Council of the
European Union

Brussels, 20 October 2022
(OR. en)

13900/22
ADD 1

COH 103
ASIM 85
CLIMA 535
FRONT 380
MARE 66
DELACT 189

COVER NOTE

From:	Secretary-General of the European Commission, signed by Ms Martine DEPREZ, Director
date of receipt:	20 October 2022
To:	Ms Thérèse BLANCHET, Secretary-General of the Council of the European Union
No. Cion doc.:	C(2022) 7357 final/ANNEX
Subject:	ANNEXES to the COMMISSION DELEGATED REGULATION (EU) .../... supplementing Regulation (EU) 2021/1060 of the European Parliament and of the Council by establishing standardised off-the-shelf sampling methodologies and modalities to cover one or more programming periods

Delegations will find attached document C(2022) 7357 final/ANNEX.

Encl.: C(2022) 7357 final/ANNEX

EUROPEAN
COMMISSION

Brussels, 20.10.2022
C(2022) 7357 final

ANNEXES 1 to 3

ANNEXES

to the

COMMISSION DELEGATED REGULATION (EU) .../...

supplementing Regulation (EU) 2021/1060 of the European Parliament and of the Council by establishing standardised off-the-shelf sampling methodologies and modalities to cover one or more programming periods

ANNEX I
SAMPLING PARAMETERS

This Annex lays down a methodology for establishing sampling parameters applicable in the following cases:

(a) the audit authority does not apply a capped sample size of 50 sampling units based on Article 5(7) of this Delegated Regulation or a size of 30 sampling units based on Article 83 of Regulation (EU) 2021/1060.

(b) the capped sample size is applied in the framework of two-period or multi-period sampling procedures and the audit authority uses the re-calculation formulas for sample size, set out in Annex II, to verify the possibility of maintaining the capped size in spite of underestimated population size or expenditure for the second or subsequent sampling periods.

1. Materiality threshold

The maximum materiality threshold must be set at the level of 2% in accordance with point 5.9 of Annex XX of Regulation (EU) 2021/1060.

2. Confidence level

The audit authority must evaluate the reliability of the system as high, average or low, taking into account the results of system audits to determine the technical parameters of sampling in such a way that the combined level of assurance obtained from the system audits and audits of operations is high. The confidence level used for sampling of operations of a system assessed as having high reliability must not be less than 60%. The confidence level used for sampling of operations of a system assessed as having low reliability must not be less than 90%.

3. Parameter *z*

To determine the parameter *z* based on the confidence level, the audit authority may use either bilateral or unilateral testing.

The following table presents *z* values using bilateral and unilateral testing:

Confidence level	90%	80%	70%	60%
z value (bilateral)	1.645	1.282	1.036	0.842
z′ value (unilateral)	1.282	0.842	0.524	0.253

4. Anticipated standard deviation of errors or error rates and anticipated error

Anticipated standard deviation of errors or error rates and anticipated error are parameters that are expected to characterise the population under audit. They may be established using a pilot sample, historical data derived from previous sampling procedures and professional judgement.

ANNEX II
FORMULAS FOR SAMPLE SIZE CALCULATION AND EXTRAPOLATION OF ERRORS

1. MUS STANDARD APPROACH

1.1. MUS standard approach – one period

NON-STRATIFIED	STRATIFIED
Sample size calculation	
$$n = \left(\frac{z \times BV \times \sigma_r}{TE - AE}\right)^2$$	$$n = \left(\frac{z \times BV \times \sigma_{rw}}{TE - AE}\right)^2$$ $$n_h = \frac{BV_h}{BV} n$$ where σ_{rw}^2 - weighted mean of the variances of the error rates for the whole set of strata, with the weight for each stratum equal to the ratio between the stratum book value (BV_h) and the book value for the whole population (BV) $$\sigma_{rw}^2 = \sum_{i=1}^{H} \frac{BV_h}{BV} \sigma_{rh}^2, h = 1,2, \dots, H;$$ and σ_{rh}^2 is the variance of error rates in each stratum
where	

BV - population book value (total declared expenditure) z - coefficient z from a normal distribution *TE* - tolerable error (maximum 2% of the total expenditure) *AE* - anticipated error σ_r - the standard deviation of the error rates	
Extrapolation of errors	
Projected/extrapolated error (MUS standard approach/PPS): For the exhaustive stratum, the projected error is the sum of the errors found in the units belonging to the stratum: $$EE_e = \sum_{i=1}^{n_e} E_i$$ For the non-exhaustive stratum, i.e. the stratum containing the sampling units with book value smaller than the interval, $BV_i < \frac{BV}{n}$ the projected error is $$EE_s = SI \sum_{i=1}^{n_s} \frac{E_i}{BV_i}$$ The projected error at the level of population is the sum of the two components above:	Projected/extrapolated error (MUS standard approach/PPS): For the exhaustive groups, the projected error is the sum of the errors found in the units belonging to those groups: $$EE_e = \sum_{h=1}^{H} \sum_{i=1}^{n_h} E_{hi}$$ For the non-exhaustive groups, i.e. the groups containing the sampling units with book value smaller than the interval, $BV_{hi} < \frac{BV_h}{n_h}$, the projected error is $$EE_s = \sum_{h=1}^{H} \frac{BV_{hs}}{n_{hs}} \sum_{i=1}^{n_{hs}} \frac{E_{hi}}{BV_{hi}}$$ The projected error at the level of population is just the sum of these two components above: $$EE = EE_e + EE_s$$

$$EE = EE_e + EE_s$$	
Sampling precision: $$SE = z \times \frac{BV_s}{\sqrt{n_s}} \times s_r$$ where s_r is the standard-deviation of error rates in the sample of the non-exhaustive stratum (calculated from the same sample used to extrapolate the errors to the population)	Sampling precision: $$SE = z \times \sqrt{\sum_{h=1}^{H} \frac{BV_{hs}^2}{n_{hs}} . s_{rhs}^2}$$ where s_{rhs} is the standard-deviation of error rates in the sample of the non-exhaustive group of stratum h (calculated from the same sample used to extrapolate the errors to the population)

