

## **MIGRATION METHODOLOGY**

The EONIA To €STR Phase 2 Transition  
for Total Return Futures On CAC 40 Index

As detailed in the Info-Flash of [24 September 2019](#), to ensure a smooth transition from EONIA to the €STR, Euronext and LCH SA will adopt the new benchmark rate for Total Return Futures on CAC 40<sup>®</sup> Index in two phases.

- **Phase 1:** Adaptation to the recalibrated EONIA: EONIA ==> €STR+8.5bps
- **Phase 2:** Phasing out EONIA: €STR+8.5bps (recalibrated EONIA) ==> €STR flat

Phase 1 was implemented on 2 October 2019. Phase 2 will be implemented in October 2021: the final migration date will be on Friday 15 October 2021 with the position transfer on Monday 18 October 2021.

This document aims to illustrate the methodology to be used in the Phase 2 transition from €STR+8.5bps (recalibrated EONIA) to €STR for Total Return Futures on CAC 40<sup>®</sup> Index (CAC TRF).

## I. Methodology for deciding the cash compensation component

The migration of the reference interest rate from **€STR+8.5bps** to **€STR flat** will create an imbalance in the current value for members who are holding open positions on CAC TRF. Thus the objective of this one-time adjustment is to make the present value of the open positions **payoff neutral** before/after the €STR migration, for each maturity.

### 1. Base hypothesis

The historical accrued parts before the migration date, i.e. Distribution/Funding, are not affected by this change. The difference caused by the migration will be reflected in the TRF settlement spread in bps, which is the settlement of the order book denominated in basis points.

As defined in the product specifications, the **TRF daily settlement price in index points** (futures price, clearing notation), is established by combining a number of underlying components based on the **TRF daily settlement price in bps** (trading notation), for each maturity T:

TRF Daily Settlement Price = CAC 40<sup>®</sup> Index + CAC 40<sup>®</sup> Cumulative Index – CAC 40<sup>®</sup> Funding Index + **TRF settlement spread in index point**

Where:

TRF settlement spread price in index point = **TRF settlement spread in bps** \* CAC Index Close<sub>t</sub> \* DaystoMaturity<sub>T</sub> / 360 / 10000

Thus the aim is to find a **new TRF settlement spread in bps**, denoted as **Basis**<sub>€STR</sub> (rounded to 0.5 bps, the tick size of the settlement basis) based on the implied forward curve as described in the next section.

In order to calculate the Final Daily Settlement Price (futures price, clearing notation) of the new TRF contract, the **Spread**<sub>€STR</sub> is inserted into the above formula by replacing the **old TRF settlement spread in bps**, denoted as **Basis**<sub>€STR+8.5</sub>, after the market close on the migration date. The rest of the calculation remains unchanged.

## 2. Implied forward curve building

In order to determine the new TRF settlement spread and the new futures price, Euronext will use an implied forward curve derived from CAC 40<sup>®</sup> Index Options (PXA) prices on the migration date.

The following data source will be used to determine the forward curve:

- Index close of CAC 40<sup>®</sup> Index
- Daily settlement price of CAC 40<sup>®</sup> Index Future (FCE)
- Prices of the CAC 40<sup>®</sup> Index Option (PXA)
  - Strategy order book of Reversal/ Conversion (Optiq strategy code: R)
  - Strategy order book of BOX (Optiq strategy code: X)
  - Forward prices derived from the put-call parity of the outright order book
  - Daily settlement price
- Any other missing forward points will be derived from the interpolation/extrapolation of the adjacent expiries available
- In the case of missing trades/quotes or if the level is deemed unfair, Euronext reserves the right to determine the prices in the most reasonable way.

### 3. Approximation of the new TRF settlement spread in bps

For a given maturity T, the following approximation is done on a per maturity level, based on the implied forward price ( $forward_t$ ) and time to maturity with 2 settlement days delay ( $\Delta_{SSP}$ ):

$$\mathbf{Basis}_{\text{€STR}} \approx \mathbf{Basis}_{\text{€STR}+8.5} + \frac{8.5\text{bps} * \sum_t^T forward_t(\tau-1)\Delta_{SSP}(\tau-1,\tau)}{IndexClose_t * \Delta_{SSP}(t,T)}$$

### 4. Techniques used to build the forward curve

#### a) Spot and the nearest maturity

The official index close of the CAC 40<sup>®</sup> Index on the migration day is taken as the index level for the forward curve calculation.

