Benchmark Determination Methodology for Efterm®

Efterm® Governance Framework

The European Money Markets Institute

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History

Version	Date Applicable	Summary of Changes
v1	14-11-2022	Original version
V2	25-01-2024	Introduction of three enhancements and clarification of terminology to the Level 3 of the Efterm waterfall methodology: 1. Not including a step change in the model at the end of the calculation month, unless a new maintenance period is starting. 2. Using ECB rate changes in preference to Futures rates, once they have been announced. The model would revert to using the Futures prices for the rest of the month until 7 days until the end of the month. 3. Using Spot Starting (T+2 business days) convention.
V3	05-12-2024	Reviewed by Oversight Committee and Board of Directors as part of 2nd Annual Review of the Methodology, no change
V4	02-06-2025	Reviewed and changed the Contingency and Error Handling sections

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1. Efterm® Specification

1. The "Underlying Interest" for Efterm® is stated as: "The rate which reflects the expected (i.e., forward-looking) average evolution of wholesale euro unsecured overnight borrowing costs of euro area banks over defined tenor periods."

2. There are five "Defined Tenors" for Efterm®, being 1 week, 1 month, 3 months, 6 months, and 12 months.

2. Input Data and Methodology Overview

3. The Benchmark Determination Methodology for Efterm® relies on the following input data:
   a. €STR-based Overnight Index Swaps ("OIS") tradeable bid and offer prices and volumes collected for the Defined Tenors as available on the central limit order books ("CLOB") of the electronic trading venues outlined in paragraph 4;
   b. €STR-based OIS dealer-to-client bid and offer prices and volumes collected for the Defined Tenors as displayed by the electronic trading venues outlined in paragraph 4;
   c. The euro short-term rate (€STR), the euro unsecured overnight interest rate administered and published by the European Central Bank (ECB);
   d. €STR-linked futures' settlement prices from trading venues outlined in paragraph 4
   e. The indicative calendar of ECB's reserve maintenance periods[1];
   f. The announced ECB Deposit Facility Rate (DFR) for the upcoming reserve maintenance period (MP)

4. Input data from the following electronic trading venues ("Trading Venues") may be used:

Input Data Type	Selected Trading Venue(s)/Futures' contract(s)
Tradeable bid and offer prices and volumes for the Defined Tenors	as published by EMMI on its website from time to time
€STR-based OIS dealer-to-client bid and offer prices and volumes for the Defined Tenors	as published by EMMI on its website from time to time
€STR-linked futures' settlement prices	as published by EMMI on its website from time to time

5. To ensure robustness in the Underlying Interest, the Benchmark Determination Methodology for Efterm® follows a hierarchical approach consisting of three levels. These levels should be employed progressively, by Defined Tenor, and in the order specified below.

[1] Available here: https://www.ecb.europa.eu/press/calendars/reserve/html/index.en.html.

a. Level 1 consists of €STR-based OIS tradeable bid and offer prices and volumes collected for the Defined Tenors and available on the CLOB of the selected Trading Venues over a predefined window preceding the Efterm® calculation.

b. Level 2 consists of €STR-based OIS dealer-to-client bid and offer prices and volumes displayed for the Defined Tenors by the selected Trading Venues over a predefined window preceding the Efterm® calculation.

c. Level 3 consists of a step function model using €STR-linked futures' settlement prices, €STR rates, announced Deposit Facility Rate (DFR) ahead of the new maintenance period (MP) and the ECB reserve maintenance periods calendar.

3. Calculation

3.1. Level 1

6. For each Defined Tenor, tradeable bid and offer prices and volumes are collected for €STR-based OIS available on the CLOB of the selected Trading Venue(s) from 8:30 to 10:30 am (CET).

7. The two-hour window is divided into 24 blocks of five minutes each. Eligible bids and offers are collected at a random point in time (referred to below as a "snapshot") within each of these five-minute blocks, i.e., 24 snapshots. These snapshots will be randomly generated such that consecutive snapshots are at least three (3) minutes apart from each other.

8. For each snapshot, a synthetic order book is created by combining the eligible bids and offers from each Trading Venue and ranking them by price.

9. These prices and the associated volumes are used to calculate the volume-weighted bid ("VWB") and the volume-weighted offer ("VWO") of the prices that would result from filling a hypothetical trade of Standard Market Size ("SMS") on each side of the market, starting from the highest bid and the lowest offer, respectively.