1.2. MUS standard approach – two periods

NON-STRATIFIED	STRATIFIED
Sample size calculation	
First period $$n_{1+2} = \frac{\left(z \times BV_{1+2} \times \sigma_{rw1+2}\right)^2}{(TE - AE)^2}$$ where	**First period** $$n_{1+2} = \frac{\left(z \times BV_{1+2} \times \sigma_{rw1+2}\right)^2}{(TE - AE)^2}$$ where

$$\sigma^2_{rw1+2} = \frac{BV_1}{BV_{1+2}}\sigma^2_{r1} + \frac{BV_2}{BV_{1+2}}\sigma^2_{r2}$$ $$BV_{1+2} = BV_1 + BV_2$$ $$n_t = \frac{BV_t}{BV_{1+2}} n_{1+2}$$ **Second period** $$n_2 = \frac{\left(z \times BV_2 \quad \times \sigma_{r2}\right)^2}{(TE - AE)^2 - z^2 \times \frac{BV_1^2}{n_1} \times s^2_{r1}}$$	$$\sigma^2_{rw1+2} = \sigma^2_{rw1} + \sigma^2_{rw2}$$ $$\sigma^2_{rwt} = \sum_{i=1}^{H_t} \frac{BV_{ht}}{BV}\sigma^2_{rht}, h = 1,2, \dots, H_t;$$ $$BV_{1+2} = BV_1 + BV_2$$ $$n_{ht} = \frac{BV_{ht}}{BV} n$$ **Second period** $$n_2 = \frac{z^2 \times BV_2 \quad \times \sum_{h=1}^{H_2}\left(BV_{h2}.\sigma^2_{rh2}\right)}{(TE - AE)^2 - z^2 \times \sum_{h=1}^{H_1}\left(\frac{BV_{h1}^2}{n_{h1}}.s^2_{rh1}\right)}$$ where $$n_{h2} = \frac{BV_{h2}}{BV_2} n_2$$

Notes:

Whenever different approximations for the standard-deviations of each period cannot be obtained/are not applicable, the same value of standard deviation may be applied to all periods. In such a case σ_{rw1+2} is just equal to the single standard-deviation of error rates σ_r .

The parameter σ refers to the standard-deviation obtained from auxiliary data (e.g. historical data) and s refers to the standard-deviation obtained from the audited sample. In the formulas, whenever s is not available, it may be substituted by σ.

Formulas under the heading "First period" are used to calculate the sample size after the first sampling period of the accounting year in the case of a standard recalculation of the sample size referred to in Article 5(6), point (a). In the case of the global recalculation of the sample size referred to in Article 5(6), point (b), these formulas are used after the first sampling period and if needed also after the second sampling period in order to adjust to updated sampling parameters.

Formulas under the heading "Second period" are applicable only in the case of a standard recalculation of the sample size referred to in Article 5(6), point (a). They are used to recalculate the sample size of the second period in order to adjust to updated sampling parameters. If the formula results in a negative number, the formula and consequently the standard approach to recalculation of the sample size cannot be applied based on the established set of the updated parameters.

Extrapolation of errors	
Projected/extrapolated error (MUS standard approach/PPS): For the exhaustive strata, the projected error is the sum of the errors found in the units belonging to the strata: $$EE_e = \sum_{i=1}^{n_1} E_{1i} + \sum_{i=1}^{n_2} E_{2i}$$ For the non-exhaustive strata, i.e. the strata containing the sampling	Projected/extrapolated error (MUS standard approach/PPS): For the exhaustive strata, the projected error is the sum of the errors found in the units belonging to the strata: $$EE_e = \sum_{h=1}^{H_1} \sum_{i=1}^{n_{h1}} E_{h1i} + \sum_{h=1}^{H_2} \sum_{i=1}^{n_{h2}} E_{h2i}$$ For the non-exhaustive strata, i.e. the strata containing the sampling units with

