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EBA Report on IRB modelling practices

Impact assessment for the GLs on PD, LGD and the treatment of defaulted exposures based on the IRB survey results

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Abbreviations

A-IRB	Advanced internal ratings-based approach
BCBS	Basel Committee on Banking Supervision
CCF	credit conversion factor
CEBS	Committee of European Banking Supervisors
CET1	Common Equity Tier 1
COREP	Common Reporting standards (Commission Implementing Regulation (EU) No 680/2014 of 16 April 2014 laying down implementing technical standards with regard to supervisory reporting of institutions according to Regulation (EU) No 575/2013 of the European Parliament and of the Council (Text with EEA relevance)
CP	consultation paper
CRR	Capital Requirements Regulation
DR	default rate
EAD	exposure at default
EL_{BE}	expected loss best estimate
F-IRB	Foundation internal ratings-based approach
GLs	Guidelines
IRB	internal ratings-based approach
LGD	loss given default
MoC	Margin of conservatism
PD	probability of default
RDS	reference dataset

RTS	regulatory technical standards
RWA	risk-weighted asset(s)
SA	standardised approach
SCRA	specific credit risk adjustment(s)
SME	small and medium-sized enterprises

Executive summary

This report provides an overview of the modelling techniques used in the estimation of risk parameters for both non-defaulted and defaulted exposures, i.e. PD, LGD non-defaulted, LGD in-default and EL_{BE}, and provides an impact assessment for the GLs on PD, LGD and the treatment of defaulted exposures. The information on these modelling practices is based on the responses that the EBA received on its survey on internal models (the IRB survey), which was conducted in the context of the GLs on PD, LGD and defaulted assets. The responses reflect the modelling practices at the time of completion of the survey, i.e. January 2017, and only the information on approved models is included in this report.

In total, 102 institutions from 22 Member States participated in the IRB survey. The 102 institutions considered in the sample for the quantitative analysis account for 64% of EU institutions' total credit risk-weighted exposures. Those 102 institutions completed the survey for a total of 252 PD models, and 95 of these institutions completed the survey for a total of 202 LGD models. The median bank completed the survey for 3 PD and 2 LGD models. In relation to the total number of PD and LGD models that institutions currently use, coverage of the PD and LGD models in the IRB survey is 17% and 20% for the PD and LGD models respectively.

In line with the scope of the GLs, which apply to both high-default and low-default portfolios, the survey (and this report) covers both portfolio types. More specifically, the models in the survey cover all exposure classes, although some are better represented than others. The COREP exposure class 'retail — secured by immovable property non-SME)' is the best represented: around 50% of PD and LGD models apply to this COREP exposure class. In contrast, the share of the low-default exposure classes is much lower: central governments and central banks (7% of PD and 4% of LGD models), institutions (11% of PD and 8% of LGD models) and specialised lending (3% of PD and LGD models).

Because the number of institutions and the number of models in the sample is not evenly distributed across countries (in some countries the number of institutions participating in the survey is much higher than in others), the results of this survey are summarised as the share of PD or LGD models applying a specific practice, as well as the share of exposures covered under these PD or LGD models. This presentation should also ensure that the exposure amounts covered by these models (the sizes of the models) are reflected in the results.

It should be emphasised that the results of this survey are dependent on the quality of the submitted responses, and are therefore subject to data quality issues, which are unavoidable in any survey context. In particular, it can be seen from the comments of some respondents that some questions have not been understood as intended. This caveat should be kept in mind when drawing conclusions on the results and/or extrapolating from them.

Furthermore, it should be acknowledged that the survey did not cover, and this report does not provide, a quantification of the potential impact of the GLs on capital requirements. Whereas such an exercise (i.e. a quantitative impact study) has been considered, it would have required substantially more resources from institutions to completely re-estimate (some of the) current models to determine the capital effect of implementing them. In addition to this resource requirement, the study's results would have been subjective given the absence of supervisory guidance. Therefore, the IRB survey (i.e. a qualitative assessment of current modelling practices) has been chosen as a compromise solution that minimises the burden for institutions while obtaining the best possible qualitative picture of surveyed institutions' current practices. As a result of this choice, this IRB survey provides an assessment of the number of model changes necessary to comply with the GLs, and does not quantify the impact on capital requirements. The quantitative capital impact of implementing the GLs will depend on the extent to which they require institutions to re-estimate existing models in practice and the effect of those re-estimations on individual capital requirements.

That being said, the distribution of current modelling practices for the firms and models surveyed has been duly taken into account in deciding on the policy choices made in these GLs. For most policy choices, the policy chosen in the GLs represents the most common approach observed. On an aggregate basis, we expect the impact of the proposal to be neutral for the models surveyed, as the specification of the GLs takes into account current practices for those models. Furthermore, it would be impossible to predict the impact on capital requirements on the basis of the responses to the IRB survey, because internal models feature many possible modelling choices. As a result, the final impact of these GLs will be known only after a redevelopment and recalibration of the models. This aspect supports the need for monitoring the impact of the implementation of these GLs.

One area where the survey results provided additional evidence to justify the chosen policy is the frequency of calculating the one-year default rate (DR). The CP on the GLs specified that institutions should **calculate one-year DRs at least quarterly**. The other options that were considered are (i) at least a monthly frequency for all retail exposures and at least a quarterly frequency for all other exposures and (ii) at least a quarterly frequency for all retail exposures and at least a semi-annual frequency for all other exposures. The survey responses, however, showed that a frequency of at least quarterly is already applied in 45% of all PD models, whereas this percentage is between 52% and 84% for the COREP retail exposure classes. Based on the fact that a quarterly frequency or higher is already quite common, the final GLs also require that institutions should evaluate the observed one-year DRs at least quarterly. This will entail a change in practice for around 54% of PD models.

Furthermore, the results on the specification of the **historical observation period** for the purpose of PD estimation showed a considerable heterogeneity of approaches, due to the variability of one-year DRs, differences in the availability of DRs from good and bad years, and changes in the economic, legal or business environment within the historical observation period. Although a precise quantification of these differences is difficult in this area, the responses to the survey confirmed the feedback to the CP with respect to the difficulty of assessing a historical observation period in which bad years are over-represented.

Therefore, the GLs clarify that the long-run average DR should be calculated as the average of observed one-year DRs if the historical observation period is representative of the likely range of variability of one-year DRs. Whenever insufficient bad years are included in the historical observation period, this average of observed one-year DRs should be adjusted upwards, whereas it may be adjusted downward, under strict conditions, where bad years are over-represented in the historical observation period. To limit possible variability stemming from the application of this concept a benchmark is proposed, namely the maximum of the average of one-year DRs over the most recent five years and the average of one-year DRs over the whole available observation period. Institutions may still estimate long-run average DRs below this benchmark, but this should be duly justified and trigger an additional margin of conservatism.

For PD estimation, the survey also provided supporting evidence that contributed to the chapter on **calibration**. The survey contained a list of possible calibration methods, and respondents were asked to indicate which method they use. These responses and the comments showed that additional clarity on the various calibration methods is necessary, and this guidance has therefore been included in the final GLs, in the form of a list of the calibration types that are allowed under the CRR. In addition, a definition of the term 'calibration' is included to (i) clarify the distinction from model development (calibration is the process that leads to appropriate risk quantification) and (ii) highlight that calibration ensures that, for a calibration segment, PD estimates in a calibration sample correspond to the long-run average DR at the level relevant for the applied calibration method. Regardless of the chosen level of calibration, the objective is to obtain PDs at grade level that are representative of the long-run average DR. Furthermore, these responses made it possible to identify whether institutions apply a portfolio calibration or a calibration at grade or pool level. Given the consequences such a decision may have for the cyclicality of capital requirements, the GLs specify that institutions should provide additional calibration tests at the level of the relevant calibration segment if calibration is performed at grade or pool level, or perform additional calibration tests at the level of the grade or pool if calibration is performed at portfolio level. To take account of these different practices with respect to the level of calibration and to enhance understanding of its consequences, these GLs require institutions to assess the potential effect of the chosen calibration method on the behaviour of PD estimates over time.

For LGD estimation, one of the areas where the survey provided useful guidance is the **treatment of economic loss for a cured case**. The responses showed that the most common approach is to assume that the economic loss for a cured case is zero, which, however, is not prudent. Furthermore, the results showed that the approach proposed in the CP on the GLs (to apply the same methodology as for other defaulted exposures without discounting additional recovery cash flows) is applied in only around 4% of the LGD models, whereas the approach where such additional recovery cash flows are discounted is applied in around 32% of LGD models. Based on a review of the pros and cons of both approaches, i.e. discounting or not discounting the artificial cash flows (i.e. the amount that was still outstanding at the moment of return to non-defaulted status (principal, interest and/or fees)), it was decided to favour the discounting of these artificial cash flows, hence to change the approach proposed in the CP.

For the treatment of **unpaid late fees and capitalised interest**, the survey revealed significant variation in practices: in most models (52% for unpaid late fees and 44% for capitalised interest), these are included in the economic loss only (numerator of the realised LGD), whereas they are not included in 20% and 26% respectively, are added to both the nominator and denominator in 8% and 10% of models, and are added to the denominator only in 5% and 8% of models respectively. Whereas the approach proposed in the CP on the GLs was the most commonly applied based on the survey results, this approach was also criticised by industry respondents to the CP, among others, because this approach would be overly conservative, and does not take into account the fact that interest and fees are not related to real cash flow from banks and are hence different from costs in that sense. After a review of alternative policy options and their pros and cons, an approach was chosen that is operationally the easiest to implement: unpaid late fees and capitalised interest after default should not increase the economic loss or amount outstanding at the moment of default, i.e. only fees and interest before default should be included. This approach does not require data on values of fees and interest capitalised after default.

Regarding the inclusion of **additional drawings** in the realised LGD, the survey demonstrated that the approach proposed in the CP was also the most commonly applied, and was retained in the final GLs. In particular, the GLs specify that the treatment of additional drawings in the realised LGD should be consistent with that treatment in the CCF estimation. Therefore, the GLs specify that additional drawings should be included in the denominator of the realised LGD whenever they are included in the CCF, and should not be included in the denominator whenever there are not included in the CCF. The responses to the survey allowed the EBA to differentiate the treatment of the additional drawings in the realised LGD, depending on their treatment in the CCF, and the results confirmed that the above policy choice was also the approach that is currently most commonly applied. Nevertheless, this policy choice will require 36% of LGD models to be changed to comply with the GLs.

The **discounting rate** in LGD estimation has been identified as one of the major drivers of undue risk weighted assets (RWA) variability across institutions. The survey shows that at the time it was carried out (January 2017) an average discounting rate of 6% was used across LGD models, but it confirms that practices are highly heterogeneous. In addition, the economic arguments that indicate which approach is most correct from a theoretical perspective have also been taken into account. Three main options have been considered: (i) the Euribor or a comparable interbank rate plus add-on; (ii) funding cost plus add-on; and (iii) the original effective interest rate. The results of the survey suggest that a risk-free rate plus add-on is applied most often, i.e. in 30% of models and 37% of exposures covered, whereas the funding rate (with or without add-on) and the effective interest rate (original or current) are used only in 19% and 22% of models respectively. Based on these results as well as the pros and cons of these options, the GLs specify that the discounting rate should be composed of a primary interbank offered rate plus a fixed add-on. The level of the add-on has been fixed at 5% as proposed in the CP. Given the current average level of the discounting rate identified for the models surveyed (6%) and the current low interest rate environment, we expect that this approach would, across institutions, not cause major cliff effects in LGD calculations.

Another area where the IRB survey provided relevant evidence for the finalisation of the GLs is the treatment of **incomplete recovery processes** in LGD estimation. On this aspect, the CRR specifies that all defaults within the data sources should be included in the LGD estimates, which could be interpreted as referring to (i) including the information on all closed defaults; (ii) including the information on all defaults, as well as those for which the recovery process is still open; or (iii) including the information on closed defaults and an estimate of costs and recoveries on exposures with incomplete recovery processes. The IRB survey responses made clear that the third approach (which was also proposed in the CP) is the most common approach; it is used in 39% of LGD models and 44% of exposures covered by these models. While other arguments have also been taken into account in this policy decision, the prevalence of this approach has contributed to this decision. Although the chosen option represents the most common approach, this policy will require a model change in 49% of LGD models and 40% of exposures covered.

For the estimation of LGD in-default and EL_{BE}, the GLs clarify that all provisions applicable to LGD (non-defaulted) also apply to LGD in-default and EL_{BE}, unless otherwise specified. This approach was chosen to minimise cliff effects as much as possible. Consequently, the policies described above are also relevant for these estimates, although the shares of LGD in-default and EL_{BE} models in the IRB survey vary between questions. Two areas where the IRB survey provided relevant input to the finalisation of the GLs for LGD in-default and EL_{BE} are the estimation approaches permitted and the approach to setting reference dates to be used for grouping defaulted exposures in accordance with the recovery patterns observed.

For LGD in-default estimation, the GLs specify that, for the purpose of incorporating the **information on time in-default and recoveries realised so far**, institutions may include this either directly as a risk driver or indirectly, by setting the reference dates for estimation. From the survey it is evident that 45% of LGD in-default models are similar to the LGD model for non-defaulted exposures, and that only 11% of such models for LGD non-defaulted exposures are enriched with additional risk drivers. In 25% of models, LGD in-default is estimated as EL_{BE} plus add-on. For the latter, it is hard to say whether or not these models will need to be changed to comply with the GLs, since this depends on whether or not the add-on reflects the additional unexpected loss during the recovery period.

For EL_{BE} estimation, it is currently common (26% of models) to use **accounting provisions** as EL_{BE} estimates. Since the GLs specify that institutions should estimate EL_{BE} based on an LGD model as for non-defaulted exposures calibrated to current economic conditions and taking into account all relevant post-default information, it will no longer be permitted to assess EL_{BE} on the basis of accounting provisions, unless these stem from a model that complies with the specified conditions. Although it is not possible to assess accurately for all survey responses whether or not a model change will be necessary, it is expected that around 63% of EL_{BE} models will need to be changed to comply with this policy choice.

Finally, the requirement to set **discrete reference dates** at which the realised LGDs should be computed should ensure that parameters for defaulted exposures are appropriate for their current status. To ensure the adequacy of the estimates, institutions should set the reference dates according to the recovery pattern observed on a specific type of exposures, where such reference dates may either be event based, e.g. linked with the realisation of collateral, or reflect certain time periods during which exposures have been in-default. Given that this approach is currently applied in only around 20% of LGD in-default and EL_{BE} models, it is expected that a significant share of these models will need to be changed to reflect this policy.

1. Background and rationale

1. This report provides an overview of the findings and the responses that the EBA received on its survey on internal models (the IRB survey), which was conducted in the context of the GLs on PD, LGD and defaulted assets[1], and presents an impact assessment for the major policy choices made in these GLs. These GLs are published on the EBA's own initiative to reduce unjustified variability in RWA and as part of the broader review of the IRB approach that is carried out by the EBA. This plan is outlined in the Report on the regulatory review of the IRB approach published in February 2016[2].

2. Since these GLs are focused on the definitions and modelling techniques used in the estimation of risk parameters for both non-defaulted and defaulted exposures, the IRB survey and this report covers the modelling practices of institutions applying the IRB approach. Related to these GLs is the EBA's work for the draft regulatory technical standards (RTS) on the specification of the nature, severity and duration of an economic downturn in accordance with Articles 181(3)(a) and 182(4)(a) of Regulation (EU) No 575/2013 (the CRR). Selected aspects of the survey and of this report cover the modelling practices that relate to the specification of an economic downturn.

3. This report shows that these GLs and these RTS will have a significant impact on modelling practices in some institutions. This report seeks to outline the current IRB modelling practices based on the IRB survey, to help inform policymaking in the GLs and the RTS. It should be mentioned, however, that the industry feedback that respondents provided to the CP on the GLs was another source of information that has been used to revise the GLs. As a result, both the evidence on current practices provided by this survey and the industry feedback and the rationale for the various policy alternatives have driven the final policy decisions in the GLs.

4. In this context, this report includes a cost-benefit analysis for the key policy decisions, where it is explained which options have been considered, and which pros and cons have been taken into account in steering the final policy direction.

5. Overall, the results confirm a very diverse set of modelling practices, which justifies the harmonisation that the GLs on PD, LGD and defaulted assets will bring, in order to reduce the undue variability in RWA.

6. It should be emphasised that the results of this survey are dependent on the quality of the submitted responses, and are therefore subject to data quality issues, which are unavoidable in any survey context. In addition, it can be seen from the comments of some respondents

[1] https://www.eba.europa.eu/regulation-and-policy/model-validation/guidelines-on-pd-lgd-estimation-and-treatment-of-defaulted-assets

[2] https://www.eba.europa.eu/-/eba-sets-out-roadmap-for-the-implementation-of-the-regulatory-review-of-internal-models

that some questions have not been understood as intended. This caveat should be kept in mind when drawing conclusions on the results and/or extrapolating from them.

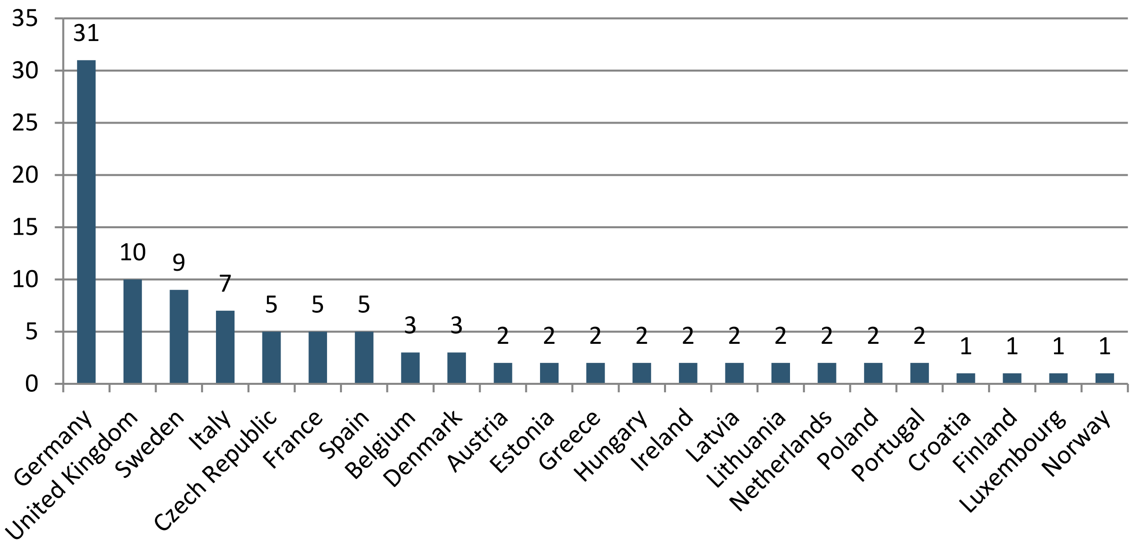
7. Finally, it should be acknowledged that the survey did not cover, and this report does not provide, a quantification of the potential impact of the GLs on capital requirements. Whereas such an exercise (i.e. a quantitative impact study) has been considered, it would have required substantially more resources from institutions to completely re-estimate (some of the) current models to determine the capital effect of implementing them. In addition to this resource requirement, the study's results would have been subjective given the absence of supervisory guidance. Therefore, the IRB survey (i.e. a qualitative assessment of current modelling practices) has been chosen as a compromise solution that minimises the burden for institutions while obtaining the best possible qualitative picture of surveyed institutions' current practices. As a result of this choice, this IRB survey provides an assessment of the number of model changes necessary to comply with the GLs, and does not quantify the impact on capital requirements. The quantitative capital impact of implementing the GLs will depend on the extent to which they require institutions to re-estimate existing models in practice and the effect of those re-estimations on individual capital requirements.

2. Introduction

2.1 Sample of institutions and models

8. In total, 102 institutions from 22 Member States[3] submitted responses to the IRB survey; see Figure 1 for an overview of banks participating by country. The responses reflect the modelling practices at the time of completion of the survey, i.e. January 2017[4], and only the information on approved models is included.

Figure 1: Number of banks participating in the IRB survey, by country



9. Those 102 institutions completed the survey for a total of 252 PD models, and 95 of these institutions completed the survey for a total of 202 LGD models, as shown in Table 1. The median bank completed the survey for 3 PD and 2 LGD models. In Figure 2 and Figure 3, the total number of PD and LGD models from institutions across countries is reported.

Table 1: Number of PD and LGD models for which survey was completed

	N	mean	min	max	p50	sum
PD	102	2.47	1	7	3	252
LGD	95	2.13	1	5	2	202

10. Taking into account the exposure values covered by these PD and LGD models, the share of institutions from each country in the total sample looks quite different. Figure 2 shows, for instance, that the share of PD models from German banks is 29%, whereas it is only 16% if the exposure values covered by these PD models are taken into account. For France and the

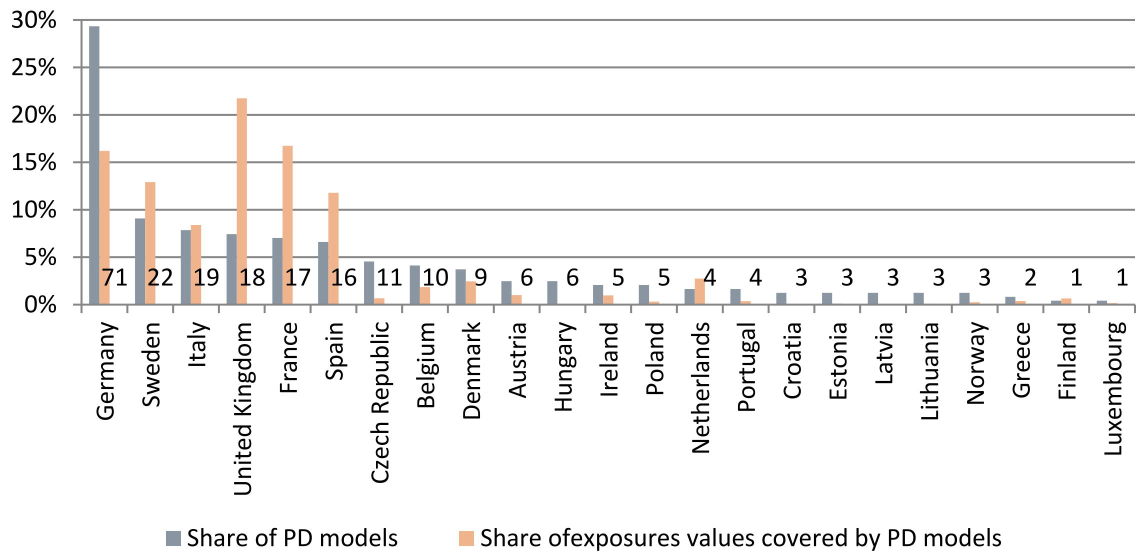
[3] Institutions from 22 EU Member States plus one institution from Norway constitute the sample.