10. For each snapshot, a volume-weighted average mid-price ("VWAMP") is calculated from the VWB price and the VWO price, and the VWB-VWO spread is collected.

11. Snapshots with insufficient tradable volume to fill the SMS, or which contain crossed or zero-spread bid and offer prices, are excluded from the calculation.

12. The remaining snapshots (maximum 24) are ordered by VWAMP and those with a VWAMP above the 85th percentile or below the 15th percentile are also excluded from the calculation.

13. If at least six snapshots remain, the VWAMPs from these snapshots are quality-weighted averaged, based on the inverse of the VWB-VWO spreads, to determine the applicable Efterm® rate for the Defined Tenor.

3.2. Level 2

14. For each Defined Tenor where fewer than six snapshots from Level 1 are calculated, the rate is calculated using Level 2.

15. Dealer-to-client bid and offer prices and volumes for €STR-based OIS are collected as displayed by the selected Trading Venue(s) from 8:30 to 10:30 am (CET).

16. The two-hour window is divided into 24 blocks of five minutes each. Eligible bids and offers are collected at a random point in time (referred to below as a "snapshot") within each of these five-minute blocks, i.e., 24 snapshots. These snapshots are the same as those generated for the waterfall level 1 (see paragraph 7).

17. For each snapshot, where a dealer provides prices for multiple categories of clients within a snapshot, the 'best' price per dealer is selected, based firstly on the tightest spread and then on the largest volume for each client category within the snapshot. When there is more than one category of clients, or tier, with the same spread and volume, the lowest tier number is selected.

18. For each snapshot, the selected, eligible bids and offers from each dealer from each trading venue are combined and ranked by price starting from the highest bid and the lowest offer, respectively, to create a synthetic order book.

19. For each snapshot, these prices and associated volumes are ranked in order to calculate the volume weighted bid ("VWB") and offer ("VWO") of the prices that would result from filling a hypothetical trade of Standard Market Size ("SMS") on each side of the market.

20. For each snapshot, a volume-weighted average mid-price ("VWAMP") is calculated from the VWB price and the VWO price, and the VWB-VWO spread is collected.

21. For each snapshot that contains crossed bid and offer prices, the best bid and best offer volumes are matched until no crossed bid and offer prices remain. If after such uncrossing, there is sufficient volume to meet the required SMS on each side, the snapshot is retained. Otherwise, the snapshot is excluded from the calculation.

22. The remaining snapshot (maximum 24) are ordered by VWAMP and the snapshot with a VWAMP above the 85th percentile and below the 15th percentile are also excluded from the calculation.

23. If at least six snapshots remain, the VWAMPs from these snapshots are quality-weighted averaged, based on the inverse of the VWB-VWO spreads, to determine the applicable Efterm® rate for the Defined Tenor.

3.3. Level 3

24. For each Defined Tenor where fewer than six snapshots from Level 2 are calculated, the rate is calculated using Level 3.

25. A Spot Starting (T+2 business days) convention in applied in the rate calculated using Level 3.

26. The following inputs are identified:
    a. the relevant overnight €STR rates (i.e., historical €STR rates from the beginning of the month and the €STR rate published on the date Efterm® is being calculated);

    b. the €STR Index Futures contracts maturing within each calendar month spanned by the relevant Defined Tenor period, and their associated settlement closing prices from the preceding trading day;

    c. the announced Deposit Facility Rate (DFR) ahead of a new maintenance period (MP);

    d. the schedule of step change dates. Except in some cases specified below, the schedule will contain exactly one step change date for each calendar month spanned by the Defined Tenor. The schedule is defined as following:
        i. For the calendar month containing the calculation date, the step change date will be:
            - the scheduled ECB Maintenance Period start date for that month, provided this occurs on or after the calculation date; or
            - the calculation date itself, where this falls after the scheduled ECB Maintenance Period start date for that month or there is no ECB Maintenance Period start date scheduled for that month, and where there are more than 7 days remaining in the month; or
            - no step change, where there are 7 or fewer days remaining in the month and no scheduled ECB Maintenance Period start in this window.

        ii. For subsequent calendar months the step change date for that month will be either:
            - the scheduled ECB Maintenance Period start date for that month; or
            - the first TARGET day of that month, where there is no scheduled ECB Maintenance Period start date meeting date for that month.