units with book value smaller than the interval, $BV_i < \frac{BV}{n}$ the projected error is $$EE_s = \frac{BV_{1s}}{n_{1s}} \times \sum_{i=1}^{n_{1s}} \frac{E_{1i}}{BV_{1i}} + \frac{BV_{2s}}{n_{2s}} \times \sum_{i=1}^{n_{2s}} \frac{E_{2i}}{BV_{2i}}$$ The projected error at the level of population is the sum of the two components above: $$EE = EE_e + EE_s$$	book value smaller than the interval, $BV_i < \frac{BV}{n}$ the projected error is $$EE_s = \sum_{h=1}^{H_1} \left(\frac{BV_{h1s}}{n_{h1s}} . \sum_{i=1}^{n_{h1s}} \frac{E_{h1i}}{BV_{h1i}} \right) + \sum_{h=1}^{H_2} \left(\frac{BV_{h2s}}{n_{h2s}} . \sum_{i=1}^{n_{h2s}} \frac{E_{h2i}}{BV_{h2i}} \right)$$ The projected error at the level of population is the sum of the two components above: $$EE = EE_e + EE_s$$
Sampling precision: $$SE = z \times \sqrt{\frac{BV_{1s}^2}{n_{1s}} \times s_{r1s}^2 + \frac{BV_{2s}^2}{n_{2s}} \times s_{r2s}^2}$$ where s_{rt} is the standard-deviation of error rates in the sample of the non-exhaustive strata of period *t* (calculated from the same sample used to extrapolate the errors to the population)	Sampling precision: $$SE = z \times \sqrt{\sum_{h=1}^{H_1} \left(\frac{BV_{h1s}^2}{n_{h1s}} . s_{rh1s}^2 \right) + \sum_{h=1}^{H_2} \left(\frac{BV_{h2s}^2}{n_{h2s}} . s_{rh2s}^2 \right)}$$ where s_{rhts} is the standard-deviation of error rates in the sample of the non-exhaustive group of stratum *h* in period *t* (calculated from the same sample used to extrapolate the errors to the population)

1.3. MUS standard approach – three periods[1]

NON-STRATIFIED	STRATIFIED
Sample size calculation	
First period $$n_{1+2+3} = \frac{\left(z \times BV_{1+2+3} \times \sigma_{rw1+2+3}\right)^2}{(TE - AE)^2}$$ where $$\sigma^2_{rw1+2+3} = \frac{BV_1}{BV_{1+2+3}}\sigma^2_{r1} + \frac{BV_2}{BV_{1+2+3}}\sigma^2_{r2} + \frac{BV_3}{BV_{1+2+3}}\sigma^2_{r3}$$ $$BV_{1+2+3} = BV_1 + BV_2 + BV_3$$ $$n_t = \frac{BV_t}{BV_{1+2+3}} n_{1+2+3}$$	**First period** $$n_{1+2+3} = \frac{\left(z \times BV_{1+2+3} \times \sigma_{rw1+2+3}\right)^2}{(TE - AE)^2}$$ where $$\sigma^2_{rw1+2+3} = \sigma^2_{rw1} + \sigma^2_{rw2} + \sigma^2_{rw3}$$ $$\sigma^2_{rwt} = \sum_{i=1}^{H_t} \frac{BV_{ht}}{BV}\sigma^2_{rht}, h = 1,2,\ldots,H_t;$$ $$BV_{1+2+3} = BV_1 + BV_2 + BV_3$$

[1] MUS standard approach may be applied with more than three sampling periods by relevant adjustments of the formulas.

	$n_{ht} = \frac{BV_{ht}}{BV} n$
Second period $n_{2+3} = \frac{\left(z \times BV_{2+3} \times \sigma_{rw2+3}\right)^2}{(TE - AE)^2 - z^2 \times \frac{BV_1^2}{n_1} \times s_{r1}^2}$ where $\sigma_{rw2+3}^2 = \frac{BV_2}{BV_{2+3}} \sigma_{r2}^2 + \frac{BV_3}{BV_{2+3}} \sigma_{r3}^2$ $BV_{2+3} = BV_2 + BV_3$ $n_t = \frac{BV_t}{BV_{2+3}} n_{2+3}$	**Second period** $n_{2+3} = \frac{z^2 \times BV_{2+3} \times \left(\sum_{h=1}^{H_2}\left(BV_{h2}.\sigma_{rh2}^2\right) + \sum_{h=1}^{H_3}\left(BV_{h3}.\sigma_{rh3}^2\right)\right)}{(TE - AE)^2 - z^2 \times \sum_{h=1}^{H_1}\left(\frac{BV_{h1}^2}{n_{h1}}.s_{rh1}^2\right)}$ where $BV_{2+3} = BV_2 + BV_3$ $n_{ht} = \frac{BV_{ht}}{BV_{2+3}} n_{2+3}$

Third period $$n_3 = \frac{\left(z \times BV_3 \times \sigma_{r3}\right)^2}{(TE - AE)^2 - z^2 \times \frac{BV_1^2}{n_1} \times s_{r1}^2 - z^2 \times \frac{BV_2^2}{n_2} \times s_{r2}^2}$$	**Third period** $$n_3 = \frac{z^2 \times BV_3 \times \left(\sum_{h=1}^{H_3}\left(BV_{h3}.\sigma_{rh3}^2\right)\right)}{(TE - AE)^2 - z^2 \times \sum_{h=1}^{H_1}\left(\frac{BV_{h1}^2}{n_{h1}}.s_{rh1}^2\right) - z^2 \times \sum_{h=1}^{H_2}\left(\frac{BV_{h2}^2}{n_{h2}}.s_{rh2}^2\right)}$$ $$n_{h3} = \frac{BV_{h3}}{BV_3} n_3$$
Notes: Whenever different approximations for the standard-deviations of each period cannot be obtained/are not applicable, the same value of standard deviation may be applied to all periods. In such a case $\sigma_{rw1+2+3}$ is just equal to the single standard-deviation of error rates σ_r . The parameter σ refers to the standard-deviation obtained from auxiliary data (e.g. historical data) and *s* refers to the standard-deviation obtained from the audited sample. In the formulas, whenever *s* is not available, it may be substituted by σ. See also notes above for the two-period MUS standard approach as regards the use of the standard approach to the recalculation of the sample size and the global approach referred to in Article 5(6).	
Extrapolation of errors	
Projected/extrapolated error (MUS standard approach/PPS):	Projected/extrapolated error (MUS standard approach/PPS):

