Nordea MARKETS

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€STR – the future of euro rates

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Executive summary

- **Euro Short-Term Rate – new EUR overnight benchmark rate**
  - Overnight wholesale borrowing transactions by 50 banks reporting to the ECB
  - First publication on 2 October, reflecting market activity on the previous business day
  - EONIA will become a tracker of €STR in October. EONIA = €STR + a fixed spread
  - Transition period until end-2021 when EONIA will be discontinued

- **Discount curve to move lower, to €STR swaps**
  - Counterparties can choose between EONIA and €STR discounting ("clean discounting") …
  - … but EONIA will be discontinued at end-2021, so sooner or later it's going to be €STR
  - Risk of a Goldman gold rush: cash payment to mitigate value transfer(?)
  - CCPs to play a key role during the transition period

- **Modelling €STR forwards: less volatility and seasonal patterns**
  - Seasonality within ECB maintenance periods very modest compared to EONIA
  - Month-/quarter-/year-end effects insignificant, reverse to EONIA

- **Liquidity in euro rates derivatives could be OIS (€STR) based in the future**
  - Financial Stability Board's guideline
  - ISDA consultation on derivatives' fallback rates
  - Challenge: asset swap, issuance swap activity in the Euro zone

- **More issuance referencing to overnight rate, ie €STR**
  - SONIA, SOFR experience
  - Derivatives liquidity
  - €STR swap curve new pricing reference in the future

- **€STR and €STR-based term rates may eventually replace Euribor**
  - But it's a topic for another research note
  - To be continued … stay tuned

€STR vs EONIA – what is going to change?

	€STR	EONIA
Economics	Unsecured borrowing	Unsecured lending
Counterparties	Wholesale	Interbank
Contributors	50 banks under MMSR regulation	28 panel banks (voluntarily)
Administrator	European Central Bank (ECB)	European Money Markets Institute (EMMI)
Calculation	Volume-weighted mean, 25% trimming	Volume-weighted mean of panel banks' transactions
Average daily volume in 2019	EUR 36 billion (Pre-€STR)	EUR 2.8 billion
Publication lag	One business day	Not currently, 1BD starting in October
Bloomberg		EONIA Index
Note	First publication on 2 October	Tracker of €STR in Oct, discontinued end-2021

Lower O/N fixings
- Borrowing vs lending
- All €STR banks' counterparties do not have access to the deposit facility

€STR is not floored by the ECB's deposit facility rate like EONIA

€STR is more stable due to its trimming mechanism, higher turnover

Less seasonality within ECB reserve maintenance periods

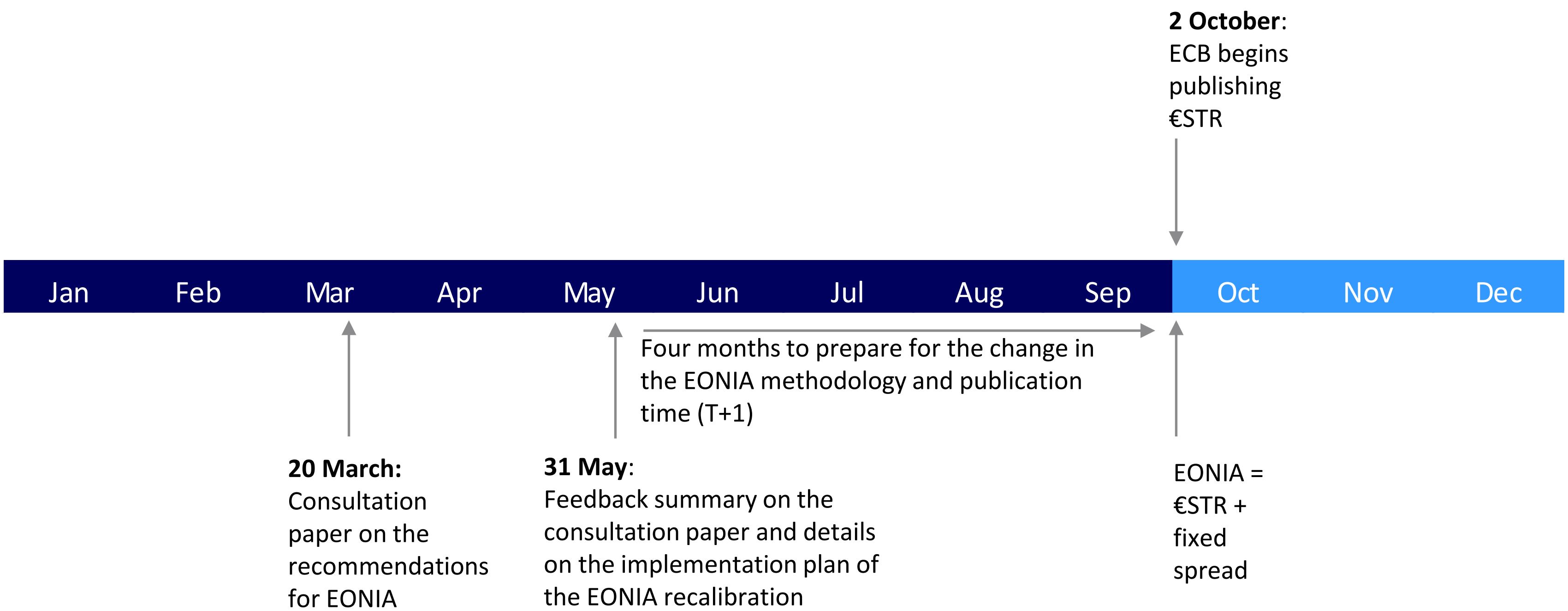
Turn-of-the-month/quarter/year effects inverted: EONIA typically rises, €STR dips