27. Published €STR rates, futures settlement prices and the announced ECB Deposit Facility Rate ahead of a new maintenance period (MP) are used to determine the initial overnight rate to apply for each calendar day (if any) prior to the step change date for that month; and the new overnight rate to apply to each calendar day from (and including) the step change date for that month, up to the end of that month. As following:

    a. For the calendar month containing the calculation date:

i. For each calendar day before the calculation date, the published historical €STR rates[1] are used.
ii. From the calculation date up until the day before the step change date, or until the end of the month if there is no step change date, the latest known €STR value (the €STR value published on the calculation date) is used
iii. From the step change date up until the last calendar day of the month, the rate to be used is one of the following[2]:
   - If the step change date is the start of a new MP and the ECB has already announced rate changes for that MP, then the value to be used will be determined by looking at the hike/cut in the ECB Deposit Facility Rate (DFR), and applying that delta to the latest €STR.
   - If the step change date is the start of a new MP and the ECB has not already announced rate changes for that MP, then the value to be used will be that required to ensure that the average of the daily overnight values for the month as a whole, matches that derived from the futures settlement price (see calculation in section 28 below);
   - If the step change date is not the start of a new MP and there are more than seven calendar days remaining in the month, then the value to be used will be that required to ensure that the average of the daily overnight values for the month as a whole, matches that derived from the futures settlement price (see calculation in section 28 below);

b. For every subsequent month up to and including the month containing the Defined Tenor Period end date:
   i. For dates earlier than the step change date, the last rate used in the previous month will be used.
   ii. If the step change date is the start of a new MP and the ECB has already announced rate changes for that MP, then the value to be used starting on the step change date will be determined by looking at the hike/cut in the ECB Deposit Facility Rate (DFR), and applying that delta to the latest €STR.
   iii. Otherwise (i.e., there is not any ECB rate announcement in relation to the step change date): the value to be used starting from the step change date will be that required to ensure that the average of the daily overnight values for the month as a whole, matches that derived from the futures settlement price (see section 28 below);

28. In order to derive the overnight rate for any step change date from Futures settlement prices, the calculation is:
   i. Sum the overnight rates for every calendar day in the month from the start of the month up to (but excluding) the step change date, using the rates for each day as determined at (27.a) and (27.b) above:
   ii. From the (T-1) €STR Index Futures settlement price for that calendar month, published at the end of trading on the preceding Futures trading

[1] For a TARGET day, this will be €STR published in respect of that day. For non-TARGET days, it will be €STR published in respect of the preceding TARGET day.

[2] As described in 26(d) above, if there are seven or fewer calendar days remaining in the month and no new MP starting in that window, there is no step change in this month. The latest €STR rate will continue to apply.

day, the implied sum of overnight interest rates is calculated for the whole calendar month.

iii. The sum of the overnight rates for the calendar days prior to the step change date is subtracted from the implied sum for the whole month, to determine a sum of the overnight rates for all calendar days from the step change date (inclusive) to the last calendar day of that month.

iv. The derived sum of the overnight rates for all calendar days from the step change date to the last calendar day of the month is divided by the number of calendar days from the step change date to the last calendar day of the month to obtain the new daily overnight rate, which will apply from the step change date for that calendar month.

29. Having determined the new overnight rates for each step change date, and consequently the overnight rate to apply to each calendar day of the Defined Tenor period, the daily compounding calculation of these overnight rates across the Defined Tenor period is used to determine the applicable Efterm® rate for the Defined Tenor.

3.4. General

29. The following Standard Market Size ("SMS") are used for Level 1 and Level 2:

Tenor	SMS (EUR)
1W	1,000 million
1M	750 million
3M	500 million
6M	250 million
12M	100 million

30. The Efterm® rates will be calculated on every TARGET[3] day at or shortly after 10:45 am (CET).

31. Efterm® follows an Actual/360 day count convention and is displayed to three decimal places following the symmetric arithmetic rounding convention: "half away from zero"[4].

4. Publication

32. The Efterm® rates will be published on every TARGET day at or shortly after 11:15 am (CET). The rates will be made available to all subscribers of the EMMI Data Package via authorised data vendors[5].

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[3] TARGET is the Trans-European Automated Real-time Gross settlement Express Transfer System. The Eurosystem maintains TARGET2, which is the second generation of TARGET and is a real-time gross settlement system. Throughout this document, references to "TARGET" should be read with respect to the euro system's TARGET2 system.

