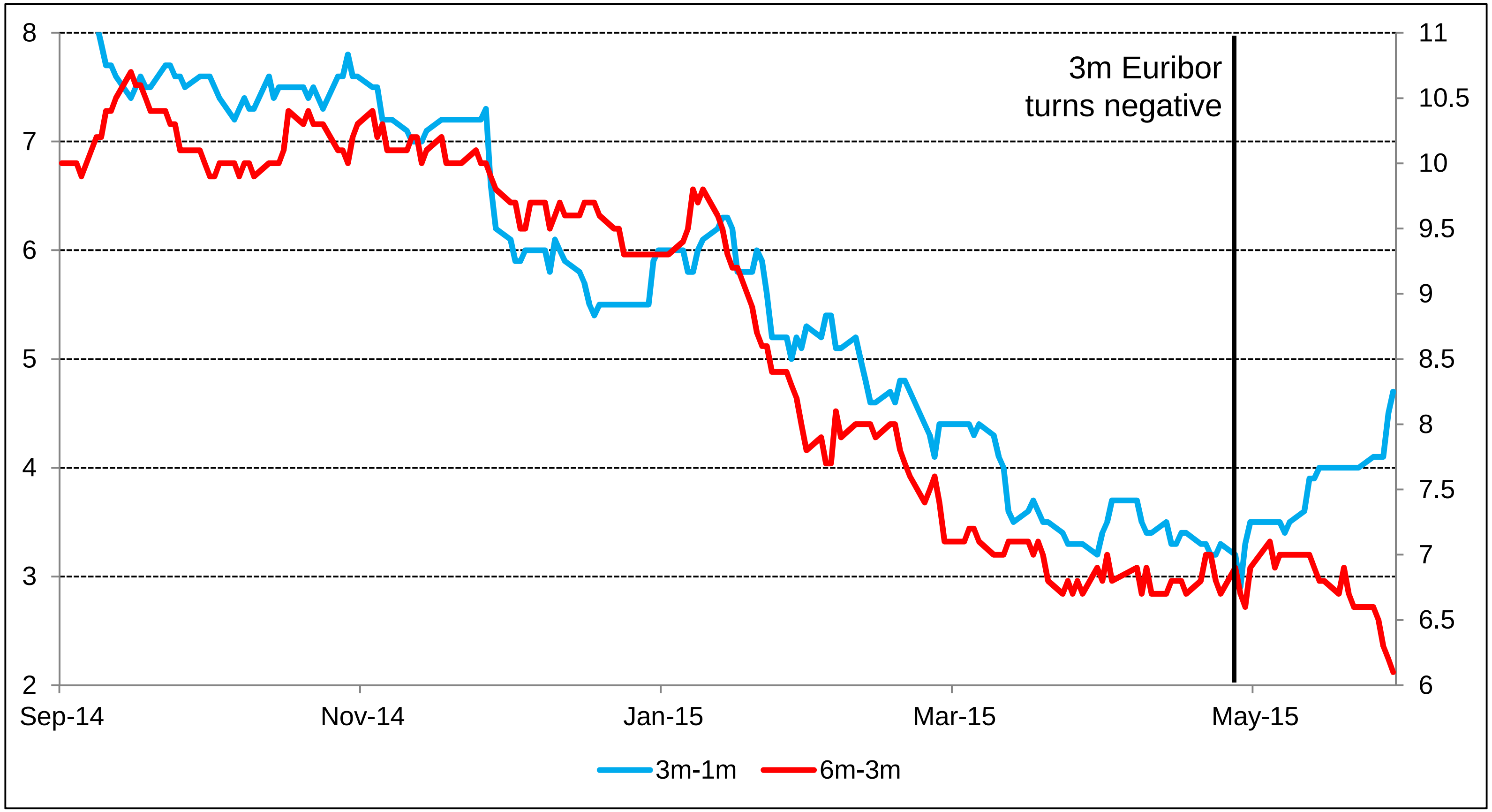
- Domestic market shows little signs of maturity extension as a consequence of lower / negative rates

3m Euribor vs 3m GC Pooling Repo rate



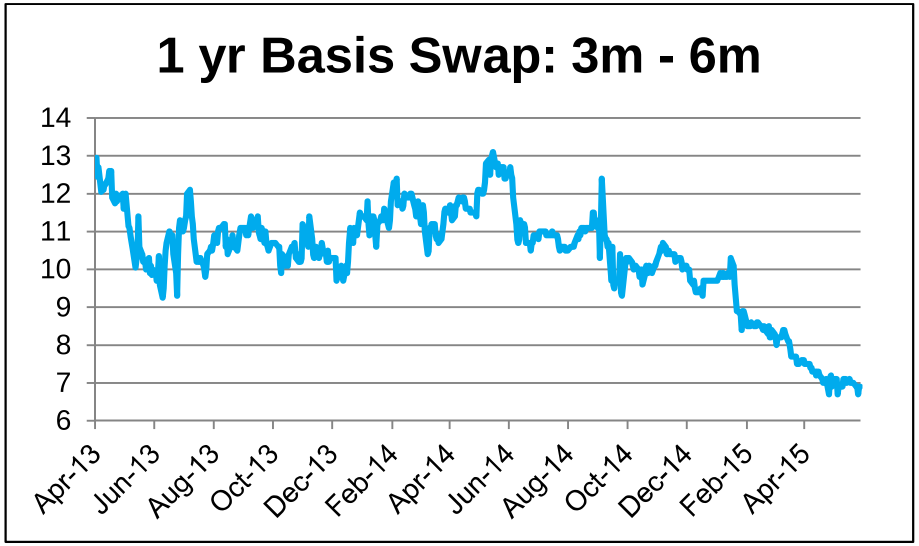
- Collateralized transactions traded at negative rates long before 3m Euribor.
- Though mildly correlated, the two instruments are independent.