[4] The deadline for submitting responses was 31 January 2017.

United Kingdom (UK), the opposite pattern can be observed: whereas the share of PD models from banks under French jurisdiction amounts to 7% (7% for the UK), these models account for 17% (22% for the UK) of the exposure values covered. Figure 3, on the other hand, shows the shares of LGD models by country (equally weighted and exposure weighted). The share of PD models from UK institutions is the highest in the sample (22%), followed by France (17%), Germany (16%), Sweden (13%), Spain (12%) and Italy (8%).

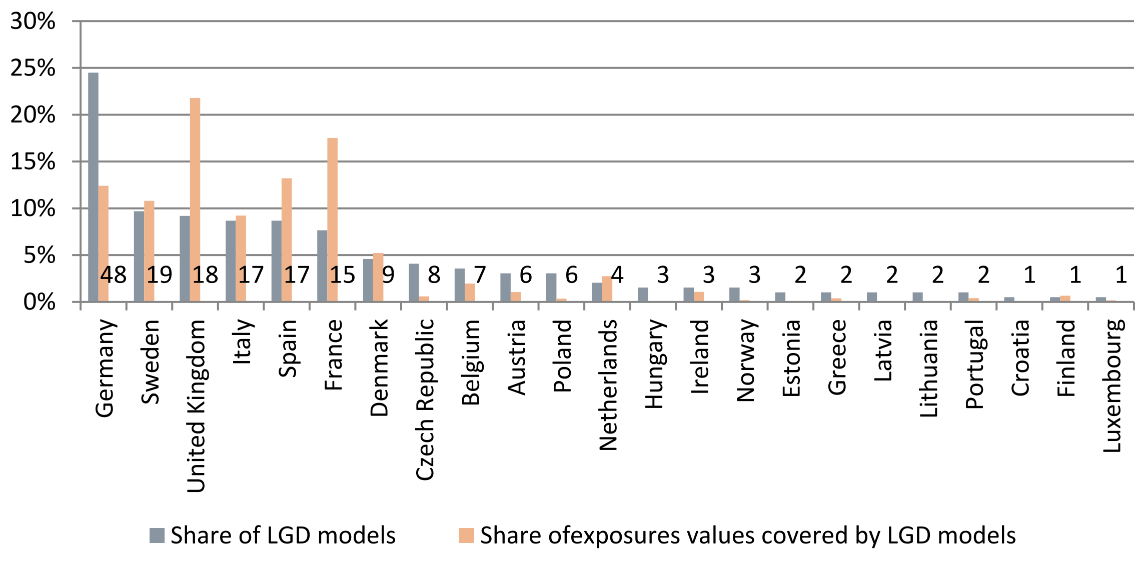
11. Similarly, the share of LGD models from UK institutions is the highest in the sample (22%), followed by France (18%), Spain (13%), Germany (12%), Sweden (11%) and Italy (9%).

Figure 2: Share of PD models in the IRB survey sample, by country of origin



Note: the numbers within the figure refer to the number of PD models for all institutions within each country.

Figure 3: Share of LGD models in the IRB survey sample, by country of origin



Note: the numbers within the figure refer to the number of LGD models for all institutions within each country.

12. Table 2 provides an overview on the coverage of models across COREP exposure classes. Throughout the report, whenever the row or column header mentions '%', this refers to share of PD or LGD models, whereas '% EAD' refers to the share of exposures covered by these PD or LGD models.

13. For the PD models, around 48% of models apply to the COREP exposure class 'retail — secured by immovable property non-SME)'. Around 28% of PD models apply to 'corporate – SME' and 'retail – other non-SME'[5]. For the LGD models, a distinction is made in the LGD model between LGD non-defaulted, LGD in-default and EL_{BE}. The exposure class 'retail secured by immovable property — non-SME' is also well represented; more than 50% of LGD models apply to this type of exposures. Table 2 shows not only the share of the models across COREP exposure classes, but also the share of the exposure values covered by these models (column with heading '% (EAD)'). Based on the exposure values, the share of the 'retail exposures secured by immovable property — non-SME' is even higher than that based on the count of the models. Overall, there appears to be a fair representation of the models used across exposure classes.

Table 2: Distribution of models across COREP exposure classes

	PD			LGD non-defaulted			LGD in-default			EL_{BE}		
	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD
Central governments and central banks	17	7	8	8	4	6	6	3	7	5	3	7
Institutions	27	11	14	16	8	9	12	7	11	11	7	10
Corporate — SME	70	28	23	54	27	25	49	28	30	44	28	28
Corporate — specialised lending	8	3	8	7	3	5	8	5	10	7	4	8
Corporate — other	82	33	31	59	29	31	52	29	34	47	30	31
Retail — secured by immovable property SME	40	16	14	50	25	24	47	27	26	40	26	24
Retail — secured by immovable property non-SME	120	48	59	109	54	63	99	56	63	84	54	66
Retail — qualifying revolving	27	11	9	30	15	14	23	13	13	22	14	15
Retail —other SME	41	16	15	49	24	20	40	23	19	36	23	20
Retail — other non-SME	71	28	21	69	34	21	60	34	22	54	35	20
Total	251			201			177			156		

14. The number of PD models in Table 2 (251) is lower than the total number mentioned in Table 1 (252) because the information in Table 2 contains only those PD models for which the institution selected at least one of all COREP exposure classes. The same holds for the LGD models (201 instead of 202). Similarly, the number of LGD in-default and EL_{BE} models (177 and

[5] Note that the percentages do not add up to one since this question was a 'tick box' question, where respondents could select multiple COREP exposure classes that are covered by their model.

156) is lower than the number of LGD non-defaulted models, because several institutions only completed the information on the LGD non-defaulted model.

2.2 PD and LGD estimates

15. For each PD model, the institutions have been asked to specify both the observed average DR during the historical observation period and the final PD estimate corresponding to the PD model at the chosen reporting date[6]. These are visualised across COREP exposure classes in Table 3[7]. Institutions were asked to specify these values as the obligor-weighted average[8] across the PD model. The observed DRs and PD estimates shown in Table 3 are the equally weighted average of those values across all PD models applicable to a certain COREP exposure class. There is a wide variation in observed average DRs and PD estimates across exposure classes and across institutions. This would not indicate any divergence in practices per se, however, as these differences may stem from differences in the risk characteristics of the underlying portfolios.

Table 3: Minimum, median and maximum of the observed average DR and final PD estimate (%) across COREP exposure classes

	Observed average DR						Final PD estimate					
	N	**%**	**% EAD**	**min**	**max**	**p50**	**N**	**%**	**% EAD**	**min**	**max**	**p50**
Total	206	2.20	1.42	0.02	30.31	1.53	215	2.52	1.60	0.01	27.24	1.67
Central governments and central banks	9	2.47	1.74	0.02	13.78	1.45	12	1.97	1.11	0.10	13.78	0.16
Institutions	15	1.15	1.13	0.06	3.23	0.88	19	1.17	1.40	0.11	2.82	1.08
Corporate — SME	54	2.58	2.01	0.45	6.79	2.41	55	2.77	2.11	0.38	15.60	2.42
Corporate — specialised lending	6	2.05	1.24	0.59	3.16	2.30	6	2.24	1.82	1.44	2.75	2.29
Corporate — other	63	2.20	1.53	0.06	6.79	1.97	65	2.74	1.99	0.10	15.60	2.37
Retail — secured by immovable property SME	33	2.58	2.19	0.06	6.79	2.10	33	3.04	2.18	0.09	25.99	2.22
Retail — secured by immovable property	103	2.12	1.35	0.06	30.31	1.15	105	2.10	1.40	0.01	27.24	1.30

[6] The reporting dates correspond to 30 June 2016 (as requested in the survey) for around 88% of PD and LGD models. For a few models, the respondents chose to report this information for 31 December 2015 or 30 September 2016 (around 5-8% of PD and LGD models), 31 December 2016 or 31 January 2017 (around 1% of PD models).

[7] Note that zero values have been excluded in this figure.

[8] In particular, institutions were asked to specify the observed average DR and PD, weighted by obligor, obligor by product type, facility or single exposure, depending on what kind of records the institution includes in its one-year DR.

	Observed average DR						Final PD estimate					
non-SME												
Retail — qualifying revolving	22	3.52	1.36	0.32	30.31	1.98	22	3.52	1.57	0.37	27.24	2.56
Retail — other SME	31	2.77	2.31	0.32	6.79	2.26	31	3.38	2.43	0.24	25.99	2.53
Retail — other non-SME	64	2.57	1.41	0.29	30.31	1.38	64	2.97	1.61	0.01	27.24	1.55

16. Table 4 focuses on the absolute and relative difference between the observed DR and the final PD estimate. Although on average the absolute difference between the observed average DR and the final PD estimate is less than one percentage point, a wide variation is observed across the PD models. Among those models where the final PD estimate is higher than the observed DR, a difference as high as 19.69 percentage points is observed in the sample. In addition, cases where the final PD is higher than the observed average DR (140) occur more often than cases where the final PD is lower than the observed average DR (60) in this sample of PD models.

Table 4: Magnitude of the absolute (in percentage points) and relative (%) differences between the observed average DR and the final PD estimate

		N	Equally weighted average	Exposure weighted average	min	p10	p50	p90	max
PD > DR	**Absolute**	140	0.98	0.40	0.01	0.05	0.31	1.61	19.69
	Relative	135	78.79	84.05	0.25	4.76	29.81	218.90	1 211.69
PD < DR	**Absolute**	60	0.88	0.40	0.01	0.06	0.34	2.12	9.20
	Relative	60	25.89	21.63	0.63	2.27	20.37	55.71	98.25

17. In Table 5, a summary of the average realised LGD, LGD non-defaulted, LGD in-default and EL_{BE} is presented across COREP exposure classes. It should be noted that the highest average LGD and EL_{BE} values are for the exposure class 'retail — qualifying revolving'. The lowest average realised LGD and LGD non-defaulted is observed in the exposure class 'retail — secured by immovable property non-SME' (values of 22% and 25% respectively). As expected, the average LGD values are higher for LGD in-default than for the LGD non-defaulted, although the difference is small for central governments and central banks.

Table 5: Average realised LGD, LGD non-defaulted, LGD in-default and EL_{BE} across COREP exposure classes (%)

	Average realised LGD			LGD non-defaulted			LGD in-default			EL_{BE}		
	N	**%**	**% EAD**	**N**	**%**	**% EAD**	**N**	**%**	**% EAD**	**N**	**%**	**% EAD**
Total	177	29	26	194	33	27	151	42	35	115	43	36
Central	6	32	38	7	37	41	5	37	39	2	42	42

	Average realised LGD			LGD non-defaulted			LGD in-default			EL_{BE}		
governments and central banks												
Institutions	13	28	29	16	31	33	10	47	48	7	43	54
Corporate — SME	53	33	31	53	36	34	42	50	50	32	46	49
Corporate — specialised lending	7	27	23	7	37	31	2	56	62	2	58	63
Corporate — other	54	32	36	57	35	37	44	47	49	35	45	49
Retail — secured by immovable property SME	45	30	28	47	32	31	37	44	41	31	46	46
Retail — secured by immovable property non-SME	94	22	19	105	25	21	85	34	27	64	35	29
Retail — qualifying revolving	28	44	36	29	48	41	21	60	54	18	65	58
Retail — other SME	46	34	30	47	39	34	35	54	52	29	59	56
Retail — other non-SME	67	38	31	68	43	36	54	55	50	41	59	51

Note: the number of observations refers to the number of models for which the parameter estimate was provided. The number of models for which the exposure-weighted average parameter estimate is calculated is not reported and is slightly lower, since the exposure value was not provided for all models.

2.3 Coverage of IRB survey

18. Institutions were asked to indicate how many PD and LGD models they have within their institution. With a total of 1 493 PD and 1 000 LGD models, the coverage of PD and LGD models in the IRB survey is 17% and 20% respectively (see Table 6). This should be taken into account when generalising the conclusions obtained from this survey.

Table 6: Total number of PD and LGD models

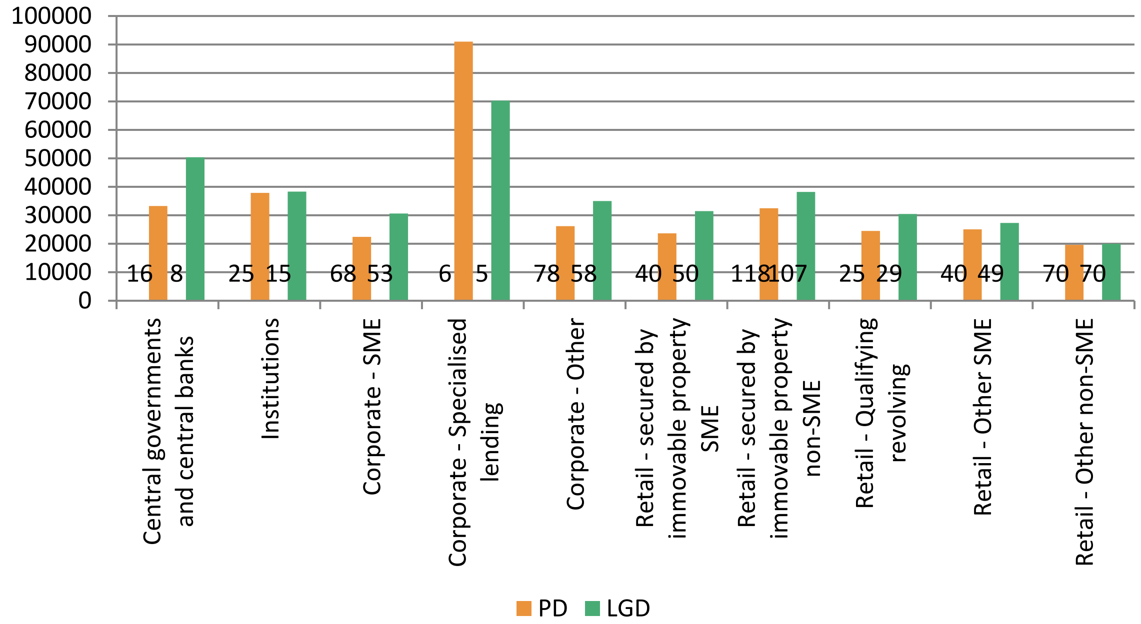
	N	sum	mean	min	max	p50
Total PD models within the institution	102	1 493	14.64	1	100	9.5
Total LGD models within the institution	97	1 000	10.31	1	91	3

19. The exposure amounts covered by these models are heterogeneous within COREP exposure classes (Figure 4)[9]. By exposure classes, specialised lending models seem to cover higher exposure amounts, EUR 90 billion (PD) and EUR 70 billion (LGD) on average, although this average is based on a smaller sample of models (6 PD and 5 LGD models). In comparison, the

[9] Note that the exposure values covered by the models refer to the reporting dates, see footnote 6 for more information.

average size of a model for retail exposures secured by immovable property (non-SME) is around EUR 32 billion (PD) and EUR 38 billion (LGD).

Figure 4: Mean exposure value covered by PD and LGD models across exposure values (in EUR millions)



Note: the numbers within the figure indicate the number of PD and LGD models within each COREP exposure class.

20. The 102 institutions considered in the sample for the quantitative analysis account for 64% of the total EU institutions' credit risk-weighted exposures[10].

2.4 Data quality

21. It should be noted that the results of this survey are dependent on the quality of the submitted responses, and are therefore subject to data quality issues, which are unavoidable in any survey context. This caveat should be kept in mind when drawing conclusions on the results and/or extrapolating from them.

22. In general, the quality of the responses varies from question to question, i.e. even if the results of one question are less satisfactory, this does not mean that the responses to other questions are also of a lesser quality. Several of the data quality issues have been addressed by data cleaning, meaning that some responses where either removed from the sample, or were re-classified as different answers based on the comments. Data cleaning was not possible for all questions, however, in particular for questions where it was not possible to re-classify answers based on the comments. For other questions, while the response seemed

[10] Obtained as the ratio of credit RWA from COREP reporting (adding up RWA in SA, F-IRB and A-IRB, i.e. IDs 77905, 82429 and 84560) to risk-weighted exposure amounts for credit risk in EU Member States (European Central Bank (ECB) statistics on consolidated banking data, code CBD2.Q.B0.W0.11._Z._Z.A.A.ECR00._X.ALL.RW._Z.LE._T.EUR).

acceptable a priori, it can be seen from the comments of some respondents that some questions have not been understood as intended.

23. Because not all respondents answered all questions for all models and because of the data cleaning described above, it should be noted that the sample of models for each individual question is smaller or equal to the total sample of models. In particular, whereas the total number of PD and LGD models is respectively 252 and 202, this sample may be smaller for some individual questions. Whenever the IRB survey contained a list of possible responses where respondents could tick multiple answers, the sample consists only of those models for which the question has been answered (i.e. models for which the particular question has been left unanswered are omitted from the sample).

24. One area where the quality of the responses may affect the results in PD estimation is where not all respondents calculate an observed average DR, i.e. institutions may only calculate the long-run average DR, using various approaches. Therefore when the question is asked of whether or not adjustments are applied to the observed average of DRs for the purpose of PD estimation, the responses may not accurately reflect whether or not the long-run average DR reflects the equally weighted average of all one-year DRs, or whether or not any adjustments have been made during the process. This also applies to the question where respondents have been asked about the reasons for applying adjustments to the observed average DR.

25. In addition, this list of reasons distinguished use of the term ‘representativeness’ for model development (i.e. risk differentiation) from that of the term ‘comparability’ with respect to risk quantification (consistent with the wording in Article 179(1)(d) of the CRR). The comments made in response to this question, however, showed that not all respondents shared this understanding, and that they used these terms interchangeably.

26. Furthermore, the instructions to the survey asked respondents to consider the notion of ‘margin of conservatism’ (MoC) to refer to the correction for the expected range of estimation error, versus the notion of ‘appropriate adjustment’ to refer to the adjustment that is made to correct the identified error. Some of the comments, however, showed that this distinction was not used when responding to the questions.

27. In addition, the distinction in meaning between risk differentiation and risk quantification was not shared among all respondents. This was made clear not only by the survey responses but also by the feedback to the CP, and has led to a re-structuring of the GLs, where these terms have been defined, and where all requirements for risk differentiation and risk quantification have been clearly differentiated and clarified. However, this lack of understanding implied that the questions on the length of the reference dataset (RDS) for risk differentiation and on the length of the historical observation period (for risk quantification) were not clear for all respondents, and that the relevant results should be treated with caution.

28. Finally, for PD estimation, it should be noted that the list of calibration types was not precise, since the reference to Article 180(2)(a) of the CRR (for retail exposures) was missing for type 1

calibrations (i.e. only the reference to Article 180(1)(a) of the CRR was included, which refers to all exposure classes except retail). However, the total list of calibration types was still exhaustive, since respondents could select the category 'other'.

29. For LGD estimation, the same caveat about the historical observation period applies as for PD estimation, i.e. whereas the IRB survey enquired about the length of the historical observation period (the length of the RDS was not requested), some respondents may have understood this as referring to the length of the RDS.

30. As regards downturn LGD estimation, the IRB survey first asked how the downturn period is defined, and, secondly, how the data to be used in downturn estimation are selected (see paragraph 240). Whereas the quality of the responses to the first question was satisfactory, the responses to the second question were quite confused, and nearly 50% of the respondents selected the category 'other'. Several of them provided a wide range of explanations not answering the question. For this question, the final sample of models for which the response was retained was much smaller (148 instead of 202 in total) due to the extensive data cleaning.

3. General estimation requirements

3.1 Principles for specifying the range of application of the rating systems

31. The GLs clarify (in paragraph 12) that a rating system should cover all those exposures where the obligors or facilities show common drivers of risk and credit worthiness, and fundamentally comparable availability of credit-related information.

32. Furthermore, the GLs include (in paragraph 8) a common definition of a PD and LGD model, and in particular:

- all data and methods used as part of a rating system within the meaning of Article 142(1) point (1) of Regulation (EU) No 575/2013, which relate to the differentiation and quantification of own estimates of PD and which are used to assess the default risk for each obligor or exposure covered by that model;

- all data and methods used as part of a rating system within the meaning of Article 142(1) point (1) of Regulation (EU) No 575/2013, which relate to the differentiation and quantification of own estimates of LGD, LGD in-default and EL_{BE} and which are used to assess the level of loss in the case of default for each facility covered by that model.

33. In relation to that requirement and these definitions, it is insightful to consider the sample of PD and LGD models in this survey, with respect to the COREP exposure classes to which they apply. Table 7 and Table 8 show the overlap between PD and LGD models across those COREP exposure classes. Note that the percentages refer to the share of the number of models; for instance, 41% of the models that apply to central governments and central banks also apply to institutions. The total number of models in each exposure class is reported in the last columns of Table 7 and Table 8; for instance, a total of eight models applies to central governments and central banks. Institutions were asked to use the definitions of PD and LGD models proposed above when completing the survey. As a result, the PD and LGD models may encompass several methods for both risk differentiation and risk quantification. It can be seen from Table 7 and Table 8 that there is considerable overlap between some COREP exposure classes. Whereas such overlap may be more common among retail and corporate models, it is more significant between retail and corporate exposures. This holds in particular for the share of 'corporate — SME' models in to 'retail secured by immovable property — SME' and vice versa (29% for PD and 39% for LGD models, and 50% and 42% vice versa), and between 'retail — other SME' (39% for PD and 37% for LGD models) and 'corporate — other' (20% for PD and 31% for LGD).

