



Blueprint for the Hybrid Methodology for the determination of Euribor

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1. Introduction

With the start of the euro in January 1999, the Euribor index was created and replaced domestic reference rates across the Eurozone. Euribor is nowadays a major euro interest reference rate, administered by the European Money Markets Institute (EMMI). In light of its wide use in the global financial system as a reference rate for a large volume and broad range of financial products and contracts, Euribor was designated in 2016 as a critical benchmark in the Commission Implementing Regulation (EU) 2016/1368 of 11 August 2016 establishing a list of critical benchmarks used in financial markets pursuant to Regulation (EU) 2016/1011 of the European Parliament and of the Council (EU BMR). EMMI was authorized by the Belgian Financial Services and Markets Authority (FSMA) for the administration of Euribor on 2 July 2019 and was included in the European Services and Markets Authority's (ESMA) Register of benchmark administrators on 4 July 2019. On 1 January 2022, ESMA became EMMI's supervisory authority.

To guarantee Euribor's transparency toward users, facilitate the identification of material changes, and in line with international practice, the Euribor specification is the result of combining two aspects:

- (i) Euribor's underlying interest, which defines the market or economic reality that Euribor seeks to measure; and
- (ii) A statement of Euribor's determination methodology, which describes how the underlying interest is to be measured, stipulating the relevant data inputs and the method of calculation.

The current version of the hybrid methodology was approved in February 2024 as an evolution from the previous hybrid methodology. In fact, with the objective of further enhancing the hybrid methodology, at the end of 2021 EMMI started to explore the possibility of reformulating some of the methodology's levels in the waterfall approach and, as a by-product, discontinuing the recourse to Panel Banks' expert judgment from the Euribor calculation. The work toward this goal was performed with the support of a dedicated Task Force in which representatives of the current Panel Banks participated. Following a 'funnelling approach,' supported by extensive and in-depth analyses, in June 2023 EMMI selected a final candidate methodology.

This document should be regarded as the *blueprint* of the Euribor hybrid methodology, and intends to provide further transparency and clarity on EMMI's course of thought when developing the hybrid methodology. This note's target audience are users and non-experts and is therefore articulated in a friendlier tone. For those parties involved in the benchmark determination process, a full account of the methodology and their responsibilities can be found in the set of documents typically referred to as the Euribor Governance Framework, and in particular the **Benchmark Determination Methodology** and the **Code of Obligations of Panel Banks**:

- a) The **Governance Code of Conduct** (GCC) explains EMMI's requirements as Euribor administrator, including responsibilities and a description of the Governing Bodies linked to Euribor, its governance and control framework, transparency, record-keeping, etc.
- b) The Euribor **Benchmark Determination Methodology** (BDM) sets out the determination methodology for the calculation of Euribor.
- c) The Euribor **Code of Obligations of Panel Banks** (COPB) sets out the requirements for Panel Banks in acting as contributors of input data for the determination of Euribor, in particular, general obligations, validation processes of contributions, control environment, etc.

- d) The Euribor **Code of Obligations of Calculation Agent** (COCA) summarizes the role and obligations of the Calculation Agent.

The Euribor blueprint is organized as follows. In Section 2, a clarification of the Euribor Specification is provided. Section 3 provides an overview of the hybrid Determination Methodology for Euribor. Sections 4 and 5 delve further into detail and provide a description of the formulaic determination for the contributions under the first two levels of the hybrid methodology. The appendices provide examples that would help the reader understand better the mechanics of the methodology's second level.

2. Euribor specification

A benchmark specification consists of two components, namely:

- a) the Underlying Interest, which defines the economic variable that a benchmark seeks to measure; and
- b) the Determination Methodology, which is applied to make a practical measurement of the Underlying Interest.

To this end, the underlying interest represents a fundamental element of the specification, as it lays down the objective for establishing the benchmark. In turn, the determination methodology is a means to measure this objective. A benchmark administrator should choose a determination methodology that faithfully portrays the underlying interest, considering the structure and dynamics of the market for the underlying interest.

EMMI states the Underlying Interest for Euribor as (c.f. paragraph 1 in Benchmark Determination Methodology for Euribor) :

“the rate at which wholesale funds in euro could be obtained by credit institutions in the EU and EFTA countries in the unsecured money market.”

There are five “Defined Tenors” for Euribor, being 1 week, 1 month, 3 months, 6 months and 12 months. The Determination Methodology for Euribor is described in the following sections of this paper.

3. Determination Methodology Overview

3.1. Euribor Panel

The Determination Methodology of Euribor relies on contributions from a broad and diversified panel of credit institutions¹ (“Panel Banks”) that are active participants in the euro money markets. In general terms, the number of Panel Banks should be sufficient to constitute a representative sample for the purposes of determining an average rate and to reflect the activity in the wholesale unsecured euro money market, including its geographic diversity.

¹ For this purpose, “credit institutions” has the meaning as specified in Article 4(1)(1) of Regulation (EU) No. 575/2013, an undertaking whose business is to receive deposits or other repayable funds from the public and to grant credits for its own account.

3.2. Panel Banks Contributions

Panel Banks submit their contribution data on every TARGET² day. The contribution data is derived from activity of the previous TARGET day. The final contribution rate of each Panel Bank is determined using the hierarchical approach defined in Section 3.3: first with Level 1 (Transactions) when possible; when there is no outcome at Level 1 then Level 2.1, 2.2 or 2.3 (Formulaic calculation techniques) is used. Panel Banks' contributions are conceived following euro money market conventions, that is, the TARGET2 rate calendar, an Actual/360-day count convention, and modified following business day with month-end adjustment convention. To this end, in this document, all references to euro money market transaction rates and activities should be read by reference to these conventions.

3.3. Rounding Conventions

Panel Banks' rate contributions are made rounded to two decimal places, using the rounding-away from-zero convention. EMMI publishes Euribor fixing rates rounded to three decimal places, also using the "half-away from zero" convention.

3.4. Calculation Hierarchy

EMMI seeks to ground the calculation of Euribor, to the extent possible, in euro money market transactions that reflect the Underlying Interest. The Euribor Determination Methodology follows a hierarchical approach consisting of two levels.

The approach illustrated in *figure 1* is to be applied progressively. Hence, a Panel Bank's contribution is determined using the Level 1 methodology when the conditions for such an approach, as specified below, are met. If such conditions are not met, the Panel Bank's contribution is based on Level 2. In each case, the Panel Bank's contribution shall consist of a contribution rate and the corresponding contribution Level. EMMI is responsible for the determination of Panel Banks' contributions under the Level 1 and Level 2 methodologies, using as input the Panel Banks' individual transactions. However, each individual Panel Bank is responsible of their individual transactions and related input.

² 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.

