

Blueprint for the Hybrid Methodology for the Determination of EURIBOR

12th February 2019

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1 Introduction

Since May 2017, and following the conclusions derived from the Pre-Live Verification exercise, EMMI has been working on the development of a *hybrid* determination methodology for EURIBOR, supported by transactions from Panel Banks whenever available, and relying on other related market pricing sources when necessary. Where the aforementioned data is absent, the hybrid methodology relies on a Panel Bank's appreciation of their cost of funds. The hybrid methodology was developed by EMMI with the support of a dedicated Task Force, in which the Belgian Financial Services and Markets Authority (FSMA) participated as an observer. The Task Force served EMMI to gather market participants' feedback and guidance on the elaboration of the new methodology.

This document should be regarded as the *blueprint* of the 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) summarises the role and obligations of the Calculation Agent.

The EURIBOR blueprint is organized as follows. In Section 2, a proposal for the 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. Section 6 provides clear guidance regarding the determination of a Panel Bank's contribution under the third level of the methodology, which provides an appreciation of the funding cost for the contributing bank using as proxies data in related markets and/or environmental market conditions. The appendices provide examples that would help the reader understanding 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.

EMMI states the Underlying Interest for EURIBOR as:

“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 for EURIBOR relies on contributions from a 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 unsecured euro money market, including its geographic diversity.

3.2 Panel Banks Contributions

Panel Banks submit their contribution data on every TARGET² day. The contribution rates of individual Panel Banks are rounded to two decimal places following the symmetric arithmetic rounding convention: “half away from zero”³. 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) will be used; and finally, if no other level is possible, then Level 3 (Panel Bank submission based on additional transactions in the underlying interest or based on related markets or models) will be 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.

¹ For this purpose, “credit institution” 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.

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.

³ Applying this convention to the EURIBOR contributions, in this instance the second decimal shall be rounded up to the nearest integer if the third decimal is more or equal to 5 and down if it is less than 5. This method applies symmetrically to negative rates. The same logic applies for the third decimal in the final EURIBOR rate (see Section 7).

3.3 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 three levels. Each day, each individual Panel Bank’s contribution, for each Defined Tenor, will be determined on the basis of one of these three levels:

Level 1	Contribution based solely on transactions in the Underlying Interest at the Defined Tenor from the prior TARGET day, using a formulaic approach provided by EMMI.
Level 2	Contribution based on transactions in the Underlying Interest across the money market maturity spectrum and from recent TARGET days, using a defined range of formulaic calculation techniques provided by EMMI.
Level 3	Contribution based on transactions in the Underlying Interest and/or other data from a range of markets closely related to the unsecured euro money market, using a combination of modelling techniques and/or the Panel Bank’s judgment.

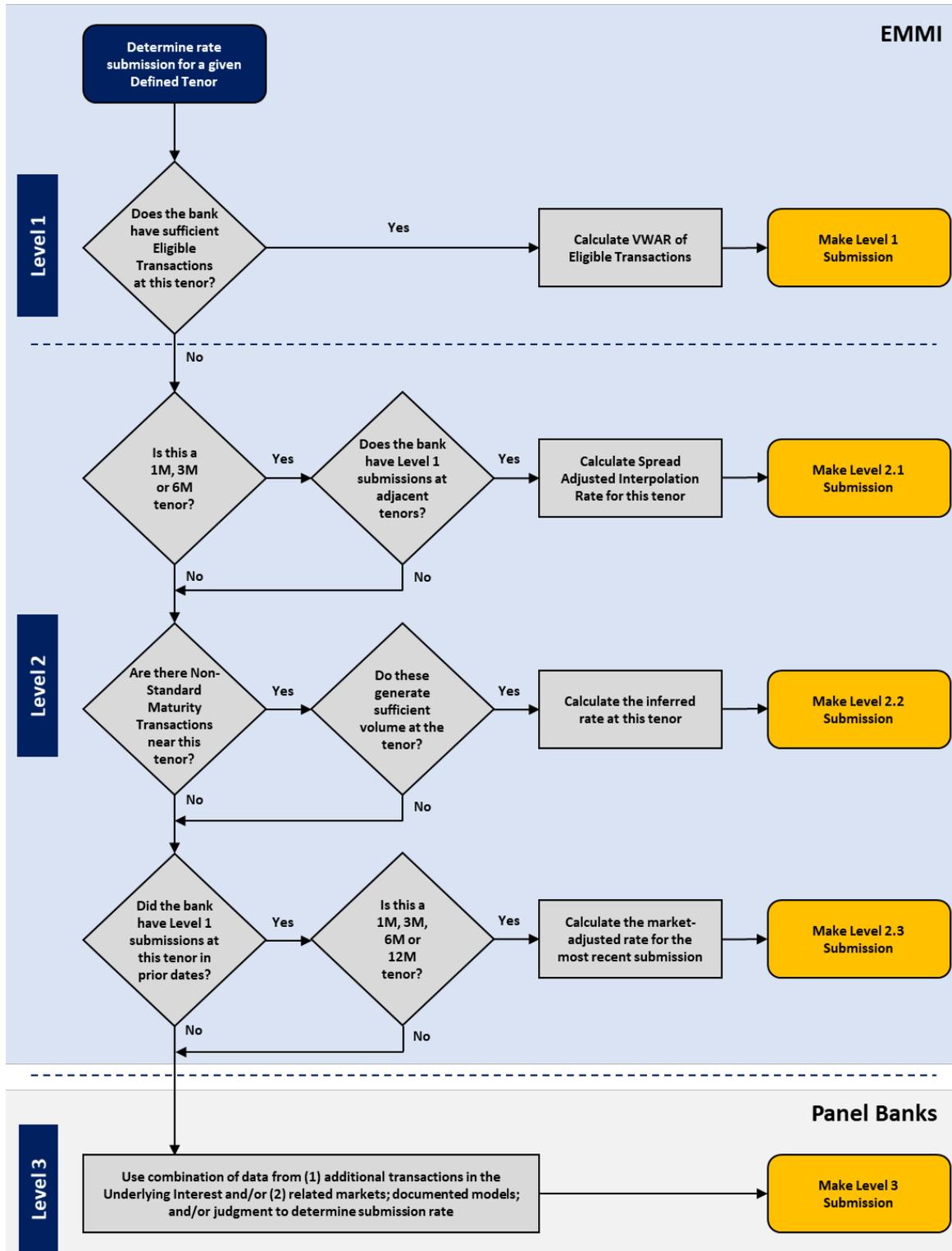
The above approach is to be applied progressively. Thus, a Panel Bank’s contribution will be determined using the Level 1 methodology when the conditions for such an approach, as specified below, are met. If such conditions are not met, it should be assessed whether the conditions for a Level 2 contribution are satisfied, and, if so, the Panel Bank’s contribution will be based on Level 2. Finally, if neither a Level 1 nor a Level 2 contribution can be made, the Panel Bank makes a Level 3 contribution. In each case, the Panel Bank’s contribution shall consist of a contribution rate and the corresponding contribution Level.