EONIA forwards starting in October and later do not exist, they are €STR-based

€STR eventually to replace EONIA as a basis for collateral interest, and thus the discount curve for EUR derivatives to move lower

One-day publication lag: market participants have to update their systems to enable a T+1 publication

Timeline in 2019



Key features and conventions of selected overnight rates

	€STR	EONIA	SOFR	SONIA
Name	Euro Short-Term Rate	Euro Overnight Index Average	Secured Overnight Financing Rate	Sterling Overnight Index Average
Administrator	European Central Bank	European Money Markets Institute	Federal Reserve	Bank of England
Economics	Unsecured borrowing	Unsecured lending	Secured borrowing (US Treasury repo)	Unsecured borrowing
Calculation	Volume-weighted mean, 25% trimming		Volume-weighted median	Volume-weighted mean, 25% trimming
Daily average volume in January-April 2019	EUR 36 billion (Pre-€STR)	EUR 2.8 billion	USD 959 billion	GBP 41 billion
Publication lag	One business day	Not currently, 1BD starting in Oct	One business day	One business day
Publication time (CET)	09.00		13.00	10.00
Bloomberg		EONIA Index	SOFRRATE Index	SONIO/N Index
Note	First publication on 2 October	Tracker of €STR in Oct, discontinued end-2021		

Euro Short-Term Rate (€STR)

- The new overnight benchmark interest rate in the Euro zone …
- … that will replace EONIA.
- €STR will reflect the wholesale euro unsecured overnight borrowing costs of Euro-area banks.
- €STR will be calculated based entirely on actual individual borrowing transactions in euro that are reported by banks in accordance with the ECB's money market statistical reporting (MMSR).
- The ECB will begin publishing €STR on 2 October 2019
  - The rate will be available by 09.00 CET on each TARGET2 business day based on actual individual transactions from the previous day.
  - It will be published on the ECB's website via the ECB's Market Information Dissemination (MID) platform and the ECB's Statistical Data Warehouse.
- €STR will also provide a basis for developing term rates as fallbacks for contracts referencing the Euribor.

EUROPEAN CENTRAL BANK

EUROSYSTEM

Euro Short-Term Rate (€STR) – methodology

- Exclusively based on borrowing transactions in euro conducted with financial counterparties that 50 banks report in accordance with MMSR Regulation.
- Overnight unsecured fixed-rate deposit transactions over EUR 1 million.
- Each TARGET2 day as a volume-weighted trimmed mean rounded to the third decimal.
- The volume-weighted trimmed mean is calculated by:
  1. ordering transactions from the lowest rate to the highest rate.
  2. aggregating the transactions occurring at each rate level.
  3. removing the top and bottom 25% in volume terms.
  4. calculating the mean of the remaining 50% of the volume-weighted distribution of rates.
- A pro rata calculation is applied to volumes that span the thresholds for trimming to ensure that exactly 50% of the total eligible volume is used in the calculation of the volume-weighted mean.
- Contingency computation methodology will be applied if the number of reporting banks is less than 20 or five banks account for 75% or more of total transaction volumes. For further details, see €STR methodology and policies.

Together with €STR, the following is published:

- total nominal value of transactions before trimming in EUR millions
- number of banks reporting transactions before trimming
- number of transactions before trimming
- percentage of total nominal amount reported by the five largest contributing banks that day, as a whole number
- calculation method: normal or contingency
- rates at the 25th and 75th percentiles with two decimal places

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50 MMSR banks and 28 EONIA panel banks

MMSR reporting agents

ABN AMRO Bank N.V.	DekaBank Deutsche Girozentrale
Allied Irish Banks plc	Deutsche Bank Aktiengesellschaft
Banca IMI S.p.A.	DB Privat- und Firmenkundenbank AG
Banca Monte dei Paschi di Siena S.p.A.	Dexia crédit local
Banco Bilbao Vizcaya Argentaria, S.A.	DZ Bank AG Deutsche Zentral-Genossenschaftsbank
Banco de Sabadell, S.A.	Hamburg Commercial Bank AG
Banco BPM Societa’ per Azioni	HSBC France
Banco Santander, S.A.	ING Bank N.V.
Bankia, S.A.	ING Belgique SA
Banque fédérative du crédit mutuel	ING-DiBa AG
Bayerische Landesbank	Intesa Sanpaolo S.p.A.
Belfius Banque SA	KBC Bank NV
BNG Bank N.V.	Kreditanstalt für Wiederaufbau
BNP Paribas	La Banque Postale
BNP Paribas Fortis SA	Landesbank Baden-Württemberg
BPCE	Landesbank Hessen-Thüringen Girozentrale
Caisse des dépôts et consignations - section générale	Natixis
Caisse Fédérale de Crédit Mutuel	Norddeutsche Landesbank -Girozentrale-
CaixaBank, S.A	Nordea Bank Abp
Cassa Depositi e Prestiti Societa' per Azioni	NRW.BANK
Commerzbank Aktiengesellschaft	Piraeus Bank, S.A.
Coöperatieve Rabobank U.A.	Société Générale
Crédit Agricole Corporate and Investment Bank	UniCredit Bank AG
Crédit Agricole S.A.	UniCredit Bank Austria AG
Crédit Lyonnais	UniCredit, Societa' per Azioni