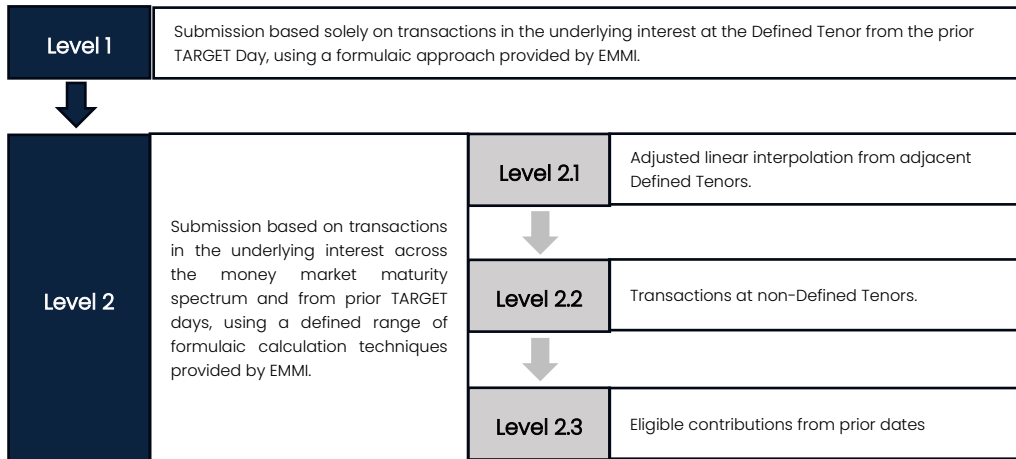
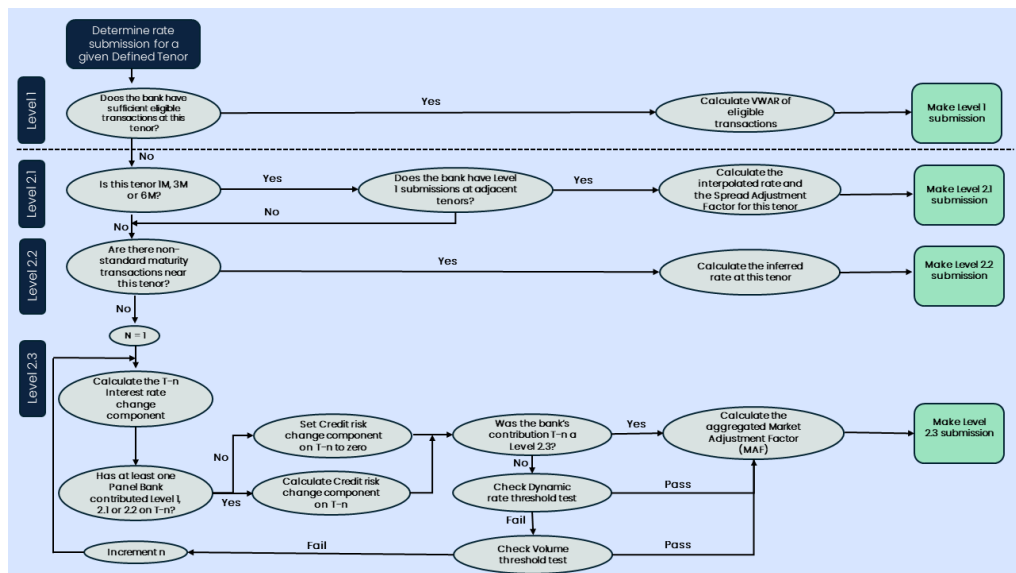


Figure 1: Euribor Hybrid Methodology

Further details can be found in the [Benchmark Determination Methodology for EURIBOR](#).



4. Level 1 Contributions

Level 1 contributions are based solely on Eligible Transactions, as defined below, in the unsecured euro money market on the TARGET day, T, preceding the contribution date, T+1.

4.1. Eligible Transactions

A Panel Bank's Eligible Transactions are determined by applying the filters in the following table:

	Filter	Description
1	Currency denomination	Only transactions directly denominated in euro are eligible. ³

³ In particular, borrowing transaction in Euro through the foreign exchange market are not eligible

2	Transaction timing	Only transactions executed ⁴ on TARGET day T are eligible for a Level 1 contribution on TARGET day T+1.
3	Transaction types and counterparties	<p>Only borrowing (i.e. cash receiving) transactions with a fixed rate, or floating rate transactions referenced to the unsecured euro overnight interest rate where the Panel Bank is able to report a fixed rate equivalent, conducted in the wholesale unsecured money markets.</p> <p>Only the following types of transactions by the Panel Bank are eligible: Unsecured cash deposits and short-term securities (i.e. CPs, ECPs, CDs, ECDs, and others) attracted from the following counterparties,⁵ irrespective of their geographic location:</p> <ul style="list-style-type: none"> - Deposit-taking corporations except the central bank (S122); - Money Market Funds (MMFs) (S123); - Non-MMF investment funds (S124); - Other financial intermediaries, except insurance corporations and pension funds (S125); - Financial auxiliaries (S126); - Captive financial institutions and money lenders (S127); - Insurance corporations (ICs) (S128); - Pension funds (S129); - Central bank (S121)⁶; - General government (S13). <p>Transactions or securities with embedded options, including but not limited to transactions where the maturity date can be rolled over every day (so-called evergreen deposits), are not eligible. Intragroup transactions are not eligible.</p>
4	Settlement dates	Only transactions with standard value date (settlement date) of T, T+1, T+2 and T+3 are eligible.
5	Maturity date windows	<p>Only transactions with maturity date falling into one of the following maturity date windows are eligible:</p> <ul style="list-style-type: none"> a. 1 week +/- 2 TARGET days; b. 1 month +/- 5 TARGET days; c. 3 months +/- 10 TARGET days; d. 6 months +/- 15 TARGET days; e. 12 months +/- 15 TARGET days.
6	Minimum transaction size	Individual transactions should have a notional volume of at least EUR 10 million.
7	Minimum number of transactions	No minimum number of transactions is set: any transaction fulfilling all conditions above is taken into account for the determination of Level 1.

⁴ TARGET2 is open every working day from 7AM to 6PM CET. Further details on the operational day in TARGET2 can be found on the ECB's website.

⁵ Further definition of each of these counterparty types can be found in Appendix 1.

⁶ Transactions related to tender operations and standing facilities or, in more general terms, any transaction conducted with Central Banks for the implementation of monetary policy, should be excluded from the file communicated to EMMI.

4.2. Level 1 Contribution Criterion

Panel Bank's contribution at a given tenor shall be made using the Level 1 methodology when the bank has at least one Eligible Transaction at that tenor for the respective day.

4.3. Level 1 Contribution Rate

The contribution rate is the volume-weighted average rate ("VWAR") of the set of Eligible Transactions for the Defined Tenor. It is calculated as:

$$\text{Contribution rate} = \frac{\sum_i (r_i \cdot Vol_i)}{\sum_i Vol_i}$$

where r_i and Vol_i are the borrowing rate and size of the Eligible Transaction i , respectively.

5. Level 2 Contributions

Where a Panel Bank has no Eligible Transactions for a Level 1 contribution to be calculated for a given tenor, but nonetheless has had transactions in nearby maturities or in prior days, the Panel Bank's contribution can be calculated using a further range of calculation techniques in order to make a Level 2 contribution for that tenor.