For the exhaustive strata, the projected error is the sum of the errors found in the units belonging to the strata:	For the exhaustive strata, the projected error is the sum of the errors found in the units belonging to the strata:
$EE_e = \sum_{i=1}^{n_1} E_{1i} + \sum_{i=1}^{n_2} E_{2i} + \sum_{i=1}^{n_3} E_{3i}$	$EE_e = \sum_{h=1}^{H_1}\sum_{i=1}^{n_{h1}} E_{h1i} + \sum_{h=1}^{H_2}\sum_{i=1}^{n_{h2}} E_{h2i} + \sum_{h=1}^{H_3}\sum_{i=1}^{n_{h3}} E_{h3i}$
For the non-exhaustive strata, i.e. the strata containing the sampling units with book value smaller than the interval, $BV_i < \frac{BV}{n}$ the projected error is	For the non-exhaustive strata, i.e. the strata containing the sampling units with book value smaller than the interval, $BV_i < \frac{BV}{n}$ the projected error is
$EE_s = \frac{BV_{1s}}{n_{1s}} \times \sum_{i=1}^{n_{1s}} \frac{E_{1i}}{BV_{1i}} + \frac{BV_{2s}}{n_{2s}} \times \sum_{i=1}^{n_{2s}} \frac{E_{2i}}{BV_{2i}} + \frac{BV_{3s}}{n_{3s}} \times \sum_{i=1}^{n_{3s}} \frac{E_{3i}}{BV_{3i}}$	$EE_s = \sum_{h=1}^{H_1}\left(\frac{BV_{h1s}}{n_{h1s}} . \sum_{i=1}^{n_{h1s}} \frac{E_{h1i}}{BV_{h1i}}\right) + \sum_{h=1}^{H_2}\left(\frac{BV_{h2s}}{n_{h2s}} . \sum_{i=1}^{n_{h2s}} \frac{E_{h2i}}{BV_{h2i}}\right) + \sum_{h=1}^{H_3}\left(\frac{BV_{h3s}}{n_{h3s}} . \sum_{i=1}^{n_{h1s}} \frac{E_{h3i}}{BV_{h3i}}\right)$
The projected error at the level of population is the sum of the two components above:	The projected error at the level of population is the sum of the two components above: $EE = EE_e + EE_s$

$$EE = EE_e + EE_s$$	
Sampling precision: $$SE = z \times \sqrt{\frac{BV_{1s}^2}{n_{1s}} \times s_{r1s}^2 + \frac{BV_{2s}^2}{n_{2s}} \times s_{r2s}^2 + \frac{BV_{3s}^2}{n_{3s}} \times s_{r3s}^2}$$ where s_{rts} is the standard-deviation of error rates in the sample of the non-exhaustive strata of period *t* (calculated from the same sample used to extrapolate the errors to the population)	Sampling precision: $$SE = z \times \sqrt{\sum_{h=1}^{H_1}\left(\frac{BV_{h1s}^2}{n_{h1s}}.s_{rh1s}^2\right) + \sum_{h=1}^{H_2}\left(\frac{BV_{h2s}^2}{n_{h2s}}.s_{rh2s}^2\right) + \sum_{h=1}^{H_3}\left(\frac{BV_{h3s}^2}{n_{h3s}}.s_{rh3s}^2\right)}$$ where s_{rhts} is the standard-deviation of error rates in the sample of the non-exhaustive group of stratum *h* in period *t* (calculated from the same sample used to extrapolate the errors to the population)

2. SIMPLE RANDOM SAMPLING

2.1. Simple random sampling – one period

NON-STRATIFIED	STRATIFIED
Sample size calculation	
$$n = \left(\frac{N \times z \times \sigma_e}{TE - AE}\right)^2$$ where σ_e is the standard-deviation of errors in the population	$$n = \left(\frac{N \times z \times \sigma_w}{TE - AE}\right)^2$$ $$n_h = \frac{N_h}{N} \times n.$$ where σ_w^2 - the weighted mean of the variances of the errors for the whole set of strata: $$\sigma_w^2 = \sum_{i=1}^{H} \frac{N_h}{N} \sigma_{eh}^2, h = 1,2, \ldots, H;$$ and σ_{eh}^2 is the variance of errors in each stratum
where	

<table>
<tr><td colspan="2">

N - population size

z - coefficient z from a normal distribution

TE - tolerable error (maximum 2% of the total expenditure)

AE - anticipated error

σ_e - the standard deviation of the errors

</td></tr>
<tr><td colspan="2">Extrapolation of errors</td></tr>
<tr><td colspan="2">In the framework of application of the off-the-shelf methodologies laid down in this Delegated Regulation, a single extrapolation method, ratio estimation, applies for SRS referred to in Article 5(1), point (b), and equal probability selection referred to in Article 6(1), point (b), for the purpose of simplification and legal certainty. This does not limit the application of other extrapolation methods by the audit authorities under Article 79 of Regulation (EU) 2021/1060.</td></tr>
<tr><td>

Projected/extrapolated error (SRS/equal probability selection):

If an exhaustive stratum is used, the projected error in this group is the sum of the errors found in the units belonging to the stratum:

$$EE_e = \sum_{i=1}^{n_e} E_i$$

For the random stratum the projected error is

$$EE_s = BV \times \frac{\sum_{i=1}^{n} E_i}{\sum_{i=1}^{n} BV_i}$$

The projected error at the level of population is the sum of the two

</td><td>

Projected/extrapolated error (SRS/equal probability selection):