Source: ECB

EONIA panel banks

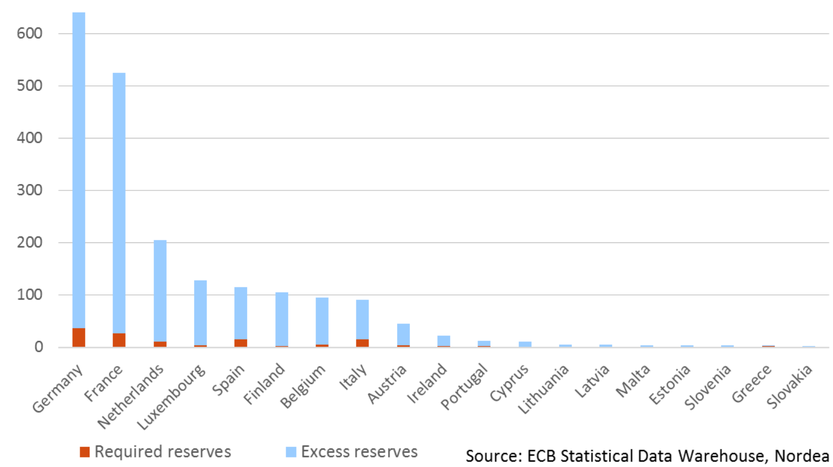
Banco Bilbao Vizcaya Argentaria
Banco Santander
Bank of Ireland
Banque et Caisse d'Épargne de l'État
Barclays
BayernLB
Belfius
BNP-Paribas
Caixa Geral De Depósitos (CGD)
CaixaBank S.A.
CECABANK
Crédit Industriel et Commercial CIC
Deutsche Bank
DZ Bank
Erste Group Bank AG
HSBC France
ING Bank
Intesa Sanpaolo
Landesbank Baden-Württemberg Girozentrale
Landesbank Hessen Thüringen Girozentrale
Monte dei Paschi di Siena
National Bank of Greece
Natixis/BPCE
Norddeutsche Landesbank Girozentrale
Nordea
Pohjola
Société Générale
UniCredit

Source: EMMI

€STR – representativeness and concentration

- Euro-area bank reserves currently concentrated in Germany and France
- Two other large EMU-4 countries, Italy and Spain, fall slightly below the Netherlands and Luxembourg

Euro-area bank reserves by country, March 2019, EURbn



Source: ECB Statistical Data Warehouse, Nordea

- French and German banks would have contributed most to €STR fixings in the ECB's backtest period from 1 August 2016 to 15 January 2018
- … with the five largest banks covering at least half of the volumes
- The 25% trimming mechanism will affect the representativeness as well

Franco-German rate, Italy and Spain barely represented

Representativeness and concentration at bank and country level

	Measure	Average	Highest	Lowest
Bank level	Five largest banks' share of total daily volumes	59%	74%	50%
	Six largest banks' share of total daily volumes	64%	78%	56%
Country level	Belgium's share of total daily volumes	15%	22%	5%
	Germany's share of total daily volumes	22%	33%	14%
	Spain's share of total daily volumes	5%	9%	1%
	France's share of total daily volumes	36%	55%	25%
	Italy's share of total daily volumes	1%	5%	0%
	Netherlands' share of total daily volumes	17%	32%	8%
	Others' share of total daily volumes	4%	8%	1%

Sources: MMSR data and ECB calculations.
Note: This table is based on daily MMSR data and covers the period from 1 August 2016 to 15 January 2018, capturing unsecured overnight transactions in the form of fixed-rate deposits.

Source: Second public consultation on the publication by the ECB of an unsecured overnight rate

EONIA as a tracker of €STR in October 2019 – December 2021

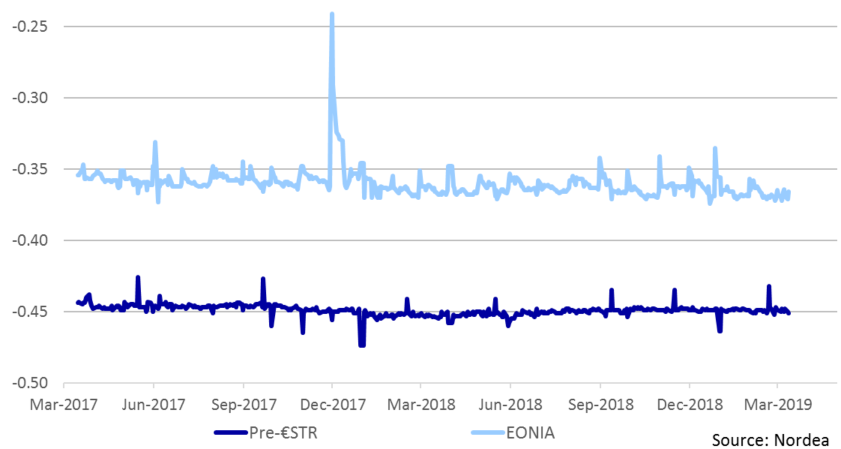
- EONIA's independence and fixing mechanism will be history in October
- EONIA will become a tracker of the new benchmark rate

EONIA = €STR + a fixed spread

- EONIA products will therefore become de facto €STR products
- EONIA forwards starting in October or later are already virtually €STR forwards, and should be modelled and priced accordingly

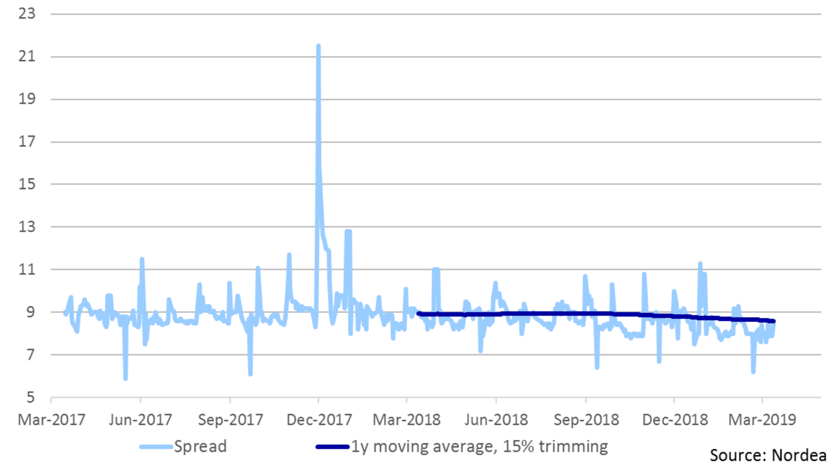
- The spread to be computed by a **historical mean** approach …
- … with **15% trimming**: 70% of the total data to be used to calculate the average spread, ie 15% of the highest and lowest observations to be excluded from the calculations
- Recommended time window of (at least) 12 months to use the most recent historical data …
- … currently suggesting a spread of 8.6bp