EMMI permits three Level 2 contribution techniques. These techniques should be employed progressively and, in the order, specified below.

Level 2.1	Adjusted linear interpolation from adjacent Defined Tenors.
Level 2.2	Transactions at non-Defined Tenors.
Level 2.3	Eligible contributions from prior dates with the Market Adjustment Factor.

Thus, where a Panel Bank's contribution can be calculated using the Level 2.1 method, that contribution constitutes the bank's contribution for the day. Similarly, a Level 2.2 contribution takes precedence over a Level 2.3 contribution.

5.1. Adjusted Linear Interpolation from Adjacent Defined Tenors (Level 2.1)

This technique applies to contributions for the 1 Month, 3 Months and 6 Months tenors only. A Panel Bank's contribution should be determined using this technique only when the Panel Bank's contributions at both adjacent tenors are calculated using the Level 1 methodology.

Level 2.1 Contribution Tenor	When Level 1 Contributions are made at adjacent defined tenors
1 Month	1 Week and 3 Months
3 Months	1 Month and 6 Months
6 Months	3 Months and 12 Months

The Panel Bank's contribution rate should be calculated as the sum of two components:

- a. the linearly interpolated rate at the contribution tenor, using the Level 1 contribution rates at the adjacent tenors; and
- b. the Spread Adjustment Factor (SAF). This factor seeks to correct for the curvature of the money market yield curve.

The linear interpolation between the adjacent tenors should be based on the respective number of days over the spot settlement date (T+2) applying to each tenor.

The SAF is determined based on the prior five days contribution rates at each of the tenors. It is calculated as follows:

- a) For each of the last five panel bank's contributions, the linearly interpolated rate at the contribution tenor is calculated based on the panel bank's contribution rates at the two adjacent tenors.
- b) The spreads of these linearly interpolated rates to the actual contribution rates are taken.
- c) The SAF is the arithmetic mean of these spreads over the past five panel bank's contributions.

A sample calculation is given in Appendix 9.

5.2. Transactions at Non-Defined Tenors (Level 2.2)

A "Qualifying Non-Standard Maturity Transaction" is a transaction that satisfies all of the conditions for being an Eligible Transaction, except that its maturity date falls between 1 Week and 12 Months but lies outside of the maturity date windows specified for Eligible Transactions.

The technique described in this section applies to contributions at all tenors. A Panel Bank's contribution should be calculated using this technique when it could not be determined as a Level 1 or Level 2.1 contribution at a particular Defined Tenor, but:

- a) The Panel Bank has at least one Qualifying Non-Standard Maturity Transaction; and
- b) The transaction volume of the original Qualifying Non-Standard Maturity Transaction is at least EUR 10 million.

The Panel Bank's contribution is determined as described below. The basic idea is to determine the contribution rate at the adjacent Defined Tenor based on a parallel shift of the yield curve from the prior day Panel Bank's contributions.

Volume Allocation

- The volume of the Qualifying Non-Standard Maturity Transaction is split between the two adjacent Defined Tenors, based on weights as defined below.
- For each Qualifying Non-Standard Maturity Transaction, the relative weights to be ascribed to each of the Defined Tenors adjacent to the non-standard maturity are calculated. These weights (rounded to the 5th decimal place) are determined as the relative proportions of the number of days over the spot date of the corresponding Qualifying Non-Standard Maturity Transaction applied to each adjacent Defined Tenor.

Contribution Rate Determination

- Using the prior day Panel Bank's contributions at each of the adjacent Defined Tenors, the linearly interpolated rate (rounded to the 10th decimal place) at the non-standard maturity date is calculated. This calculation uses the same weights as above.
- The spread between the Qualifying Non-Standard Maturity Transaction rate and the linearly interpolated rate is calculated. The ascribed rate at each of the adjacent Defined Tenors is calculated as the sum of this spread and the prior day Panel Bank's contribution at the respective tenor.
- The Panel Bank's contribution rate is calculated at either of the adjacent tenors as the ascribed rate at the respective tenor. When the Panel Bank has more than one Qualifying Non-Standard Maturity Transaction contributing to a Defined Tenor, the contribution is calculated as the volume-weighted average rate over each of the transactions, based on the volumes ascribed to the tenor.

A sample calculation is given in Appendix 10.

5.3. Prior contributions with Market Adjustment Factor (Level 2.3)

This technique applies to all Euribor tenors and is applied when a contribution rate for a Panel Bank for a specific Defined Tenor could not be determined using Level 1, Level 2.1 or Level 2.2.

The Panel Bank's contribution on TARGET date T+1 for a given Defined Tenor is determined as the sum of:

- a. The bank's **Cost of funding component**: the contribution rate on TARGET date T; and
- b. The **Interest rate change component**: the difference between the Eferm rate published on TARGET date T and the Eferm rate published on TARGET date T-1; and
- c. The **Credit risk change component**: the difference between the Euribor-Eferm spread on TARGET date T and the Euribor-Eferm spread on TARGET date T-1⁷.

The credit risk change component is applied if and only if at least one Euribor Panel Bank submits a Level 1, 2.1 or 2.2 for a given Defined Tenor on TARGET date T, otherwise it is set to zero.

Level 2.3 Contribution	
Bank's cost of funding	Market Adjustment Factor
Historical Level 1, 2.1, 2.2 and 2.3 contributions	Interest rate change component + Credit risk change component

⁷ The Euribor -Eferm spread on TARGET date T is equal to the difference between the Euribor rate published on TARGET date T and the Eferm rate published on TARGET date T-1.

A Sample calculation of the Level 2.3 components is provided in Appendix 11.

5.3.1. *A Qualifying Criterion for the Panel Bank's cost of funding component*

To guarantee the representativeness of the Bank's cost of funding component that is used as an anchor for the determination of Level 2.3, some additional controls are performed.

On a given day, the previous day's Level 1, Level 2.1 or Level 2.2 can be used as basis for the determination of a Level 2.3 contribution if any (or both) of the following two tests are passed:

- **Dynamic rate threshold test.** When compared against a measure of the dispersion of prior days' contribution rates, the candidate rate to act as the 'Bank's cost of funding' is in line with the usual Panel Bank's contribution pattern.
- **Volume threshold test.** The notional volume associated with the candidate rate above a predefined notional volume.

Level 2.3 contributions from TARGET date T are not subject to the Qualifying Criteria and can be used directly as the Cost of funding input.

5.3.1.1. The Dynamic rate threshold test

EMMI proposes to identify outlier rates as per the Empirical Rule in statistics⁸, and discard rates that are more than two standard deviations away from the average.

