# EUROPEAN CENTRAL BANK

## EUROSYSTEM

# Public consultation on the publication by the ECB of compounded term rates using the €STR

**July 2020**

# Contents

# 1 Introduction

## 1.1 Motivation

The ECB is to provide benchmark users with compounded values of the euro short-term rate (€STR) for selected maturities. These values will be published every TARGET2 day, similarly to the €STR itself. This initiative has two aims:

1. in line with the recommendations of the Financial Stability Board, to encourage and support the wider use of the near-risk-free rates (RFRs), and hence the €STR, by providing a "golden source" for the compounded €STR values;

2. in line with the EU Benchmarks Regulation (BMR), to provide a rate that may be used in contractual fall-back provisions by users of the EUR LIBOR and EURIBOR who are required to prepare in their contingency planning for a scenario in which the EUR LIBOR and the EURIBOR may cease to exist.

This consultation seeks feedback from market participants and benchmark rate users about a number of parameters that would be applied when publishing these compounded values.

## 1.2 Context

### The global reform of benchmarks

Following the manipulation scandals and litigation procedures related to some of the widely used Interbank Offered Rates (IBOR-type rates), both the official and private sectors have been working on what is commonly referred to as the benchmark reform. It has one overarching objective: to reduce the risks related to the reliance on "IBORs". For the euro, the most essential IBOR is EURIBOR.

The first source of risk stems from the nature of the IBORs. The long-term sustainability of these rates may not be taken for granted: it depends: (i) on the stability of the panel of contributing banks; and (ii) on the evolution of the unsecured money market activity that these rates aim to measure.

The second source of risk is related to the way IBORs are used in contracts. Only a limited number of contracts that refer to an IBOR have workable fall-back provisions that could deal with a scenario involving a permanent discontinuation of the IBOR. This implies that, should the benchmark in question cease to exist, it might result in serious disruption to a number of market segments.

Therefore, the benchmark reform's objective of reducing the risks related to the reliance on IBORs encompassed in particular[1]:

- establishing a robust alternative rate anchored in a sufficiently liquid market, i.e. the so-called near-risk-free rates (RFRs), including the €STR for the euro area;

- promoting the wider use of the RFRs across market segments and therefore reducing the direct reliance on IBORs in contracts;

- improving the robustness of all contracts that make use of IBORs by introducing workable fall-back provisions.

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The publication of the compounded €STR using publicly available data can help achieve the above-mentioned objective in the following five ways:

**1.  Compounded term rates can form part of the fall-back provisions in EURIBOR contracts.**

The publication of compounded €STR term rates by the ECB is expected to encourage the adoption of robust fall-back provisions by the industry. Having a concrete and credible solution for fall-backs is therefore viewed as an important way to support the necessary acceleration of preparations and contract amendments by and within the industry.

**2.  Compounded €STR rates will be available even in adverse market circumstances and will be as robust as the €STR.**

Compounded rates based on the €STR would benefit from its proven robustness as the €STR is built on an active overnight borrowing market. This implies that even in times of market uncertainty – when long-term market activity may be declining or non-existent and the representativeness of IBOR-type of rates may be questioned – the compounded €STR rate will remain robust because the overnight markets remain by far the most liquid. This would provide certainty for users that such rates would be both representative of and accurately reflect the fair value of money.

Other types of rates, such as forward-looking rates stemming from the €STR derivatives market, may also provide an alternative to the EURIBOR, however such rates have a number of drawbacks. Most importantly: (i) they do not exist currently and there is no certainty as to whether they will develop; (ii) their future availability depends on the development of the €STR derivatives market, which would have to provide sufficient liquidity, with enough market participants and transactions; (iii) their robustness during episodes of market volatility would be uncertain. Hence, compared to forward-looking rates, compounded rates provide a much simpler, more robust and safer solution for the contingency planning in case the EURIBOR is discontinued or ceases to be representative. Compounded €STR rates can be applied to contracts with immediate effect.

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[1]  FSB 2019 progress Report – Reforming Major Interest Rate Benchmarks.

### 3. Compounded €STR rates can facilitate the increased usage of the €STR in the cash market.

Benchmark users may see them as an opportunity and make greater use of the €STR and compounded €STR as a reference rate in new products (rather than only as IBOR fall-backs). The development of market liquidity directly linked to the €STR is important. This will create sufficient awareness about how to use overnight rates and will help establish standards and best practices. It will be essential to support market functioning if the EURIBOR ceases to be representative or is discontinued, as there would already be an underlying €STR market.