Following the introduction of the new methodology, EMMI will be responsible for the determination of Panel Banks’ contributions under the Level 1 and Level 2 methodologies, using as input the Panel Banks’ individual transactions. In turn, given the heterogeneity observed in the composition of the EURIBOR Panel (aimed at capturing the geographic diversity of the euro money market), each individual Panel Bank will be responsible of determining their individual Level 3 contribution.

3.4 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.

Euribor Hybrid Determination Methodology



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:

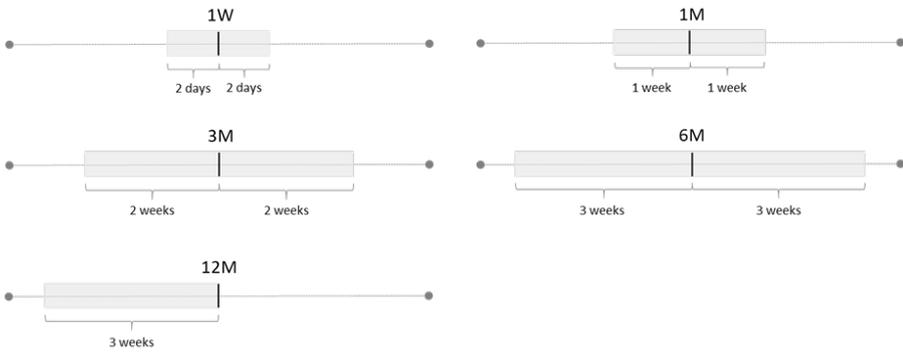
	Filter	Description
1	Currency denomination	Only transactions directly denominated in euro are eligible. ⁴
2	Transaction timing	Only transactions executed ⁵ on TARGET day T are eligible for a Level 1 contribution on TARGET day T+1.
3	Transaction types and counterparties	<p>Only transactions with a fixed 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 and based on the following types of unsecured borrowing by the Panel Bank are eligible:</p> <ul style="list-style-type: none"> • Unsecured cash deposits attracted from the following counterparties,⁶ irrespective of their geographic location: <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)⁷; – General government (S13). • Short-term securities (i.e. CPs, ECPs, CDs, ECDs, and others) irrespective of the type and location of the counterparty. <p>Borrowings or securities with embedded options are not eligible. Intragroup transactions are not eligible.</p>
4	Settlement dates	For all eligible transactions, the standard value date window for each TARGET day is T, T+1, and T+2.
5	Maturity date windows	For each of the tenors for which EURIBOR is determined, transactions should fall into the following maturity windows:

⁴ In particular, borrowing transaction in Euro through the foreign exchange market are not eligible.

⁵ 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.

⁶ Further definition of each of these counterparty types can be found in Appendix 1.

⁷ 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.

	Filter	Description
		<p>Pictorial representation of the maturity windows associated to each of the Defined Tenors</p>  <p>(Trades with maturities over 366 days may be influenced by dynamics of the euro capital markets, hence not being fully reflective of the behaviour of longer-term end of the money market curve)</p>
6	Minimum size	Individual transactions should have a notional volume of at least EUR 20 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.

4.2 Level 1 Contribution Criterion

A 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:

$$\text{Contribution Rate} = \frac{\sum_i (r_i \cdot \text{Vol}_i)}{\sum_i \text{Vol}_i}$$

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 insufficient Eligible Transactions for a Level 1 contribution to be calculated for a given tenor, but nonetheless has had transactions in nearby maturities or has had recent transactions, 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 transactions from prior dates

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:

- the linearly interpolated rate at the contribution tenor, using the Level 1 contribution rates at the adjacent tenors; and
- 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 applying to each tenor.

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

- › For each of the last five fixings, the linearly interpolated rate at the contribution tenor is calculated based on the fixing rates at the two adjacent tenors.
- › The spread of these linearly interpolated rates to the actual fixing rates is taken.
- › The SAF is the arithmetic mean of these spreads over the past five fixings.

A sample calculation is given in Appendix 2.