Under this empirical rule, EMMI first calculates the Panel Bank specific contribution spreads (vis-à-vis EFTERM for the corresponding tenor) over a pre-defined 21 days lookback period as well as a set of day-on-day changes of those spreads over this same period. After the determination of the average and the standard deviation of this set of day on-day changes in term spreads, the spread of the candidate rate vis-à-vis EFTERM is calculated⁹, as well as the corresponding change since the previous day. If the absolute difference between the day-on-day change of the candidate rate with respect to the previous day and the average day-on-day change falls within two standard deviations from the average spread, the candidate rate will have passed the dynamic rate threshold test, and thus be considered eligible. Otherwise, the candidate rate will have failed the test, being then considered an outlier (if it fails also the Volume Threshold test) not qualifying as the 'Bank's cost of funding' component.

5.3.1.2. The Volume threshold test

The second eligibility test imposes a condition on the notional volume associated to a Panel Bank contribution under Level 1, Level 2.1 and Level 2.2. The volume threshold test looks at the notional volume associated to the candidate contribution rate. The formulation of the volume threshold test changes: depending on the Level at which the candidate rate was submitted:

⁸ The Empirical (or 68-95-99.7) Rule states that for data sets having a distribution that is approximately bell shaped, the following properties apply:

- About 68% of all values fall within 1 standard deviation of the average.
- About 95% of all values fall within 2 standard deviations of the average.
- About 99.7% of all values fall within 3 standard deviations of the average.

⁹ This calculation is the well-known process of standardisation or calculation of z-values for normal distributions

- If the candidate rate corresponds to a Level 1 contribution, EMMI will assess whether the sum of the volume(s) underlying the transaction(s) composing the contribution is larger than or equal to EUR 20 million.
- If the candidate rate corresponds to a Level 2.1 contribution, EMMI will assess whether the weighted average of the sum of the volumes of the transaction underlying the Level 1 contribution in the adjacent tenors is larger than or equal to EUR 20 million. The weights will be based on the respective number of days over the spot settlement date applying to each tenor (following the logic used to determine contributions under Level 2.1).
- If the candidate rate corresponds to a Level 2.2 contribution, EMMI will assess whether the sum of the volume(s) underlying the split transaction(s) composing the contribution is larger than or equal to EUR 20 million.

If the candidate rate satisfies the volume threshold condition, the candidate rate will have passed the volume threshold test. Otherwise, the candidate rate will have failed the test, not qualifying as the Bank's cost of funding component (if the Dynamic Threshold test has failed as well).

A Sample calculations of the Level 2.3 tests are provided in Appendix 10.

5.3.2. *Look-back methodology to guarantee a Bank's contribution*

In case the previous day's Panel Bank's contribution under Level 1, Level 2.1 or Level 2.2 does not successfully pass both tests, the Level 2.3 methodology looks back to prior Level 1 and Level 2 contributions reversed-chronologically, until it encounters a contribution that was either:

- Performed at Level 2.3; or
- Performed at Level 1, Level 2.1, or Level 2.2 and successfully passes at least one of the two tests in the Qualifying Criterion described above.

Using this qualifying contribution as the Bank's cost of funding component, the corresponding interest rate change and credit risk change components will be calculated to reflect moves from the date of this qualifying rate (say T-n) and T-1: the interest rate change component will be obtained as the sum of day-to-day interest rate changes between T-1 and T-n. The credit rate change component will be calculated similarly.

6. Euribor Fixing

Based on the daily contributions from each of the Panel Banks, EMMI calculates and publishes the final Euribor fixing rates for each of the Defined Tenors. EMMI generally publishes Euribor daily on every TARGET¹⁰ day, at or shortly after 11:00 a.m. CET. In the event of contingencies, provisions for delayed publication and re-fixing are specified in the Euribor Governance Framework. For each

¹⁰ 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.

Defined Tenor, Euribor is calculated as the 15% trimmed mean¹¹ of individual Panel Banks' contributions. For the purpose of calculation, EMMI measures the Underlying Interest as the average rate of borrowing by credit institutions over the TARGET day preceding the day of publication. The published Euribor rates follow euro money market conventions, that is, the TARGET2 rate calendar, an Actual/360 day count convention, and modified following business day with month-end adjustment convention.

7. Calculation in Contingency

The daily Euribor calculation comes equipped with a contingency arrangement, triggered under the following conditions. If by 12.30 p.m. (CET) fewer than 12 Panel Banks have provided data, or if the Panel Banks, which have provided data, are from fewer than 3 countries, Euribor rates of the previous business day are republished at 12.30 p.m. (CET) and are used as the Euribor rates for that day. Any republished rates from the previous business day are identified as such by EMMI on its webpage. This contingency arrangement is applied to each Defined Tenor separately.

8. Annex – Counterparty Classifications

The counterparty classification used for the specification of counterparties follows the definitions of institutional sectors and subsectors described by the European System of Accounts (ESA 2010) developed by the European Union's Eurostat group¹². The eligible transaction counterparty classification groups map directly to certain ESA 2010 institutional sectors and sub-sectors. The ESA 2010 classification system is also used by the European Central Bank (ECB) in its data specification and reporting requirements outlined in the Money Market Statistical Reporting (MMSR) framework and instructions¹³. The mapping of the ESA 2010 institutional sector designations to the Euribor eligible transaction counterparty classifications is as follows:

Transaction Counterparty Classification	ESA 2010 Designation	ESA 2010 Institutional Sector/ Sub-Sector	ESA 2010 Definition of Institutional Sector/Sub-Sector
Deposit-Taking Corporations except the Central Bank subsector	S.122	Deposit-Taking Corporations except the Central Bank	The Deposit-Taking Corporations except the Central Bank subsector (S.122) includes all financial corporations and quasi-corporations, except those classified in the central bank and in the Money Market Funds subsectors, which are principally engaged in financial intermediation and whose business is to receive deposits and/or close substitutes for deposits from institutional units, hence not only from Monetary Financial Institutions, and, for their own account,

¹¹ To calculate the 15% trimmed mean the contribution rates are arranged in ascending order from lowest to highest. The highest and lowest 15% of these rates are discarded and the benchmark is obtained as the simple average of the remaining rates.