If an exhaustive stratum is used, the projected error in this group is the sum of the errors found in the units belonging to those groups:

$$EE_e = \sum_{h=1}^{H} \sum_{i=1}^{n_h} E_{hi}$$

For the random strata the projected error is

$$EE_s = \sum_{h=1}^{H} BV_h \times \frac{\sum_{i=1}^{n_h} E_i}{\sum_{i=1}^{n_h} BV_i}$$

The projected error at the level of population is just the sum of these two

</td></tr>
</table>

components above: $$EE = EE_e + EE_s$$	components above: $$EE = EE_e + EE_s$$
Sampling precision: $$SE \quad = N \times z \times \frac{s_q}{\sqrt{n}}$$ where s_q is the sample standard deviation of the variable q: $$q_i = E_i - \frac{\sum_{i=1}^{n} E_i}{\sum_{i=1}^{n} BV_i} \times BV_i.$$ Precision is exclusively calculated with data pertaining to the non-exhaustive strata.	Sampling precision: $$SE \quad = N \times z \times \frac{s_{qw}}{\sqrt{n}}$$ where $$s_{qw}^2 = \sum_{h=1}^{H} \frac{N_h}{N} s_{qh}^2$$ is a weighted mean of the sample variances of the variable q_h, with $$q_{ih} = E_{ih} - \frac{\sum_{i=1}^{n_h} E_{ih}}{\sum_{i=1}^{n_h} BV_{ih}} \times BV_{ih}.$$ Precision is exclusively calculated with data pertaining to the non-exhaustive strata.

2.2. Simple random sampling – two periods

NON-STRATIFIED	STRATIFIED
Sample size calculation	

First period $n_{1+2} = \frac{\left(z \times N_{1+2} \times \sigma_{ew1+2}\right)^2}{(TE - AE)^2}$ where $\sigma_{ew1+2}^2 = \frac{N_1}{N_{1+2}}\sigma_{e1}^2 + \frac{N_2}{N_{1+2}}\sigma_{e2}^2$ $N_{1+2} = N_1 + N_2$ $n_t = \frac{N_t}{N_{1+2}} n_{1+2}$ **Second period**	**First period** $n_{1+2} = \frac{\left(z \times N_{1+2} \times \sigma_{ew1+2}\right)^2}{(TE - AE)^2}$ where $\sigma_{ew1+2}^2 = \sum_{i=1}^{H_1} \frac{N_{h1}}{N}\sigma_{h1}^2 + \sum_{i=1}^{H_2} \frac{N_{h2}}{N}\sigma_{h2}^2,$ $N_{1+2} = N_1 + N_2$ $n_{ht} = \frac{N_{ht}}{N_{1+2}} n_{1+2}$ **Second period**

$$n_2 = \frac{\left(z \times N_2 \times \sigma_{e2}\right)^2}{(TE - AE)^2 - z^2 \times \frac{N_1^2}{n_1} \times s_{e1}^2}$$	$$n_2 = \frac{z^2 \times N_2 \times \sum_{h=1}^{H_2}\left(N_{h2}.\sigma_{eh2}^2\right)}{(TE - AE)^2 - z^2 \times \sum_{h=1}^{H_1}\left(\frac{N_{h1}^2}{n_{h1}}.s_{eh1}^2\right)}$$

Notes:

Whenever different approximations for the standard-deviations of each period cannot be obtained/are not applicable, the same value of standard deviation may be applied to all periods. In such a case σ_{ew1+2} is just equal to the single standard-deviation of errors σ_e .

The parameter σ refers to the standard-deviation obtained from auxiliary data (e.g. historical data) and s refers to the standard-deviation obtained from the audited sample. In the formulas, whenever s is not available, it may be substituted by σ.

Formulas under the heading “First period” are used to calculate the sample size after the first sampling period of the accounting year in the case of a standard recalculation of the sample size referred to in Article 5(6), point (a). In the case of the global recalculation of the sample size referred to in Article 5(6), point (b), these formulas are used after the first sampling period and if needed also after the second sampling period in order to adjust to updated sampling parameters.

Formulas under the heading “Second period” are applicable only in the case of a standard recalculation of the sample size referred to in Article 5(6), point (a). They are used to recalculate the sample size of the second period in order to adjust to updated sampling parameters. If the formula results in a negative number, the formula and consequently the standard approach to re-calculation of the sample size cannot be applied based on the established set of the updated parameters.

Extrapolation of errors
In the framework of application of the off-the-shelf methodologies laid down in this Delegated Regulation, a single extrapolation method, ratio estimation, applies for SRS referred to in Article 5(1), point (b) and equal probability selection referred to in Article 6(1), point (b), for the purpose of simplification and legal certainty. This does not limit the application of other extrapolation methods by the audit authorities under Article 79 of