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:

- › The Panel Bank has a Qualifying Non-Standard Maturity Transaction(s), as specified below, at a nearby non-standard maturity date; and
- › The transaction volume allocated to the Defined Tenor from at least one Qualifying Non-Standard Maturity Transaction, as specified below, is at least EUR 20 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's EURIBOR fixing.

Volume Allocation and Threshold

- › For each Qualifying Non-Standard Maturity Transaction, the Panel Bank calculates the relative weights to be ascribed to each of the Defined Tenors adjacent to the non-standard maturity. These weights are determined as the relative proportions of the number of days over the spot settlement date. [For example, if the transaction is at 4 Months maturity, the relative weights would be approximately 66% and 34% for the 3 Months and 6 Months adjacent Defined Tenors respectively.]
- › The volume of the Qualifying Non-Standard Maturity Transaction is split between the two adjacent Defined Tenors, based on these weights. If the allocated volume to either of these tenors does not meet the threshold level specified above, the transaction cannot be used to make a Level 2.2 contribution for that tenor.

Contribution Rate Determination

- › Using the prior day EURIBOR fixing rates at each of the adjacent Defined Tenors, the linearly interpolated rate at the non-standard maturity date is calculated. [This calculation uses the same weights as above.]

- › The spread between the 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 EURIBOR fixing rate 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 3.

5.3 Transactions from Prior Dates (Level 2.3)

This technique applies to contributions at all tenors except the 1 Week tenor. A Panel Bank’s contribution should be calculated using this technique when the contribution rate could not be determined as a Level 1, Level 2.1 or Level 2.2 contribution at a particular Defined Tenor, but recent Level 1 contributions were recorded by the Panel Bank at this tenor. Specifically, the Panel Bank’s contribution on TARGET date T+1 in respect of TARGET date T should be calculated using this technique when a Level 1 contribution was made as follows:

Level 2.3 Contribution Tenor	When Level 1 Contributions were made ⁸ on any of:
1 Month	Days T to T-3
3 Months	Days T to T-3
6 Months	Days T to T-3
12 Months	Days T to T-5

For a given Defined Tenor, the contribution made under this technique is based on only the most recent Level 1 contribution made, within the time windows given in the table above.⁹

The Panel Bank’s contribution rate for a given Defined Tenor should be determined as the sum of:

- a) the contribution rate on the most recent day at that tenor when a Level 1 contribution was made; and

⁸ The days in the table refer to the dates when contributions were made. The corresponding Level 1 Eligible Transactions will have been executed on the prior day. Thus, a Level 1 contribution on day T-3 would have been based on transactions executed on day T-4, etc.

⁹ For example, if a Panel Bank had Level 1 contributions in the 1 Month tenor on T-2 and T-3, and on no other days between T and T-3, only the contribution on T-2 would be used.

- b) the Market Adjustment Factor (MAF). This factor seeks to correct for the overall movement in interest rates between the date of the contribution in a) and the current date.

The MAF is calculated based on both the Defined Tenor and the market movement between the date of the most recent Level 1 contribution and the current date. EMMI specifies that the MAF should be determined based on changes in the closing prices of the ICE EURIBOR futures contracts for the quarterly months (that is, the March, June, September and December expiries)¹⁰ as follows:

Level 2.3 Contribution Tenor	Market Adjustment Factor derived from:
1 Month	Near-month contract
3 Months	Near-month contract
6 Months	First two near-month contract strip ¹¹
12 Months	First four near-month contract strip

For each tenor, the MAF is calculated as the (average)¹² change in the closing price(s) of the respective contracts between the TARGET date preceding the most recent date when a Level 1 contribution was made and the current reference date for transactions.¹³

Futures contracts may be used up to their last full day of trading. Where the period over which the market change is being calculated straddles such a futures roll date, the next near-month contract(s) should be used so that the market change is calculated consistently using the same contracts.

A sample calculation is given in Appendix 4.

Choice of Market Adjustment Factor (MAF)

As noted above, the MAF is intended to capture the overall movement in interest rates, relevant to each tenor, in order to update the contribution data from prior days. In making a choice of the instruments from which the MAF is determined, EMMI considers it important that there be a generally-accepted closing or fixing price available for those instruments. The EURIBOR futures closing prices meet this criterion.

EMMI has also considered whether OIS swaps could be used to furnish a MAF. Using OIS swaps might be preferable to futures in that the liquid maturities of these swaps align more closely to the EURIBOR tenors than those of the futures. However, there are currently no well-defined benchmark rates for

¹⁰ The serial contracts at the intermediate months are relatively illiquid and so the quarterly contracts are used here.

¹¹ For example, a contribution being made in July 201X for the 6 Months tenor would use a Market Adjustment Factor derived from the September 201X and December 201X futures contracts.

¹² Where there is more than one contract used, the average change in the closing prices is a simple but very close approximation to the change in the corresponding strip rate.

¹³ Thus, if a Panel Bank uses its contribution from day T-3 to make its contribution on day T+1, its reference dates for transactions will be T-4 and T respectively. The Market Adjustment Factor will be the change in the closing prices between T-4 and T.

the OIS market. Should such benchmarks emerge in the future, EMMI may re-visit the use of the OIS swaps data to provide a set of MAFs.