[4] The third decimal shall be rounded up to the nearest integer if the fourth decimal is more or equal to 5 and down if it is less than 5. This method applies symmetrically to negative rates.

[5] The list of authorised data vendors is publicly available on EMMI's official website.

33. Historical data for Efterm® is also made publicly available on a delayed basis on EMMI's official website, as per Paragraph 36.e

5. Contingency

34. If is still not possible to calculate Efterm® for a Defined Tenor in accordance with the above-mentioned Waterfall Methodology, then Efterm® of the previous TARGET day will be republished instead at or shortly after 12:30 p.m. (CET) and will be used as the Efterm® rates for that day. This convention is applied to each Defined Tenor separately.

    Any republished rates from the previous TARGET day will be identified as such by EMMI.

    In such an event, the Efterm® Oversight Committee shall be informed as soon as practicable.

    This strategy should be implemented within a period no longer than 3 TARGET days of the prior publication established under the regular process.

35. The oversight committee should be convened in a special session to devise a resolution strategy preserving the continuity of Efterm® in case of:

    - a complete failure to publish Efterm rates in any TARGET day;
    - to deliberate on the need to publish previous day Efterm rates for more than 3 TARGET days

6. Error-handling Policy and Republication

36. For errors in input data, calculations, or publication processes that are identified by or reported to EMMI prior to 2:00 p.m. (CET) that affect a published Efterm® tenor by more than 2 basis points, the corresponding Efterm® tenor will be revised and republished on the same day, no later than 3:00 p.m. (CET). The same principle applies in case of the activation of the contingency procedure described above.

37. Any republished rate will be identified as such by EMMI.

7. Transparency

38. The following information on the Efterm® governance and benchmark determination process shall be publicly disclosed on the EMMI website:
    a. The Efterm® Governance Framework, including this DBM and the Efterm® Governance Code of Conduct;
    b. The procedures for consulting on any proposed material change in the Efterm® methodology and the rationale for such changes, including a definition of what constitutes a material change to the Efterm® benchmark and the circumstances in which EMMI should notify users, as determined on the EMMI Benchmarks Consultation Policy;
    c. Membership and Terms of Reference of the Efterm® Oversight Committee along with declarations of conflicts of interest;
    d. The Efterm® daily rates on a delayed basis;
    e. Quarterly summary information on errors larger than 0.1 basis points that were detected after the publication and did not meet the republication criteria; and
    f. Transparency indicators on a monthly basis including the frequency of each of the methodology level used.

8. Periodic Review of the Methodology

8.1. Assessment of Underlying Market and Methodology

39. EMMI prepares a quarterly report on the Underlying Market, using statistics on the collected input data and complemented with other sources, most notably the Money Market Statistical Reporting ("MMSR") statistics of the ECB, to assess the activity, size, normal liquidity, concentration, and dynamics of the market.

40. In addition to quarterly reporting, EMMI performs an annual assessment of the Efterm® methodology that builds on the quarterly analysis.

41. In conjunction with the annual assessment of EMMI, the Efterm® Oversight Committee performs a review of the benchmark's definition and methodology at least annually, and makes recommendations to EMMI's Governing Bodies (as per the Efterm® Oversight Committee Terms of Reference).

8.2. Criteria for the Implementation of Changes

42. Based on the assessment above, EMMI will decide annually on any changes to the Efterm® methodology. Potential changes include, but are not limited to, changes to the eligibility, source, and/or hierarchy of input data, changes to the formulaic calculation mechanisms, or changes to the methodology parameters (for instance the Standard Market Size).
43. The objective of any change to the methodology is to ensure that the input data and methodology represent the market and economic reality Efterm® seeks to measure. Further objectives are to consider the reliance on transaction data in the calculation of the benchmark to the greatest extent possible, while ensuring that the benchmark remains reflective of the Underlying Interest, responsive to events and developments in the Underlying Market and that the methodology itself does not contribute to artificial volatility that does not stem from market events.
44. Where a proposed change to the methodology would constitute a material change to the benchmark, EMMI will follow the due process set out in the EMMI Benchmarks Consultation Policy. The Efterm® Oversight Committee ultimately defines what constitutes a material change of the benchmark.
45. Any proposed changes to the methodology are overseen, monitored and approved for implementation by the Efterm® Oversight Committee and the guiding principles are as set out in the EMMI Benchmarks Changes and Cessation Policy.

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