Regulation (EU) 2021/1060.	
Projected/extrapolated error (SRS/equal probability selection): If an exhaustive stratum is used, the projected error in this group is the sum of the errors found in the units belonging to the strata: $$EE_e = \sum_{i=1}^{n_1} E_{1i} + \sum_{i=1}^{n_2} E_{2i}$$ For the non-exhaustive strata, the projected error is: $$EE_s = BV_1 \times \frac{\sum_{i=1}^{n_1} E_{1i}}{\sum_{i=1}^{n_1} BV_{1i}} + BV_2 \times \frac{\sum_{i=1}^{n_2} E_{2i}}{\sum_{i=1}^{n_2} BV_{2i}}$$ The projected error at the level of population is the sum of the two components above.	Projected/extrapolated error (SRS/equal probability selection): If an exhaustive stratum is used, the projected error is the sum of the errors found in the units belonging to the strata: $$EE_e = \sum_{h=1}^{H_1} \sum_{i=1}^{n_{h1}} E_{h1i} + \sum_{h=1}^{H_2} \sum_{i=1}^{n_{h2}} E_{h2i}$$ For the non-exhaustive strata, the projected error is: $$EE_s = \sum_{h=1}^{H_1} BV_{h1} \times \frac{\sum_{i=1}^{n_{h1}} E_i}{\sum_{i=1}^{n_{h1}} BV_i} + \sum_{h=1}^{H_2} BV_{h2} \times \frac{\sum_{i=1}^{n_{h2}} E_i}{\sum_{i=1}^{n_{h2}} BV_i} 1$$ The projected error at the level of population is the sum of the two components above.

Sampling precision: $$SE = z \times \sqrt{\left(N_1^2 \times \frac{s_{q1}^2}{n_1} + N_2^2 \times \frac{s_{q2}^2}{n_2}\right)}$$ $$q_{ti} = E_{ti} - \frac{\sum_{i=1}^{n_t} E_{ti}}{\sum_{i=1}^{n_t} BV_{ti}} \times BV_{ti}$$ Precision is exclusively calculated with data pertaining to the non-exhaustive strata.	Sampling precision: $$SE = z \times \sqrt{\sum_{h=1}^{H_1}\left(\frac{N_{h1}^2}{n_{h1}} . s_{qh1}^2\right) + \sum_{h=1}^{H_2}\left(\frac{N_{h2}^2}{n_{h2}} . s_{qh2}^2\right)}$$ $$q_{iht} = E_{iht} - \frac{\sum_{i=1}^{n_{ht}} E_{ih}}{\sum_{i=1}^{n_{ht}} BV_{ih}} \times BV_{iht}.$$ Precision is exclusively calculated with data pertaining to the non-exhaustive strata.

2.3. Simple random sampling – three periods[2]

NON-STRATIFIED	**STRATIFIED**
Sample size calculation	
First period $$n_{1+2+3} = \frac{\left(z \times N_{1+2+3} \times \sigma_{ew1+2+3}\right)^2}{(TE - AE)^2}$$	**First period** $$n_{1+2+3} = \frac{\left(z \times N_{1+2+3} \times \sigma_{ew1+2+3}\right)^2}{(TE - AE)^2}$$

[2] Simple Random Sampling may be applied with more than three sampling periods by relevant adjustments of the formulas.

where $$\sigma^2_{ew1+2+3} = \frac{N_1}{N_{1+2+3}}\sigma^2_{e1} + \frac{N_2}{N_{1+2+3}}\sigma^2_{e2} + \frac{N_3}{N_{1+2+3}}\sigma^2_{e3}$$ $$N_{1+2+3} = N_1 + N_2 + N_3$$ $$n_t = \frac{N_t}{N_{1+2+3}} n_{1+2+3}$$ **Second period** $$n_{2+3} = \frac{\left(z \times N_{2+3} \times \sigma_{ew2+3}\right)^2}{(TE - AE)^2 - z^2 \times \frac{N_1^2}{n_1} \times s^2_{e1}}$$ where	where $$\sigma^2_{ew1+2+3} = \sum_{i=1}^{H_1} \frac{N_{h1}}{N}\sigma^2_{h1} + \sum_{i=1}^{H_2} \frac{N_{h2}}{N}\sigma^2_{h2} + \sum_{i=1}^{H_3} \frac{N_{h3}}{N}\sigma^2_{h3}$$ $$N_{1+2+3} = N_1 + N_2 + N_3$$ $$n_{ht} = \frac{N_{ht}}{N_{1+2+3}} n_{1+2+3}$$ **Second period** $$n_{2+3} = \frac{z^2 \times N_{2+3} \times \sigma_{ew2+3}}{(TE - AE)^2 - z^2 \times \sum_{h=1}^{H_1}\left(\frac{N_{h1}^2}{n_{h1}} . s^2_{eh1}\right)}$$ $$\sigma^2_{ew2+3} = \sum_{h=1}^{H_2}\left(N_{h2} . \sigma^2_{eh2}\right) + \sum_{h=1}^{H_3}\left(N_{h3} . \sigma^2_{eh3}\right)$$

$$\sigma_{ew2+3}^2 = \frac{N_2}{N_{2+3}}\sigma_{e2}^2 + \frac{N_3}{N_{2+3}}\sigma_{e3}^2$$ $$N_{2+3} = N_2 + N_3$$ $$n_t = \frac{N_t}{N_{2+3}} n_{2+3}$$ **Third period** $$n_3 = \frac{\left(z \times N_3 \times \sigma_{e3}\right)^2}{(TE - AE)^2 - z^2 \times \frac{N_1^2}{n_1} \times s_{e1}^2 - z^2 \times \frac{N_2^2}{n_2} \times s_{e2}^2}$$	**Third period** $$n_3 = \frac{z^2 \times N_3 \times \sigma_{ew3}}{(TE - AE)^2 - z^2 \times \sum_{h=1}^{H_1}\left(\frac{N_{h1}^2}{n_{h1}}.s_{eh1}^2\right) - z^2 \times \sum_{h=1}^{H_2}\left(\frac{N_{h2}^2}{n_{h2}}.s_{eh2}^2\right)}$$ $$\sigma_{ew3} = \sum_{h=1}^{H_3}\left(N_{h3}.\sigma_{eh3}^2\right)$$
Notes: Whenever different approximations for the standard-deviations of each period cannot be obtained/are not applicable, the same value of standard deviation may be applied to all periods. In such a case $\sigma_{ew1+2+3}$ is just equal to the single standard-deviation of errors σ_e . The parameter σ refers to the standard-deviation obtained from auxiliary data (e.g. historical data) and s refers to the standard-deviation obtained	

<table>
<tr><td colspan="2">from the audited sample. In the formulas, whenever s is not available, it may be substituted by σ.