EMMI notes that using futures as the basis for the MAFs poses two potential technical timing mismatches:

- › The reference dates for the contracts will not align with the cash maturity dates of the respective EURIBOR tenors. For example, in January, the 3 Month EURIBOR tenor corresponds to an interest rate period from January to April, whereas the near-month EURIBOR futures contract corresponds to a 3 month period from March to June.
- › In the case of the 1 Month EURIBOR tenor, the MAF is based on a futures contract that refers to a 3 month interest rate period.¹⁴

Nevertheless, EMMI considers that EURIBOR futures currently offer the best basis for the MAFs. The MAF is intended to capture the change in overall interest rates between the reference dates of transactions, rather than the absolute level of rates. As such, it is not necessary to have a precise alignment between the time periods referenced by the MAF basis instruments and by the corresponding EURIBOR tenors. Rather, it is sufficient that there be a close correlation between movements in the rates implied by the MAF basis instruments and EURIBOR at the corresponding tenors. Based on analysis performed by EMMI, such a correlation does indeed exist for each of the EURIBOR tenors listed above, making the approach described here acceptable.

Exclusion of 1 Week Tenor

EMMI has excluded the 1 Week tenor from the Level 2.3 method because no suitable mechanism is currently available to arrive at a MAF for this tenor. EMMI explored a number of alternatives but none proved technically suitable. Rates at 1 Week are subject to a number of idiosyncratic influences so that they do not correlate well with either overnight rates, on the one hand, or with rates at longer-dated tenors on the other hand. As such, determining a suitable MAF for the 1 Week tenor is not feasible at present.

¹⁴ This type of mismatch does not apply to the 3 Month, 6 Month or 12 Month tenors however. The MAF for the 3 Month EURIBOR tenor references a (single) EURIBOR futures contract, also covering a 3 month interest rate period. The MAF for the 6 Month EURIBOR tenor references a two-contract futures strip, thus covering a total 6 month interest rate period. Similarly, the MAF for the 12 Month EURIBOR tenor references a two-contract futures strip, thus covering a total 12 month interest rate period.

6 Level 3 Contributions

Where a Panel Bank's contribution at a given Defined Tenor cannot be made using either a Level 1 or Level 2 methodology, the Panel Bank must make a Level 3 contribution. Such contributions may be based on two sources of data:

- › Additional transactions in the Underlying Interest that were excluded from Level 1 and Level 2 contributions; and/or
- › Other data from a range of markets closely related to the unsecured euro money market.

Panel Banks should determine a Level 3 contribution using the above data through the application of a combination of modelling techniques and/or the Panel Bank's judgment. While EMMI does not mandate that Panel Banks employ a particular model or type of analysis in using data from these other markets, in making such determinations, each Panel Bank should reflect its own particular circumstances and business patterns, while observing the General Principles given below. Panel Banks should apply established risk management standards in using such analyses as a basis for their contributions. In particular, Panel Banks should have regard to the robustness of their analyses in providing an accurate estimate of their unsecured funding costs, and especially in times of market or institutional stress.

Level 3 contributions should be determined to conform to the calculation basis set out in Section 2.2. Thus, a Level 3 contribution should reflect the average rate of borrowing by the Panel Bank over the TARGET day preceding the day of publication.

6.1 General Principles

EMMI expects that Panel Banks observe the following principles in determining their Level 3 contributions:

a) Responsibility

Each Panel Bank acknowledges that it bears full responsibility for the particular determination methodologies and data sourcing that it employs in arriving at its Level 3 contributions. EMMI performs periodic surveys of methodologies and provides feedback to Panel Banks on how each individual Panel Bank's approach compares to peers. However, each Panel Bank is ultimately responsible for the analytic and operational robustness of its approach.

b) Governance

Panel Banks should apply established risk management standards and practices to the governance, documentation, testing, implementation, review, record-keeping and change control of Level 3 determination methods.

Within Panel Banks, clear roles and responsibilities should be established for:

- › the overall design, approval, implementation and review of Level 3 determination methods;
- › the selection of specific input data and data sources; and
- › the ongoing monitoring of performance of the Level 3 determination methods, and periodic review by independent functions and/or third parties.

c) Transparency

Panel Banks should provide information on their Level 3 determination methods, including methodology descriptions, performance and independent review reports, on request, to EMMI and the corresponding national competent regulatory authorities. Any changes in a Bank's Level 3 determination methodology should be brought to EMMI's attention.

d) Tenors

Panel Banks should ensure that their determination methodologies for Level 3 contributions adequately reflect the differentiation in market drivers between each tenor.

e) Input Data

Where data other than those used in Level 1 and Level 2 determinations are used as inputs for Level 3 contributions, these data should, where feasible:

- › be publicly available (subject to a possible subscription arrangement);
- › be sourced from regulated markets, trading venues or entities; or
- › possess or otherwise be amenable to an audit trail.

EMMI permits the use of data from prior days, including a Panel Bank's prior contributions, provided that such data are appropriately adjusted to take account of market movements or changes in the Panel Bank's relative borrowing costs from the time of the original contribution to the current reference period.

6.2 Use of Data from Additional Transactions in the Underlying Interest

EMMI requires that the determination of EURIBOR be anchored to the greatest extent possible in transactions in the Underlying Interest. Accordingly, Panel Banks are expected to consider taking account of data from additional transactions that may have not been used for Level 1 or Level 2 contributions, provided that these transactions accurately¹⁵ reflect the individual Panel Bank's unsecured wholesale borrowing costs. Specifically, Panel Banks may incorporate into their Level 3 contributions data derived from:

¹⁵ For the purpose of Level 3 contributions, as considered here, Panel Banks are permitted to exclude individual transactions or classes of transactions from their calculations if such transactions can reasonably be considered to be conducted at rates that do not reflect the bank's wholesale unsecured funding costs. Specifically, transactions with special pricing arrangements or with special structural terms can be so excluded.