Table 7: Overlap between COREP exposure classes (PD)

	Central governments and central banks (%)	Institutions (%)	Corporate — SME (%)	Corporate — specialised lending (%)	Corporate — other (%)	Retail — secured by immovable property SME (%)	Retail — secured by immovable property non-SME (%)	Retail — qualifying revolving (%)	Retail — other SME (%)	Retail — other non-SME (%)	Total models
Central governments and central banks	100	41	18	6	35	0	6	0	6	6	17
Institutions	26	100	41	11	59	4	0	0	4	0	27
Corporate — SME	4	16	100	7	86	29	13	7	29	10	70
Corporate — specialised lending	13	38	63	100	88	13	0	0%	13	0	8
Corporate — other	7	20	73	9	100	20	9	2	20	5	82
Retail — secured by immovable property SME	0	3	50	3	40	100	58	23	70	40	40
Retail — secured by immovable property non-SME	1	0	8	0	6	19	100	18	14	43	120
Retail — qualifying revolving	0	0	19	0	7	33	81	100	26	85	27
Retail — other SME	2	2	49	2	39	68	41	17	100	41	41
Retail — other non-SME	1	0%	10	0	6	23	73	32	24	100	71

Table 8: Overlap between COREP exposure classes (LGD non-defaulted)

	Central governments and central banks (%)	Institutions (%)	Corporate — SME (%)	Corporate — specialised lending	Corporate — other (%)	Retail — secured by immovable property SME (%)	Retail — secured by immovable property non-SME (%)	Retail — qualifying revolving (%)	Retail — other SME (%)	Retail — other non-SME	Total models
Central governments and central banks	100	25	25	0	25	0	13	0	13	0	8
Institutions	13	100	63	13	69	13	19	19	25	25	16
Corporate — SME	4	19	100	11	87	39	30	15	35	28	54
Corporate — specialised lending	0	29	86	100	86	14	0	0	14	0	7
Corporate — other	3	19	80	10	100	32	24	12	31	25	59

Retail — secured by immovable property SME	0	4	42	2	38	100	80	36	66	58	50
Retail — secured by immovable property non-SME	1	3	15	0	13	37	100	22	28	42	109
Retail — qualifying revolving	0	10	27	0	23	60	80	100	67	87	30
Retail — other SME	2	8	39	2	37	67	63	41	100	82	49
Retail — other non-SME	0	6	22	0	22	42	67	38	58	100	69

3.2 Data requirements

34. One of the most important aspects of the data requirements included in the GLs is to ensure that the data used for the purpose of estimation of risk parameters, including model development and risk quantification (calibration), is representative of the current portfolio covered by the model under consideration.

35. From the responses to the IRB survey as well as the feedback to the GLs it emerged that additional clarity is needed on the distinction between model development and calibration. Definitions of these concepts have therefore been included in the GLs (in paragraph 8), where it is specified that model development is the process that leads to risk differentiation, and calibration is the process that leads to appropriate risk quantification. In this regard, the requirements on representativeness are specified separately for risk differentiation and for risk quantification in the final GLs. Whereas the requirements on data representativeness were included in separate sections for PD and LGD in the CP on the GLs, they have been merged in the final GLs and merged into the data requirements in the section on general estimation requirements, i.e. they have been redrafted so as to apply to both PD and LGD estimation.

36. As regards model development, the GLs (in paragraph 23) do not require that the definition of default that is used for model development is identical to that used for the purpose of Article 178 of the CRR. Instead, the GLs contain requirements to ensure consistency in the definition of default during the observation period, and to ensure that the default definition used for the purposes of model development does not have a negative impact on the structure and performance of the rating model, in terms of risk differentiation and predictive power. On the contrary, the GLs do require (in paragraph 30) the definition of default underlying the data used for risk quantification to be consistent with the definition of default specified in the CRR.

37. The IRB survey contained an explicit question on whether or not the definition of default used for model development in PD estimation is the same as that in the CRR. The responses indicate that a different definition of default was used in 18.18% of PD models (see Table 9). Across exposure classes, the share of PD models that use a different definition of default is higher for retail and sovereign exposures (above 20% on average) and lower for exposures to institutions and corporates.

Table 9: Is the default definition used during model development for risk differentiation the same as that defined by the CRR? By exposure class

	No, the definition of default is different from the CRR definition			Yes, the definition of default corresponds to the CRR definition			Total
	No.	%	% EAD	No.	%	% EAD	No.
Total	44	18	19	198	82	81	242
Central governments and central banks	5	31	4	11	69	96	16
Institutions	3	12	8	22	88	92	25

	No, the definition of default is different from the CRR definition			Yes, the definition of default corresponds to the CRR definition			Total
Corporate — SME	12	17	23	57	83	77	69
Corporate — specialised lending	0	0	0	7	100	100	7
Corporate — other	11	14	19	69	86	81	80
Retail — secured by immovable property SME	10	25	40	30	75	60	40
Retail — secured by immovable property non-SME	24	21	23	89	79	77	113
Retail — qualifying revolving	7	26	13	20	74	87	27
Retail — other SME	8	20	33	33	80	67	41
Retail — other non-SME	19	28	27	50	72	73	69

38. The questions in the IRB survey for PD estimation did use the distinct wording of representativeness with respect to model development and comparability with respect to risk quantification. In particular, the term 'comparability' was used only with respect to risk quantification, which is consistent with the wording in Article 179(1)(d) of the CRR[11] (as well as with the RTS on assessment methodology Article 45(2)(a), referring to comparability to the required degree). From the responses to the survey, however, it can be seen that not all respondents had this same understanding, and that they may have understood the two concepts interchangeably. This caveat should be kept in mind when interpreting the results in Figure 5 and Table 10[12].

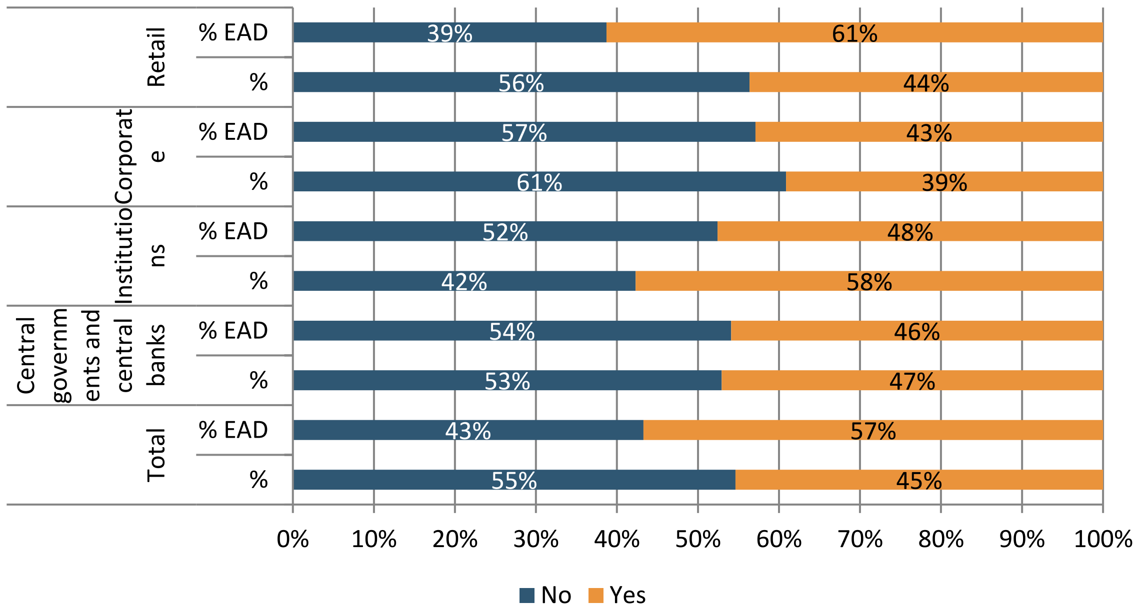
39. Figure 5 shows for how many models (%) and how many exposure values (% EAD) the institutions apply adjustments to the observed average DR for the purpose of PD estimation. From the responses it can be seen that adjustments are applied in around half of the models (exposures). The shares of models (exposures) for which adjustments are applied is also higher for retail models than for corporate models[13].

[11] 'The population of exposures represented in the data used for estimation, the lending standards used when the data was generated and other relevant characteristics shall be comparable with those of the institution's exposures and standards. The economic or market conditions that underlie the data shall be relevant to current and foreseeable conditions.'

[12] This caveat applies also to Figure 23 on page 68 in section 4.8 on Long-run average DR.

[13] This may be related to the requirement in Article 180(2)(e) of the CRR for retail exposures, i.e. 'An institution need not give equal importance to historic data if more recent data is a better predictor of loss rates' (see also paragraph 95 and Figure 19).

Figure 5: Do you apply adjustments to the observed average of DRs for the purpose of PD estimation? Retail, corporate, institutions, and central governments and central banks



40. Institutions were also asked to indicate the reasons for which they make adjustments to the observed average DR[14]. These results are shown in Table 10. It is noteworthy that the category 'other' was selected in 55% of the models under consideration, and these other triggers are therefore analysed in more detail below. The most common reasons for applying adjustments to the observed average DR is to ensure representativeness of the observed average DR for the long-run average (25% of PD models), to adjust for insufficient one-year DR from economic downturn periods (14%) and because the observed average DR is not representative of the default behaviour of the current portfolio (13%).

Table 10: What are the main reasons for applying adjustments to the observed average DR?

	No.	Total	%	% EAD
The observed average DR is not representative of the long-run average DR (is not composed of an appropriate mix of good and bad years)	29	116	25	29
The observed average DR is not representative of the default behaviour of the current portfolio	15	116	13	16
There are insufficient one-year DRs available from economic downturn periods	16	116	14	6
Non-comparability due to different structure of the portfolio in terms of risk drivers	0	116	0	0
Non-comparability due to different lending standards	4	116	3	0
Non-comparability due to different legal environment	0	116	0	0
Non-comparability due to different definition of default	10	116	9	20
Non-comparability due to different market or economic conditions	2	116	2	0
Non-comparability due to modified scope of application of the model	4	116	3	1

[14] Note that in Table 10 only those responses are shown where the institution indicated that they make adjustments to the observed average DR (as shown in Figure 5).

	No.	Total	%	% EAD
Other	64	116	55	38

Note: this was a 'tick box' question, hence respondents could select several of the above answers.

41. Many of the reasons for making adjustments are unclassified (i.e. 'other' in more than half of the PD models in Table 10). Based on the comments, however, it is possible to obtain more insight into these other reasons. Caution is necessary in interpreting these results, because it appeared that the distinction between appropriate adjustment and MoC has not been properly understood by the respondents. In particular, the instructions for the survey required respondents to consider the notions of MoC and 'appropriate adjustment' as specified in the GLs (in paragraphs 38 and 41), i.e. MoC relates to the expected range of estimation error, which is distinct from the appropriate adjustment[15], which in turn relates to the adjustment made to correct the identified error. Nevertheless, it appeared that these concepts had not been understood as intended, since several respondents mentioned that additional conservatism was a reason for adjusting the observed average DR. The most common other reasons for adjusting the observed average DR were additional conservatism in general (more than one third of the other reasons), conservatism to account for uncertainty in the data, and a need to address shortcomings of external data. Other reasons were the low number of defaults in certain portfolios, lack of one-year DRs in certain time periods, IT errors, and a lack of risk drivers during certain periods.

42. To provide clarity as to which situations and deficiencies should (at least) be corrected by means of an appropriate adjustment, and for which an MoC related to the expected range of estimation error should be added, the GLs clarify the meaning and intended use of these concepts (i.e. 'appropriate adjustment' and 'MoC') (in section 4.4.2. and 4.4.3.).

43. When it comes to LGD estimation, the survey enquired about the various triggers for using an MoC in the estimates, including in particular the various dimensions of representativeness (changes in the definition of default, changes in lending standards and recovery policies, changes in the current and foreseeable economic and market conditions, and other reasons of (non)-representativeness).

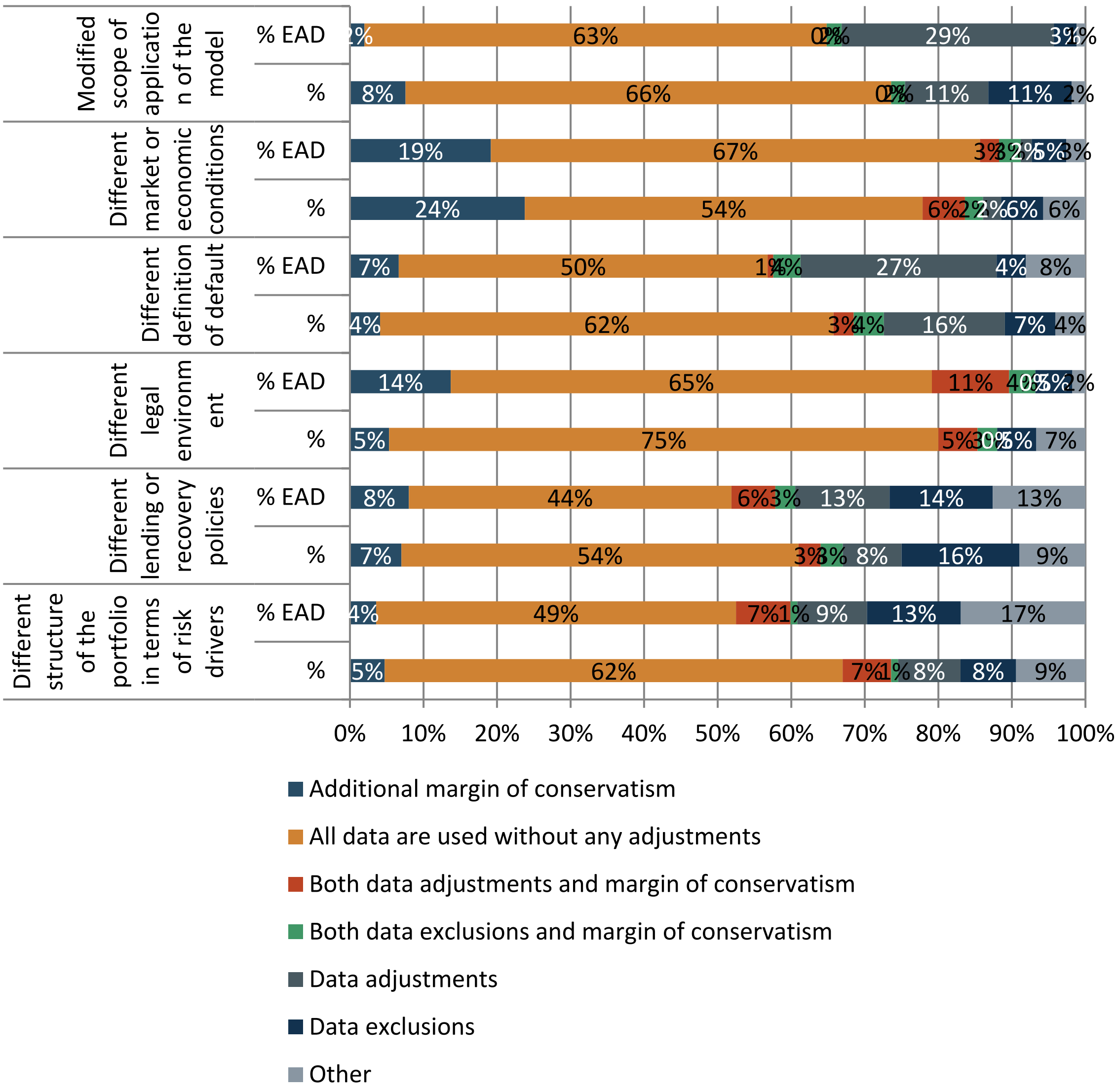
44. Non-representativeness for risk quantification should lead not to data exclusion but to appropriate adjustments, where possible, and additional MoC. This is particularly important and is consistent with Article 181(1)(a) of the CRR, which requires the use of all observed defaults for LGD estimation.

45. Figure 6 shows how institutions currently deal with issues related to data representativeness for LGD (non-defaulted) estimation along several dimensions. It can be seen that for around half of the models or exposures covered, institutions do not apply any treatment (i.e. no

[15] Strictly speaking, the instructions for the survey as well as the CP on the GLs used the term 'data adjustment', which has been renamed as 'appropriate adjustment' in the final GLs.

MoC, data adjustment or data exclusions). Depending on the origin of the non-representativeness, MoC, data adjustments and data exclusions are among the most common options. In particular, data adjustments and data exclusions are most often applied in cases of non-representativeness due to a change in the scope of application of the model, different structure of the portfolio in terms of risk drivers, and different lending or recovery policies. For non-representativeness due to a different definition of default, it is most common to apply data adjustments. For non-representativeness due to a different legal environment, or different market or economic conditions, it is most common to apply an MoC.

Figure 6: How do you treat non-representativeness of data (LGD non-defaulted)?

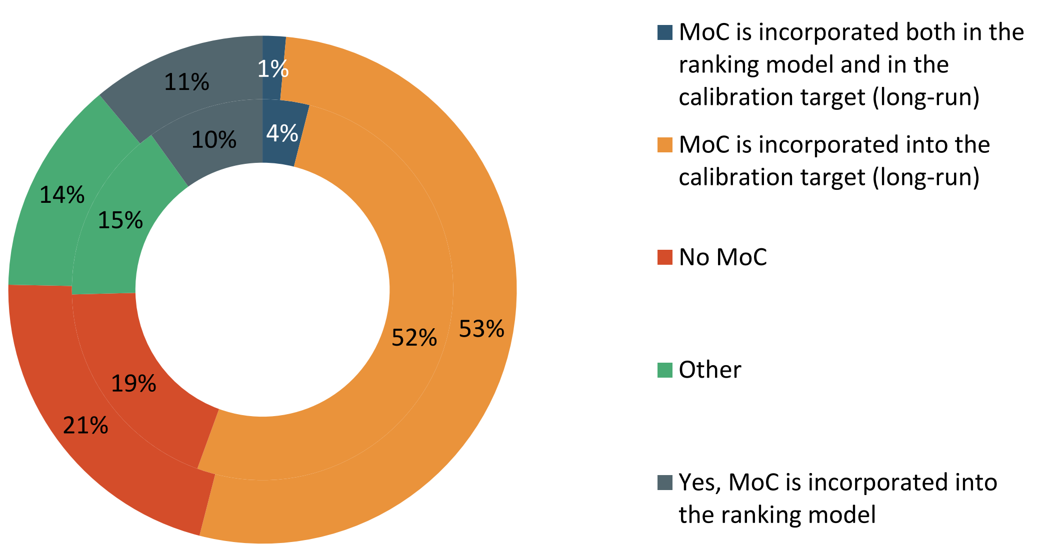


3.3 Margin of conservatism

46.The GLs require (in paragraph 41) institutions to implement a framework for the quantification, documentation and monitoring of estimation errors, in relation to the requirement in Article 179(1)(f) of the CRR that requires institutions to add an MoC, which in turn is related to the expected range of estimation errors. As a general concept institutions are required to address the identified deficiencies in data or methods via appropriate adjustments and MoC. An appropriate adjustment consists of rectifying the identified errors; for instance, missing data points are filled in with the most probable information, or the inaccuracies in data are corrected. The objective of the appropriate adjustment is to achieve the most accurate estimates possible. However, as the appropriate adjustment is performed to estimate and correct the bias due to the data deficiency, additional MoC has to be added to address the uncertainty related to this estimation. Moreover, MoC aims at addressing all errors that cannot be rectified through appropriate adjustment and any other uncertainties related to the estimation of risk parameters. Furthermore, the GLs (in paragraphs 43-52) contain requirements on the framework for quantifying, documenting and monitoring MoC. In particular, it is required that an MoC is quantified for each of three specified categories: Category A, identified data and methodological deficiencies; Category B, relevant changes to underwriting standards, risk appetite, collection and recovery policies, and any other source of additional uncertainty; and Category C, general estimation error.

47.Figure 7 shows the variety of industry practices regarding the inclusion of MoC in the PD estimates. In general, 20% of PD models do not contain an MoC. In more than half of the PD models, an MoC is included in the calibration target (i.e. long-run average DR). In 10% of PD models, an MoC is included only in the ranking models, and less than 4% of PD models contain an MoC in both the ranking and the calibration part of the model.

Figure 7: How is MoC included in your PD estimates?

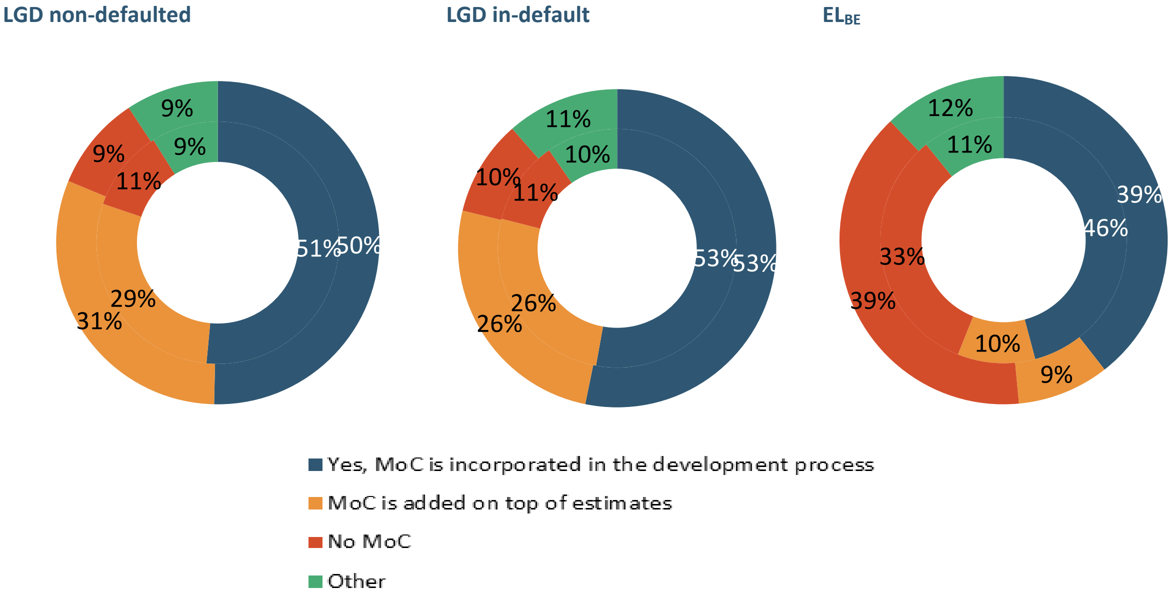


Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where all PD models are weighted by their corresponding exposure value.