Pre-€STR and EONIA



Source: Nordea

… and EONIA – pre-€STR spread



Source: Nordea

EONIA vs €STR: seasonality and jumps

To price EONIA swaps, one needs to model and estimate a daily path of the fixings

At least the following has to be taken into account:

- Seasonality within the ECB's reserve maintenance period
- Month-/quarter-/year-end effects
- Jumps/drops on ECB meeting dates (or precisely, at starts of reserve maintenance periods)
- Spread to the ECB's deposit facility rate mainly determined by excess liquidity

But because EONIA will become a tracker of €STR,
market participants have to model €STR forwards that start in October and later

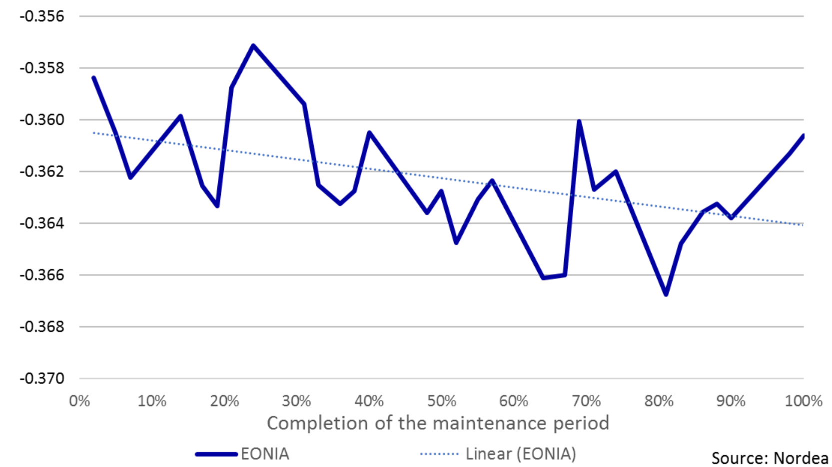
Observations from the pre-€STR era

- Less seasonality within maintenance periods
- Quarter- and year-end effects seem more moderate …
- … and inverse to EONIA

Seasonality within the ECB's reserve maintenance periods

- We observe the pre-€STR period of the past two years which has been featured by
  - negative deposit facility rate of -40bp
  - ample excess liquidity
- Market conditions are likely to remain similar in the early days of €STR
- EONIA has been elevated during the first 2-3 weeks of the maintenance periods …
- … and the fixings have typically bottomed about 1.5 weeks before the end of the periods

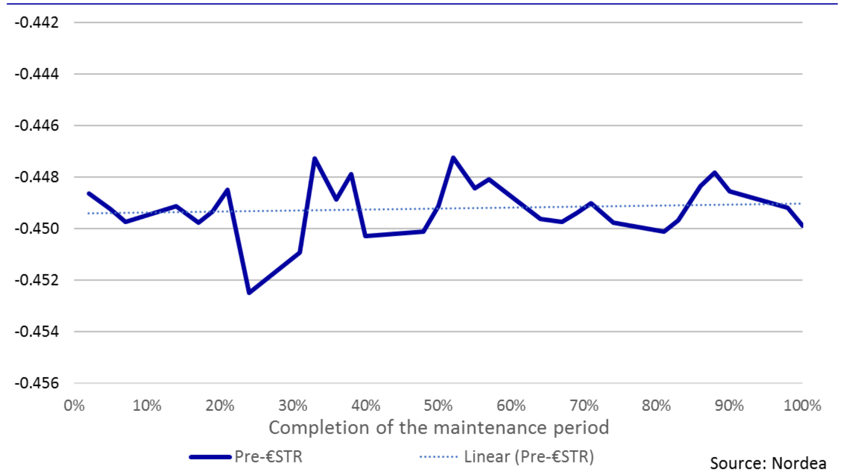
EONIA elevated at the beginning of maintenance periods



Source: Nordea

- By contrast, €STR does not show any particular seasonality
- Fixings fluctuate only modestly around their mean

Pre-€STR has remained stable



Source: Nordea

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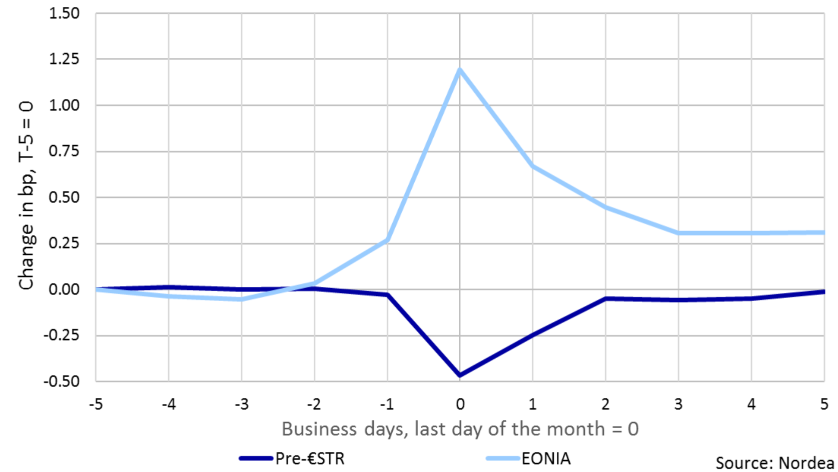
Month-/quarter-/year-ends – inverse reactions