- › Transactions that would be classed as Level 1 Eligible Transactions, except that they fall below the Minimum Size threshold;
- › Qualifying Non-Standard Maturity Transactions whose volumes allocated to Defined Tenors are below the tenor threshold; and
- › Transactions with Non-Financial Corporations, where such Corporations are not categorized as small business customers in the Basel III LCR regulations. These transactions should otherwise be Level 1 Eligible Transactions or be Qualifying Non-Standard Maturity Transactions for the purposes of Level 2, but without restrictions on the notional volume.

6.3 Use of Data from Other Markets

In determining Level 3 contributions Panel Banks may also use data from markets that reflect or are closely correlated with the Underlying Interest of EURIBOR. EMMI considers that the markets and instrument types listed below generally fulfil this criterion.

- › Futures contracts referencing EURIBOR;
- › Forward Rate Agreements (FRAs), Fixed/Floating Interest Rate Swaps, and Basis Swaps referencing EURIBOR;
- › Overnight Index Swaps referencing EONIA or other short-term euro interest rates; and
- › Overnight and term securities financing transactions in euro.

For this purpose “securities financing transaction” has the meaning as specified in Article 3(11) of Regulation (EU) No. 2015/2365.

Panel Banks may request EMMI to confirm the addition of other inputs.

Where a choice of such data exists for the particular market or set of instruments above, the following hierarchy of preferences should apply:

- › Data grounded¹⁶ in actual transactions, where the transaction reasonably reflects the Underlying Interest;
- › Data based on executable quotes;
- › Indicative prices, rates or quotes, with no firm commitment for execution;
- › Data reliant primarily on the expert judgment of the Panel Bank.

In considering this hierarchy of preferences, a Panel Bank should take account of the particular micro-structure of the specific market and the Panel Bank’s role and level of activity in this market.

Choice of Markets and Instruments

In compiling the list of markets and instruments that may be considered in arriving at a Level 3 contribution, EMMI has sought to choose markets that are strongly correlated with EURIBOR and that banks commonly use as references when constructing their funding curves. Futures, FRAs and swaps

¹⁶ EMMI considers that closing reference prices on regulated markets and trading venues would be so grounded.

that reference EURIBOR ultimately are anchored by the benchmark at their expiry or reset dates. The rates implied by such instruments are therefore expected to offer strong pricing signals for EURIBOR itself. Many banks use these instruments in constructing unsecured funding curves from which EURIBOR rates may be inferred.

Banks also frequently consider funding analyses that relate their secured and unsecured funding rates. Curves for secured funding can be derived from actual overnight and term secured funding arrangements, on the one hand, and synthetic term borrowings that combine overnight cash transactions with OIS swaps. In turn, unsecured funding rates can be assessed by applying spreads to the secured funding curve, representing the additional credit component of the bank's overall borrowing costs. Banks use a variety of techniques to evaluate these spreads, including historical analyses and estimates based on peer bank funding rates.

Considerations for Specific Market and Instrument Types

Where a Panel Bank uses data from the above instruments to derive a Level 3 contribution, EMMI expects the Panel Bank to make due provision for the particular characteristics of the instrument. As specific examples:

- › If a Panel Bank makes use of repo or similar secured rates as input data, the bank should consider how to adjust for any special characteristics of the underlying collateral. Collateral from different asset classes, with differing degrees of liquidity, or trading "special", all may cause repo rates to vary. The Panel Bank will need to include appropriate adjustments in its analyses to accommodate these effects. The bank might also choose to restrict the repos to be considered as inputs for Level 3 contributions to those whose collateral is in pre-defined classes such as sovereign bond "General Collateral".
- › Where a Panel Bank uses futures or swaps as inputs to construct a funding curve, the bank should consider how the margin arrangements for such contracts affect the predicted funding rates.

Limitations of Use

EMMI restricts the use of certain inputs for Level 3 contributions.

EMMI considered whether implied euro interest rate data from the foreign exchange forward markets for euro could be used as inputs for a Level 3 contributions. However, the basis between the implied euro interest rates and actual euro interest rates is very volatile in practice. Specifically, in the most liquid case of euro versus the US dollar, the availability of US dollar funding relative to euro funding for the European operations of banks can vary significantly, and particularly so at times of market stress, leading to considerable swings in the basis between the implied and actual euro funding rates. Moreover, the derivation of the implied euro interest rate relies on the availability of a benchmark interest rate in the counter-currency, which is itself problematic. Finally, the use of collateralization of forward contracts in some jurisdictions introduces a further complicating factor into the derivation of the implied interest rates. Taken in combination, these factors lead EMMI to conclude that the implied

euro interest rates are not suitable as direct inputs to Level 3 contribution calculations. Panel Banks may nonetheless consider the availability of euro funding through the foreign exchange market as a general environmental factor in exercising their expert judgment.

6.4 Combining Additional Transaction Data and Data from Other Markets

EMMI does not intend that there be a hierarchy between the two broad approaches above—additional transactions in the Underlying Interest (5.2), and data from other markets (5.3). Rather these two approaches may be used in a combination that is appropriate to each Panel Bank’s own business profile. Panel Banks should of course document the general rationale by which they combine these two approaches. EMMI indeed places a general emphasis on the use of transaction data in the Underlying Interest. However, it may be the case that a Panel Bank has a high volume of activity in the other markets that in turn provides a better gauge of its funding costs, as opposed to sparse or low-volume transactions in the Underlying Interest.

6.5 Consistency in Choice of Methods

Where a Panel Bank has a range of available methods for making a Level 3 contribution, the Panel Bank should seek to ensure that a particular method is applied consistently over time and with a documented rationale or criteria for switching between methods.