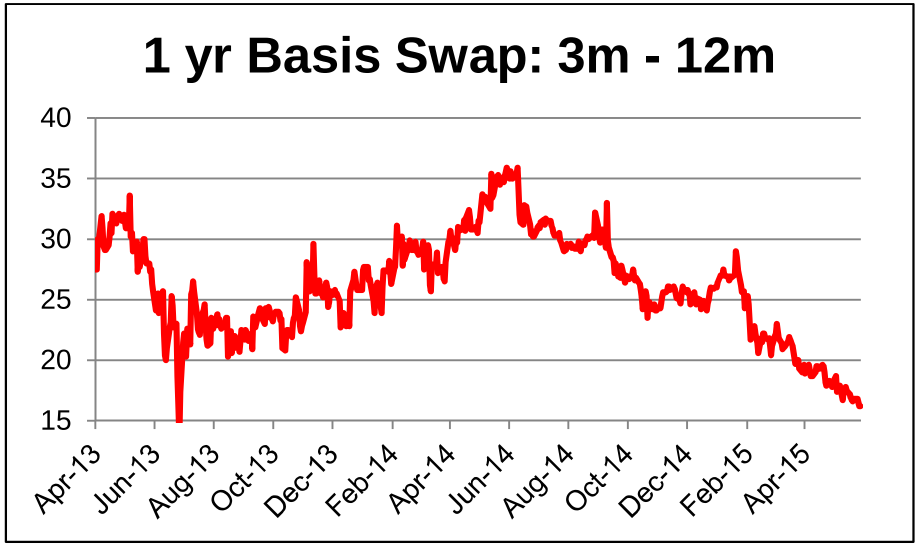
3m Euribor stickiness



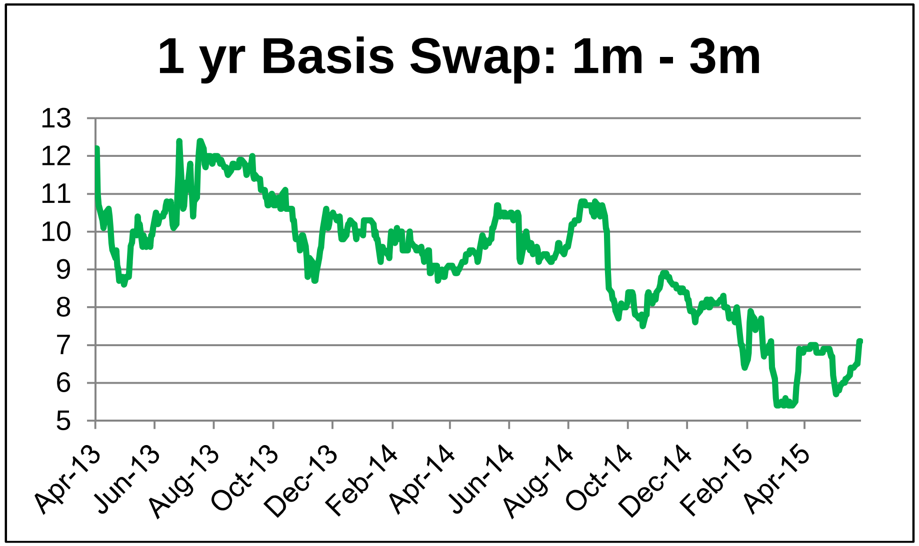
- 6m Euribor keeps on sliding toward zero, and 1m Euribor dives.
- 3m Euribor has become stickier.

Basis swaps anticipated the move into negative territory





- As market participants felt the possibility of having negative fixings for 3m Euribor, they have been selling the basis swap, anticipating a higher inelasticity or stickiness of short tenor negative rates vs long tenor positive ones.



Effect of negative rates on interest rate options

- Traditional pricing models (e.g. Black and Scholes) are based on a lognormal distribution, that does not allow negative rates. Implied volatility tends to infinity when forward rates approach zero; actually, it is not even defined for rates equal or lower than zero.

- In order to cope with current market conditions, alternative models have been used, for instance "Normal" model.

- Market participants opted using “Displaced lognormal model” for swaptions and a “Normal model” for Caps/Floors and Interest rate Futures' Options.

- The displaced lognormal model simply shifts the lognormal distribution to allow slightly negative rates.

- The normal model uses a normal Gaussian distribution and allows rates to span the whole real axis (from –infinity to infinity). Implied volatilities are quoted as “Normal”.

Open Issues

- Commercial side: three main alternatives may be identified for existing loans' stock:
  1. the base rate (Euribor) is floored at zero → the commercial spread is granted
  2. client rate (i.e. base rate+spread) is floored at zero → negative Euribor erode margins
  3. no zero-floor → negative base rate may cause negative all-in client rate[1]

- Legal: alternatives bear possible legal risks, as class actions may occur; banks may decide to opt for different solutions, causing reputational risks. New loans production need to be treated accordingly.

- IT:
  - Are bank's procedures negative-rates proof?

- Hedge Accounting:
  - Derivatives used for hedging specific commercial assets/liabilities may not be perfectly recognized from an accounting point of view.