### 4. The publication of a compounded €STR would support international consistency.

In a number of major jurisdictions, such as the United States and the United Kingdom, the RFRs are expected to take over from LIBOR for a large variety of contracts upon the discontinuation of the benchmark. Accordingly, the Federal Reserve Bank of New York as well as the Bank of England have also committed to publishing compounded RFR rates and/or daily indices. While no discontinuation of EURIBOR is foreseen, the availability of similar compounded rates for the euro will facilitate the development of corresponding markets for the euro and therefore facilitate consistency in the way benchmarks are used across major markets.

### 5. The publication of compounded €STR rates by the ECB will respond to demand from the private sector.

The WG RFR highlighted, during its meeting of 27 February 2020[2], that there are clear "advantages of a trusted authority as a source for the publication of the €STR compounded rate instead of institutions calculating the rate themselves. As with the recently published initiatives by the Bank of England and the FED, the publication by one "golden" and trusted free source that is available every business day would be very beneficial as (i) it would provide transparency to the market and encourage acceptance of the rate; (ii) it would avoid confusion or discrepancies related to the calculation of the rate, and facilitate its adoption in systems and documentation; and (iii) it would reduce conduct and litigation risks".

The ECB shares this view that a multiplication of sources could entail a risk of confusion and of potential disputes between parties, which may be detrimental to the smooth implementation of the BMR as regards fall-backs. The existence of a trusted source, providing clarity and transparency to users, whether market professionals or consumers, is an important way to limit these risks of confusion and support the pricing of contracts on a sound basis in commercial negotiations.

## Why use a compounded €STR to derive a substitute for a term rate?

The interest payments in various types of contracts (e.g. the monthly interest on some mortgages, the coupon of a bond, the interest on a deposit) are sometimes calculated on the basis of interest rate

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[2]    See the minutes of the 27 February 2020 WG RFR.

benchmarks like EURIBOR. These benchmarks are usually published for a set of tenors (e.g. one month, three months or six months) and theoretically reflect the expected fair value of money over the respective tenor (e.g. the benchmark rate will factor in any expectation of a change in the central bank policy rate) and also incorporate some liquidity and credit risk premia. This can be illustrated better by the following theoretical example:

If a person has one euro to invest and does not expect to need to spend this one euro in the next three months, then she may have two alternative investment opportunities:

1.  Place this one euro in a daily deposit (overnight deposit). This would mean that every subsequent business day, the person would have the freedom to decide whether to deposit the money for one additional day or alternatively withdraw and spend it if the opportunity arises. This also implies that every day the person would earn overnight interest, which could be re-invested over the subsequent days, i.e. effectively resulting in the compounding of the overnight interest.

2.  Place this one euro in a three-month deposit and earn a one-off interest payment at the end of the period. In this scenario, the investor will lose the flexibility of being able to spend the money before the end of the three-month period and will also be faced with an additional risk – what if the borrower (the entity holding the deposit) becomes less trustworthy or insolvent, increasing the risk that they will not pay the money back? Therefore, the investor might only opt for this second investment opportunity if the three-month rate is somewhat higher than the compounded overnight rate from the first scenario, to compensate for the loss of flexibility (through a liquidity premium) and the additional risk related to the creditworthiness of the borrower (credit risk).

This theoretical example illustrates that a compounded overnight rate represents a good proxy for a term rate and a solid theoretical basis for applying adjustments that may correspond to liquidity and credit premia.

Question 1:
Are you in favour of the ECB publishing €STR compounded rates? (Y/N). Please elaborate your answer.

# 2 Methodology

## 2.1 Rate compounding formula

The daily €STR compounded rates will be computed for various maturities with a one-day lag[3] using the formula already in place for certain products (e.g. in the derivatives market[4]). The formula will use the historical daily values of €STR and return an average rate for the respective tenor in which the €STR values were recorded (e.g. past week or month), using the actual number of days over 360 days annually as is standard in European money markets.