7 EURIBOR Fixings

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 TARGET¹⁷ 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 Defined Tenor, EURIBOR is calculated as the 15% trimmed mean¹⁸ 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.

¹⁷ 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.

¹⁸ 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.



8 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.

Appendix 1: 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 group¹⁹. 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 instructions²⁰. 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, 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

¹⁹ <http://ec.europa.eu/eurostat/documents/3859598/5925693/KS-02-13-269-EN.PDF/44cd9d01-bc64-40e5-bd40-d17df0c69334>

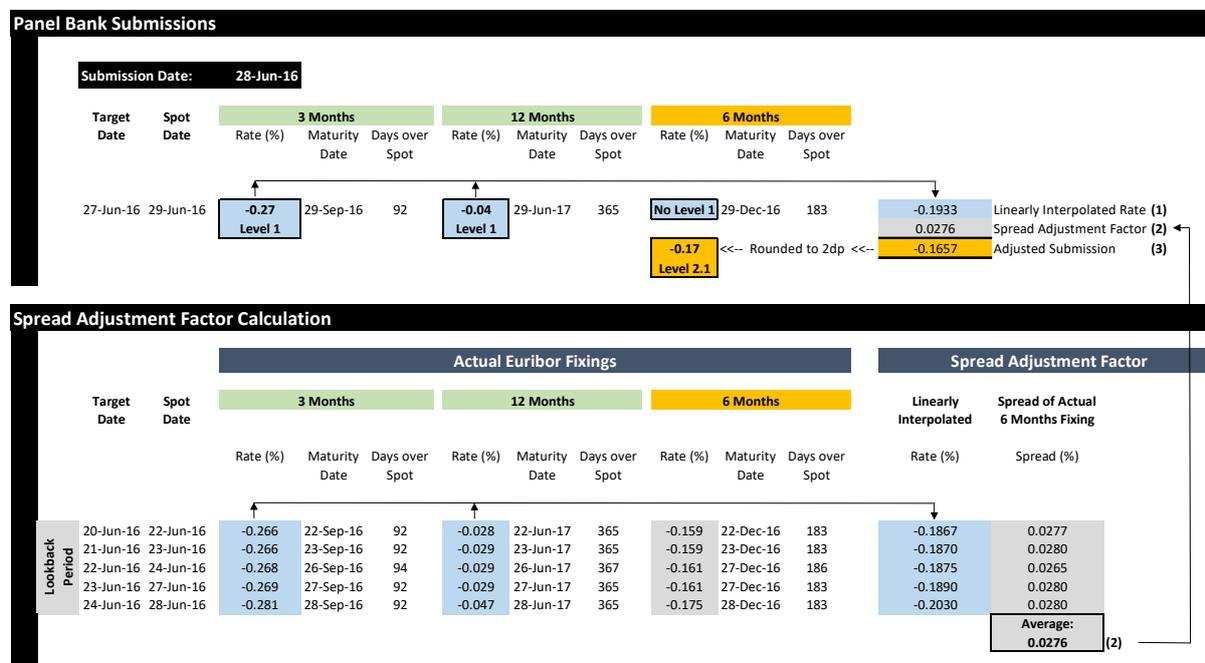
²⁰ https://www.ecb.europa.eu/ecb/legal/pdf/oj_jol_2014_359_r_0006_en_txt.pdf

Transaction Counterparty Classification	ESA 2010 Designation	ESA 2010 Institutional Sector/ Sub-Sector	ESA 2010 Definition of Institutional Sector/Sub-Sector
			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.
Non-financial Corporations (Level 3 contributions only)	S.11		The non-financial corporations sector (S.11) consists of institutional units which are independent legal entities and market producers, and whose principal activity is the production of goods and non-financial services.
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 guidance and examples for each of the institutional sectors and sub-sectors referenced in the table above.

Appendix 2 : Example Level 2.1 Contribution (Spread-Adjusted Interpolation)

The following is an example of a Level 2.1 contribution for the 6 Months tenor, based on interpolation between Level 1 contributions being made for the 3 Months and 12 Months tenors.



In this example, the Panel Bank is making its 6 Months contribution on 28 June 2016, in respect of activity from the previous TARGET day, 27 June 2016.

The bank had no eligible transactions on the previous day to allow it to make a Level 1 contribution in the 6 Months tenor. However, the bank has sufficient eligible transactions in order to make Level 1 contributions in the 3 and 12 Months tenors. In this case, the bank can make a Level 2.1 contribution in the 6 Months tenor. The contribution rate is calculated by interpolation from contributions for the 3 and 12 Months tenors, with a correction factor to account for the curvature of the money market yield curve. This correction factor, the Spread Adjustment Factor, is calculated from the actual EURIBOR fixings in the lookback period of the prior 5 days.

The calculations proceed through the following steps:

1. The bank first determines the linearly interpolated 6 Months rate from its Level 1 contributions of -0.27% (3 Months) and -0.04% (12 Months) using the day count over the Spot Date. The result is a rate of **-0.1933%**.
2. The Spread Adjustment Factor is calculated from the actual 3, 6 and 12 Months fixings from the prior 5 days. For each of these days, a linearly interpolated 6 Months rate is calculated from the fixings at the 3 and 12 Months tenors. These linear interpolants are then compared to the actual 6 Months fixing rate and the spread calculated. Finally, the average of these spreads over the lookback period is taken, resulting in a Spread Adjustment Factor of **+0.0276%**. In this case, the

yield curve has a positive curvature, so that pure linear interpolation is underestimating the 6 Month rate.