48. Therefore, it is common practice to add MoC to the long-run average DR or the central tendency (which is quite often specified based on the long-run average DR of the portfolio under consideration).

49. Around 11% of the LGD and LGD in-default models do not contain an MoC (Figure 8), which is about half the relevant number of PD models. However, in 33% of EL_{BE} models, no MoC is included. In more than half the LGD (non-defaulted and in-default) models, an MoC is incorporated into the development process, and in 29% (LGD non-defaulted) and 26% (LGD in-default), an MoC is added on top of the estimates.

Figure 8: Do you include an MoC in your LGD estimates? How?



The CRR does not contain any guidance on the quantification of MoC for certain triggers or in general. Therefore, the following options were considered:

(a) non-exhaustive longlist of triggers for MoC as part of the GLs (including recommendations for the according appropriate adjustments):

- ✓ pros: provides a more harmonised approach towards the triggers that require MoC and the method to quantify the impact;
- ✓ cons: could lead to less suitable approaches for individual models;

(b) MoC categories with minimum list of triggers in the GLs:

- ✓ pros: provides a base for a more harmonised reporting on the level of MoC, but also leaves room for distinct approaches;
- ✓ cons: different approaches could still lead to different levels of MoC.

50.In the GLs, option (b) has been chosen. However, the various categories of MoC have been revised vis-à-vis those included in the CP on the GLs on the basis of the industry feedback, as well as the responses to the IRB survey, which indicated that institutions use a wide range of triggers for applying MoC, and signalled that sufficient clarity would be needed in the GLs to clearly differentiate the various triggers from one another.

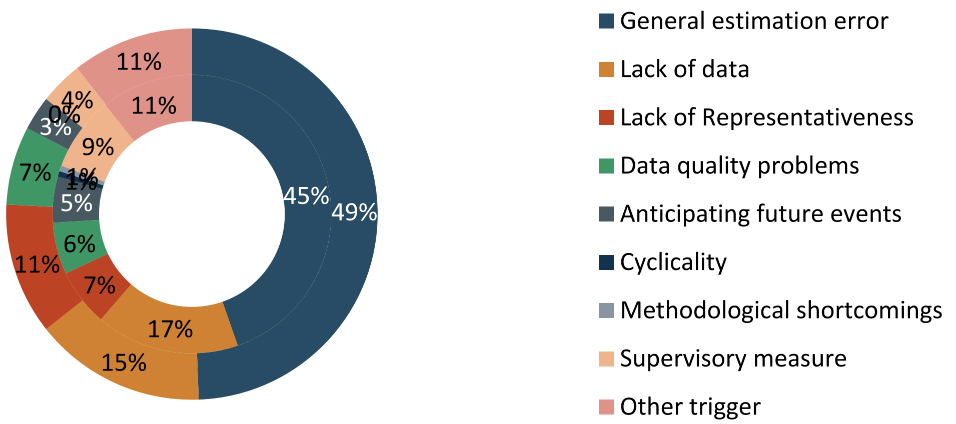
51.In the IRB survey, institutions were asked to indicate which aspects in model estimation trigger the inclusion of an MoC. For each PD model, institutions could tick several boxes, including (i) missing default trigger in historical observations; (ii) changed default trigger in historical observations; (iii) changed underwriting standards (i.e. not reflected in the historical observations); (iv) changed rating system (e.g. newly relevant risk driver or change in scope of application); and (v) other. However, the majority of respondents did not make use of the predefined answers (86% or 175 models) and selected the category 'other'. This indicates the importance of providing sufficient clarify with respect to the various categories of triggers for MoC, as proposed in the GLs (in section 4.4.3).

52.On the basis of the comments, however, it was possible to obtain a more accurate picture of the other sources of triggers for using an MoC in the PD estimates[16]. The comments revealed, as shown in Figure 9, that the most frequent other trigger is general estimation errors (around 50% of the other triggers), and many respondents made explicit reference to the legal requirement given in Article 179(1)(f) of the CRR. The second most common trigger for MoC concerns data issues (i.e. lack of data and data quality issues), present in around 15% of the other triggers. The third most mentioned other trigger for MoC in the survey is based on a supervisory measure (9% of other triggers).

53.The anticipation of potential future events represents around 5% of the other triggers. In these cases, institutions mention they that have observed negative trends in the recent years and therefore apply conservatism to prepare for this potential downturn. Note that the percentages are simple sums by triggers, not weighted by the amount of MoC.

[16] Wherever the comment was not clear, the response for that model was discarded and omitted from the results shown in the table.

Figure 9: Other triggers for using MoC in PD estimates



Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where all PD models are weighted by their corresponding exposure value.

54. With respect to the triggers for using MoC in the LGD estimates, a variety of triggers can be observed. However, in more than half of the LGD and EL_{BE} models, data deficiencies and missing data, as well as general estimation errors, caused the application of MoC in the estimates. To a smaller extent, aspects related to the representativeness (due to changes in the definition of default, changes in lending standards, and changes in the current and foreseeable economic conditions) are a driver for using MoC in the estimates.

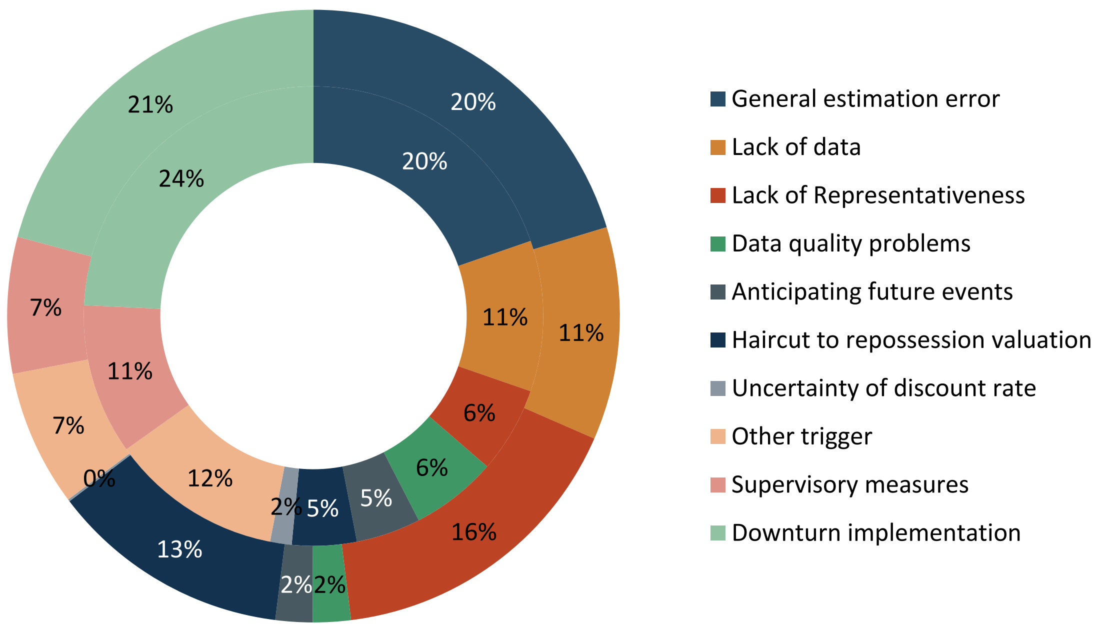
Table 11: What are the main triggers for using an MoC in your LGD estimates?

	LGD non-defaulted			LGD in-default			EL_{BE}		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**	**No.**	**%**	**% EAD**
Data errors/deficiencies and missing data	96	52	56	88	56	59	58	53	58
Diminished representativeness due to changes in the definition of default	9	5	10	8	5	11	9	8	13
Diminished representativeness due to changes in the lending standards and recovery policies	12	6	10	12	8	11	5	5	4
Diminished representativeness due to changes in the current and foreseeable economic or market conditions	32	17	14	28	18	15	14	13	10
Diminished representativeness due to other reasons	13	7	10	10	6	9	9	8	13
General estimation errors including errors stemming from methodological deficiencies	99	54	61	88	56	61	57	52	59
Others	74	40	31	58	37	33	38	35	38

Note: this was a 'tick box' question, hence respondents could select several of the above answers.

55. It can be seen from Table 11 that many respondents selected the category 'other' to describe the triggers for MoC that are used in LGD estimates (40% for LGD non-defaulted, 37% for LGD in-default and 35% for EL_{BE}). In the case of LGD non-defaulted, the comments have been analysed to produce a more granular picture of the other sources of triggers for applying MoC in LGD estimates. For 66 of the 74 models for which the option 'other' was selected, it was possible to identify a more precise reason (shown in Figure 10). To some extent, the answers show patterns similar to the corresponding answers relating to PD, although other LGD specific triggers have also been identified. These include downturn implementation, haircut to repossession valuation and uncertainty stemming from the discount rate, as shown in Figure 10.

Figure 10: Other triggers for using MoC in LGD estimates



Note: the inner circle shows the share of each option where all LG models are weighted equally, whereas the outer circle shows the share of each option where all LGD models are weighted by their corresponding exposure value.

56. The key finding from this analysis is that 24% of these other triggers of MoC stems from banks that consider their downturn add-on as an MoC (16 answers). This points to the need to provide clarity on the downturn concept in the draft RTS stemming from the mandate in Article 181(1)(c) of the CRR. Apart from that, the general estimation error is the most common answer (13 answers). Aligned with the corresponding analyses for PD, data issues are another common trigger for using MoC in the LGD estimates. More granularly, lack of data in general (low default portfolios, lack of representativeness (external or internal data), and data quality problems have been mentioned by the respondents of the survey. Note that

larger deviations between the equally weighted and exposure weighted responses can be observed, which is due to the smaller sample size in Figure 10 (66 models).

57. Institutions are required to quantify the final MoC to be added to the best estimate of the risk parameter as the sum of the MoC for categories A, B and C. On this aspect, the following options have been considered:

(a) the total MoC should be computed as the sum of the MoCs of the categories A, B and C, and institutions may decide how to determine the MoC at the level of the individual category:

- ✓ pro: clear and uniform methodology is used by all institutions;
- ✓ pro: institutions retain discretion on how to aggregate the MoCs per category that stem from different deficiencies;
- ✓ con: the sum of the MoCs of categories A, B and C is not mathematically correct if A, B and C are not mutually exclusive (i.e. in case of overlaps between the categories);

(b) institutions should specify how the MoCs of categories A, B and C are aggregated to determine the total MoC;

- ✓ pro: institutions may develop innovative methods to ensure that the total MoC is computed in a mathematically correct way;
- ✓ con: given that the three categories are already relatively distinct, overlap between them may be limited, and therefore institutions may sum up the individual MoCs in any event;
- ✓ con: could lead to unnecessary complexity in modelling

58. Based on these pros and cons, option (a) has been chosen in the final GLs, given that it was deemed that institutions are allowed sufficient flexibility to quantify the MoC at the level of the individual category.

4. PD models

4.1 Characteristics of the survey sample

Table 12: Level of governance of PD models

	All institutions			Only consolidated institutions			Only individual institutions		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**	**No.**	**%**	**% EAD**
Central model	110	45	59	87	53	62	20	26	27
Central model partly developed on an external pool	17	7	4	9	5	4%	8	10	4
Local model	84	34	26	49	30	27	35	45	30
Local model but centrally developed	29	12	8	16	10	4	13	17	31
Local model partly developed on an external pool	3	1	2	3	2	3	—	—	—
Other	1	0	1	—	—	—	1	1	8
Total	244	100	100	164	100	100	77	100	100

59. Table 12 shows that there is a fair balance between central models (52%) and local models (47%) in the sample. The results are also differentiated along the level of consolidation of the institution, which further shows that consolidated institutions chose to report central models (58%), whereas the prevalence of local models is higher among individual institutions (62%).

Table 13: Advanced or foundation IRB approach, by exposure class

	Advanced IRB			Foundation IRB			Total
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**	**No.**
Total	219	87	96	32	13	4	251
Central governments and central banks	11	65	85	6	35	15	17
Institutions	17	63	88	10	37	12	27
Corporate — SME	57	81	93	13	19	7	70
Corporate — specialised lending	6	75	98	2	25	2	8
Corporate — other	62	76	88	20	24	12	82
Retail — secured by immovable property SME	36	90	99	4	10	1	40
Retail — secured by immovable property non-SME	118	98	100	2	2	0	120
Retail — qualifying revolving	26	96	100	1	4	0	27
Retail — other SME	38	93	100	3	7	0	41
Retail — other non-SME	69	99	100	1	1	0	70
Other	5	71	74	2	29	26	7

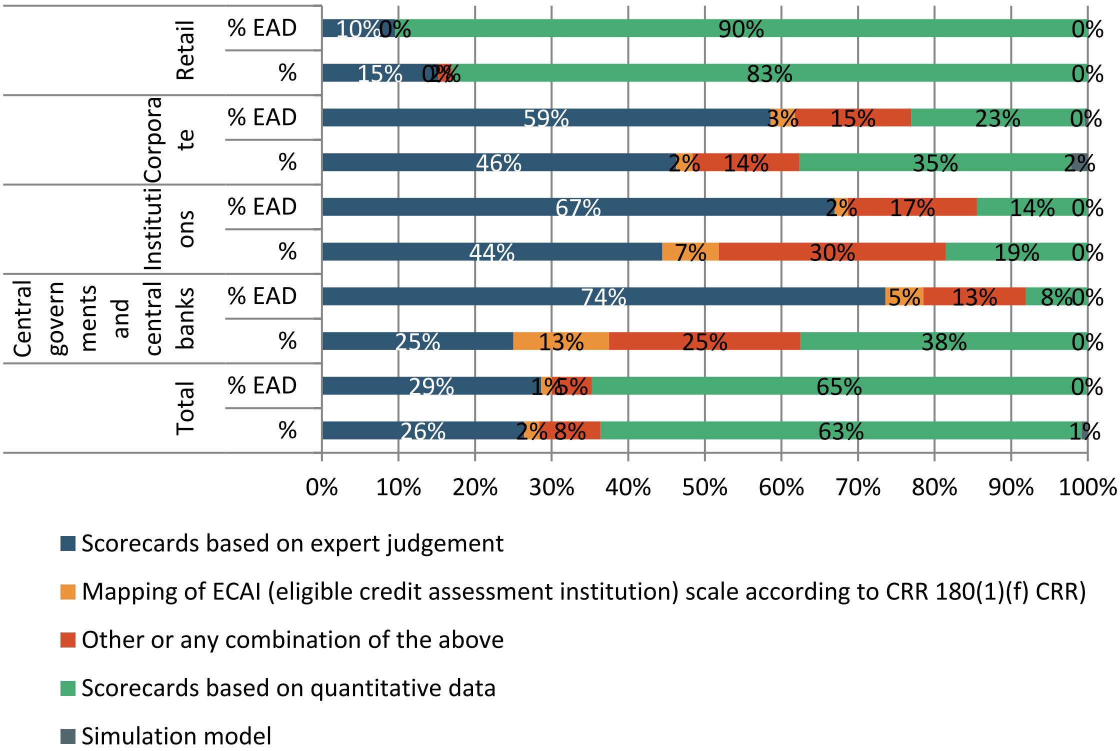
60. As shown in Table 13, the majority of the PD models in the sample of the survey use the advanced IRB approach (87% of PD models and 96% of exposures covered), where advanced IRB refers to where the institution has received permission from the competent authority to use both PD and own LGD estimates, and foundation IRB refers to where the institution has received permission only to use own PD estimates. It is further interesting to analyse this distribution across exposure classes, since the CRR specifies that the use of the advanced IRB approach is mandatory for retail exposures (Article 151(7) of the CRR). However, for some of the reported PD models that apply only to retail exposures (four models altogether), the institutions indicated that they use the foundation IRB approach, which seems to contradict this CRR requirement. For sovereign exposures, exposures to institutions and corporates, the split between the advanced and foundation IRB approaches is generally around 70% and 30% respectively. When expressed in terms of exposure shares covered by the models, 96% of exposures fall under the advanced IRB approach. This is due to the relatively high weight of retail models, where generally 100% of exposures are in the advanced IRB approach.

61. Figure 11 shows the distribution of types of PD models in the IRB survey, in total and across groups of exposures, i.e. central governments and central banks, exposures to institutions, corporates and retail exposures[17]. The sample of PD models included in the IRB survey consists mostly of PD models based on scorecards (based on expert judgement or quantitative data), which account for almost 90% of all models. Scorecards based on quantitative data are the best represented, accounting for 63% of all PD models, and 65% of all exposures covered by PD models in the sample. For the retail exposure classes, such scorecard models are even used exclusively.

62. For sovereign exposures, exposures to institutions and corporates, some of the PD models make use of external ratings by means of a mapping scale, in accordance with Article 180(1)(f) of the CRR (five PD models altogether). Simulation models are seldom used (only two models, or 1% of all reported PD models), and in none of the retail models for which the survey was completed is the PD derived from total losses (EL and LGD estimates).

[17] Note that these groups of exposures are not mutually exclusive, because institutions could indicate to which of the COREP exposure classes the PD model applies. Therefore, there are, for instance, PD models that apply both to corporate and retail exposures, such that there is a partial overlap in the information shown in Figure 11.

Figure 11: Types of PD models — retail, corporate, institutions, and central governments and central banks



63. As shown in Table 14, the majority of the PD models in the sample (82% of models and 73% of exposures) make use of a discrete rating scale, whereas only 17% of models (25% of exposures covered) have a continuous rating scale. Table 15 and Figure 12 show that a PD model has on average 15 living grades or pools, but a wide variation can be observed, ranging from 4 to 67.

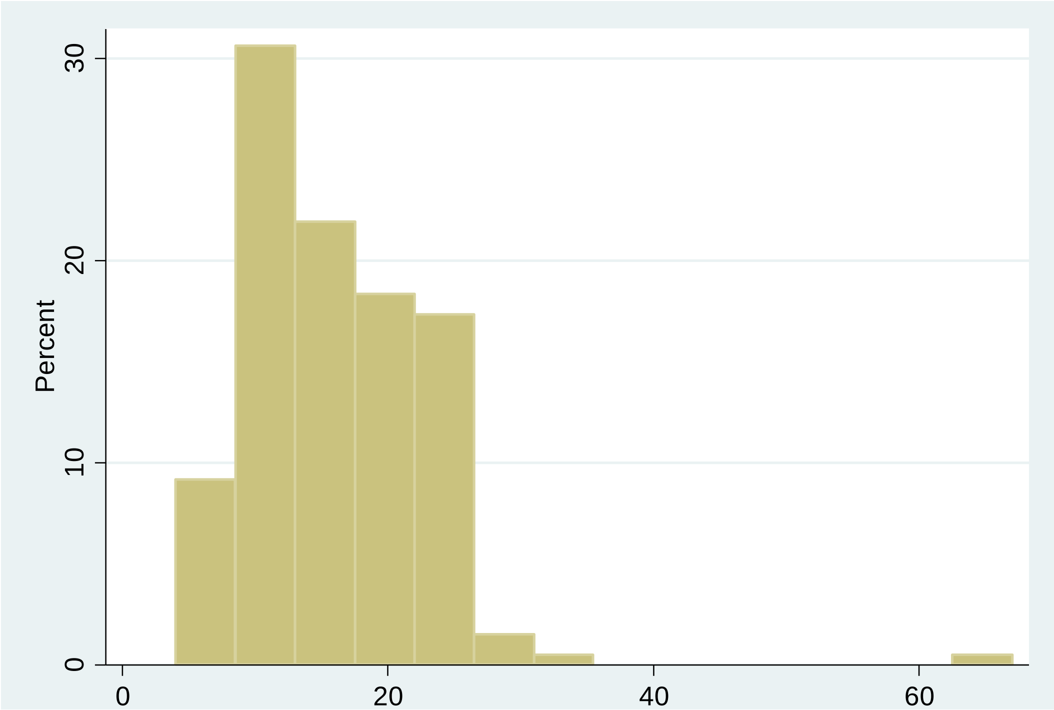
Table 14: Use of continuous or discrete rating scale

	N	%	% EAD
Continuous rating scale	42	17	25
Discrete rating scale	203	82	73
Other	4	2	2
Total	249	100	100

Table 15: Number of living grades or pools (if a discrete rating scale is used)

N	mean (%)	mean (% EAD)	min	p10	p50	p90	max
196	15.32	15.87	4	9	14	23	67

Figure 12: Number of living grades or pools (if discrete rating scale is used)



4.2 Data requirements for model development

64. To obtain insight into the characteristics of the RDS for model development, i.e. for risk differentiation, institutions have been asked to indicate the length of the RDS for risk differentiation. However, based on the responses and the comments of institutions, it became clear that this question was understood in various ways by the respondents. Some institutions understood the question as intended, i.e. as referring only to the dataset used for risk differentiation, whereas others understood it as referring to the total length of the dataset for both risk differentiation and quantification, and others as the length of the time period used for model calibration. Consequently, even though it was mentioned in the instructions that these questions refer to the RDS for the purpose of risk differentiation, not all respondents had that understanding when responding to this question[18]. These apparent differences in understanding imply that the statistics of the length of the RDS should be treated with caution.

65. From Table 16 it can be seen that the average length of the RDS (8.73 years) is slightly longer than the average length of the historical observation period (shown in Table 27). The average length of the RDS is longest for sovereign exposures (23 years), institutions (12 years) and

([18]) This became clear from respondents who indicated that they use, for instance, five years of data to calculate scores but 12 years of data to calculate the central tendency, whereas the response to the length of the RDS was 12 years.

specialised lending (13 years). The RDS seems to be shorter for retail exposures, and for qualifying revolving exposures in particular, the RDS is shortest (5.33 years).