¹² <http://ec.europa.eu/eurostat/documents/3859598/5925693/KS-02-13-269-EN.PDF/44cd9d01-bc64-40e5-bd40-d17df0c69334>

¹³ https://www.ecb.europa.eu/ecb/legal/pdf/oj_jol_2014_359_r_0006_en_txt.pdf

			to grant loans and/or to make investments in securities.
Other Financial Institutions	S.123	Money Market Funds	The Money Markets Funds subsector (S.123) consists of all financial corporations and quasi-corporations, except those classified in the central bank and in the credit institutions subsectors, which are principally engaged in financial intermediation. Their business is to issue investment fund shares or units as close substitutes for deposits from institutional units, and, for their own account, to make investments primarily in money market fund shares/ units, short-term debt securities, and/or deposits.
	S.125	Other Financial Intermediaries, except Insurance Corporations and Pension Funds	The other financial intermediaries, except insurance corporations and pension funds subsector (S.125) consists of all financial corporations and quasi-corporations which are principally engaged in financial intermediation by incurring liabilities in forms other than currency, deposits, or investment fund shares, or in relation to insurance, pension and standardized guarantee schemes from institutional units.
Official Sector Institutions	S.121	Central Bank	The Central Bank subsector (S.121) consists of all financial corporations and quasi-corporations whose principal function is to issue currency, to maintain the internal and external value of the currency and to hold all or part of the international reserves of the country.
	S.13	General Government	The general government sector (S.13) consists of institutional units which are non-market producers whose output is intended for individual and collective consumption, and are financed by compulsory payments made by units belonging to other sectors, and institutional units principally engaged in the redistribution of national income and wealth.
Insurance Corporations	S.128	Insurance Corporations	The insurance corporations subsector (S.128) consists of all financial corporations and quasi-corporations which are principally engaged in financial intermediation as a consequence of the pooling of risks

			mainly in the form of direct insurance or reinsurance.
Pension Funds	S.129	Pension Funds	The pension funds subsector (S.129) consists of all financial corporations and quasi-corporations which are principally engaged in financial intermediation as the consequence of the pooling of social risks and needs of the insured persons (social insurance). Pension funds as social insurance schemes provide income in retirement, and often benefits for death and disability.

The European System of Accounts provides additional guidance¹⁴ and examples for each of the institutional sectors and sub-sectors referenced in the table above.

¹⁴ <https://ec.europa.eu/eurostat/esa2010/chapter/view/23/>

9. Annex – Example L2.1 contribution

The following is an example of a Level 2.1 contribution for the 1 Month tenor. The contribution is, based on interpolation between Level 1 contributions being made for the 1 Week and 3 Month tenors. To simplify the reading the rates are displayed without %-sign.

The date at which the contribution is calculated is Tuesday 11 June 2024. All contributions relate to activities from the previous TARGET day, 10 June 2024.

The panel bank had no eligible transactions to allow it to make a Level 1 contribution in the 1 Month tenor. However, there were sufficient eligible transactions to make Level 1 contributions in both the 1 Week and 3 Month tenors. In this case, following the waterfall approach in the methodology, a Level 2.1 contribution in the 1 Month tenor can be calculated as follows:

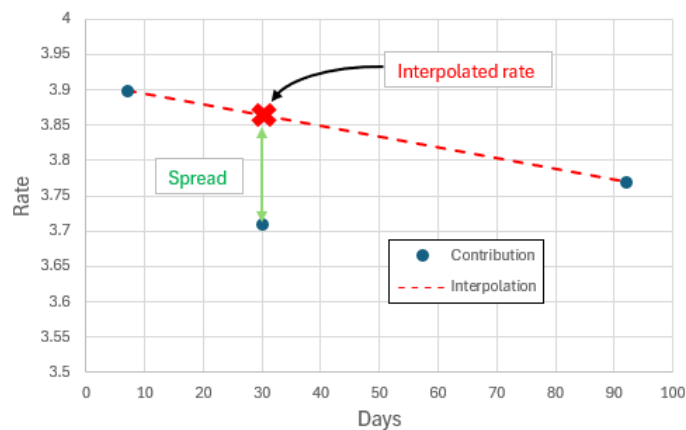
- Interpolating linearly from contributions for adjacent tenors: for Level 2.1 contribution in the 1 Month tenor the 1 Week and 3 Month tenors are used.
- Adding to this interpolated rate a correction factor to capture the curvature in that tenor of the panel bank's money market yield curve. This correction factor, the Spread Adjustment Factor (SAF), is calculated from the panel bank's contributions of the 5 preceding Target days. This period is the lookback period.

The table below shows all relevant data and calculations needed for the calculation:

Submission date		11-Jun-24												
Lookback	Date			Theoretical end date			Days			Contributions			Interpolated	Spread
	Trade	Submission	Settlement	1W	1M	3M	1W	1M	3M	1W	1M	3M	1M	1M
	03-Jun-24	04-Jun-24	05-Jun-24	12-Jun-24	05-Jul-24	05-Sep-24	7	30	92	3.90	3.72	3.77	3.86482	-0.14482
	04-Jun-24	05-Jun-24	06-Jun-24	13-Jun-24	08-Jul-24	06-Sep-24	7	32	92	3.97	3.71	3.76	3.90824	-0.19824
	05-Jun-24	06-Jun-24	07-Jun-24	14-Jun-24	08-Jul-24	09-Sep-24	7	31	94	3.83	3.7	3.76	3.81069	-0.11069
	06-Jun-24	07-Jun-24	10-Jun-24	17-Jun-24	10-Jul-24	10-Sep-24	7	30	92	3.97	3.67	3.75	3.91047	-0.24047
	07-Jun-24	10-Jun-24	11-Jun-24	18-Jun-24	11-Jul-24	11-Sep-24	7	30	92	3.82	3.66	3.75	3.80106	-0.14106
	10-Jun-24	11-Jun-24	12-Jun-24	19-Jun-24	12-Jul-24	12-Sep-24	7	30	92	3.90	??	3.75	3.85941	
										Interpolated rate		3.85941	Average	
										Spread Adjustment Factor		-0.16706		
										Contribution		3.69	Sum + rounding	

- The first five rows provide the contributions and details of the panel bank for the previous 5 days ("lookback")
- The last row of the table relates to the current contribution, which is in this example for submission date "11-Jun-24". The 1 Week and 3 Months contributions are available as Level 1. The 1 Month needs to be determined.
- The columns provide the following information:
 - Dates:
 - The trade date (T) – date at which the transactions were executed
 - The submission date (T+1) – date of the Euribor publication
 - The settlement date (T+2) – theoretical initial settlement date of a transaction, same for all tenors
 - Theoretical end date – theoretical final settlement date for each of the tenors. This date is determined by adding the tenor period (1W / 1M / 3M) to the settlement date and applying modified following day count convention.
 - Calendar days associated with each tenor: this is the number of days between initial and final settlement date.
 - Contributions:

- the panel bank's contributions from the previous days in all three tenors
- the panel bank's contributions already available for the current contribution, here 1W and 3M
- Interpolated rate: this is obtained by linearly interpolating the data (i.e. days and contributions) associated to the outer tenors.
- Spread: the spread is the difference between the interpolated rate and the contribution in the middle tenor. The graph below shows this graphically:



The calculation relies on the linearly interpolated rate using the number of calendar days associated to each tenor. For each of the submissions (each time a row in the graph above) the interpolated rate of the 1 Month is determined by using the contributions at the adjacent tenors and the calendar days relevant on that submission date. The average spread between interpolated rate and contribution rate during the lookback period is determined, this is the SAF.