3. Finally, the Spread Adjustment Factor is added to the linearly interpolated 6 Month rate from the bank's Level 1 contributions, and the result is rounded to give the 6 Month Level 2.1 contribution of **-0.17%**:

Linear Interpolant (**-0.1933%**) + Spread Adjustment Factor (**+0.0276%**) = **-0.1657%**,
or **-0.17%** rounded to 2 decimal places.

Appendix 3: Example Level 2.2 Contribution (Transaction with Non-Standard Maturity Date)

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.

(1) Input Data			
Submission Date	18-Jun-14		
Transaction Date	17-Jun-14		
Spot Date	19-Jun-14		
Transaction with a Non-Standard Maturity Date			
Maturity Date	20-Oct-14	123 days over Spot	
Rate	0.270%		
Volume (€ Million)	60.000		
			Prior Fix Date 16-Jun-14
Neighboring Tenors		Prior Fix Rates	
3 Months	19-Sep-14	92 days over Spot	3 Month 0.223%
6 Months	19-Dec-14	183 days over Spot	6 Month 0.316%
(2) Linear Interpolation Weights			
3 Month		$(183 - 123) / (183 - 92) =$	66%
6 Month		$(123 - 92) / (183 - 92) =$	34%

In this example, the Panel Bank is making its 3 Months contribution on 18 June 2014, T+1, in respect of activity from the previous TARGET day T, 17 June 2014.

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 the bank cannot make a Level 2.1 (interpolation) at this tenor either.

The bank did however execute a funding transaction on day T at approximately the 4 Months tenor, for EUR 60 Million at a rate of 0.27%. This transaction is inferred to be split between two transactions at the 3 Months and 6 Months tenors respectively. 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 derived by shifting the rates at the prior EURIBOR fixings in parallel so that the linearly interpolated rate at the non-standard maturity matches the actual transaction rate. This shift adjustment is intended to compensate for any overall market movement between the prior fixing and the time of the transaction.

The calculations proceed through the following steps:

1. The basic input data, the transaction terms and the prior fixings, are given in the table above.
2. The linear interpolation weights to be ascribed to the 3 Months and 6 Months tenors, relative to the non-standard maturity date, are calculated based on day counts over the Spot Date. In the given example of a 4 Months transaction, a weight of approximately 2/3rds (**66%**) is assigned to the 3 Months tenor and of 1/3rd (**34%**) to the 6 Months tenor.

(3) Rate Calculation			
Transaction Rate			0.270%
Linearly Interpolated Rate from Prior Fixes to Maturity Date	$66\% \times 0.223\% + 34\% \times 0.316\%$	=	0.255%
Spread to Linearly Interpolated Rate ("Shift Adjustment")			0.015%
Inferred 3 Months Rate	$0.223\% + 0.015\%$	=	0.238%
Inferred 6 Months Rate	$0.316\% + 0.015\%$	=	0.331%

(4) Volume Calculation			
			(€ Million)
Allocated 3 Months Volume	$66\% \times 60.000$	=	39.560
Allocated 6 Months Volume	$34\% \times 60.000$	=	20.440
Total Volume			60.000

3. The shift adjustment to be applied to the prior day fixings is next calculated. The linearly interpolated rate to the non-standard maturity is determined based on the prior day fixings. In this example, the rate is calculated as 0.255%. The actual transaction rate was 0.270%, so the transaction rate was 0.015% above the interpolated rate from the prior day fixings. This shift adjustment is interpreted as the overall market movement between the prior fixing and the time of the transaction.

The inferred 3 Months and 6 Months rates are calculated by adding the shift adjustment to the prior fixing rates at these tenors. This results in inferred rates of **0.238%** (3 Months) and **0.331%** (6 Months) respectively.

4. A transaction can contribute to a Level 2.2 contribution at a Defined Tenor only when the volume allocated to that tenor meets a threshold amount, currently set at EUR 20 Million. The allocated volume is calculated based on the same linear interpolation weights as determined above.

In this example, the allocated volumes are EUR 39.560 Million (3 Months) and EUR 20.440 Million (6 Months). The 3 Months volume exceeds the minimum threshold of EUR 20 Million. Consequently, the transaction can be used to provide a Level 2.2 contribution at 3 Months. [The same is true for the 6 Months tenor also in this particular case.]

(5) Inferred Transactions				
	<u>Original</u>		<u>3 Months</u>	<u>6 Months</u>
Maturity Date	20-Oct-14	==>	19-Sep-14	19-Dec-14
Rate	0.270%	==>	0.238%	0.331%
Volume (€ Million)	50.000	==>	39.560	20.440

5. The inferred transactions are summarized in the above table.

If the example transaction is the only transaction at a non-standard maturity that would contribute to the 3 Months tenor, then the Panel bank will make a Level 2.2 contribution at this tenor of **0.24%**, that is, the inferred transaction rate of 0.238% rounded to decimal places.

If the bank has further transactions contributing 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.

Appendix 4: Example Level 2.3 Contribution (Transactions from Prior Dates)

The following is an example of Level 2.3 contribution for the 3 Months tenor, based on a recent Level 1 contribution.