**Formula 1**

$$\text{compound interest formula} = \left[ \prod_{i=1}^{d_b} \left( 1 + \frac{r_i \times n_i}{N} \right) - 1 \right] \times \frac{N}{d_c}$$

Where:

$d_b$ = number of business days in the interest period

$d_c$ = number of calendar days in the interest period

$r_i$ = interest rate applicable on business day $i$, i.e. €STR on business day $i$

$n_i$ = number of calendar days for which rate $n_i$ applies (generally 1, except for Friday where it will be 3 to account for the accrual over the weekend; this number will also be adjusted to reflect TARGET2 holidays)

$N$ = number of days in the year, i.e. 360 in European money market calculations

Example of how the compounding will work over a week horizon

| Daily €STR publication date | €STR rate for the prior business day | Compounding factor |
|---|---|---|
| Friday | $u$ | $1 + u * 1/360$ |
| Saturday | n/a | n/a |
| Sunday | n/a | n/a |
| Monday | $v$ | $1 + v * 3/360$ |
| Tuesday | $w$ | $1 + w * 1/360$ |
| Wednesday | $x$ | $1 + x * 1/360$ |
| Thursday | $y$ | $1 + y * 1/360$ |
| Friday | $z$ | $1 + z * 1/360$ |

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[3]   A one-day lag means that the compounded rate published on a given day, will use as the last €STR value the €STR published on the same day, which reflects market developments since the previous business day.

[4]   https://www.isda.org/a/CMVTE/Supplement-59-EUR-EuroSTR-COMPOUND-FRO-2006-ISDA-Defs.pdf

## 2.2 Index value

The ECB intends to publish an index value for every TARGET2 business day. The index will allow users to compute rates for non-standard dates. The index will aggregate the daily compounded values for one euro, starting on 1 October 2019, which is the first trade date of the €STR (as it will be published for the first time on 2 October 2019).

The index would allow users who need to compute interest rates to do so in an easy and transparent manner to obtain rates for customised maturities. It will be published with a starting value of 1.000 000 000 for 1 October 2019.

For non-business days the rate for the last known business day would be applied until the next business day.

**Formula 2**

$$\text{€STR index } i = \begin{cases} 1, & \text{if } i = 0 \\ \prod_{t=1}^{i} \left(1 + \dfrac{€STR_t \times n_t}{N}\right), & \text{if } i > 0 \end{cases}$$

**Formula 3**

$$\text{€STR compounded average } x, y = \left(\frac{\text{€STR index } y}{\text{€STR index } x} - 1\right) \times \frac{N}{d_c}$$

Where:

$n_t$ = number of calendar days

$x$, $y$ = reference dates to calculate the customised compounded average

$N$ = number of days in the year i.e. 360 in European money market calculations

$d_c$ = number of calendar days in the interest period

$t$ = 0 refers to 1 October 2019 (first €STR reference date)

€STR compounded average $x, y$ = €STR compounded rate from date $x$ to date $y$

Example

| Start date | Index value | End date | Index value | Number of calendar days | Compounded rate |
|---|---|---|---|---|---|
| 11 February 2020 | 0.986 448 434 | 28 February 2020 | 0.986 197 411 | 17 | -0.5389% |

Question 3:
Do you agree with the index calculation methodology? (Y/N).
Please elaborate your answer.

# 3 Applicable day-count convention

## 3.1 Start and end date definitions

For almost any contract, the start date and the end date of an interest period are defined at the moment of the contract negotiation. For standard interest periods, it is often the case that the end date is a function of the start date and the application of a day count.

When interest rates are set on a backward-looking basis (i.e. at the end of the interest period) then the start date of a standard interest period (e.g. one, three or six months) is defined as a function of the end date. Therefore, on some occasions there can be a slight mismatch in the interest period between the way contracts are negotiated (at the start of an interest period) and the way backward-looking interest rates are computed (from the end-date of an interest period counting backwards). The critical point is therefore to investigate how these potential discrepancies can be minimised, and which day-count convention could be used for this purpose.

In European money markets, when users negotiate contracts they have recourse to the modified following business day convention. If the end date of a contract falls on a non-business day, then this convention shifts the end date of the contract to the next business day, unless this date falls in the next month. In this case, the end date is the last business day of the previous month.

When the modified following business day convention is used in a standard way, i.e. whereby the end-date is adjusted, in most cases this tends to extend the interest period somewhat (since the following business day is used). However, if the modified following business day convention is used to re-create, ex post, the correct start dates for compounding realised term rates, this may lead to shorter interest periods (since the start date is shifted to the following business day). When using the same day-count convention in a backward-looking fashion, the length of interest periods only appears to be "accurate" to within one day in 75% of cases, leaving 25% of cases with discrepancies in tenors' definitions of more than one day (Figure 1). For users, this means that published term rates would correspond to the negotiated terms at the inception of contracts on 75% of dates, leaving a mismatch for the other 25%.