In this specific example, the calculations then proceed as follows:

1. Determination of the linearly interpolated 1 Month rate from the Level 1 contributions which are 3.90 (1 Week) and 3.75 (3 Months) using the actual number of calendar days between the tenor spot date and its corresponding maturity date for each tenor: 7 days (1 Week), 30 days (1 Month) and 92 days (3 Months)

$$3.90 + \frac{(30 - 7)}{(92 - 7)}(3.75 - 3.90) = 3.85941$$

2. The Spread Adjustment Factor is calculated from the actual 1 Week, 1 Month and 3 Months contributions from the prior 5 days. For each of these days, a linearly interpolated 1 Month rate is calculated from the contributions in the adjacent tenors (using the same approach as in point 1.) and the spread between the interpolated number and the actual contribution is determined. Finally, the average of these 5 spreads is taken, resulting in a Spread Adjustment Factor of -0.16706. In this case, the yield curve has a negative curvature, meaning that a simple linear interpolation would overestimate the 1 Month rate.
3. Finally, the Spread Adjustment Factor is added to the linearly interpolated 1 Month rate calculated in step 1 and the result is rounded: Interpolated rate (3.85941) + Spread Adjustment Factor (-0.16706) = 3.69236 or 3.69 rounded to 2 decimal places.

10. Annex – Example L2.2 contribution

The following is an example of Level 2.2 contribution for the 3 Months tenor, based on a transaction at a nearby, but non-standard, maturity date. In the example, the Panel Bank is making its 3 Months contribution on 11 June 2024 (T+1). This contribution is in respect of activity from the previous TARGET day T on 10 June 2024.

The bank had no eligible transactions on day T to allow it to make a Level 1 contribution in the 3 Months tenor. It is further assumed that no Level 2.1 (interpolation) can be calculated at this tenor either.

The bank however executed a transaction that had a maturity of approximately 4 Months, for EUR 60 Million at a rate of 3.76%. This transaction is split between two transactions at the 3 Months and 6 Months tenors. The inferred transaction at 3 Months is used as the basis for a Level 2.2 contribution at this tenor.

The rates for the two inferred transactions are determined by shifting the previous day contribution of the panel bank such that the linear interpolation matches the rate of the non-standard maturity transaction. This adjustment can be considered to represent the overall market movement between the previous contribution date and the current contribution date.

The transaction data and the prior day contributions of the panel bank are:

Submission date		11-Jun-24
Transaction		
Trade date	10-Jun-24	
Settlement date	12-Jun-24	
End date	14-Oct-24	
Days	124	
Rate	3.76	
Previous day contribution		
3M	3.72	
6M	3.75	

The calculations then proceed as follows:

- The linear interpolation is based on days over the transaction Settlement Date:
 - For the transaction this is simply the number of days between settlement date and the end date.
 - For the adjacent tenors, it is the number of days between the theoretical end date and the settlement date. The theoretical end date is found by adding the tenor period to the initial settlement date of the transaction and adjusting the day according to the modified following convention. The table below shows the number of days for our example.

	Date		Days
	Settlement	Theoretical end	
3M	12-Jun-24	12-Sep-24	92
6M	12-Jun-24	12-Dec-24	183

2. The days associated to the 3 Months tenor, the transaction and the 6 Months tenor are 93, 124 and 183 respectively. In our example (4 Months transaction) the weight of approximately 2/3 is assigned to the 3 Months tenor and of 1/3 to the 6 Months tenor. The more precise calculation for the 3 Months weight is $(183-124)/(183-92)=64.835\%$

	Date		Days	Weight
	Settlement	Theoretical end		
3M	12-Jun-24	12-Sep-24	92	64.835%
6M	12-Jun-24	12-Dec-24	183	35.165%

3. The shift adjustment is calculated next. Using the weights, the linearly interpolated rate for the non-standard maturity is determined on the prior day. In this example, the rate is calculated as $((3.72 \times 0.64835) + (3.75 \times 0.35165)) = 3.73055$. Combining this with the transaction rate of 3.76 gives a shift adjustment of $3.76 - 3.73055 = 0.02945$. This shift adjustment is interpreted as the market movement for this bank between the prior day contribution and the time of the transaction.

Interpolated rate previous day	3.73055
Transaction rate	3.76
Shift adjustment	0.02945

4. With this, the inferred 3 Months and 6 Months rates are calculated by adding the shift adjustment to the prior day contribution. This results in inferred rates of 3.74945 (3 Months) and 3.77945 (6 Months) respectively:

Tenor	Previous day	Current
3M	3.72	3.74945
6M	3.75	3.77945

5. The weight is also used to allocate the volume to each of the tenors. In our example of a EUR 60 million transaction, the volume associated with the 3 Months tenor would be EUR 38.901 million and the volume associated with the 6 Months tenor would be EUR 21.099 million.

If the example transaction is the only transaction at a non-standard maturity that would contribute to the 3 Months tenor, then the inferred rate is rounded to two decimals and a Level 2.2 contribution is calculated for the Panel bank at this tenor with a value of 3.75.

If the bank has more than one transaction at non-standard maturity dates which could contribute to the 3 Months tenor, then the bank would make a Level 2.2 contribution of the volume-weighted average rate, based on the allocated volumes and inferred rates of all of the relevant transactions.

Applying the same calculation logic to a second qualifying non-standard transaction, would for example yield the following calculations:

Qualifying Non-standard transactions	Previous Day 3M Contribution	Shift Adjustment	Inferred 3M Rate	Inferred Volume
Tx #1 (3M allocations)	3.72	0.02945	3.74945	38,901,000
Tx #2 (3M allocations)	3.72	0.04124	3.76124	15,033,000

In turn, the final Level 2.2 rate for the Panel Bank at the 3 Months tenor is calculated as $((3.74945 \times 38,901,000) + (3.76124 \times 15,033,000)) / 53,934,000 = 3.75273622$. That is 3.75 after rounding to 2 decimal places.

11. Annex – Example L2.3 contribution

This section presents three examples explaining the different aspects of Level 2.3 in the enhanced hybrid methodology. It covers the calculation of Level 2.3 contributions and the interaction with the Qualifying Criteria.

11.1. Example 1 – Level 2.3 base contribution

The first example shows the calculation of a Level 2.3 contribution in case the candidate rate to act as the “Panel Bank’s cost of funding” component was performed at Level 2.3. In this case, the candidate rate is not subject to the Qualifying Criteria.

In this example the bank is making its 1 Week contribution on 11 May, in respect of activity from the previous TARGET day, 10 May. The bank had no eligible transactions in this tenor, and it is assumed that no Level 2.1 and 2.2 can be calculated. Therefore a Level 2.3 contribution will be made. The following table summarises the information relevant for the example.