Transaction and Market Data					Submission Data		
Lookback Period	TARGET Date	VWAR (%)	Volume (€ Million)	Closing Futures Price (Sep 16 Contract)	TARGET Date	Level	Submission Rate (%)
		T-7 21-Jun-16	:	:	100.270	T-6 22-Jun-16	:
	T-6 22-Jun-16	:	:	100.275	T-5 23-Jun-16	:	:
	T-5 23-Jun-16	-0.24	15	100.270	T-4 24-Jun-16	1	-0.24
	T-4 24-Jun-16	n/a	n/a	100.315	T-3 27-Jun-16	:	:
	T-3 27-Jun-16	n/a	n/a	100.300	T-2 28-Jun-16	:	:
	T-2 28-Jun-16	-0.25	30	100.305	T-1 29-Jun-16	1	-0.25
	T-1 29-Jun-16	n/a	n/a	100.310	T 30-Jun-16	:	:
	T 30-Jun-16	n/a	n/a	100.315	T+1 1-Jul-16	2.3	-0.26
Change in futures from T-2 to T: (positive, so rates decreased)				0.010			

In this example, the Panel Bank is making its 3 Months contribution on 1 July 2016, T+1, in respect of activity from the previous TARGET day T, 30 June 2016.

The bank had no eligible transactions on day T in order to make a Level 1 contribution. It is further assumed that the bank cannot make Level 2.1 (interpolation) or Level 2.2 (non-standard maturity) contributions either.

The bank examines its activity for the applicable 5-day lookback period. It made Level 1 contributions during this period and so can make a Level 2.3 contribution on T+1 based on these contributions. The methodology uses only the most recent Level 1 contribution.

The bank made its most recent Level 1 contribution two days earlier, on 29 June 16, at a rate of -0.25%, in respect of transaction activity on day T-2. To calculate its contribution for the current day, it must adjust this rate to account for market movements in the interim. For the 3 Months tenor, the Market Adjustment Factor uses the near-month EURIBOR futures contract, in this case the September 2016 contract. The factor is calculated as the change in the futures price between the closes on T-2 and T. The futures price increased by 1 basis point during this period, indicating a rate decrease of -0.01%. The contribution rate for the current day is therefore:

$$\text{Prior Level 1 Contribution Rate } (-0.25\%) + \text{Market Adjustment Factor } (-0.01\%) = -0.26\%$$

Appendix 5: Counterparty Legal Entity Identifier (LEI) Code—List of supranational authorities

When a transaction is undertaken with a supranational authority as counterparty, it should be reported with the sector codes included in the following table.

Name of the organization	LEI code - confirmed in GLEIF	
African Development Bank (AfDB)	549300LNCLMO3ITVCU07	S.13
African Export-Import Bank	21380068LJCDYA42GJ76	S.13
Andean Development Corporation – Development Bank of Latin America	UKZ46SXGNVCZK0UOZE76	S.13
Arab Bank for Economic Development in Africa (BADEA)	549300BZGC73FHYP9S05	S.13
Arab Fund For Economic & Social Development (AFESD)	54930004QHK2ENLCGV47	S.13
Arab Monetary Fund (AMF)	549300WT3YR8YON1F749	S.13
Asian Development Bank (AsDB)	549300X0MVH42CY8Q105	S.13
Bank for International Settlements (BIS)	UXIATLMNPCXXT5KR1S08	S.13
Black Sea Trade and Development Bank (BSTDB)	529900J7FSFACAGZ5042	S.13
Caribbean Development Bank (CDB)	549300TSCH0ZTLR5W421	S.13
Central American Bank for Economic Integration (CABEI)	549300OLDAMXBPSHIC05	S.13
Council of Europe Development Bank (CEB)	549300UYNXMI821WYG82	S.13
Eastern Caribbean Central Bank (ECCB)	549300JQ26UYI7I7C72	S.121
Eurasian Development Bank (EDB) / Евразийский банк развития	253400Q2AQ3F58BLL187	S.13
European Bank for Reconstruction and Development (EBRD)	549300HTGDOVDU6OGK19	S.13
European Central Bank (ECB)	549300DTUYXVMJXZNY75	S.121
European Company for the Financing of Railroad Rolling Stock (EUROFIMA)	4S66HJ5RNB5ZWG9YW219	S.13
European Investment Bank (EIB)	5493006YXS1U5GIHE750	S.13
European Stability Mechanism (ESM)	222100W4EEAQ77386N50	S.13
Foreign Trade Bank of Latin America / Banco Latinoamericano de Comercio Exterior – Bladex	549300CN3134K4LC0651	S.13
Inter-American Development Bank (IDB)	VKU1UKDS9E7LYLMACP54	S.13
International Bank for Economic Cooperation (IBEC)	253400HA8YB1HUTNC692	S.13

Name of the organization	LEI code - confirmed in GLEIF	
International Bank for Reconstruction and Development (IBRD)	ZTMSNXROF84AHWJNKQ93	S.13
International Development Association (IDA)	P41R60HC414IWQA1XW02	S.13
International Finance Corporation (IFC)	QKL54NQY28TCDAI75F60	S.13
International Finance Facility for Immunisation (IFFIm)	549300ILK2NRULX3HX87	S.13
International Fund for Agricultural Development (IFAD)	54930018GXVZ0BEQ7K32	S.13
International Investment Bank (IIB) / Международный инвестиционный банк	2534000PHLD27VN98Y03	S.13
International Monetary Fund (IMF)	E7EXN6FJGRUTJYNZ3Z71	S.13
Latin American Reserve Fund / Fondo Latinoamericano de Reservas (FLAR)	5493004ND385U1DPOZ64	S.13
Multilateral Investment Guarantee Agency (MIGA)	549300ZG5PH6MA164968	S.13
Nordic Development Fund (NDF)	213800UECLFCL057RQ80	S.13
Nordic Investment Bank (NIB)	213800HYL1S7VAXG6Z48	S.13
North American Development Bank (NADB)	5493008W785ZKQMVNG08	S.13
OPEC Fund for International Development (OPEC Fund)	HHX3T53LK1P186EUNV37	S.13