See also notes above for the two-period simple random sampling as regards the use of the standard approach to the recalculation of the sample size and the global approach referred to in Article 5(6).</td></tr>
<tr><td colspan="2">Extrapolation of errors</td></tr>
<tr><td colspan="2">In the framework of application of the off-the-shelf methodologies laid down in this Regulation, a single extrapolation method, ratio estimation, applies for SRS referred to in Article 5(1), point (b), and equal probability selection referred to in Article 6(1), point (b), for the purpose of simplification and legal certainty. This does not limit the application of other extrapolation methods by the audit authorities under Article 79 of Regulation (EU) 2021/1060.</td></tr>
<tr><td>Projected/extrapolated error (SRS/equal probability selection):

For the exhaustive strata, the projected error is the sum of the errors found in the units belonging to the strata:

$$EE_e = \sum_{i=1}^{n_1} E_{1i} + \sum_{i=1}^{n_2} E_{2i} + \sum_{i=1}^{n_3} E_{3i}$$

For the non-exhaustive strata, the projected error is:

$$EE_s = BV_1 \times \frac{\sum_{i=1}^{n_1} E_{1i}}{\sum_{i=1}^{n_1} BV_{1i}} + BV_2 \times \frac{\sum_{i=1}^{n_2} E_{2i}}{\sum_{i=1}^{n_2} BV_{2i}} + BV_3 \times \frac{\sum_{i=1}^{n_3} E_{3i}}{\sum_{i=1}^{n_3} BV_{3i}}$$

The projected error at the level of population is the sum of the two</td>
<td>Projected/extrapolated error (SRS/equal probability selection):

For the exhaustive strata, the projected error is the sum of the errors found in the units belonging to the strata:

$$EE_e = \sum_{h=1}^{H_1} \sum_{i=1}^{n_{h1}} E_{h1i} + \sum_{h=1}^{H_2} \sum_{i=1}^{n_{h2}} E_{h2i} + \sum_{h=1}^{H_2} \sum_{i=1}^{n_{h3}} E_{h3i}$$

For the non-exhaustive strata, the projected error is:

$$EE_s = \sum_{h=1}^{H_1} BV_{h1} \times \frac{\sum_{i=1}^{n_{h1}} E_i}{\sum_{i=1}^{n_{h1}} BV_i} + \sum_{h=1}^{H_2} BV_{h2} \times \frac{\sum_{i=1}^{n_{h2}} E_i}{\sum_{i=1}^{n_{h2}} BV_i} + \sum_{h=1}^{H_3} N_{h3} \times \frac{\sum_{i=1}^{n_{h3}} E_i}{n_{h3}}$$

The projected error at the level of population is the sum of the two</td></tr>
</table>

components above.	components above.
Sampling precision: $$SE = z \times \sqrt{\left(N_1^2 \times \frac{s_{q1}^2}{n_1} + N_2^2 \times \frac{s_{q2}^2}{n_2} + N_3^2 \times \frac{s_{q3}^2}{n_3}\right)}$$ $$q_{ti} = E_{ti} - \frac{\sum_{i=1}^{n_t} E_{ti}}{\sum_{i=1}^{n_t} BV_{ti}} \times BV_{ti}$$ Precision is exclusively calculated with data pertaining to the non-exhaustive strata.	Sampling precision: $$SE = z \times \sqrt{\sum_{h=1}^{H_1}\left(\frac{N_{h1}^2}{n_{h1}}.s_{qh1}^2\right) + \sum_{h=1}^{H_2}\left(\frac{N_{h2}^2}{n_{h2}}.s_{qh2}^2\right) + \sum_{h=1}^{H_3}\left(\frac{N_{h3}^2}{n_{h3}}.s_{qh3}^2\right)}$$ $$q_{iht} = E_{iht} - \frac{\sum_{i=1}^{n_{ht}} E_{ih}}{\sum_{i=1}^{n_{ht}} BV_{ih}} \times BV_{iht}.$$ Precision is exclusively calculated with data pertaining to the non-exhaustive strata.

ANNEX III
ADJUSTEMENS RELATED TO SINGLE AUDIT ARRANGEMENTS

The following Tables 1 and 2 include information on the approaches to sample selection, extrapolation of errors and calculation of precision under the principles of single audit arrangements, in particular where the operations cannot be audited in accordance with Article 80(3) of Regulation (EU) 2021/1060. In non-statistical sampling methods, the approach set out in those tables may be used to determine the extrapolation of errors using PPS and equal probability selection.

Such approaches apply also to exceptional cases where supporting documentation of the sampled operations is not available.