Table 16: Length of the RDS used for model development for risk differentiation (in years), by exposure class

	N	mean (%)	mean (% EAD)	min	p10	p50	p90	max
Total	213	8.73	8.43	1.00	2.17	6.75	15.00	45.00
Central governments and central banks	13	23.04	11.66	1.00	8.75	26.00	41.00	41.00
Institutions	20	12.45	8.00	3.00	6.00	8.46	10.50	45.00
Corporate — SME	54	8.50	9.21	2.00	5.00	7.75	11.00	33.00
Corporate — specialised lending	7	12.79	9.24	3.00	6.00	10.50	15.00	35.00
Corporate — other	65	9.09	9.16	2.75	6.00	8.00	10.50	35.00
Retail — secured by immovable property SME	33	7.45	7.21	1.00	4.00	6.00	11.00	19.00
Retail — secured by immovable property non-SME	101	7.00	8.20	1.00	3.00	5.50	10.00	23.00
Retail — qualifying revolving	21	5.33	4.05	2.00	3.00	5.00	5.92	12.42
Retail — other SME	32	6.86	7.30	1.00	4.00	5.50	10.00	19.00
Retail — other non-SME	59	6.84	6.18	1.00	5.00	5.50	10.00	19.00

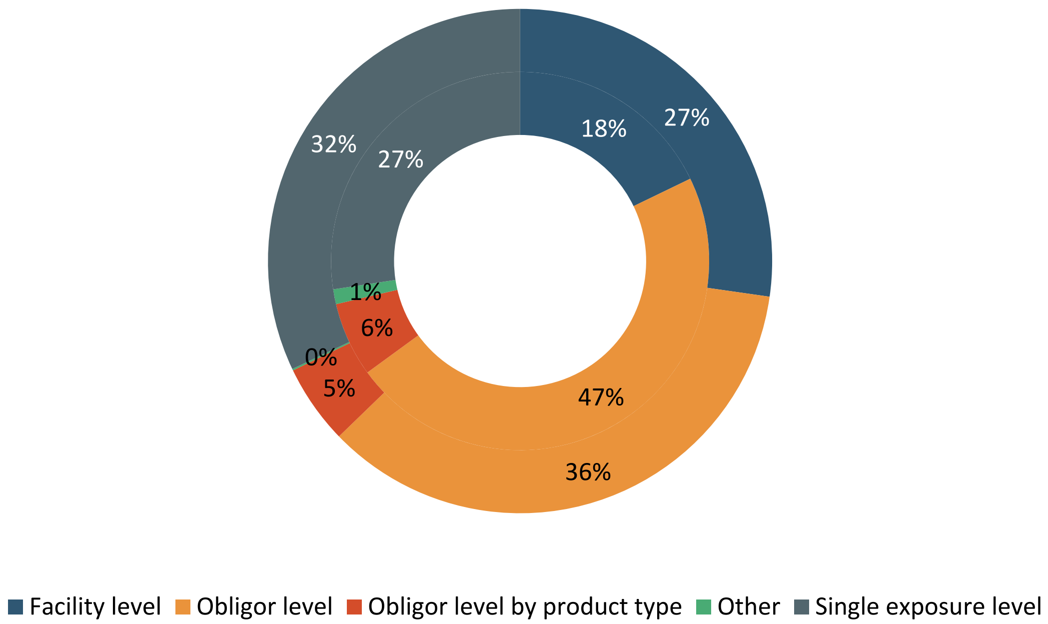
4.3 DRs and PD assignment at obligor or facility level (retail exposures)

66. The CRR allows, in Article 178, second subparagraph, that institutions apply the definition of default at the level of an individual credit facility rather than in relation to the total obligations of a borrower. To ensure that the recognition of default at facility level does not bias the PD estimates, the GLs (in paragraph 61) require that, where there is a significant number of customers carrying multiple facilities of the same type within the retail rating system under consideration, and the institution identifies defaults at the level of an individual credit facility, institutions should analyse the level of risk of such customers compared with customers carrying only one facility of the relevant type and, where necessary, reflect the difference in the level of risk in the model through appropriate risk drivers. Furthermore, institutions should ensure that the estimates based on facility-level default identification are not biased due to cases of customers carrying multiple facilities.

67.This bias could stem from a different increase in the denominator of the one-year DR compared with the increase in the numerator, where obligors with multiple facilities have a different DR to obligors with one facility. In particular, the bias in the one-year DR would depend on the average number of facilities per obligor.

68.To assess current practices in every step of the process, institutions have been asked to indicate the level at which they recognise default, the type of records included in the one-year DR calculation, and the level of the final PD assignments. Institutions could choose between single-exposure level, facility level, obligor level, obligor level by product type and a residual category, 'other'. Single-exposure level refers to where one PD is assigned to each contract. The option 'obligor level' refers to where one PD is assigned to each obligor, irrespective of the product type, whereas the option 'obligor level by product type' refers, for instance, to where one PD is assigned to two mortgages related to two properties of one obligor, but where a credit card of this obligor receives a different PD. 'Facility level' corresponds to cases that do not refer to the single exposure, obligor or obligor by product type; for instance, several mortgages with different durations of one obligor related to the same property could be seen as one facility.

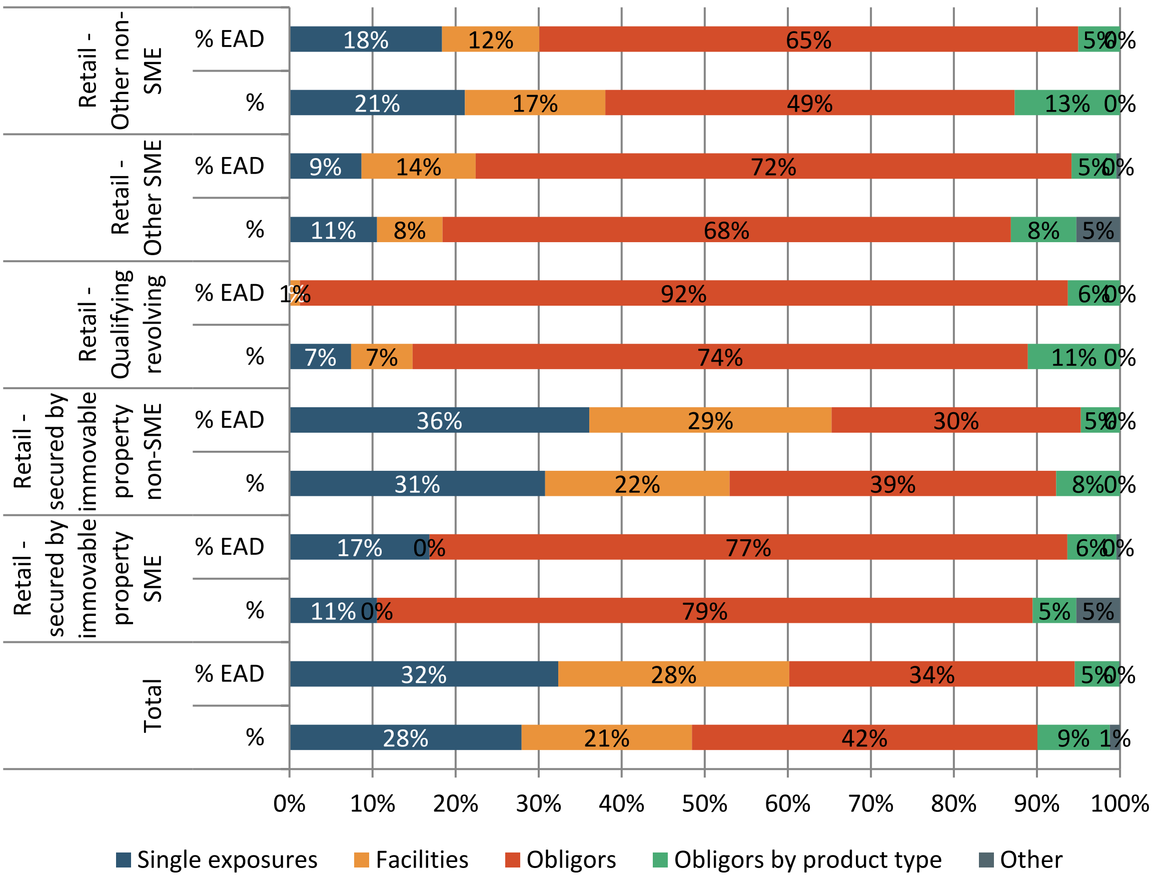
Figure 13: At what level does the institution recognise default? Retail exposures only



Note: the inner circle shows the share of each option where PD models are weighted equally, whereas the outer circle shows the share of each option where PD models are weighted by their corresponding exposure value

69.Given that the requirement to allow the application of the definition of default in points (a) and (b) of Article 178(1) of the CRR at the level of an individual credit facility is allowed only for retail exposures, the responses in Figure 13 are shown only for retail exposures. It can be seen from Figure 13 that default is recognised at obligor (or obligor level by product type) in more than half of the PD models, whereas the PD models where default is recognised at a lower level (facility or exposure level) represent 45.22% of all models. Where default is recognised at lower level, institutions were also asked to indicate whether or not they perform an analysis to compare the DR at that lower level with the DR at obligor level. From the responses it is clear that such an analysis is exceptional; it is performed only in 7% of the PD models (5 of 72). Therefore, the requirement (in paragraph 61) of the GLs will result in a change in practice for institutions.

Figure 14: What type of records are considered in the one-year DR calculation? By (retail) COREP exposure class



70. The next step in the process concerns the type of records (single exposures, facilities, obligors or obligors by product type) that are included in the one-year DR calculation. Figure 14 provides a picture very similar to that in Figure 13. Across exposure classes, the inclusion of single exposures or facilities in the one-year DR seems to be less common in the SME exposure classes (immovable property SME and other SME). On average, the share of models (exposures) where default is recognised at single-exposure or facility level in SME portfolios is 14% (20%), whereas it is 46% (48%) for non-SME portfolios. Table 17 replicates the statistics shown in Figure 14 when considering only those retail exposures for which the default is recognised at facility or at single-exposure level. It should be noted that, among those PD models, the institution considers obligors in the one-year DR calculation in 2.82% of models.

71. A similar conclusion can be obtained from Table 18, which shows that, of the 70 PD models where default is recognised at facility or single-exposure level, the final PD is assigned at obligor level (or obligor by product type) in only three models (representing only 4.29%). This means that, whenever default is recognised at single-exposure or facility level, the institution continues to include those records at a level lower than obligor level in the calculation of the one-year DR and in the final PD estimate.

Table 17: What type of records are considered in the one-year DR calculation?

	All retail exposures			Retail exposures for which default is recognised at facility or at single-exposure level (see Figure 13)		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**
Facilities	33	21	28	30	42	46
Obligors	67	42	34	2	3	1
Obligors by product type	14	9	5	0	0	0
Single exposures	45	28	32	39	55	52
Other	2	1	0	0	0	0
Total	161	100	100	71	100	100

Table 18: Level of PD assignment

	All retail exposures			Retail exposures for which default is recognised at facility or at single-exposure level (see Figure 14)		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**
Facility level	32	19	30	29	41	52
Obligor level	73	44	34	2	3	1
Obligor level by product type	15	9	9	1	1	4
Single exposure level	44	27	27	38	54	43
Other	2	1	0	0	0	0
Total	166	100	100	70	100	100

72. Figure 15 shows the level of PD assignment across all exposure classes. Across all exposure classes, PDs are most often assigned at obligor level and obligor level by product type (68% in terms of PD models and 62% in terms of exposures covered). In the exposure classes ‘corporates’ and ‘institutions’, PDs are assigned only at obligor level. For retail exposures secured by immovable property non-SME, the split between lower level (single exposure or facility) and obligor level (or obligor level by product type) is quite balanced, whereas for the other retail exposure classes, the PD assignment is most often at obligor level (or obligor level by product type) (between 63% and 88% of PD models, depending on the exposure class, and between 70% and 90% in terms of retail exposure values).

Figure 15: Level of PD assignment, by COREP exposure class

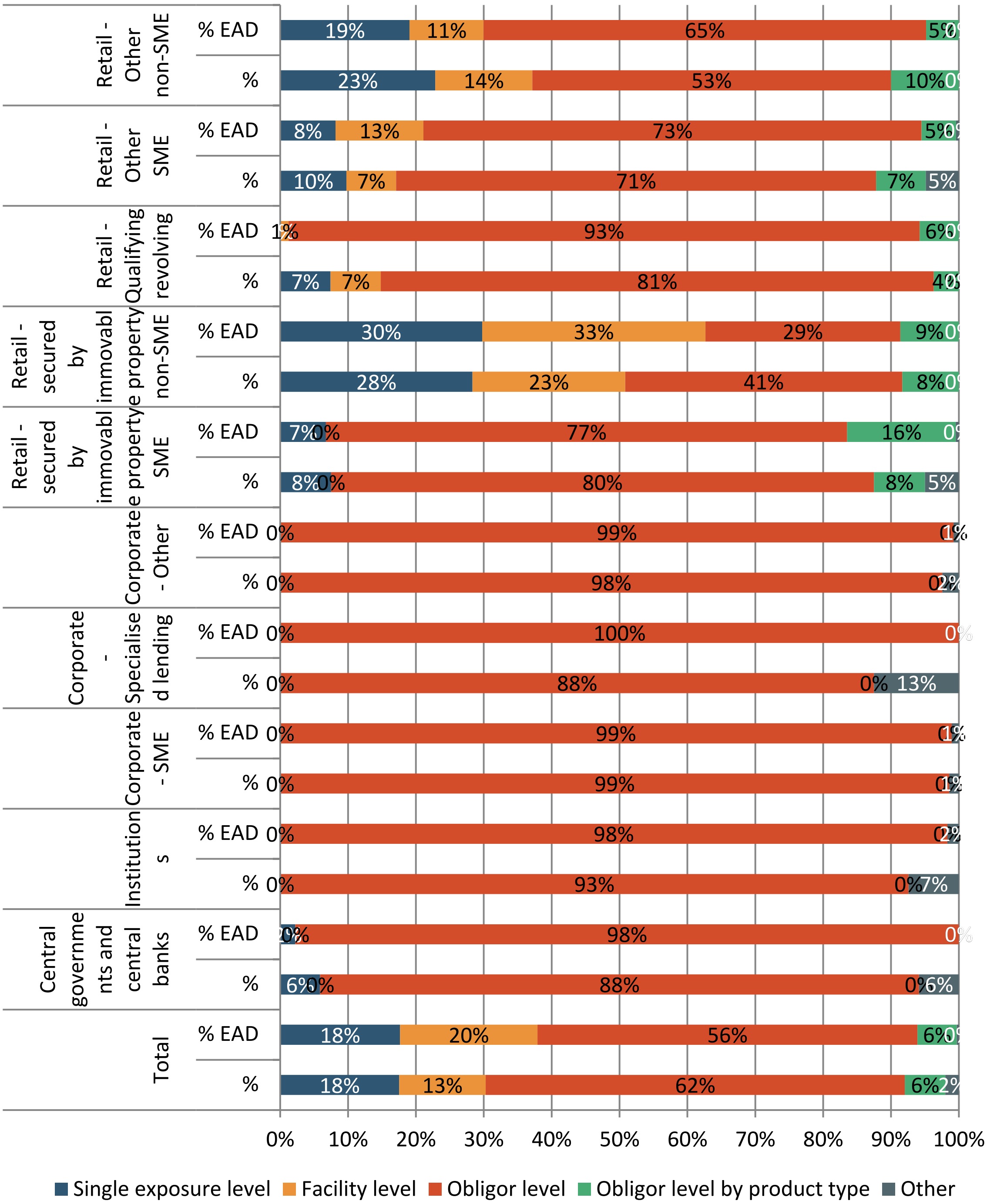


Table 19: Average DR and PD estimate for different levels of PD assignment, retail exposures only

		Level of PD assignment											
		Facility level			Obligor level			Obligor level by product type			Single-exposure level		
		No.	%	% EAD	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD
All retail exposures	**DR**	25	2.12	1.69	63	2.57	1.68	13	1.33	1.55	40	2.51	1.14
	PD	27	2.04	1.68	63	2.94	1.82	13	1.39	1.36	40	2.37	1.26

		Level of PD assignment											
Retail — exposures secured by immovable property non-SME	**DR**	21	1.75	1.56	44	2.25	1.32	8	0.90	1.39	30	2.53	1.14
	PD	23	1.63	1.56	44	2.41	1.45	8	0.92	1.08	30	2.33	1.24
Retail — qualifying revolving and other non-SME	**DR**	11	2.47	2.91	46	2.96	1.73	8	1.57	1.79	17	2.79	1.41
	PD	11	2.71	3.09	46	3.53	1.93	8	1.66	2.05	17	2.86	1.49

73. Table 19 shows the average observed DRs and average final PD estimates for retail exposures along the different levels of PD assignment. It should be noted that that the average observed DR of PD models where the PD is assigned at facility level (2.12) is lower than when the PD is assigned at obligor level (2.57), but they are similar when comparing the PD assignment at single-exposure level (2.51) with that at obligor level (2.57). In addition, the DR at single-exposure level is higher than the DR at obligor level when only retail exposures secured by non-SME are considered. It should be noted that figures are not at grades or pools level but at the portfolio level, and therefore subject to portfolio composition. A Kolmogorov-Schmirnov test for difference in distribution between the facility assignments (facility or single-exposure level) and obligor level (obligor level or obligor level by product type) did not[19] show a significant difference. Therefore, it is not possible to establish statistical evidence that PD assignments at facility level lead to a bias vis-à-vis models where PD estimates are assigned at obligor level.

4.4 Rating philosophy

74. To assess how possible RWA variability stemming from different rating and calibration philosophies could be addressed, several questions were included in the survey.

Table 20: How would the rating assignment process capture changes in the economic conditions? By COREP exposure class

	Fully sensitive	Highly sensitive	Neutral	Low sensitive	Not sensitive	Not known	Total
Total	8	63	72	83	7	11	244
%	3	26	30	34	3	5	100
% EAD	7	28	28	28	6	4	100
Central governments and central banks	1	5	3	7	1	0	17
%	6	29	18	41	6	0	100
% EAD	31	40	22	7	0	0	100
Institutions	1	6	7	8	3	1	26

[19] The test was performed for all subsamples listed in the three columns of Table 19, i.e. for retail exposures, for retail secured by immovable property non-SME and for retail exposures secured by qualifying revolving and other retail, but none of the tests showed statistical significance.

	Fully sensitive	Highly sensitive	Neutral	Low sensitive	Not sensitive	Not known	Total
%	4	23	27	31	12	4	100
% EAD	8	22	39	29	3	0	100
Corporate — SME	4	11	27	24	0	2	68
%	6	16	40	35	0	3	100
% EAD	7	14	39	40	0	0	100
Corporate — specialised lending	0	3	2	2	1	0	8
%	0	38	25	25	13	0	100
% EAD	0	22	37	41	0	0	100
Corporate — other	4	19	26	28	1	2	80
%	5	24	33	35	1	3	100
% EAD	5	17	44	35	0	0	100
Retail — secured by immovable property SME	4	10	9	13	0	4	40
%	10	25	23	33	0	10	100
% EAD	10	40	20	14	0	15	100
Retail — secured by immovable property non-SME	5	30	35	37	3	6	116
%	4	26	30	32	3	5	100
% EAD	5	32	21	27	9	6	100
Retail — qualifying revolving	3	7	7	8	0	2	27
%	11	26	26	30	0	7	100
% EAD	15	56	11	14	0	4	100
Retail — other SME	4	10	10	14	0	3	41
%	10	24	24	34	0	7	100
% EAD	10	36	22	27	0	5	100
Retail — other non-SME	4	23	18	18	1	5	69
%	6	33	26	26	1	7	100
% EAD	7	45	23	13	6	5	100
Other	1	2	4	0	0	0	7
%	14	29	57	0	0	0	100
% EAD	40	26	33	0	0	0	100

75. Taking an overall look to the figures in Table 20, it can be seen that:

- for approximately 3% of the models, the rating assignment process is described as fully sensitive to economic conditions;
- for approximately 26% of the models, the rating assignment process is described as highly sensitive to economic conditions;
- for approximately 33% of the models, the rating assignment process is described as low sensitive to economic conditions;

- for approximately 29% of the models, the rating assignment process is described as neutral sensitive to economic conditions;
- for approximately 3% of the models, the rating assignment process is described as not sensitive to economic conditions;
- for approximately 5% of the models, the rating assignment process sensitiveness to economic conditions is not known.

76. According to the comments provided, the option 'neutral' from the drop-down menu has mostly been understood as 'medium sensitive' or 'somewhat sensitive'. This being the case, these results indicate that, for over 70% of models, institutions consider that their models do not exhibit a significant sensitivity towards the economic cycle.

77. Institutions have also been asked to provide a description of the rating philosophy of the model under consideration in an open manner (i.e. no drop-down menu was provided). All responses to this question have been thoroughly analysed, and re-classified, according to whether or not the answer is referring to the philosophy of the ranking part of the model (rating philosophy), to the philosophy of the calibration (calibration philosophy), or both. For some answers, however, it was not possible to assess whether the description relates to the ranking part or the calibration part.

78. First, it can be seen that many different understandings of what the rating philosophy is coexist among the institutions. Many answers described the philosophy underlying either the ranking part of the models (30%) or the calibrations (19%), whereas 51% of the answers described the philosophy underlying both parts of the model as a whole (see Table 21). In 40% of the answers, it was not mentioned if they were referring to the ranking method, to the calibration or to both. Therefore, it can be concluded that there is no common interpretation of what the rating philosophy is.

Table 21: Descriptions related to ranking method, calibration method or both

	No.	%
Ranking method	45	30
Calibration method	29	19
Ranking + calibration method	76	51
N/a	102	—
Total	252	100

79. Secondly, for those cases in which either the ranking method or the ranking plus calibration method is described, the answers are summarised in Table 22. It can be seen that the majority of the philosophies underlying the ranking part of the PD models (rating philosophy) have a predominant point in time (PIT) component (PIT + HYBRID PIT = 58% approximately)[20].