Example: the index close on the migration day of 1 October 2021 is 6517.69

The front month forward point is equal to the settlement price of the front month CAC 40<sup>®</sup> Index Future (FCE) on the migration day.

Example: FCE settlement price for Jul-21 is 6516.00

#### b) Maturities after the front expiry for common maturities between PXA and FCS

The strategy order book of Reversal/Conversion (Optiq strategy code: R) will be used to decide the fair value of each forward point. Euronext will take the VWAP of the trades between 16:30 and 17:00 CET, or, if no trade, the mid-BBO at a random time close to the end of the trading window at 17:00 CET. The futures leg of the strategy is the front month CAC 40<sup>®</sup> Index Future, with a price equal to the strike prices of the other two options legs.

Example: For Dec-22 maturity, the price of 'R' strategy with a strike price of 6500 is decided to be -133.75.

Then the Dec-22 forward point =  $[-133.75 + (6516.00 - 6500.00)] / 1.0061 + 6500.00 = 6382.96$

1.0061 is the discount factor calculated using the below methodology.

**c) Discount factors for common maturities between PXA and FCS**

Strategy order book of BOX (Optiq strategy code: X) will be used to decide the fair value of discount factors matching the TRF expiry. Euronext will take the VWAP, or, if no trade, the mid-BBO to decide the fair value of the strategy for each maturity.

Example: For Dec-22 maturity, the price of 'X' strategy of 1000/8000 is decided to be 7042.

Then the Dec-22 discount factor is  $7042/(8000-1000) = 1.0061$

**d) Maturities after the front expiry where the strategies R or X are not available or deemed unfair**

In this case, interpolation based on theoretical Put-Call parity will be used.

Example:

Expiry	Final Forward curve	Theoretical Forward Price (put-call parity)
Jun-22	6402.94	6343.00
Sep-22	No data	6324.00
Dec-22	6382.96	6297.50

Sep-22 Forward point =  $6402.94 + (6382.96 - 6402.94) * (6324.00 - 6343.00) / (6297.50 - 6343.00) = 6394.60$

**e) Maturities after the front expiry where the CAC 40 Index Option expiries are not available**

In this case, interpolation based on seasonal proportionality will be used.

Example:

Expiry	Final Forward curve
Dec-22	6382.96
Mar-23	6377.77
Dec-23	6262.86
Mar-24	No data
Dec-24	6153.81

Mar-24 Forward point =  $6262.86 + (6153.81 - 6262.86) * (6377.77 - 6382.96) / (6262.86 - 6382.96) = 6258.15$

**f) Exceptional cases**

In the case of insufficient pricing from the market, or if the implied level is deemed unfair, or any other exceptional cases which are not foreseen in the methodology detailed above, Euronext reserves the right to determine the prices in the most reasonable way.

## II. A numerical example of the calculation

### 1. Pricing of the TRF contract under €STR+8.5bps (FCS - the 'old' contract)

Valuation date	1-Oct-21
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	Contract_code	Expiry date	(1)	(2)	(3)	DaysToMaturity	Settlement in bps (Trading notation)	(4)	(5) = (1) + (2) - (3) + (4)
			CAC index close	Accrued dividend	Accrued funding			Settlement in Index Points	Final futures settlement price (Clearing notation)
OLD contract (FCS)	JFFCS	12/17/2021	6517.69	773.12	-73.251015	77	-2	-0.278812294	7363.78
	JFFCS	3/18/2022	6517.69	773.12	-73.251015	168	3	0.9124766	7364.97
	JFFCS	6/17/2022	6517.69	773.12	-73.251015	259	20	9.378231722	7373.44
	JFFCS	9/16/2022	6517.69	773.12	-73.251015	350	14	8.871300278	7372.93
	JFFCS	12/16/2022	6517.69	773.12	-73.251015	441	10	7.98417025	7372.05
	JFFCS	3/17/2023	6517.69	773.12	-73.251015	532	11	10.59486719	7374.66
	JFFCS	6/16/2023	6517.69	773.12	-73.251015	623	18	20.30260435	7384.36
	JFFCS	9/15/2023	6517.69	773.12	-73.251015	714	17	21.97547812	7386.04
	JFFCS	12/15/2023	6517.69	773.12	-73.251015	805	16	23.31884644	7387.38
	JFFCS	3/15/2024	6517.69	773.12	-73.251015	896	16	25.95488996	7390.02
	JFFCS	6/21/2024	6517.69	773.12	-73.251015	994	22	39.59134581	7403.65
	JFFCS	9/20/2024	6517.69	773.12	-73.251015	1085	21	41.25154629	7405.31
	JFFCS	12/20/2024	6517.69	773.12	-73.251015	1176	21	44.7113534	7408.77
	JFFCS	3/21/2025	6517.69	773.12	-73.251015	1267	22	50.46502529	7414.53
	JFFCS	6/20/2025	6517.69	773.12	-73.251015	1358	27	66.38267265	7430.44
	JFFCS	9/19/2025	6517.69	773.12	-73.251015	1449	27	70.83099608	7434.89
	JFFCS	12/19/2025	6517.69	773.12	-73.251015	1540	28	78.06744244	7442.13
	JFFCS	3/20/2026	6517.69	773.12	-73.251015	1631	28	82.68051859	7446.74
JFFCS	6/19/2026	6517.69	773.12	-73.251015	1722	32	99.76410827	7463.83	
JFFCS	9/18/2026	6517.69	773.12	-73.251015	1813	32	105.0361953	7469.10	
JFFCS	12/18/2026	6517.69	773.12	-73.251015	1904	32	110.3082823	7474.37	