Another day-count convention may give better results when used in a backward-looking way, namely the modified previous business day convention. This convention mirrors the modified following business day convention by adjusting non-business days over weekends or holidays to the previous business day instead of the following one. If this results in a change of month, the next business day is retained.

Using this convention to calculate realised rates works better than the modified following business day convention, as the number of dates on which the result is accurate to within one day jumps to 87% (Table 1). This is a material improvement for users of the published rates.

**Table 1**

Deviation in number of days from current business practice if the modified following and modified previous day-count conventions are used ex-post

| Deviation vs ex ante periods, in days | Modified previous | | Modified following | |
|---|---|---|---|---|
| | Number of dates | % | Number of dates | % |
| -5 | 1 | 0% | 0 | 0% |
| -4 | 3 | 0% | 0 | 0% |
| -3 | 20 | 1% | 12 | 0% |
| -2 | 20 | 1% | 21 | 1% |
| **-1** | 43 | 2% | 46 | 2% |
| **0** | 1736 | 68% | 1571 | 61% |
| **1** | 447 | 17% | 298 | 12% |
| 2 | 274 | 11% | 264 | 10% |
| 3 | 12 | 0% | 167 | 7% |
| 4 | 2 | 0% | 150 | 6% |
| 5 | 0 | 0% | 20 | 1% |
| 6 | 0 | 0% | 9 | 0% |
| **Total days** | **2558** | **100%** | **2558** | **100%** |

Source: ECB.
Note: One-month tenor, period 1 July 2017 to 1 July 2026.

The concrete example below illustrates that in some cases, the two conventions return results that are quite different, while the modified previous day-count convention is generally closer to what is effectively negotiated.

Example

| DATES AT CONTRACT'S NEGOTIATION | | DATES USED TO COMPOUND TERM RATES | |
|---|---|---|---|
| Start date, 1-month | End date, 1-month | Start date, modified following convention | Start date, modified previous convention |
| **Thursday 18 April 2019** | Monday 20 May 2019 | Tuesday 23 April 2019 | Thursday 18 April 2019 |

Another way to look at this is the effective average length of a one-month contract in terms of the number of days using these conventions. As a reference, a one-month tenor negotiated ex ante based on the modified following business day convention (business practice) over the period 2017-26 would represent on average a duration of 30.962 calendar days. Using the same modified following business day convention ex post would return an average length of 29.926 calendar days. The modified previous business day convention used ex post would better match the modified following day convention used ex ante (the current market practice) with on average 30.982 calendar days per month.

Therefore, the use of the modified previous business day convention for the backward-looking computation of term rates would minimise discrepancies with the usual way term rates are used. For that reason, it is proposed to use this convention as explained in more detail below.

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## 3.2 Previous day day-count convention for determining the tenors of the compounded €STR

The tenors will be determined using the European modified previous business day convention. When a date falls on a non-business day, the preceding business day will be used, unless the first preceding business day is in the previous calendar month. In the latter case that date will be the first following business day. In line with that principle, for example:

- the one-week rate published for Thursday 23 April 2020 starts on Thursday 16 April (standard case);

- the one-month rate published for Monday 25 May 2020 starts on Friday 24 April;

- the one-month rate published for 1 February 2019 starts on 2 January 2019 (this being the first following business day, given that the preceding one falls in the previous month).

Question 4:
Do you agree with the proposed day-count convention, namely the *modified previous business day convention*? (Y/N).
Please elaborate your answer.

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# 4 How to solve residual calendar discrepancies

## 4.1 Various issues involved in determining the start date

Though it is a better match, the *modified previous business day convention* does not resolve all issues, as in around 12% of cases the published rates would be based on start dates that would be more than one day out of line with negotiated terms, thereby introducing a deviation from the interest periods used in actual contracts.

### Case 1:
### Repetition of the start date

On some non-business days, for example, adjustments using the *modified previous business day convention* to define the start date could lead to outcomes where the start date of the averaging period would differ from what would have been negotiated ex ante in a standard contract. This is because over certain bank holidays the same start date could be repeated two days in a row for the same tenor.