[20] Note that for the remaining 131 answers no description of the rating philosophy was provided; therefore, the percentages have been computed with respect to 121.

Table 22: PIT-TTC description of the rating philosophy

		TTC		HYBRID-TTC		HYBRID		HYBRID-PIT		PIT		N/a	
	TOTAL	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Ranking method	45	14	31	6	13	8	18	1	2	10	22	6	13
Ranking + calibration method	76	2	3	0	0	10	13	5	7	54	71	5	7
Total	121	16	13	6	5	18	15	6	5	64	53	11	9

80.On the other hand, the majority of the methods underlying the calibration part of the PD models have a higher TTC component (TTC + HYBRID TTC = 70% approximately)[21] (see results in Table 23). It has to be highlighted that 47 answers shared a PIT rating philosophy and a TTC calibration philosophy. Some of the institutions described this as a hybrid approach, which again raises the need to clarify the notion of rating philosophy.

Table 23: PIT-TTC description of the calibration philosophy

		TTC + FORECAST		TTC		HYBRID-TTC		HYBRID		HYBRID-PIT		PIT		N/a	
	TOTAL	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Ranking + calibration method	76	0	0	57	75	4	5	1	1	0	0	8	11	6	8
Calibration method	29	5	17	13	45	0	0	6	21	3	10	2	7	0	0
Total	105	5	5	70	67	4	4	7	7	3	3	10	10	6	6

4.5 Data requirements for observed DRs

81.To ensure that all obligors in the scope of application of a PD model are assigned a PD, the GLs specify (in paragraphs 53-54) that each and every natural or legal person or IRB exposure is rated by the institution, with the model approved to be used on and appropriate to the single original obligor, including where there is unfunded credit protection as referred to in Article 161(3) of the CRR[22]. This requirement ensures that all obligors or exposures within the

[21] Note that for most of the remaining 147 answers no description of the calibration philosophy was provided; therefore, the percentages have been computed with respect to 105.

[22] Related to that, the CP on the GLs specify (in paragraph 49) that the denominator of the one-year DR should refer to all obligors assigned to a rating grade or pool at the beginning of the observation period, taking over-rides into account, but excluding any substitution effects due to credit risk mitigation, as well as any *ex post* conservative adjustments. The latter provision has been included, because it was deemed necessary to clarify in the GLs that obligors should be included in the calculation of the one-year DR of the grade they are assigned to, before taking into account any substitution effects due to credit risk mitigation. This means that the pool or grade assignment of the obligor should be based on the obligor's creditworthiness, and not that of the protection provider, since the latter would only protect against potential losses in case of default of the obligor.

scope of application of the rating system have a rating in line with the applicable model, and that potential existence of any guarantees does not change that requirement. The GLs further specify in the section on data requirements for PD calibration (in paragraph 71) that exclusion of observations from the DR calculation should be performed only (i) where an obligor did not default in accordance with the definition of default specified in Article 178 of the CRR, or (ii) where an obligor has been wrongly assigned to the considered rating model.

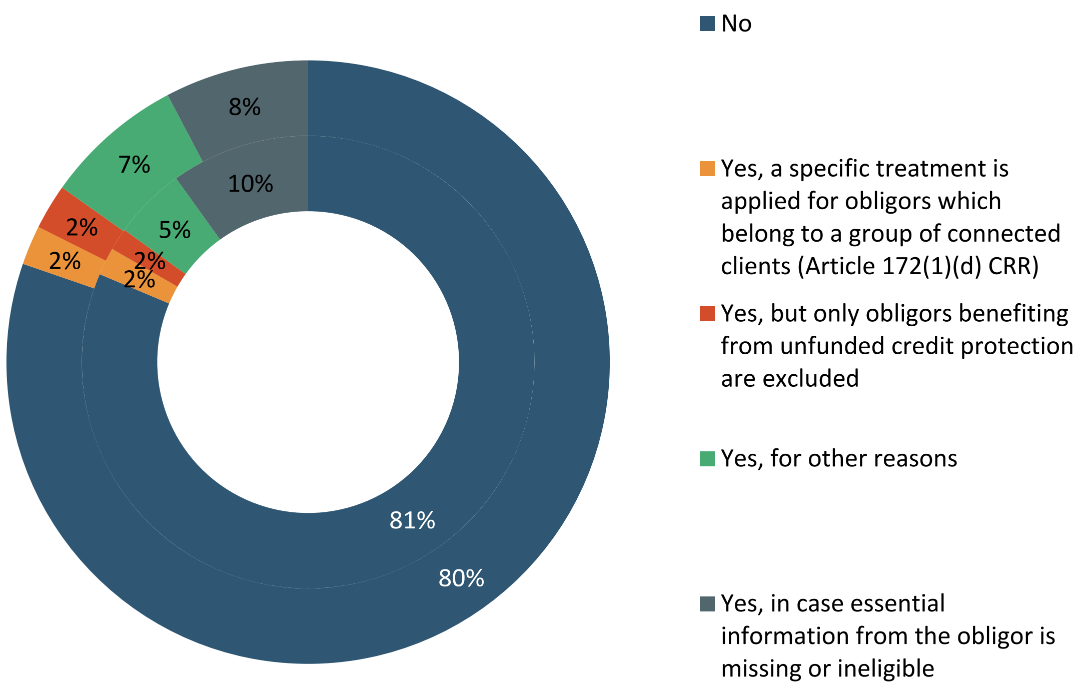
82. To enquire about current practices and obtain information on whether or not there are justifications to exclude obligors from the rating assignment, a question was included in the IRB survey on whether or not there are any obligors or exposures that are in the scope of application but which do not receive an individual PD estimation.

83. From the responses shown in Figure 16 it can be seen that all obligors are assigned a rating in around 80% of the PD models, whereas for around 10% of PD models it is mentioned that a specific treatment is envisaged for obligors for which essential information from the obligor is missing or ineligible. In most cases where the mentioned reason is missing or ineligible essential information from the obligor, this refers to cases where balance sheet information is missing, or to relatively new clients. Some respondents mentioned that certain obligors with missing, insufficient or ineligible information are excluded from the calculation of the one-year DR, but that those obligors are treated in the standardised approach (SA). Some others mention that those obligors are assigned to the worst living grade of the discrete rating scale, to the obligor grade of the protection provider (if any), or to a predefined rating grade for unrated clients.

84. Some other respondents mentioned that a specific treatment is applied for obligors that belong to a group of connected clients (in line with the requirement in Article 172(1)(d) of the CRR), or where the obligor benefits from unfunded credit protection. Some respondents mention that an obligor can only remain unrated in exceptional circumstances. Such obligors include VIP customers, customers whose age is lower or equal to 18 years or above 100 years, inactive customers, customers under guardianship with or without removal of legal capacity, staff of the institution (bank), obligors without a current account, residents outside the euro zone, and legally incapacitated adults.

85. It should be noted that an individual assessment of these practices is needed, but that several of the above practices are not compliant with the CRR and/or with the requirements in the GLs.

Figure 16: Are there any obligors who are in the scope of application that do not receive an individual PD estimation?



Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where all PD models are weighted by their corresponding exposure value.

4.6 Calculation of the one-year DR

86. The GLs contain (in paragraphs 73-77) specific guidance on which obligors should be included in the numerator and denominator of the one-year DR. In particular, it is specified that obligors who migrated to a different rating grade, pool or rating model, rating system, or approach to calculation of capital requirements, should also be included in the denominator and numerator. Obligors whose ratings are based on missing or partly missing information, or ratings based on outdated information, should also be included.

87. Table 24 gives an overview on current practices with respect to the reasons for excluding obligors or adjusting the observed average DR. It should be noted that the most common reason for excluding observations relates to IT errors (mentioned in around 21% of PD models), whereas the presence of short-term, new or terminated contracts (15% of PD models) and the exclusion of obligors without payment obligation (15% of PD models), for instance when no amount has been withdrawn) are also reported often. It should be mentioned that for all the above reasons, institutions almost always reported that they

excluded observations from the sample, rather than applying adjustments, which was only mentioned in few exceptional cases.

Table 24: What are the reasons for applying adjustments or data exclusions to overcome issues in the calculation of the observed average DR?

	N	%	% EAD
Short-term, new or terminated contracts	209	15	16
IT errors	209	21	15
Exposures without payment obligation	209	14	9
Diminished representativeness of older exposures or exposures for which certain risk drivers are not available	209	6	7
Exposures that do not meet the definition of default or materiality threshold at the beginning of the observation period are excluded	209	11	13
Loans for which no amount has been withdrawn or loans of non-active clients are excluded	209	1	1
Migrated obligors or obligors of a connected client that is assigned to a different rating model are excluded	209	5	6
Diverse other reasons	209	7	4

Note: the respondents could select several of the above answers.

88. Consequently, the aspects specified in the GLs (in paragraphs 73-7 and 80) will entail some change in practice for institutions. In particular for the treatment of short-term, new or terminated contracts, the GLs do not allow any data exclusions, but rather prescribe that the institution should analyse the potential bias, choose between overlapping and non-overlapping windows, and apply an economic adjustment and appropriate MoC if necessary. The provision to also include migrated obligors will entail a change in policy for those 5% of PD models.

89. Furthermore, a credit obligation refers to any amount of principal, interest and fees as well as to any off-balance-sheet items including guarantees (as prescribed in paragraph 73(a) of the GLs). Excluding obligors that have not withdrawn any amount (as was mentioned by some respondents) is therefore not in line with the GLs.

90. The GLs prescribe (in paragraph 78) that institutions evaluate one-year DRs at least quarterly, to monitor the appropriateness of PD estimates. On this aspect, the following policy options have been considered:

(a) the one-year DR should be calculated at least at a monthly frequency for all retail exposures, and at least quarterly for all other exposures:

- ✓ pro: ensures up-to-date information for the purpose of internal risk management, and allows identification of changes in the trends in a timely manner;
- ✓ con: low-default portfolios probably contain no new information;
- ✓ con: could be overly burdensome;

(b) the one-year DR should be evaluated at least quarterly for all exposures:

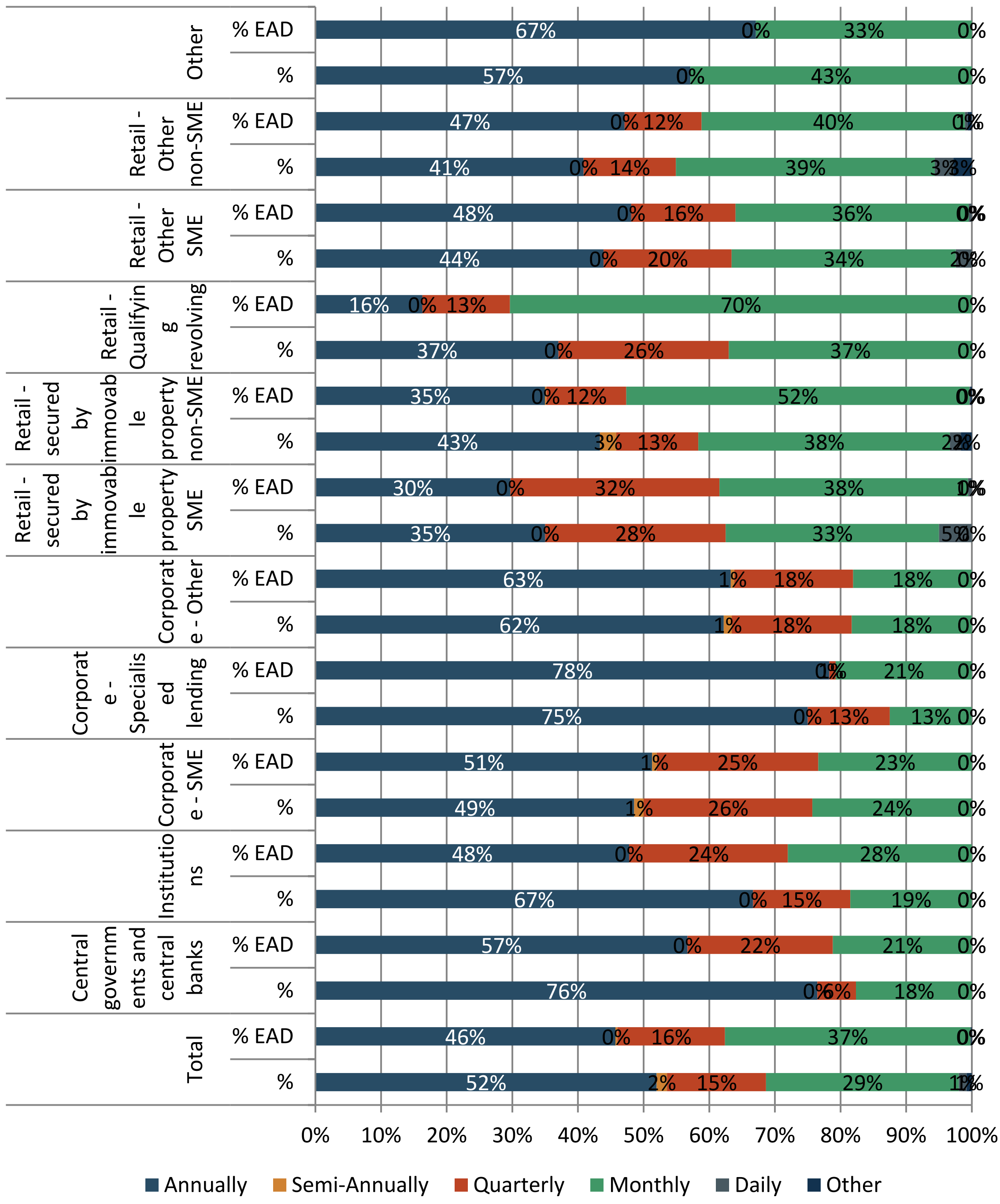
- ✓ pro: less burdensome but at the same time ensures minimum frequency of monitoring, allowing identification of any seasonal effects;
- ✓ con: obligors that default in less than three months after credit origination could be omitted in the DR;

(c) the one-year DR should be calculated at least quarterly for all retail exposures, and at least semi-annually for all other exposures:

- ✓ con: obligors that default in less than half a year (for non-retail) after credit origination could be omitted in the DR.

91. Option (b) has been chosen in the GLs as the option that balances the burden on the institutions and ensures a base for comparability of analysis and reporting of DRs. The results of the IRB survey (Figure 17) show that, in 45% of all PD models, the one-year DR is calculated at least quarterly (i.e. quarterly, monthly or daily). However, for retail exposures secured by immovable property SME and non-SME, these shares are higher (respectively 65% and 53%), and this also holds for qualifying revolving retail exposures (63%) and other retail exposures (around 56%). Based on the fact that a quarterly frequency or higher is already quite common, this requirement has been maintained in the final GLs. Nevertheless, it should be acknowledged that this will entail a change in practice for, on average, around 54% of PD models.

Figure 17: Frequency at which one-year DRs are calculated, by COREP exposure class

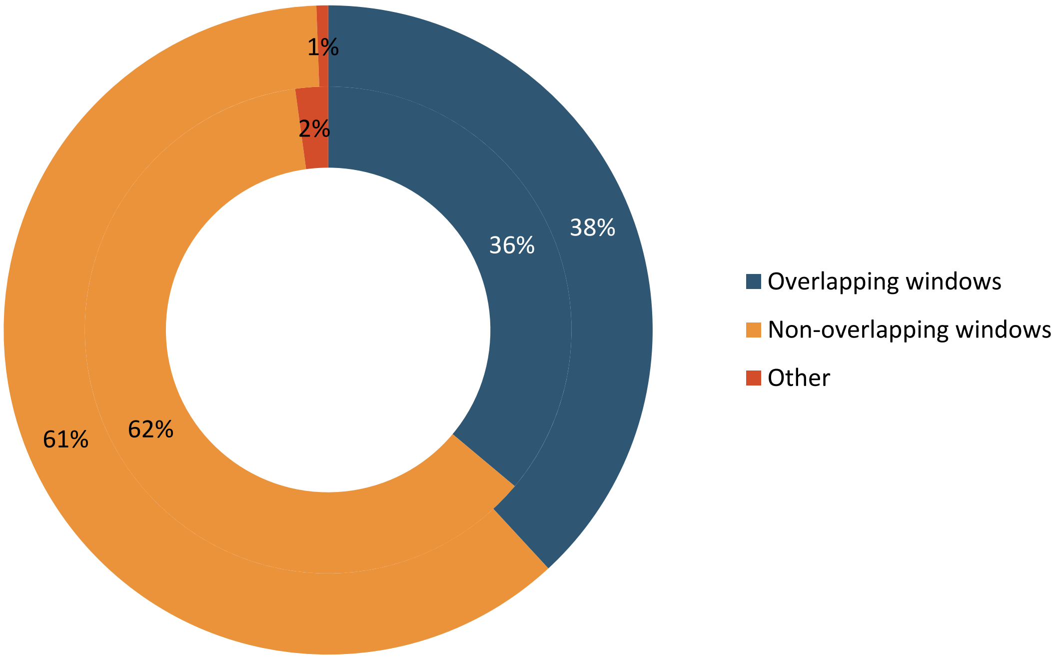


4.7 Calculation of the observed average DR

92. With respect to the calculation of the observed average DR, the GLs allow calculation using both overlapping and non-overlapping windows, but require (in paragraph 80) that this choice should be based on a documented analysis reflecting certain aspects. To obtain a view on common practices across institutions, they were asked to indicate whether they use overlapping or non-overlapping windows for the PD models under consideration, and

whether or not a specific analysis is undertaken to justify this choice. From the responses shown in Figure 18 it is evident that non-overlapping windows are the most common approach across PD models, i.e. the split between non-overlapping windows and overlapping windows is roughly 60:40.

Figure 18: Use of overlapping versus non-overlapping windows in calculation of observed average DR



Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where PD models are weighted by their corresponding exposure value.

93. In most PD models (85%), no specific analysis was performed to justify this choice, although this percentage is lower (70%) in those models where the calculation is performed based on overlapping windows (see Table 25). Therefore, the requirement (in paragraph 80 of the GLs) to analyse and document the considerations for choosing one or the other approach will entail a change in practice in roughly 85% of PD models.

Table 25: Was any specific analysis undertaken to justify the choice of overlapping versus non-overlapping windows for the calculation of the observed average DR?

	All PD models			PD models with non-overlapping windows			PD models with overlapping windows		
	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD
No	192	85	81	133	94	95	58	71	60
Yes	35	15	19	9	6	5	24	29	40
Total	227	100	100	142	100	100	82	100	100

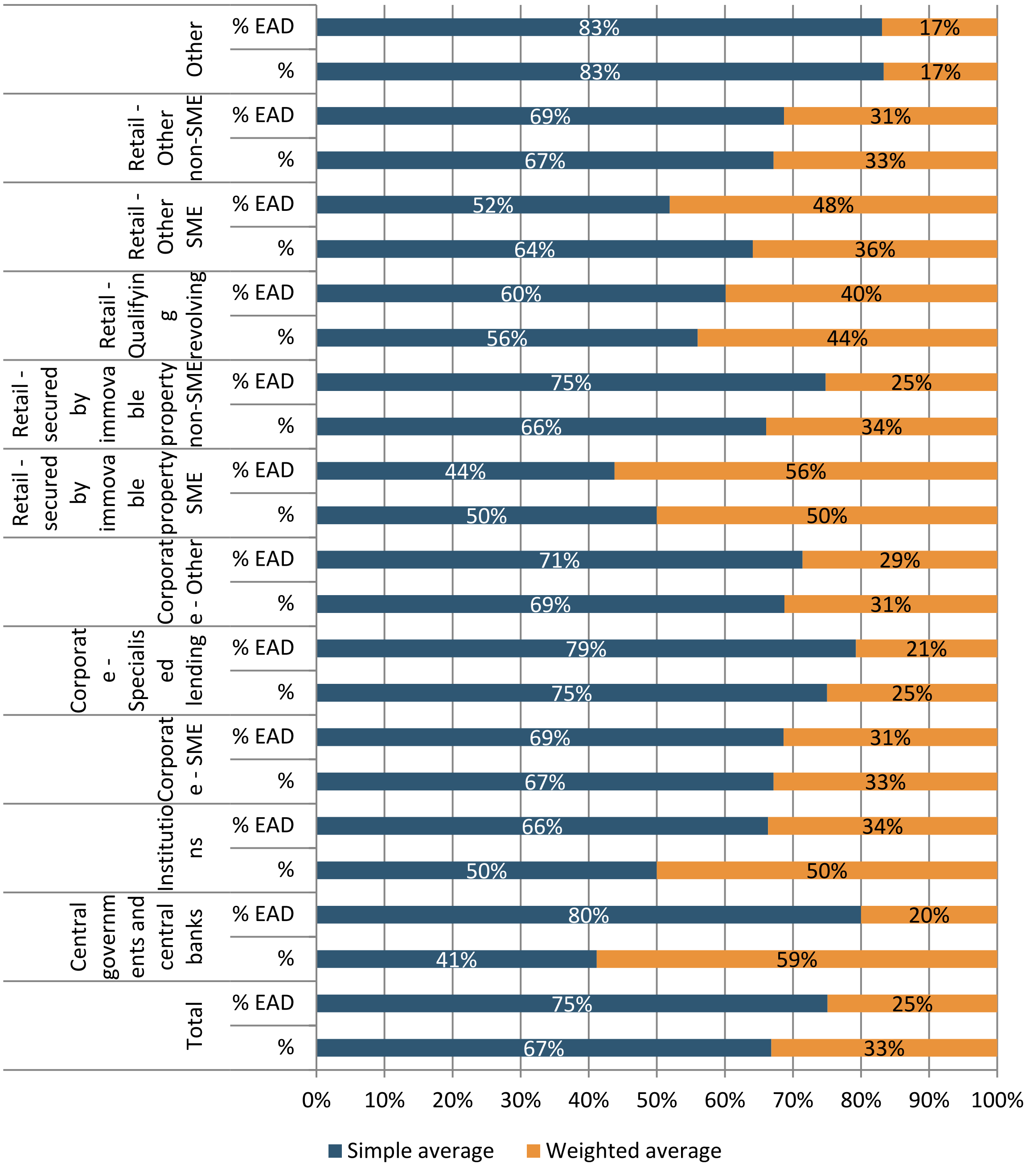
94. From Table 26 it can be seen that the share of short-term or terminated contracts is not significant in the majority of PD models (91%), although this share is lower (86%) in models with overlapping windows and higher in models with non-overlapping windows (94%). This lends support to the hypothesis that the presence of a short-term or terminated contract could be one of the drivers for choosing to calculate the observed average DR using overlapping windows. For 16 of 19 PD models for which a significant share of short-term or terminated contracts was reported, the share of those contracts was specified. The average share is around 11.5%, but the share ranges between 3% and 32%.