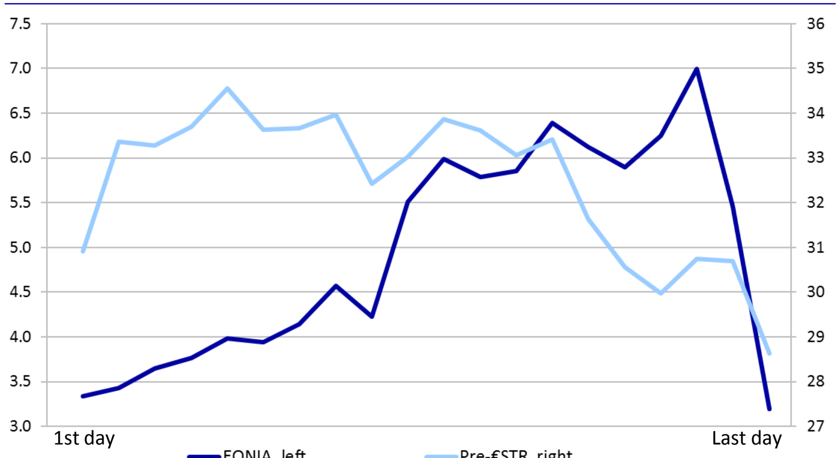
- EONIA tends to rise at month-ends
  - EONIA volumes typically peak a couple of days before the month-end
  - … with collapsing on the last day of the month
- By contrast, €STR seems to trade like a risk-free/repo rate, with falling on the last business day of the month, but only modestly
  - Highly rated MMSR banks raise wholesale O/N funding at attractive levels
  - … and/or banks with a weaker credit rating attract less overnight wholesale deposits, as turnover declines on the last day
- Pre-€STR recorded its yearly lows on the last business day of the year in 2017 and 2018

EONIA and pre-€STR around month-ends (Nov-17 excluded)



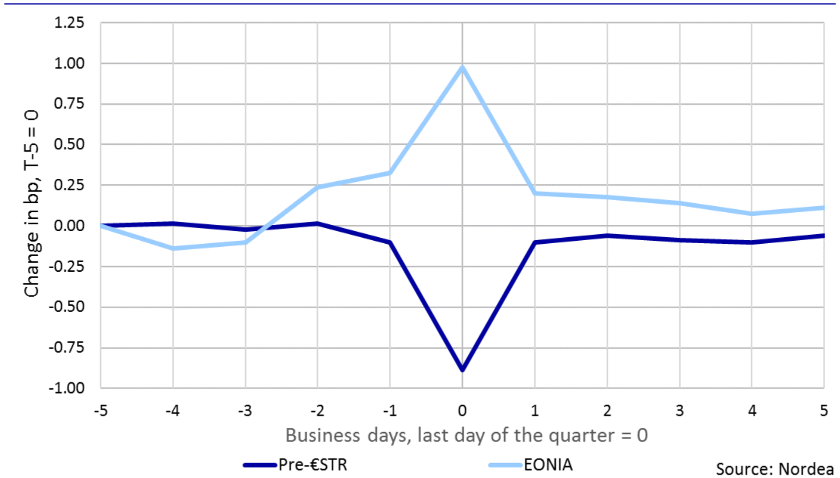
Source: Nordea

EONIA, pre-€STR volumes within a month, €bn, past two years



Source: Nordea

… and around quarter-ends only, past two years

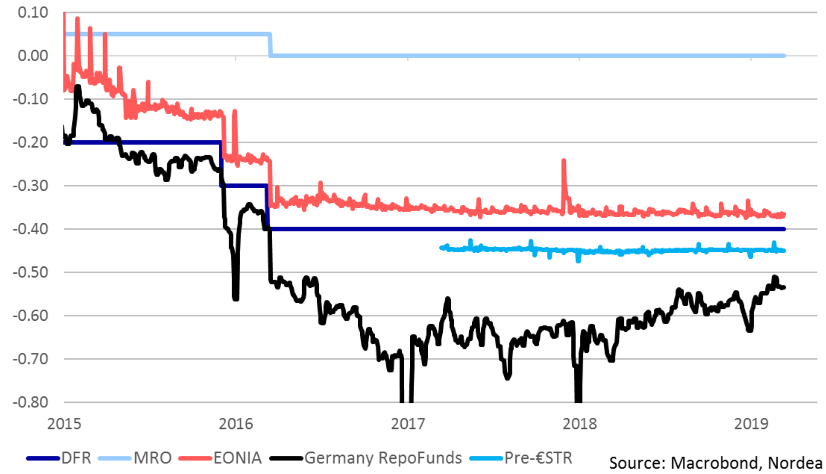


Source: Nordea

€STR vs ECB deposit facility rate (DFR) – excess liquidity

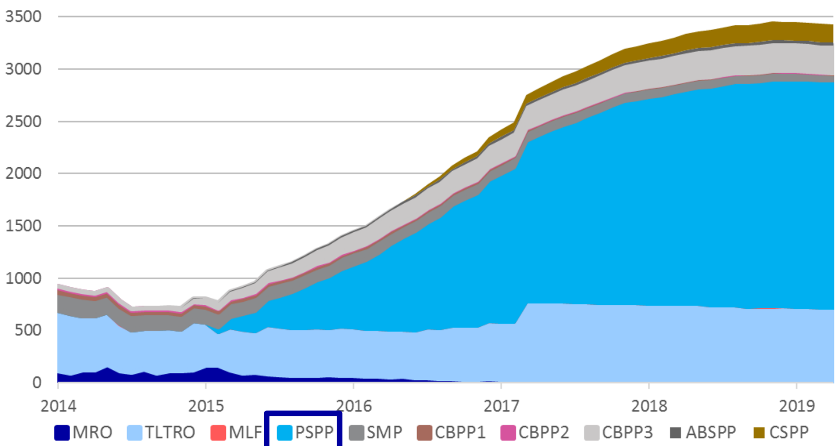
- The ECB's deposit facility rate will not floor the new key overnight benchmark rate starting October.
- €STR is a borrowing (bid) rate. All MMSR banks' counterparties do not have access to the ECB's deposit facility (pension funds, insurance companies, money market funds etc).
- €STR may necessarily not follow the key ECB rates higher 1:1, when the ECB hikes rates. Retail deposits more valuable than O/N wholesale funding from the regulation point of view. At worst, €STR stuck near zero, when ECB rates positive.
- Then the ECB may have to find new ways to control excess liquidity, and, thus €STR, to ensure smooth monetary policy transmission. The PSPP is difficult to unwind because it might ignite a new euro crisis.