Example for the one-week tenor over Easter 2020

| Day-count convention used | Start date | End date |
|---|---|---|
| **Modified following business day European convention used ex ante in a negotiation** | Thursday 9 April 2020 | Thursday 16 April 2020 |
| **Modified previous business day convention used ex post to compound the one-week rate** | Thursday 9 April 2020 | Thursday 16 April 2020 |
| | Thursday 9 April 2020 | Friday 17 April 2020 |

For users entering into contracts on 9 April 2020, this situation can be confusing, as two possible end dates would qualify for the same tenor.

### Case 2:
### Repetition of the end date

Conversely, in some cases and especially over bank holidays, the same end date can be used ex ante in contract negotiations three days in a row:

| Negotiation start date | Negotiation end date |
|---|---|
| Wednesday 25 September 2019 | Friday 27 December 2019 |
| Thursday 26 September 2019 | Friday 27 December 2019 |
| Friday 27 September 2019 | Friday 27 December 2019 |

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This situation is more complex than in Case 1 as here:

1. The administrator of a backward looking rate has three possible start dates to consider for when publishing the rate for the three-month tenor. Applying the modified previous business day convention proposed in this consultation would lead to publishing only the three-month rate for contracts entered into on 27 September:

| Publication date | End date | Start date |
|---|---|---|
| Friday 27 December 2019 | Friday 27 December 2019 | Friday 27 September 2019 |

2. Users entering into three-month contracts on 25 and 26 September would not see the rate for the three months corresponding to their start date, thereby creating uncertainty about valuations.

It is complex and hardly possible for the administrator to publish the three-month rate three times using the three different start dates, especially in a context of multiple national holidays in the euro area that do not always coincide.

For example, there are specific bank holidays which are not TARGET2 holidays (Corpus Christi in some regions of Germany for example). Meanwhile the opposite is also true in some countries with TARGET2 holidays that are not bank holidays (26 December and Good Friday are not bank holidays in France or in Italy, for example). In the latter case, as TARGET2 is closed there would be no published €STR value for those dates, which could also make the pricing of retail contracts more difficult.

## 4.2 The recourse to the index

There are various options for dealing with these issues. However, these add complexity and none of them will ensure that the interest period as assumed for the backward-looking computation will always match the interest period as negotiated by counterparties at the initiation of the contract.

In the event of such a mismatch, users can apply the daily index values and flexibly determine the start and end dates of the interest period using Formula 4 above, as long as the start and end date fall on TARGET2 business days.

## 4.3 Example

In the case mentioned above, users can enter a three-month contract on three different dates and use the index value to determine the rate that fits to the negotiated period:

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- Rate for a three-month contract starting 25 Sept. 2019, ending 27 Dec. 2019: -0.5430%

- Calculation with index: ((0.987126202/ 0.988512846)-1)*360/93 *100 = -0.5430%

- Rate for a three-month contract starting 26 Sept. 2019, ending 27 Dec. 2019: -0.5429%

- Calculation with index: ((0.987126202/ 0.988497662)-1)*360/92 *100 = -0.5429%

- Rate for a three-month contract starting 27 Sept. 2019, ending 27 Dec. 2019: -0.5428%

- Calculation with index: ((0.987126202/ 0.988482587)-1)*360/91 *100 = -0.5428%

Using the standard modified previous business day convention, the three-month rate published by the administrator on Friday 27 December will be the rate covering the period 27 September to 27 December, i.e. -0.5428%. For the other start dates, the index will have to be used.


## Question 5:
Do you agree that the use of the daily index value is a simple and transparent solution for the non-standard situations described in the Public Consultation document? (Y/N). Please elaborate your answer.


## Question 6:
If you have replied "No" to Question 5, what other alternative approach would you suggest? Please explain the advantages you associate with this alternative approach.

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# 5 Publication policy

## 5.1 Selection of maturities

The envisaged maturities for which €STR compounded rates will be published are one week, one month, three months, six months and twelve months. This choice is in line with market needs as regards the pricing of financial instruments and retail products.

Example

| End date | | | |
|---|---|---|---|
| **Thursday 28 May 2020** | | | |
| | | | |
| **TERM** | **START DATE** | **END DATE** | **COMPOUNDED RATE (%)** |
| **Overnight** | 27-May-20 | 28-May-20 | -0.5410 |
| **1W** | 21-May-20 | 28-May-20 | -0.5406 |
| **1M** | 28-Apr-20 | 28-May-20 | -0.5402 |
| **3M** | 28-Feb-20 | 28-May-20 | -0.5367 |
| **6M** | 28-Nov-19 | 28-May-20 | -0.5372 |
| **12M** | 28-May-19 | 28-May-20 | -0.5110 |

Question 7:
Does the proposed range of maturities cover market participants' business needs? (Y/N). Please elaborate your answer.