Table 26: Is there a significant share of short-term or terminated contracts within the period over which the observed average DR is calculated?

	All PD models			**PD models with non-overlapping windows**			**PD models with overlapping windows**		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**	**No.**	**%**	**% EAD**
No	202	91	92	128	94	94	69	86	88
Yes	19	9	8	8	6	6	11	14	12
Total	221	100	100	136	100	100	80	100	100

95. With respect to the calculation of the observed average DR, the GLs specify (in paragraph 81) that institutions should calculate the observed average DRs as the arithmetic average of all one-year DRs, i.e. a simple average should be computed instead of a weighted average. With respect to the weighting scheme, it appears that for around 67% of PD models (75% of exposure values), a simple average is used to compute the long-run average, whereas a weighted average is computed in about 33% of PD models (25% of exposure values). Some small differences can be observed across COREP exposure classes, as shown in Figure 19. In particular, the share of models using weighted averages to calculate the long-run average DR is slightly higher (around 37% on average) for retail exposures than for exposures to corporates (around 32% on average). This is probably related to the fact that the CRR mentions, for retail exposures (see Article 180(2)(e) of the CRR), that an institution does not need to give equal importance to historic data if more recent data are a better predictor of loss rates.

Figure 19: What method (simple average or weighted average) is used to determine the long-run average DR? By COREP exposure class



96. For those models where a weighted average is used, several respondents mentioned how these weights had been determined. In around 74% of those cases, it was mentioned that the weight is determined by the number of observations in each one-year window. In around 25% of cases, a higher weight is given to more recent observations. For the latter, the most common reason mentioned is that more recent observations reflect in a more adequate way the credit policy of the institution, or because of improved processes and stricter credit policies (i.e. the restricted availability of detailed information of the obligors in more distant

time periods). The determination of these weights is most often based on expert judgement. For one model, it was mentioned that an appropriate weight is assigned to downturn years, in line with specific guidance given by the competent authority.

4.8 Long-run average DR

97. Section 5.3.4. of the GLs describes provisions for estimating the long-run average DR.

98. Table 27 shows that the average length of the historical observation period from internal data is 9.33 years, but there is a significant variation across exposure classes. Figures 20, 21 and 22 visualise the start and end dates of the reported historical observation period from internal data for PD models applied to selected COREP exposure classes.

99. In these figures, wide variation can be observed among institutions, with respect not only to duration but also to the start and end date. However, such differences may stem from the availability of data and may be related to the variability of observed DRs, the existence, lack or prevalence of one-year DRs relating to bad years, and to changes in the economic, legal or business environment. None of the institutions uses non-consecutive periods.

100. It can also be seen from Table 27 that the length of the historical observation period is shorter than five years for some models, which would contradict the CRR requirements in Article180(1)(h) and 180(2)(e) of the CRR. Based on the comments, it became clear that several of these institutions specified the length of the development sample (for risk differentiation) instead of the length of the historical observation period. Other institutions mentioned that that the model has been estimated on that (shorter than five-year) historical observation period, but that a re-estimation of the model on the full historical observation period leads to the same results.

101. It should be emphasised, however, that explanations justifying the length of the historical observation period shorter than five years are not in line with the CRR.

Table 27: Length of the historical observation period for PD estimation (internal data), by exposure class

	N	mean (%)	mean (% EAD)	min	p10	p50	p90	max
Total	222	8.72	9.75	0.83	4.92	8.00	14.01	21.85
Central governments and central banks	10	7.56	10.60	5.00	5.25	5.75	12.92	12.92
Institutions	18	7.50	8.93	4.00	5.00	6.67	12.92	12.92
Corporate — SME	64	8.84	9.33	1.50	5.00	8.00	13.92	17.51
Corporate — specialised lending	6	7.63	8.09	1.50	1.50	6.13	15.01	15.01
Corporate — other	65	8.85	8.97	1.50	5.00	8.00	13.92	19.01
Retail — secured by immovable property SME	38	8.69	8.66	3.50	4.84	8.96	13.92	17.51
Retail — secured by immovable property non-SME	117	8.90	10.39	0.83	4.00	8.92	15.01	21.85
Retail — qualifying revolving	26	6.27	6.77	3.02	3.50	5.00	10.01	12.35

	N	mean (%)	mean (% EAD)	min	p10	p50	p90	max
Retail — other SME	39	8.43	8.59	3.50	4.84	8.92	13.01	17.51
Retail — other non-SME	70	7.68	7.66	2.00	4.00	6.00	12.18	20.01

Figure 20: Start and end date of the historical observation period by PD model (internal data, retail mortgages — non-SME)

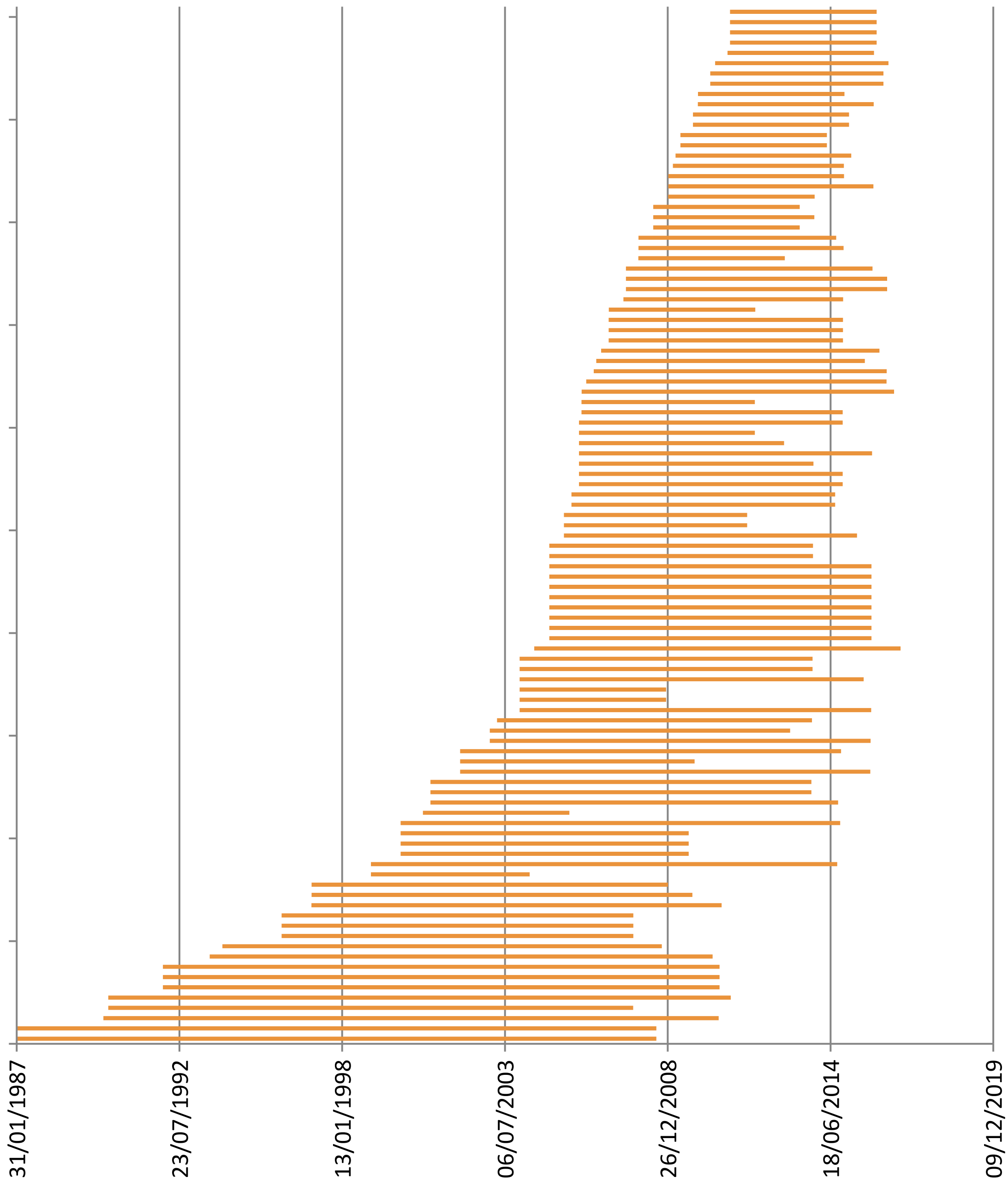


Figure 21: Start and end date of the historical observation period by PD model (internal data, corporate — SME)

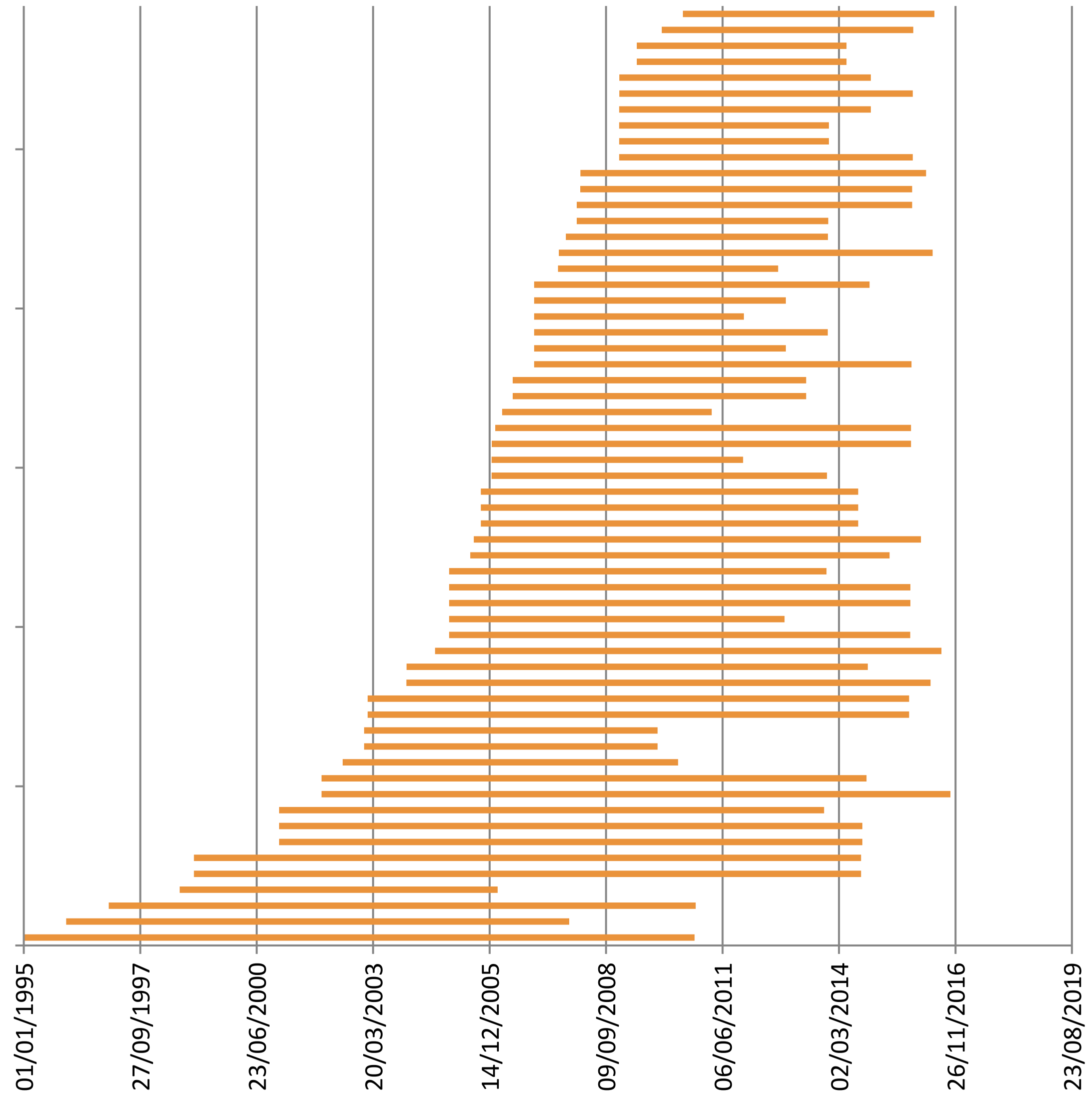
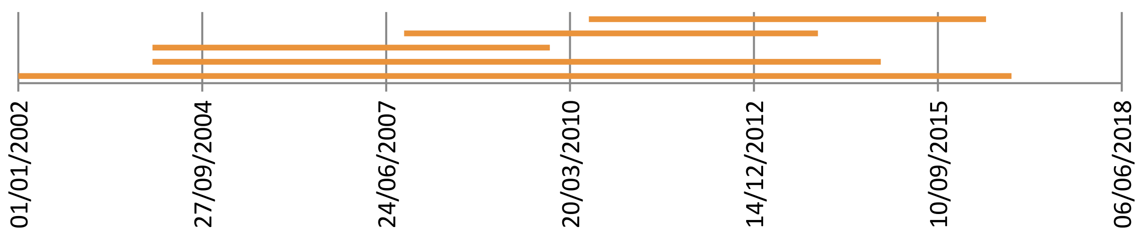


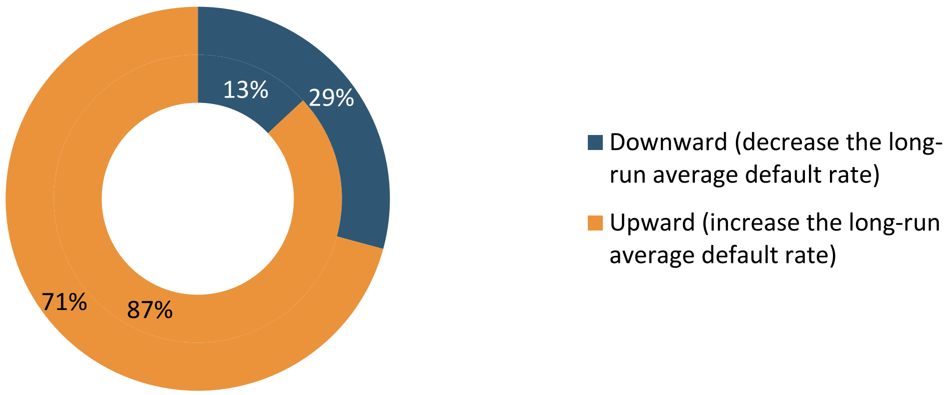
Figure 22: Start and end date of the historical observation period by PD model (internal data, corporate — specialised lending)



102. Figure 5 shows for how many models (%) and how many exposure values (% EAD) the institutions apply adjustments to the observed average DR for the purpose of PD estimation, where such adjustments are applied in around half of the models (exposures). Figure 23

further shows that the direction of the adjustment is upward, i.e. conservative, in 87% of PD models (71% of exposure values covered), and downward in 13% of models (29% of exposures), corresponding to only 12 models in the sample.

Figure 23: If you apply adjustments to the observed average DR, what is the direction of the adjustment?



Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where all PD models are weighted by their corresponding exposure value.

103. Table 10 showed the distribution of reasons for applying (upward and downward) adjustments to the observed average DR. When analysing the reasons for applying those downward adjustments, the most common reason (applied in five of these 12 models, covering 41% of models or 31% of exposures) is that the observed average DR is not representative of the long-run average DR (i.e. it is not composed of an appropriate mix of good and bad years), or the observed average DR is not representative of the default behaviour of the current portfolio. In three models, it was mentioned that external data have been used, which have been adjusted. However, it is necessary to exercise caution when drawing conclusions from a small sample size (12 models). In addition, it cannot be ruled out that several respondents took a literal reading of the question[23], such that institutions that apply downward adjustments to the long-run average DR responded 'no' to this question.

104. To ensure harmonisation in the determination of the historical observation period, and to ensure that the historical observation period is representative of the likely range of variability of DRs, the GLs specify how to assess the representativeness of the likely range of variability of DRs (in paragraph 83).

105. The GLs further specify that when the historical observation period is representative of the likely range of variability of DRs, the long-run average DR should be computed as the observed average of the one-year DRs in that period. Where no or insufficient bad years are included, the average of the observed one-year DRs should be adjusted. Where bad years are over-represented, the average of the observed one-year DRs may be adjusted, if institutions

[23] Do you apply any adjustments to the observed average of DRs for the purpose of PD estimation?

can demonstrate a significant correlation between economic indicators and the available one-year DRs. Finally, a benchmark is included in the GLs (in paragraph 86), to avoid unjustified downward adjustments.

106. In relation to the over-representation of downturn years in the historical observation period, institutions were asked whether or not they exclude some of the one-year DRs from the historical observation period, i.e. whether or not the length of the period for which one-year DRs is available is different from the length of the historical observation period. The responses show that in 60% of reported PD models, all available periods for which one-year DRs are available are included in the historical observation period, whereas some periods are excluded in 40% of the PD models.

107. Many respondents explained these differences by mentioning in particular that only certain periods are included, because the aim is to cover exactly one economic cycle. Some respondents mentioned that older data are excluded because they are no longer representative, but some other respondents also mentioned that the most recent data have not been included because this would decrease the weight of the downturn periods. Some mentioned that in older periods internal data were available, but that these data are not granular enough (e.g. not available at segment level), and therefore that they include these data after linking them with pooled data. Other respondents mentioned that only the most recent data are included because these allow better predictions of loss rates.

108. The IRB survey further verified whether or not inclusion of years/periods for which no one-year DRs are available in the historical observation period is common practice. Such a situation may arise in particular in jurisdictions where no recent crisis has been experienced, such that the most recent (available) DRs are not fully representative of the likely range of variability of one-year DRs. Alternatively, institutions may include one-year DRs from older periods, because only DRs from recent crisis years are available, and hence older data are used to cover a full economic cycle. The responses show that the historical observation period spans years for which one-year DRs are not available in only 20% of PD models.

109. These aspects have been taken into account in the GLs in the section on the long-run average DR (section 5.3.4.), where there are criteria and conditions for assessing whether or not the historical observation period is representative of the likely range of variability. In particular, it is specified (i) that where no or insufficient bad years are included in the historical observation period, the average of observed one-year DRs should be adjusted to estimate a long-run average DR and (ii) that where bad years are over-represented in the historical observation period, the average of observed one-year DRs may be adjusted to estimate a long-run average DR if institutions can demonstrate the significance of the correlation between economic indicators and the available one-year DRs. In addition, a benchmark is included in the GLs (in paragraph 86), i.e. the maximum of the observed average DR of the most recent five years, and the observed average DR of all available one-year DRs, to include a backstop for unjustified downward adjustments of the PD estimates.

4.9 Calibration to the long-run average DR

110. One of the goals of the survey was to analyse the extent to which institutions apply portfolio calibration (types 2 and 4) or grade calibration (type 1 and 3), whether or not this involves an explicit function or methodology, and whether or not the PD is the long-run average rate of that pool or grade. The explanation of the various calibration types, provided in the instructions for the survey, is included here again for the convenience of the reader.

Type 1: Implicit calibration in accordance with Article 180(1)(a) of the CRR at grade or pool level. The PD estimate per grade or pool is achieved by calculating the long-run average DR of the relevant grade or pool. Therefore, the according grade or pool may have to be reconstructed if a newly relevant risk driver has been incorporated into the model. The calibration sample equals the sample where the long-run average DR is calculated.

Type 2: Explicit calibration in accordance with Article 169(3) of the CRR at portfolio level. The rating model produces individual PDs per obligor or facility ('raw PDs'). The underlying definition of default may deviate from the regulatory notion of default. The raw PDs are adjusted such that the average of the raw PDs is equal to the long-run average DR (usually on the level of the whole portfolio, or of a calibration segment where relevant). The calibration sample equals the sample on which the raw PDs are assessed for this purpose.

Type 3: Explicit calibration in accordance with Article 180(1)(a) of the CRR at grade or pool level, based on individual estimates (which may also be scores) in accordance with Article 169(3) of the CRR, and to a predefined master scale. The PD estimate is achieved by determining intervals of estimates (or score) values such that the long-run average DR of obligors or facilities carrying these values is equal to a predefined DR on a master scale (which will then be the PD estimate for obligors with score values within the interval under consideration). The calibration sample equals the sample on which the individual estimates are assessed.

Type 4: Explicit calibration in accordance with Article 180(1)(g) of the CRR at portfolio level, based on averages of individual estimates in accordance with Article 169(3) of the CRR, and to a predefined master scale. PD estimates are achieved by first adjusting the individual estimates such that the average of the individual estimates equals the long-run average DR at portfolio level, and then averaging the individual estimates that fall into a predefined interval on the master scale. However, this type should also be chosen if the shifted individual estimates are sorted into predefined PD intervals on the master scale. The calibration sample equals the sample on which the individual estimates are assessed.

Type 5: Explicit calibration in accordance with Article 180(2)(b) of the CRR at portfolio level. PD estimates are derived from an estimate of total losses and appropriate estimates of LGD. These PD estimates are adjusted such that the average of these estimates equals the long-run average DR at portfolio level.