Key money market rates, €STR and repo, below ECB rates



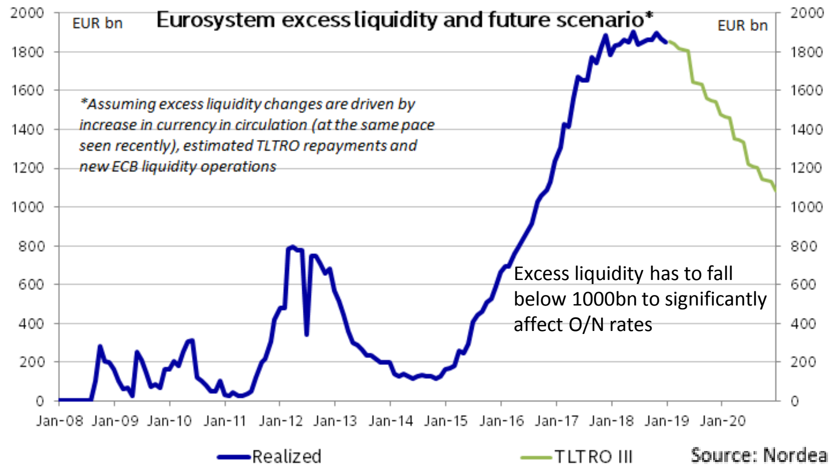
Source: Macrobond, Nordea

Main contributors to excess liquidity in the Eurosystem, €bn



Source: Nordea

Excess liquidity to decline, but remain ample



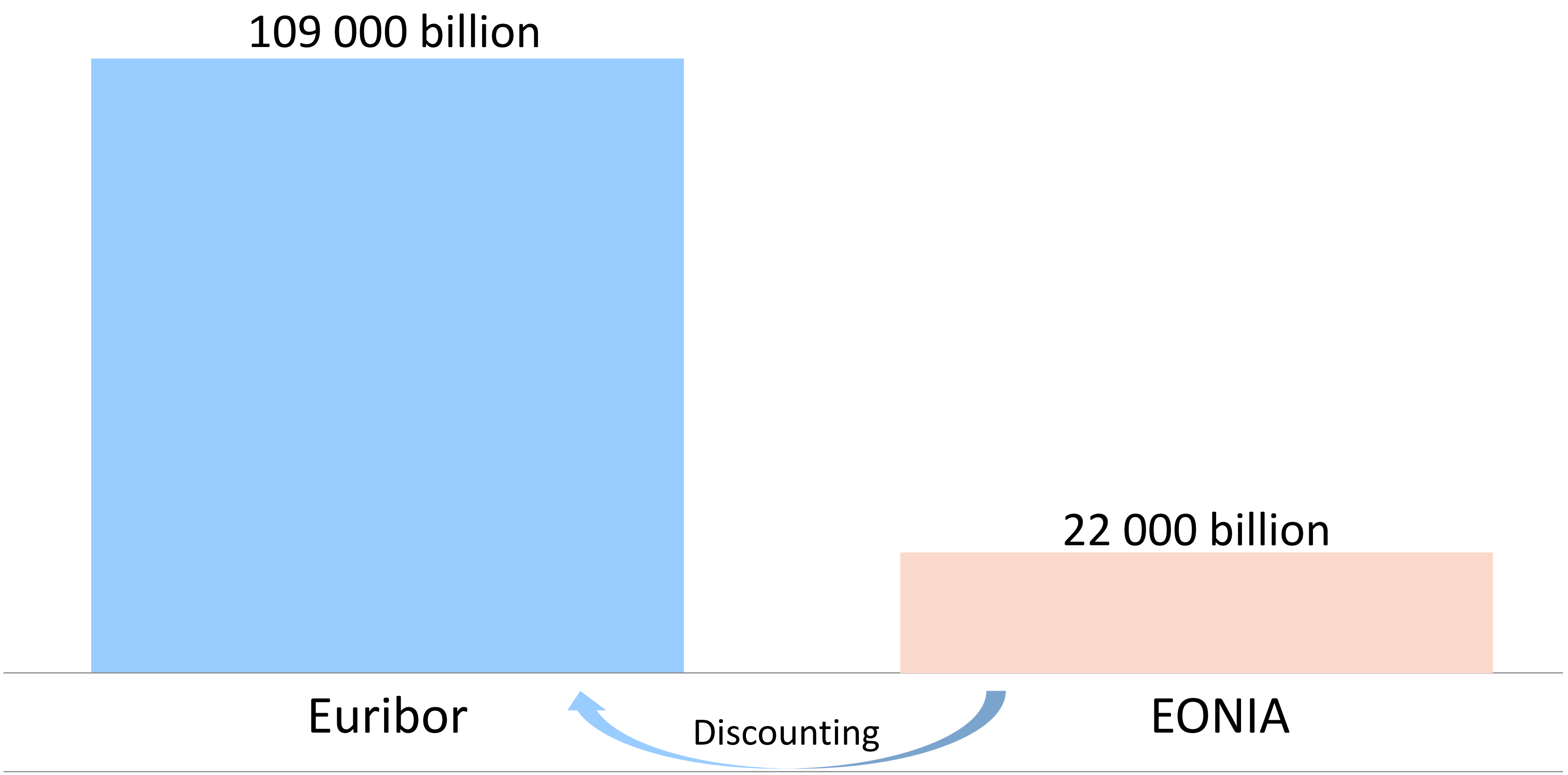
Discounting

EONIA is used as price alignment interest (PAI) and thus for discounting purposes in most of EUR derivatives.