Table 1: MUS standard approach/PPS selection

Sampling design	**MUS standard/PPS:** **Exclusion of sampling units**	**MUS standard/PPS:** **Replacement of sampling units**
Population used for sample selection	Reduced (adjusted) population (i.e. population excluding operations/other sampling units affected by Article 80 of Regulation (EU) 2021/1060)	Original population[3]
Parameters used for sample size calculation	Correspond to the original population	
Recommended approach to projection/ extrapolation of errors and precision calculation	Projection of error and precision calculation is carried out in the first stage for the reduced population. In the next stage it is adjusted to reflect the original population. Such adjustment may be performed by multiplying the projected error and precision by the ratio between expenditure $BV_{(h)\ original}$ of the original population and the expenditure $BV_{(h)\ reduced}$ of the reduced	Projection of error and precision calculation is carried out for the original population. The units of high-value stratum (or units of any other exhaustive stratum), which are excluded from the audit procedures due to provisions of Article 80 of Regulation (EU) 2021/1060 should be replaced by the sampling units of the low-value stratum. In such a case there

[3] In case the selected sample includes any sampling units that need to be replaced, the replacement units are selected from the population excluding the sampling units of the original sample.

	population. In the case of units of high-value stratum affected by Article 80 of Regulation (EU) 2021/1060 (or any other exhaustive stratum), there could be a need to calculate the error for the high-value stratum and to project this error to the units which were not audited in this stratum using the formula $EE_e = EE_{e\ reduced} \times \frac{BV_{e\ original}}{BV_{e\ reduced}}$ (where $EE_{e\ reduced}$ represents the amount of error in the sampling units of the high-value stratum audited, $BV_{e\ original}$ refers to book value of the original high-value stratum and $BV_{e\ reduced}$ refers to the book value of units in the high-value stratum which were subject to audit.)	could be a need to calculate the error for the high-value stratum and to project this error to the units which were not audited in this stratum using the formula $EE_e = EE_{e\ reduced} \times \frac{BV_{e\ original}}{BV_{e\ reduced}}$ (where $EE_{e\ reduced}$ represents the amount of error in the sampling units of the high-value stratum audited, $BV_{e\ original}$ refers to book value of the original high-value stratum and $BV_{e\ reduced}$ refers to the book value of units in the high-value stratum which were subject to audit).

Table 2: Simple Random Sampling/equal probability selection (ratio estimation)

Sampling design	**Simple Random Sampling/equal probability selection:** **Exclusion of sampling units**	**Simple Random Sampling/equal probability selection:** **Replacement of sampling units**
Population used for sample selection	Reduced (adjusted) population (i.e. population excluding operations/other sampling units affected by Article 80 of Regulation (EU) 2021/1060)	Original population[4]
Parameters used for sample size calculation	Correspond to the original population	
Recommended approach to	Projection of error and precision calculation is carried out for the	Projection of error is carried out for the original

[4] In case the selected sample includes any sampling units that need to be replaced, the replacement units are selected from the population excluding the sampling units of the original sample.

Sampling design	**Simple Random Sampling/equal probability selection:** **Exclusion of sampling units**	**Simple Random Sampling/equal probability selection:** **Replacement of sampling units**
projection/ extrapolation of errors and precision calculation	reduced population. In the next stage it is adjusted to reflect the original population based on the following approaches: The adjustment may be performed by multiplying the projected error and precision by the ratio between expenditure $BV_{(h)\ original}$ of the original population and the expenditure $BV_{(h)\ reduced}$ of the reduced population. Projection of error may also be performed directly for the original population. Precision should not be calculated directly for the original population. The precision calculated for reduced population should be adjusted for the original population by multiplying the precision of the reduced population by the ratio $\frac{BV_{(h)\ original\ population}}{BV_{(h)\ reduced\ population}}$. In the case of units of high-value stratum (or any other exhaustive stratum) subject to Article 80 of Regulation (EU) 2021/1060, there could be a need to calculate an error for the high-value stratum and to project this error to the units which were not audited in this stratum. It would be performed using the formula $EE_e = EE_{e\ reduced} \times \frac{BV_{e\ original}}{BV_{e\ reduced}}$, where	population. Precision has to be calculated for the reduced population (population from which all sampling units subject to Article 80 of Regulation (EU) 2021/1060 were deducted). Subsequently, it should be in the next stage adjusted to reflect the original population. It may be performed by multiplying the precision of the reduced population by the ratio between expenditure $BV_{(h)\ original}$ of the original population and the expenditure $BV_{(h)\ reduced}$ of the reduced population. It should be also noted that even if the audit authority did not select any sampling units affected by Article 80 of Regulation (EU) 2021/1060 in its sample, the precision will also have to be calculated to the reduced population and subsequently adjusted using the above mentioned formula. In the case of units of high-value stratum (or any other exhaustive stratum) subject to Article 80 of Regulation (EU) 2021/1060, there could be a need to calculate an error for the high-value stratum and to project this error to the units which were

Sampling design	**Simple Random Sampling/equal probability selection:** **Exclusion of sampling units**	**Simple Random Sampling/equal probability selection:** **Replacement of sampling units**
	$EE_{e\ reduced}$ represents the amount of error in the sampling units of the high-value stratum audited, $BV_{e\ original}$ refers to book value of the original high-value stratum and $BV_{e\ reduced}$ refers to the book value of units in the high-value stratum which were subject to audit.	not audited in this stratum. It would be performed using the formula $EE_e = EE_{e\ reduced} \times \frac{BV_{e\ original}}{BV_{e\ reduced}}$, where $EE_{e\ reduced}$ represents the amount of error in the sampling units of the high-value stratum audited, $BV_{e\ original}$ refers to book value of the original high-value stratum and $BV_{e\ reduced}$ refers to the book value of units in the high-value stratum which were subject to audit.