Date	Contribution Rate	Volume (in mio)	Contribution Level	μ_T	σ_T	EURIBOR	EFTERM
Mon 8 May							3.136
Tue 9 May	3.48					3.078	3.137
Wed 10 May	3.51	-	2.3			3.096	3.140
Thu 11 May	?		2.3				

The calculation in this example goes as follows:

1. **To determine the ‘Bank’s cost of funding’ component**, we consider the Level under which the previous day’s submission was performed. On 10 May, the Bank’s contribution was performed under Level 2.3, with a rate of 3.51%. Being a Level 2.3 contribution, it has no associated notional volume. The Bank’s cost of funding component is therefore 3.51%.
2. **To determine the Bank’s Market Adjustment Factor**, we need to calculate the Interest rate change component and the Credit Risk Change Component

i. Interest rate change component

The interest rate change component (IR) is determined by taking the change in Efterm rates. As the Efterm publication date is also the date to which the activity relates, we take the Efterm change from 9 May to 10 May. In this case the interest rate change component is

$$IR_{11\text{May}} = E_{\text{fterm}_{10\text{May}}} - E_{\text{fterm}_{9\text{May}}} = 3.140 - 3.137 = 0.003$$

ii. Credit risk change component

The credit risk is the difference between the Euribor rate and Efterm rate relating to the same activity date. Remember that this implies that the Euribor rate is combined with the Efterm rate of a day earlier to obtain the credit risk (Euribor is published using transactions of the previous business day, whereas Efterm is published on the same day).

The credit risk change component (CR) is the change of the credit risk from one business day to the next business day. In our example we get:

$$CR_{11\text{May}} = (\text{Euribor}_{10\text{May}} - \text{Efterm}_{9\text{May}}) - (\text{Euribor}_{9\text{May}} - \text{Efterm}_{8\text{May}}) \\ = (3.096 - 3.137) - (3.078 - 3.136) = 0.017$$

The bank's Market Adjustment Factor (MAF) is the sum of the interest rate change component and the credit risk change component

- In this case the Bank's Level 2.3 Contribution is determined by adding the interest rate change component and the credit risk change component to the bank's base contribution. In a formula, where Cont stands for contribution, it becomes:

$$\text{Cont}_{11\text{May}}^{2.3} = \text{Cont}_{10\text{May}}^{2.3} + \text{IR}_{11\text{May}} + \text{CR}_{11\text{May}} \\ = 3.51 + 0.003 + 0.017 = 3.53$$

- In this case the contribution for this panel bank on 11 May will be 3.53%.

11.2. Example 2 – at least one qualifying criterion met

This second example shows the calculation of a Level 2.3 contribution, when the 'Panel Bank's cost of funding' component does not pass the Dynamic Rate Threshold Test, but does satisfy the Volume Threshold Test.

In this example the bank is making its 1 week contribution on 11 May, in respect of activity from the previous TARGET day, 10 May. The bank had no eligible transactions on the previous day so a Level 2.3 contribution is made, assuming that L2.1 and L2.2 cannot be calculated.¹⁵ The following table summarises the information relevant for the example.

Date	Contribution Rate	Volume (in mio)	Contribution Level	μ_T	σ_T	EURIBOR	EFTERM
Mon 8 May							3.136
Tue 9 May	3.48					3.078	3.137
Wed 10 May	3.80	100	2.2	4.44	3.70	3.096	3.140
Thu 11 May	?		2.3				

The steps in the calculation are as follows:

- To determine the 'Bank's cost of funding' component, we consider the Level under which the previous day's submission was performed. On 10 May, the Bank's contribution was performed under Level 2.2, with a rate of 3.80%, which has an associated volume of EUR 100 million.
- The Qualifying Criteria dictate that for this candidate rate to be valid, either the rate follows the bank's contribution pattern (Dynamic Rate Threshold Test passed) or the notional volume associated to the candidate rate is considered as sufficient (Volume Threshold Test passed):
 - Dynamic Rate Threshold Test:** according to the available data, it is observed that the average day-on-day change in the spreads of Panel Bank's contributions against EFTERM over the last 21 days is $\mu_{10\text{May}} = 4.44$ bps. The

¹⁵ Note that under the hybrid methodology, Level 2.1 is not applicable to the 1 week tenor.

standard deviation of these day-on-day spread changes over the last 21 days is $\sigma_{10\text{ May}} = 3.70$ bps. In turn, the day-on-day change in spread of the candidate rate versus EFTERM is

$$\begin{aligned} & (\text{Cont}_{10\text{ May}}^{2.3} - \text{Efterm}_{9\text{ May}}) - (\text{Cont}_{9\text{ May}}^{2.2} - \text{Efterm}_{8\text{ May}}) \\ &= (3.80 - 3.137) - (3.48 - 3.136) \\ &= 0.319 \end{aligned}$$

This change of spread is in percent, or expressed in basis points is 31.9 bps

Calculating now the absolute value of the difference between the day-on-day change in spread of the candidate rate with respect to the previous day and the average day-on-day change, and dividing it by the standard deviation of the day-on-day spreads,¹⁶ we obtain

$$\frac{|31.9 - \mu_{10\text{ May}}|}{\sigma_{10\text{ May}}} = \frac{|31.9 - 4.44|}{3.7} = 7.42$$

In other words, the day-on-day change of the candidate rate with respect to the previous day is more than 7 standard deviations away from the mean of the distribution. We therefore consider the candidate rate to fail the Dynamic Rate Threshold Test.

- **Volume Threshold Test:** the data shows that the volume underlying the Level 2.2 contribution on 10 May was of EUR 100 million. As this value is above the EUR 20 million threshold, the candidate rate passes the Volume Threshold Test. This rate can thus be considered as a valid 'Bank's cost of funding' component for the calculation of the Level 2.3 contribution.
3. We can now calculate the Level 2.3 contribution for 11 May which is, similar to the previous example, the sum of:

- Base contribution:

$$\text{Cont}_{10\text{ May}}^{2.2} = 3.80$$

- Interest change component:

$$\text{IR}_{11\text{ May}} = \text{Efterm}_{10\text{ May}} - \text{Efterm}_{9\text{ May}} = 3.140 - 3.137 = 0.003$$

- Credit risk change component:

$$\begin{aligned} \text{CR}_{11\text{ May}} &= (\text{Euribor}_{10\text{ May}} - \text{Efterm}_{9\text{ May}}) - (\text{Euribor}_{9\text{ May}} - \text{Efterm}_{8\text{ May}}) \\ &= (3.096 - 3.137) - (3.078 - 3.136) = 0.017 \end{aligned}$$

4. The resulting contribution for 11 May is then:

$$\begin{aligned} \text{Cont}_{11\text{ May}}^{2.3} &= \text{Cont}_{10\text{ May}}^{2.2} + \text{IR}_{11\text{ May}} + \text{CR}_{11\text{ May}} \\ &= 3.80 + 0.003 + 0.017 = 3.82 \end{aligned}$$

¹⁶ Note that we are standardising the distribution of day-on-day changes in spreads (or calculating the z-value of yesterday's day-on-day change in spread).

11.3. Example 3 – None of the qualifying criteria are met

This third example shows the calculation of a Level 2.3 contribution in case the candidate rate to act as the 'Panel Bank's cost of funding' does not pass any Qualifying Criteria test. The methodology then requires going back further in time until a contribution satisfying at least one of the Qualifying Criteria tests is identified.

In this example the bank is making its 1 Week contribution on 11 May, in respect of activity from the previous TARGET day, 10 May. The bank has no eligible transactions so a Level 2.3 contribution is made assuming that Level 2.1 and 2.2 cannot be calculated¹⁷. The following table summarises the information relevant for the example.