Not only for EONIA, but also for Euribor-linked contracts and other derivatives.

EONIA will be discontinued at end-2021, so we eventually need to move to €STR discounting.

EUR rates derivatives outstanding (ECB – Update on quantitative mapping exercise, May 2018)



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Clean discounting – recommendation by the working group on euro risk-free rates

- The working group encourages market participants to make all reasonable efforts to replace EONIA with €STR as a basis for collateral interest for both legacy and new trades with each of its counterparties.
- “Clean discounting applies at counterparty level. This means that **for each counterparty only one curve will be used**.
- For example counterparties A and B can choose either EONIA or €STR as the basis for discounting. Once they agree, a single curve will be used for all their bilateral transactions whether for their legacy or for their forward book.
- The agreement between A and B does not prevent counterparty B to use a different benchmark with counterparty C as long as a single curve is used for all transactions between B and C.”
- The rationale for this path: its simplicity, the protection of less sophisticated users that may not be prepared to use €STR right away and the encouragement to transition in one single step per counterparty once they are ready.”

Source: Working Group on euro risk-free rates

Discounting: challenge and solution

Counterparty A

- Derivatives in the money
- Would like to have €STR as a price alignment interest …
- … ie would like to switch into €STR discounting …
- … because the discount curve would move lower (by about 8.6bp)
- … increasing the positive P/L of the derivatives

Counterparty B

- Derivatives out of the money
- Would like to stick to EONIA discounting
- … keeping the negative P/L unchanged, limiting any adverse P/L impact

- Counterparty A could eventually win, as EONIA will be permanently discontinued at end-2021, and the market is set to adopt €STR discounting.
- Regarding the timing, CCPs will probably play a key role. The market is likely to follow their practices.
- ➢ Risk/reward would favour being long discounting risk (ie it's even more important to have euro derivatives in the money).
- However, authorities are unlikely to facilitate another "Goldman gold rush".

Solution: cash payment to mitigate the value transfer (P/L impact), when changing the PAI and discounting regime.

To further smoothen the transition to €STR, the WG is considering additional steps

Standard compensation payment

To facilitate the calculation of compensation payment when moving computation framework from the recalibrated EONIA to €STR

a) a standard procedure that determines parameters to compute a compensation payment such as valuation dates and times, settlement dates, zero coupon methodology, spreads …

b) identification of standard data sources as the inputs to the computation methodology

c) determination of a high-level standard formula with some high level examples

EONIA – €STR transition protocol

A standard documentation protocol that helps coordinating transition of legacy contracts from EONIA to €STR

Source: Working Group on euro risk-free rates

€STR market liquidity?

- In the US, the SOFR market has been developing slowly as the effective Fed funds rate and Libor exist.

- So it has been questioned whether the EONIA-€STR transition period until end-2021 is long enough to establish a liquid €STR swap market.
- The key difference: because EONIA will become a tracker of €STR in October, the market risk of the existing EONIA products will move into €STR.
- Hence, all EUR OIS liquidity will soon be €STR-based. And it's better to emerge rapidly, otherwise we may face challenges.
- And as said before, old EONIA forward pricing models do not work anymore, when it comes to EONIA forwards starting in October or later. Thus, for example the EONIA 1y1y swap rate is already a de facto €STR product.

- The GBP market is transitioning fast to SONIA.
    - In LCH-cleared derivatives, SONIA/OIS notional exceeded the Libor/IRS in January-April 2019.
    - In Q1 2019, the GBP-denominated volume using the SONIA benchmark for floating-rate note tranches surpassed the volume of those using Libor for the first time. About 80% of the total GBP 19.2bn of FRN issuance will make coupon payments using SONIA (dealogic.com).

ISDA Interest Rate Benchmarks Review: First Quarter of 2019. Interest Rate Benchmarks Traded Notional and Trade Count.

	Q1 2019	
	Traded Notional (US$ billions)	Trade Count
USD LIBOR	34,772.4	171,350
SOFR	19.6	46
Basis Swaps: SOFR	3.0	23
GBP LIBOR	3,442.8	24,566
SONIA	1,672.5	2,581
Basis Swaps: SONIA	41.0	300
CHF LIBOR	187.9	2,462
SARON	1.1	8
Basis Swaps: SARON	0.0	0
JPY LIBOR	1,237.3	11,219
TIBOR/Euroyen TIBOR	0.9	21
TONA	41.0	129
Basis Swaps: TONA	1.0	1
EUR LIBOR	0.0	1
EURIBOR	7,030.0	50,087
€STR	0.0	0
Other*	21,486.2	114,435
Total	**69,936.9**	**377,229**

*Other includes IRD with other reference rates and IBOR/non-RFR basis swaps

Source: DTCC and Bloomberg SDRs

Liquidity in rates derivatives, longer-term perspective

We expect that liquidity in interest rate derivative markets will in future be **OIS-based**, ie directly linked to the overnight RFRs.

Andrew Bailey, Chief Executive of the Financial Conduct Authority, regulator of Libor: "Interest rate benchmark reform: transition to a world without LIBOR", speech at Bloomberg, London, 12 July 2018.