2. The implied forward curve decided by Euronext

Expiry	Final Forward curve
Oct-21	<b>6516.00</b>
Nov-21	<b>6474.98</b>
Dec-21	<b>6496.98</b>
Mar-22	<b>6445.98</b>
Jun-22	<b>6402.94</b>
Sep-22	<b>6394.60</b>
Dec-22	<b>6382.96</b>
Mar-23	<b>6377.77</b>
Jun-23	<b>6292.83</b>
Sep-23	<b>6277.85</b>
Dec-23	<b>6262.86</b>
Mar-24	<b>6258.15</b>
Jun-24	<b>6181.03</b>
Sep-24	<b>6167.42</b>
Dec-24	<b>6153.81</b>
Mar-25	<b>6149.32</b>
Jun-25	<b>6075.73</b>
Sep-25	<b>6062.74</b>
Dec-25	<b>6049.76</b>
Mar-26	<b>6045.34</b>
Jun-26	<b>5972.99</b>
Sep-26	<b>5960.23</b>
Dec-26	<b>5947.47</b>

### 3. Pricing of the TRF contract under €STR (FCT - the 'new' contract)

				(6)	(7) = (1) + (2) - (3) + (6)	
	Contract_code	Expiry date	Adjusted basis - implied curve (Unrounded)	Conversion basis settlement (Rounded)	Settlement in Index Points	Final futures settlement price (Clearing notation)
<b>NEW contract (FCT)</b>	JFFCT	12/17/2021	8.479	6.5	0.906139957	<b>7364.97</b>
	JFFCT	3/18/2022	8.476	11.5	3.497826967	<b>7367.56</b>
	JFFCT	6/17/2022	8.451	28.5	13.3639802	<b>7377.42</b>
	JFFCT	9/16/2022	8.425	22.5	14.25744688	<b>7378.32</b>
	JFFCT	12/16/2022	8.407	18.5	14.77071496	<b>7378.83</b>
	JFFCT	3/17/2023	8.393	19.5	18.78181002	<b>7382.84</b>
	JFFCT	6/16/2023	8.382	26.5	29.88994529	<b>7393.95</b>
	JFFCT	9/15/2023	8.360	25.5	32.96321718	<b>7397.02</b>
	JFFCT	12/15/2023	8.340	24.5	35.70698362	<b>7399.77</b>
	JFFCT	3/15/2024	8.323	24.5	39.74342524	<b>7403.80</b>
	JFFCT	6/21/2024	8.307	30.5	54.88800215	<b>7418.95</b>
	JFFCT	9/20/2024	8.286	29.5	57.94860074	<b>7422.01</b>
	JFFCT	12/20/2024	8.267	29.5	62.80880597	<b>7426.87</b>
	JFFCT	3/21/2025	8.250	30.5	69.96287598	<b>7434.02</b>
	JFFCT	6/20/2025	8.235	35	86.05161269	<b>7450.11</b>
	JFFCT	9/19/2025	8.215	35	91.81795788	<b>7455.88</b>
	JFFCT	12/19/2025	8.197	36	100.372426	<b>7464.43</b>
	JFFCT	3/20/2026	8.180	36	106.3035239	<b>7470.36</b>
	JFFCT	6/19/2026	8.164	40	124.7051353	<b>7488.77</b>
	JFFCT	9/18/2026	8.145	40	131.2952441	<b>7495.36</b>
JFFCT	12/18/2026	8.127	40	137.8853529	<b>7501.95</b>	