Date	Contribution Rate	Volume (in mio)	Contribution Level	μ_T	σ_T	EURIBOR	EFTERM
Fri 5 May							3.099
Mon 8 May	3.44	15	1			3.012	3.136
Tue 9 May	3.48	5	2.2	4.72	3.10	3.078	3.137
Wed 10 May	3.62	12	1	4.44	3.70	3.096	3.140
Thu 11 May	?		2.3				

The steps in the calculation are as follows:

- To determine the 'Bank's cost of funding' component, we consider the previous day contribution Level. On 10 May, the bank's contribution was performed under Level 1, with a rate of 3.62, which has an associated volume of EUR 12 million.
- The Qualifying Criterion stipulate that, for this candidate rate to be valid, either the rate follows the bank's contribution pattern (Dynamic Rate Threshold Test passed) or the notional volume associated to the candidate rate is considered as sufficient (Volume Threshold Test passed):
 - Dynamic Rate Threshold Test:** according to the available data, it is observed that the average day-on-day change in the spreads of Panel Bank's contributions against EFTERM over the last 21 days is $\mu_{10\text{ May}} = 4.44$ bps. The standard deviation of these day-on-day spreads is $\sigma_{10\text{ May}} = 3.70$ bps. In turn, the day-on-day change in spread of the candidate rate versus EFTERM is

$$\begin{aligned} & (\text{Cont}_{10\text{ May}}^1 - \text{Efterm}_{9\text{ May}}) - (\text{Cont}_{9\text{ May}}^{2.2} - \text{Efterm}_{8\text{ May}}) \\ &= (3.62 - 3.137) - (3.48 - 3.136) \\ &= 0.139 \end{aligned}$$

This change of spread is in percent, or expressed in basis points is 13.9 bps

Calculating now the absolute value of the difference between the day-on-day change in spread of the candidate rate with respect to the previous day and the average day-on-day change, and dividing it by the standard deviation of the day-on-day changes,¹⁸ we obtain

$$\frac{|13.9 - \mu_{10\text{ May}}|}{\sigma_{10\text{ May}}} = \frac{|13.9 - 4.44|}{3.7} = 2.56$$

¹⁷ Note that under the hybrid methodology, Level 2.1 is not applicable to the 1 week tenor.

¹⁸ Note that we are standardising the distribution of day-on-day changes in spreads (or calculating the z-value of yesterday's day-on-day change in spread).

In other words, the day-on-day change of the candidate rate with respect to the previous day is more than 2 standard deviations away from the mean of the distribution. We therefore consider the candidate rate to fail the Dynamic Rate Threshold Test.

- **Volume Threshold Test:** the volume underlying the Level 1 contribution on 10 May was EUR 12 million. As this value is below the EUR 20 million threshold, the candidate rate fails the Volume Threshold Test, thus not qualifying as a 'Bank's cost of funding' component for the calculation of the Level 2.3 contribution.
3. The methodology now considers as a candidate rate the rate submitted by the Panel Bank on 9 May. The bank's contribution on that day was performed under Level 2.2, with a rate of 3.48% and an associated volume of EUR 5 million.
 4. As before both tests must be assessed for this rate: does the rate follow the bank's contribution pattern (Dynamic Rate Threshold Test passed) or can the notional volume associated to the rate be considered to be sufficiently large (Volume Threshold Test passed):
 - **Dynamic Rate Threshold Test:** according to the available data, it is observed that the average day-on-day change in the spreads of Panel Bank's contributions against EFTERM over the last 21 days is $\mu_{9\text{ May}} = 4.72$ bps. The standard deviation of these day-on-day spreads is $\sigma_{9\text{ May}} = 3.10$ bps. In turn, the day-on-day change in spread of the candidate rate versus EFTERM is

$$\begin{aligned} & (\text{Cont}_{9\text{ May}}^1 - \text{Efterm}_{8\text{ May}}) - (\text{Cont}_{8\text{ May}}^2 - \text{Efterm}_{5\text{ May}}) \\ &= (3.48 - 3.136) - (3.44 - 3.102) \\ &= 0.006 \end{aligned}$$

This change of spread is in percent, or expressed in basis points is 0.6 bps

Calculating now the absolute value of the difference between the day-on-day change in spread of the candidate rate with respect to the previous day and the average day-on-day change, and dividing it by the standard deviation of the day-on-day changes,¹⁹ we obtain

$$\frac{|0.6 - \mu_{9\text{ May}}|}{\sigma_{9\text{ May}}} = \frac{|0.6 - 4.72|}{3.1} = 1.33$$

In other words, the day-on-day change of the candidate rate with respect to the previous day is less than 2 standard deviations away from the mean. This rate is thus considered a valid 'Bank's cost of funding' component for the calculation of the Level 2.3 contribution.

As this test is passed, there's no need to perform the Volume Threshold test.

5. We can now calculate the Level 2.3 contribution for 11 May. In this example the contribution is the sum of a contribution rate of 2 days before and the change components over 2 days. It's the sum of:
 - Base contribution of 9 May:

¹⁹ Note that we are standardising the distribution of day-on-day changes in spreads (or calculating the z-value of yesterday's day-on-day change in spread).

$$\text{Cont}_{9\text{May}}^{2,2} = 3.48$$

- Interest change component:

$$\begin{aligned} \text{IR} &= \text{IR}_{11\text{May}} + \text{IR}_{10\text{May}} \\ &= (\text{Efterm}_{10\text{May}} - \text{Efterm}_{9\text{May}}) + (\text{Efterm}_{9\text{May}} - \text{Efterm}_{8\text{May}}) \\ &= (3.140 - 3.137) + (3.137 - 3.136) = 0.004 \end{aligned}$$

- Credit risk change component:

$$\begin{aligned} \text{CR} &= \text{CR}_{11\text{May}} + \text{CR}_{10\text{May}} \\ &= (\text{Euribor}_{10\text{May}} - \text{Efterm}_{9\text{May}}) - (\text{Euribor}_{9\text{May}} - \text{Efterm}_{8\text{May}}) \\ &\quad + (\text{Euribor}_{9\text{May}} - \text{Efterm}_{8\text{May}}) - (\text{Euribor}_{8\text{May}} - \text{Efterm}_{5\text{May}}) \\ &= (\text{Euribor}_{10\text{May}} - \text{Efterm}_{9\text{May}}) - (\text{Euribor}_{8\text{May}} - \text{Efterm}_{5\text{May}}) \\ &= (3.096 - 3.137) - (3.012 - 3.099) \\ &= 0.046 \end{aligned}$$

5. The resulting contribution for 11 May is then:

$$\begin{aligned} \text{Cont}_{11\text{May}}^{2,3} &= \text{Cont}_{9\text{May}}^{2,2} + \text{IR} + \text{CR} \\ &= 3.48 + 0.004 + 0.046 \\ &= 3.53 \end{aligned}$$