Major trends in rates reforms

In general	IBOR	→	O/N RFR and RFR term rates
Derivatives	IBOR	→	O/N RFR
Cash products	IBOR	→	RFR term rates or even O/N RFR

The Financial Stability Board (FSB) statement on the future roles for overnight RFRs and term rates, 12 July 2018

Overnight RFRs are robust because they are anchored in active, liquid underlying markets.

This contrasts with the scarcity of underlying transactions in the term interbank and wholesale unsecured funding markets from which some interbank offered rates (IBORs) are constructed.

Some of the working groups on RFRs have also been considering the development of new forward-looking term rates derived from RFRs (these may also be described as “RFR-based term rates” or “term RFRs”).

In some markets, notably the largest part of the interest rate derivative markets, it will be important, however, that transition away from IBORs is to the new overnight RFRs rather than to these types of term rates.

Transition will only reduce vulnerabilities if it addresses the core weakness of the IBORs – the lack of deep and liquid underlying markets.

Because derivatives represent a particularly large exposure to certain IBORs, and because these prospective RFR-derived term rates can only be robustly created if derivatives markets on the overnight RFRs are actively and predominantly used, **the FSB believes that transition of most derivatives to the more robust overnight RFRs is important to ensuring financial stability.**

The FSB supports a focus on the overnight RFRs as a primary IBOR fallback rate in the work which it has invited the International Swaps and Derivatives Association (**ISDA**) to lead on robust fallbacks **for derivatives** which reference IBORs.

Term rates could also **form part of a fallback in some cash product contracts** which reference an IBOR, notably where that contract requires planned interest or coupon payments based on a forward-looking rate.

In other cash products, contract holders may prefer overnight RFRs, for example in order to facilitate hedges using derivatives, and to maintain consistency across cash products and derivatives contracts.

Likely fallback solutions if benchmark rate permanently discontinued

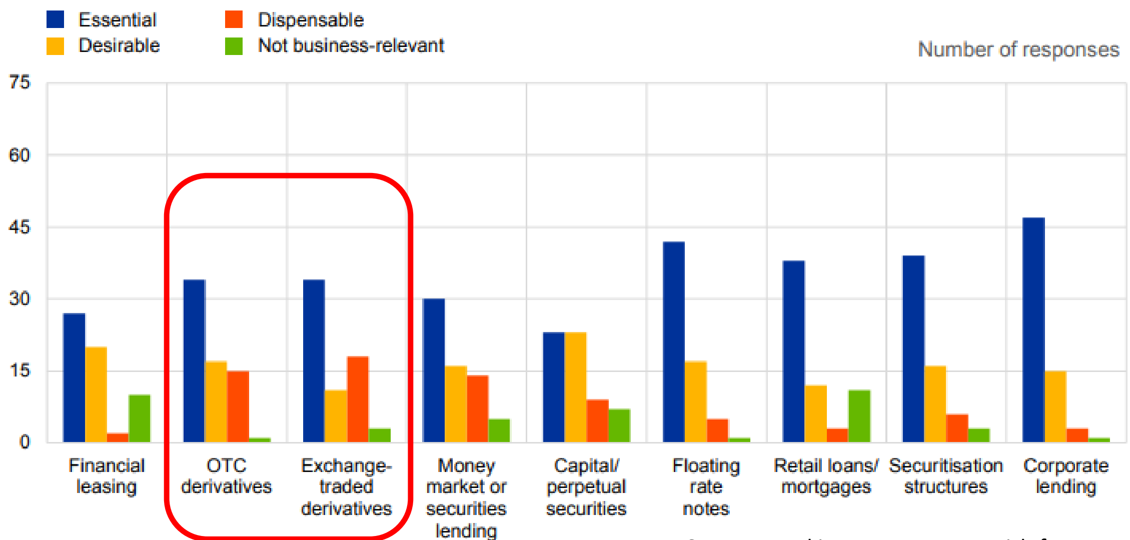
Derivatives	Cash products
• International Swaps and Derivatives Association (ISDA) consultations • Financial Stability Board statement: derivatives to refer to O/N RFR, not to term rates	• Working groups on risk-free rates
• Fallback = compounded O/N RFR fixing in arrears + a fixed spread • The spread derived by historical mean/median approach	• Fallback = forward-looking RFR term rate + a fixed spread

Consistency swap vs bond

Derivatives	Cash products
• EONIA to be discontinued at end-2021: ISDA fallback solution to be applied for legacy derivatives contracts (if any remaining) • ISDA will launch supplemental consultations covering Euribor and EUR Libor following the publication of €STR • ISDA has already indicated that, as recommended by the Financial Stability Board (FSB), the options proposed will not include forward-looking methodologies, ie term rates.	• Working group on euro risk-free rates is developing €STR term rates as fallbacks for Euribor

Are the FSB guideline and ISDA consultation results applicable in the Euro zone?

Need for forward-looking term rate as fallback for Euribor across product types



Source: Working group on euro risk-free rates

The working group on euro risk-free rates consulted EUR market participants on €STR-based term rates as fallbacks for Euribor

Despite the FSB guideline and ISDA's consultation, several respondents regarded term rates as essential or desirable as Euribor fallbacks in derivatives …

Potential asset vs liability mismatches, if cash products referencing to term rates (3M, 6M, even 12M) and derivatives to O/N rates

Assets	Liabilities
Corporate and consumer loans, mortgages linked to IBOR/term rate	Fixed-rate bond swapped into floating ~~IBOR~~ O/N RFR

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If the EUR market follows the FSB guideline, UK/US example …

- The above-mentioned path depends on the new Hybrid Euribor – whether it will survive and/or for how long …
- … and if not, it’s up to the usage of new €STR-based term rates in cash products, asset and liability swaps
- SOFR, SONIA and their term rates are set to replace Libor in the US and the UK, but €STR term rates are developed as fallbacks for Euribor

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