## 5.2 Rates' behaviour

Compounded rates will involve a change from current working practices for potential users. Chart 1[5] shows that in the stable interest rate environment prevailing until the ECB rate cut of September 2019, compounded term rates remained quite close to each other. In the absence of risk and liquidity premia, such an outcome is consistent with the stability and risk-free nature of the overnight rate forming the basis for these calculations. When the overnight rate changes, compounding progressively drives these term rates to the new policy rate level.

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[5]    The data use pre-€STR time series for the values prior to 1 October 2019 for illustrative purposes.

**Chart 1**
Time series for various maturities
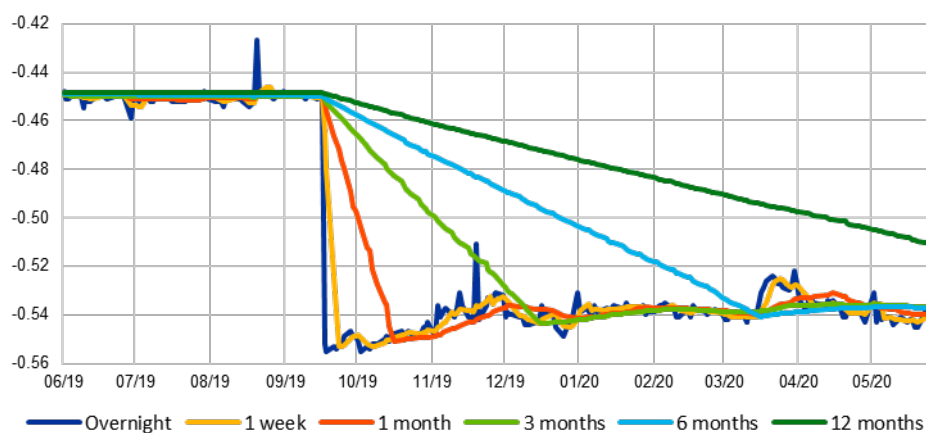


## 5.3    Rate and index precision

The rates for the various maturities will be published with four decimal places, while the index will be published with nine decimal places. This level of precision approximates current practices for similar published benchmarks and therefore is deemed adequate to meet users' needs. Moreover, the degree of precision of the published index values would be such that users could fully reconcile the values for the different tenors.

Question 8:
Do you agree that (a) four decimal places for the published term rates, and (b) nine decimal places for the published index values are sufficient to meet user's needs? (Y/N). Please elaborate your answer.

## 5.4    Timing of daily publication and corrections

The rates for the proposed maturities and the index value for the respective day will be published on the ECB website shortly after 09:15 CET each TARGET2 day.

The values for the rates and the index value can be amended without any time limit if computation errors are detected after the initial publication. However, corrections are seen as extremely unlikely.

Question 9:
Do you agree with the envisaged publication timing and correction policy? (Y/N). Please elaborate your answer.

# 6 Data source and IOSCO principles

## 6.1 Input data

The term rates will exclusively use public information, as they will be produced based on the publically available €STR by applying the mathematical formula described above.

## 6.2 IOSCO principles for financial benchmarks

As in the case of the €STR, the ECB will seek to align its policies and processes as regards the €STR compounded rates with the IOSCO principles for financial benchmarks[6]. The €STR compounded rates will be published using solid procedures, both from a system and from a quality assurance perspective. The Guideline on the €STR (EU) 2019/1265 (ECB/2019/19).may need to be amended in order to provide the necessary legal basis for the production and publication of the term rates, as this will represent a new benchmark activity for the Eurosystem.

Transparency is also one key element of the quality of these publications, and the present consultation aims to ensure that market professionals and benchmark rate users are duly informed and their feedback taken into consideration.

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[6] See: https://www.iosco.org/library/pubdocs/pdf/IOSCOPD415.pdf

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# 7 Deadline for replies

The deadline for replies using the template provided by the ECB is 11/09/2020 18:00 CET.

A summary of the answers received will be published within three weeks of this deadline.