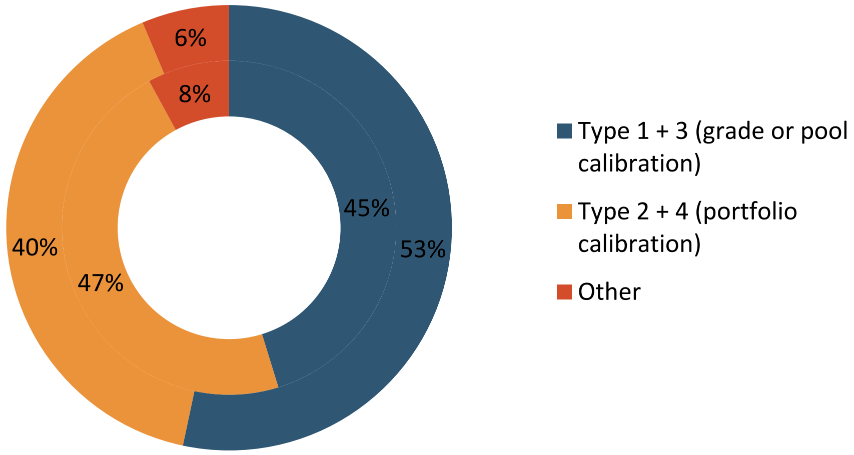
Type 6: Implicit calibration in accordance with Article 180(2)(b) of the CRR at portfolio level. PD estimates are derived from an estimate of total losses and appropriate estimates of LGD over the relevant observation period.

Table 28: Use of different calibration types, by COREP exposure class

	Type 1			Type 2			Type 3			Type 4			Other		
	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD
Total	67	27	28	61	24	24	47	19	25	57	23	16	20	8	6
Central governments and central banks	3	18	5	1	6	3	8	47	60	3	18	13	2	12	19
Institutions	4	15	26	3	11	14	6	22	15	9	33	26	5	19	19
Corporate — SME	13	19	25	23	33	30	7	10	4	22	31	26	5	7	16
Corporate — specialised lending	3	38	76	2	25	21	2	25	1	1	13	1	0	0	0
Corporate — other	17	21	28	20	24	20	11	13	8	27	33	28	7	9	17
Retail — secured by immovable property SME	6	15	10	16	40	47	5	13	22	12	30	18	1	3	4
Retail — secured by immovable property non-SME	30	25	29	35	29	31	19	16	24	24	20	13	12	10	2
Retail — qualifying revolving	5	19	39	8	30	24	3	11	7	10	37	25	1	4	6
Retail — other SME	6	15	16	15	37	31	6	15	33	13	32	17	1	2	3
Retail — other non-SME	21	30	37	17	24	22	9	13	19	20	28	19	4	6	3

111. From Table 28 it can be seen that the only calibration types chosen by institutions are (i) (implicit or explicit) calibration in accordance with Article 180(1)(a) of the CRR by grade or pool level (i.e. types 1 and 3) and (ii) (implicit or explicit) calibration in accordance with Article 169(3) of the CRR at portfolio level (i.e. types 2 and 4). The other types provided in the drop-down menu (i.e. types 5 and 6, calibration based on total losses (implicit or explicit) in accordance with Article 180(2)(b) of the CRR) have not been reported by institutions.

Figure 24: Grade versus portfolio calibration



112. Overall, type 1 calibration is used the most (in 27% of models), and is closely followed by type 2 (3 percentage points less), type 4 (23% of models), type 3 (19% of models), and other calibration types. The survey shows a balanced range of practices in terms of level of calibration. In terms of number of models, overall a slight majority calibrates to portfolio central tendency (118 PD models, representing 47% of all PD models), while the remainder calibrate by pool or grade (114 PD models, representing 45%) (see Figure 24). In terms of share of EAD, a slight majority calibrates by pool or grade (53%), while the remainder calibrate to portfolio central tendency (40%). Differentiating between retail and non-retail does not reveal significantly different results.

113. Calibration type usage of single-exposure classes such as central governments or retail secured by immovable property show more clear usage of grade calibration (with central governments) and portfolio calibration (with retail secured by immovable property). This may, however, be due to a low number of models analysed in these classes overall.

114. Regarding calibration types that were not covered by the given selection, the following were mentioned, among others:

- explicit calibration in accordance with Article 180(2)(a) of the CRR — grade or pool level (other institutions, however, claimed this to be type 1, and unfortunately the reference to Article 180(2)(a) of the CRR was missing in the type 1 description above);
- mapping of ECAI (eligible credit assessment institution) scale in accordance with Article 180(1)(f) of the CRR.

115. The GLs do not intend to restrict the various calibration types, but aim at clarifying the them by providing a list of the references included in the CRR (in paragraph 91). Furthermore, a definition of the term ‘calibration’ is included in the GLs in the definition sections (in paragraph 8), to (i) clarify the distinction from model development (calibration is

the process that leads to appropriate risk quantification) and (ii) highlight that calibration ensures that, for a calibration segment, PD estimates in a calibration sample correspond to the long-run average DR at the level relevant for the applied calibration method.

116. The IRB survey results allow an assessment of the shares of models where calibration is performed at portfolio level versus where calibration is performed at grade or pool level. In the following, if the term 'portfolio calibration' is used, it refers to a process where banks estimate one PD for each grade, with the objective (probably among other objectives) that the average PD of the portfolio equals the long-run average DR at portfolio level. To avoid misunderstandings, it should be noted that the objective of portfolio calibration and of grade calibration is to estimate one PD for each grade. Therefore the term 'portfolio calibration' refers to the process of how the PD estimates per grade are achieved, rather than the result of the calibration.

117. When the calibration of the current estimated average PD to the long-run average DR is performed at portfolio level (types 2 or 4), the obligors will migrate across grades when recalibrating. On the other hand, calibration to long-run average DR can also be checked and assured at rating-grade level, taking into account the grades over the historical observation period (types 1 or 3). Under this approach, and where this is combined with PIT rating assignments, rating migrations induced by economic changes are transmitted to the average portfolio PD, leading to cyclical capital requirements.

118. With respect to the level of calibration (grade or pool level, or at portfolio level), Table 29 shows (for the exposure class 'retail exposures secured by immovable property') that the adjustment from the observed average DR to the final PD estimate is higher when calibration is performed at grade or pool level (i.e. types 1 and 3) than when it is performed at portfolio level.

Table 29: Observed average DR and final PD estimate across calibration types (retail exposures secured by immovable property)

	Calibration type									
	Type 1 or 3			Type 2 or 4			Other			Total
	N	%	% EAD	N	%	% EAD	N	%	% EAD	N
Observed average DR	50	2.14	1.50	57	2.33	1.47	12	2.53	0.89	119
Average final PD	52	2.74	1.49	57	2.22	1.62	12	1.62	0.77	121
Difference (PD – observed average DR)	50	0.68	0.11	57	-0.11	0.14	12	-0.92	-0.13	119
Absolute difference if PD > DR	33	1.24	0.26	27	0.30	0.47	8	0.52	0.22	68
Relative difference if PD > DR	33	51.38	22.50	27	45.19	51.61	8	64.11	45.25	68
Absolute difference if PD < DR	13	0.56	0.34	25	0.59	0.32	4	3.80	3.95	42
Relative difference if PD < DR	13	29.23	25.77	25	15.36	17.08	4	64.39	62.48	42

119. To take account of these different practices with respect to calibration at portfolio level versus at grade or pool level, the GLs specify (in paragraph 92) that institutions should provide additional calibration tests at the level of the relevant calibration segment (which corresponds to the portfolio level if there is only one calibration segment) where case

calibration is performed at grade or pool level, or perform additional calibration tests at the level of the pool or grade where the calibration is performed at portfolio level.

120. For portfolio calibration (types 2 or 4), the number of time slices used (only one, or all points in time available) determines whether the calibration sample is comparable with the current portfolio in terms of obligor and transaction characteristics (usually only one point in time), or whether the calibration sample is representative of the likely range of variability (all points in time available). To prevent misunderstandings, ‘calibration sample’ here refers to the dataset on which the ranking or pooling method is applied to perform the calibration; this definition is also included in the GLs (in paragraph 8).

121. Using all time slices contained in the development sample refers to a situation where all time slices that underlie the long-run average default rate calculation, are used in the calibration. The calibration sample would then usually reflect the likely range of variability of DR contained in the development sample. Therefore, the calibration sample would be equal to the RDS used for the long-run average DR and the model development sample. Using this approach, the current average PD at portfolio level may significantly deviate from the long-run average DR at portfolio level, and this may lead to cyclical capital requirements, reflecting the variability observed at the various points in time covered by the calibration sample.

122. Using only one (the most recent) point in time for calibration would, on the other hand, ensure that the current average PD at portfolio level is close to the long-run average PD at portfolio level, and therefore that the calibration sample is most representative of the current portfolio. This ensures that the requirement in Article 179(1)(d) of the CRR (referring to comparability for the purpose of risk quantification) is met: ‘the calibration sample should be comparable to the current portfolio in terms of obligor and transaction characteristics’. This approach would lead to more stable capital requirements.

123. To assess how many points in time are used where institutions apply portfolio calibration, a question was included in the survey. The results of the survey are as follows:

Table 30: If you use type 2 or 4 calibration, how many points in time were reflected in the calibration sample?

	All time slices contained in the development sample			Otherwise: 1 time slice			Otherwise: 2-5 time slices			Otherwise: more than 5 time slices			Other		
	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD
Total	56	48	45	27	23	20	12	10	12	20	17	23	2	2	0
Central governments and central banks	3	75	80	1	25	20	0	0	0	0	0	0	0	0	0
Institutions	9	75	62	1	8	9	0	0	0	1	8	30	1	8	0
Corporate — SME	25	56	48	11	24	23	5	11	13	4	9	16	0	0	0
Corporate — specialised lending	1	33	6	1	33	3	0	0	0	1	33	91	0	0	0

	All time slices contained in the development sample			Otherwise: 1 time slice			Otherwise: 2-5 time slices			Otherwise: more than 5 time slices			Other		
Corporate — other	28	60	55	11	23	20	5	11	9	3	6	15	0	0	0
Retail — secured by immovable property SME	13	46	29	8	29	34	3	11	10	4	14	27	0	0	0
Retail — secured by immovable property non-SME	22	38	36	13	22	21	8	14	15	14	24	28	1	2	0
Retail — qualifying revolving	9	50	27	7	39	38	2	11	35	0	0	0	0	0	0
Retail — other SME	8	29	8	11	39	43	3	11	12	6	21	37	0	0	0
Retail — other non-SME	13	35	18	13	35	33	4	11	27	7	19	22	0	0	0

124. Using all time slices contained in the development sample was the most common answer (48% of all PD models) (see Table 30). However, a significant number of models (representing 23%) are also calibrated to only one time slice. Among those institutions that answered that they took into account all time slices of the sample, some also mentioned the use of external data.

125. To foster understanding of the impact of this aspect of calibration, and to achieve convergence in practices, the GLs specify (in paragraph 88) that institutions should find an appropriate balance between the calibration sample being comparable with the current portfolio, in terms of obligor and transaction characteristics, and it reflecting the likely range of variability of DRs.

126. As with portfolio calibration, where the number of time slices used determines whether the calibration sample is comparable with the current portfolio in terms of obligor and transaction characteristics (usually only one point in time), or whether the calibration sample is representative of the likely range of variability (all points in time available), the timing of the information used for grade calibration (type 1 or 3) affects the characteristics of the calibration sample.

127. When the model is applied backwards to calculate the observed average DR per grade or pool, the calibration sample is more representative of the likely range of variability, and less of the current portfolio.

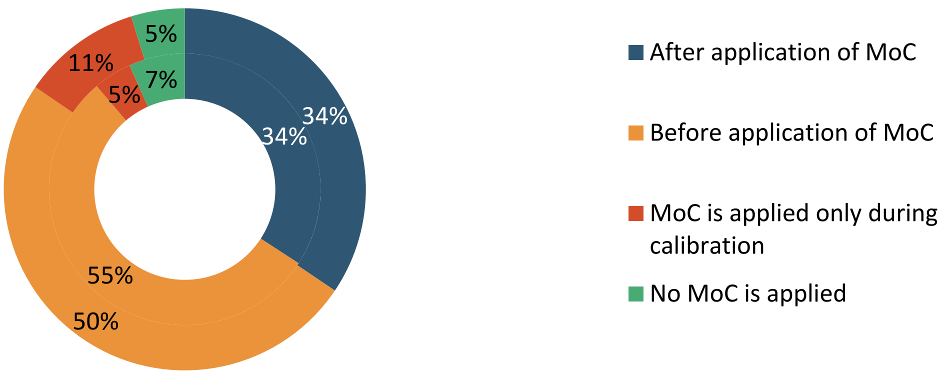
128. The analysis for type 1 and 3 calibrations reveals that a majority (65%) apply the model backwards to assess the long-run average DR per grade and pool (see Table 31). However, a significant share (35%) applies a variety of other methods. Most respondents were silent on how they apply the model backwards in time, and none of them explained how they apply it with qualitative components. On the basis of some comments, however, it is clear that the model is applied backwards only for those risk drivers that are available at more distant points in time.

Table 31: If you use type 1 or 3 calibration, which method do you apply when calculating the long-run average PD per grade? By COREP exposure class

	Apply the model backwards to be able to calculate the observed average DR per grade or pool			Other method		
	No.	%	% EAD	No.	%	% EAD
Total	69	65	75	37	35	25
Central governments and central banks	2	25	83	6	75	17
Institutions	2	25	81	6	75	19
Corporate — SME	13	65	78	7	35	22
Corporate — specialised lending	3	75	53	1	25	47
Corporate — other	18	69	54	8	31	46
Retail — secured by immovable property SME	6	55	83	5	45	17
Retail — secured by immovable property non-SME	35	74	82	12	26	18
Retail — qualifying revolving	5	63	92	3	38	8
Retail — other SME	9	75	93	3	25	7
Retail — other non-SME	24	80	87	6	20	13

129. The GLs specify (in paragraph 89) that institutions should conduct calibration before the application of MoC or PD floors. This requirement has been inserted because, if an institution first adds MoC to its long-run average DR and then calibrates (i.e. calibrates to the long-run average plus MoC), then the effect of the calibration is smaller than when the PD estimates are calibrated to the long-run average without inclusion of the MoC. Figure 25 shows that, in around half of the PD models or exposures under PD models, the calibration is conducted before the application of MoC, which is in line with the requirement of the GLs. This requirement will, however, lead to a change in practice for around 41% of PD models, either where no MoC is applied, or where calibration is currently conducted after the application of MoC (where MoC is applied during calibration, the result is difficult to predict; whether or not it will lead to a change in practice depends on the precise current practice).

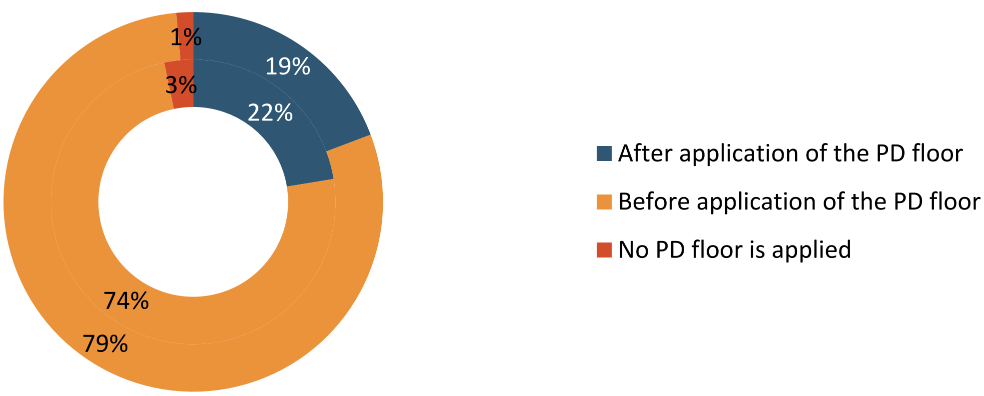
Figure 25: Do you conduct calibration before or after the application of MoC?



Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where PD models are weighted by their corresponding exposure value

130. The requirement in the GLs that calibration should be conducted before the application of the PD floor follows the same logic as that for MoC, i.e. the application of the PD floor before calibration leads to less conservative PD estimates. In the case of the PD floor, practices are more consistent with the requirement in the GLs, i.e. in around 75% of PD models (79% of exposures) calibration is already conducted before the application of the PD floor (see Figure 26). A change in practice is needed in around 20% of PD models.

Figure 26: Do you conduct calibration before or after the application of the PD floor?



Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where PD models are weighted by their corresponding exposure value

4.10 Summary of model changes in PD estimation

131. From the above results of the survey it was possible, for selected questions, to directly assess the shares of models (in the IRB survey sample) and the shares of exposure amounts that would be affected by the chosen policy, and for which a change in modelling practice will therefore be required once the GLs enter into force. For those selected questions for which it is possible to directly assess whether or not there will be an impact, Table 32 provides an overview of the resulting model changes, in terms of both the share of PD models (%) and the share of exposure values covered by these PD models (% EAD).

132. The appendix of this report shows how the various possible answers from the drop-down menus in the survey have been classified to assess whether or not there would be a model change, or if this is unknown.

Table 32: Summary of selected policy choices for PD estimation and the number of model changes

		No model change			Model change		Not known	
Paragraph in the GLs	**Policy choice**	**No.**	**%**	**% EAD**	**%**	**% EAD**	**%**	**% EAD**
53-54	All obligors who are in the scope of application of the PD model should receive an individual PD estimation	252	81	80	19	20	0	0
78	Quarterly frequency to calculate one-year DRs	252	46	54	54	46	1	0
80	Conduct a specific analysis to justify the choice for overlapping versus non-overlapping windows for the calculation of the observed average DR	227	15	19	85	81	0	0
89	Conduct calibration before the application of MoC[24]	229	54	50	42	42	4	8
89	Conduct calibration before the application of the PD floor[25]	203	73	78	23	20	3	2

133. The requirement to conduct a specific analysis to justify the choice of overlapping versus non-overlapping windows for the calculation of the observed average DR, and the requirement to calculate one-year DRs at least at a quarterly frequency, will lead to a change in practice in, respectively, 85% and 54% of the models. For the other policy aspects, the share of affected models is smaller than the share of unaffected models.

[24] Where the option 'MoC is applied during calibration' was selected by the respondent, it is difficult to assess whether or not the GLs will entail a change in practice, since the precise practice is unknown and since the GLs introduce also a definition of the concept of calibration. Those cases represent the category 'not known' in the last two columns of Table 32.

[25] Where the option 'no PD floor is applied' was selected by the respondent, it is difficult to assess whether or not the GLs will entail a change in practice. Those cases represent the category 'not known' in the last two columns of Table 32.

134. Table 33 further shows how many aspects will at least need to be changed in the PD models. It can be seen, for instance, that the share of unaffected models is only 8%, although it should be mentioned that this relates only to the five aspects of PD models on which explicit questions were included in the survey, described above. The areas where guidance is given on PD models is very broad, however, and is likely to affect many more modelling aspects. In addition, these calculations include only the models for which a model change is expected, and not those for which it is unknown whether or not there a model change will be necessary. The share of models for which at least two aspects will have to be changed is 33%.

135. Given that the list of policy aspects specified in the GLs is much longer than the selected aspects included in Table 32 and Table 33, the estimates below are a lower bound to the true number of affected models. In practice, one may assume that all models will probably have to be changed in one or more aspect.

Table 33: Summary of number of aspects to be changed in PD estimation

Number of aspects to be changed	No.	%	% EAD
0	21	8	21
1	62	25	20
2	82	33	29
3	59	23	16
4	25	10	10
5	3	1	4
Total	252	100	100

5. LGD models

5.1 Characteristics of the survey sample

136. Institutions have been asked to indicate which types of LGD models are used within their institution. The results are presented in Table 34. Overall, 82% of institutions make use of work-out LGD and almost 40% of institutions use multivariate regression analysis. Note that the shares of types of LGD models do not add up to 100% because this as a 'tick box' question, where institutions could select multiple answers.

Table 34: Types of LGD models used within the institutions

	No.	N	%
Work-out LGD	78	95	82
Market-implied LGD (market based)	8	95	8
LGD based on total losses and PD estimates	2	95	2
Multivariate regression analysis	36	95	38
Other	18	95	19

Note: this was a 'tick box' question, hence respondents could select several of the above answers.

137. The same question was also asked for the LGD models for which the survey was completed, in the format of a drop-down menu. The results are presented in Table 35, for the LGD non-defaulted, LGD in-default and EL_{BE} models. It should be noted that the sample size of the LGD in-default and EL_{BE} models is usually smaller than that of the non-defaulted LGD models, since several institutions did not always complete these additional columns. The drop in the sample size of the non-defaulted (190) versus the total number of LGD models (202; see Table 1) is due to data quality issues, or because some banks left this question open. More than half of the non-defaulted LGD, LGD in-default and EL_{BE} models tested use a work-out LGD approach, while the second most common approach is multivariate regression analysis, consistent with the reporting in Table 34. Overall, the types of models for which the survey was completed are representative of the types of models within the institution.

Table 35: Different types of LGD models for which the survey was completed

	LGD non-defaulted			LGD in-default			EL_{BE}		
	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD
LGD based on total losses and PD estimates	1	1	1	1	1	1	1	1	1
Market-implied LGD (based on market data)	3	2	4	4	2	5	1	1	0
Multivariate regression analysis/sophisticated statistical model	45	23	25	38	22	25	25	1%	15
Work-out LGD	115	58	53	95	56	52	81	55	52
Other or any combination of the above	33	17	17	32	19	18	40	27	32
Total	197	100	100	170	100	100	148	100	100

138. The GLs specify (in paragraph 102) that LGD estimates should be based on the institution's own loss and recovery experience as it is reflected in historical data on defaulted exposures, and that LGD estimates should not be derived only from the market prices of financial instruments. Consequently, the GLs will entail a change for around 1.52%, 2.35% and 0.38% of LGD non-defaulted, LGD in-default and EL_{BE} models respectively.

139. A variety of types of scales are being used for LGD models. Among all options, a continuous LGD scale is most popular (representing 48%, 55% and 61% of LGD non-defaulted, LGD in-default and EL_{BE} models), followed by facility pools (representing around 20-25% of models) (see Table 36).

Table 36: Types of scales used in LGD and EL_{BE} estimation

	LGD non-defaulted			LGD in-default			EL_{BE}		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**	**No.**	**%**	**% EAD**
Continuous LGD scale	95	48	55	95	55	61	92	61	60
Discrete scale of facility grades	36	18	11	27	16	10	17	11	13
Facility pools	50	25	19	41	24	13	31	20	10
Other	17	9	15	11	6	15	12	8	16
Total	198	100	100	174	100	100	152	100	100

140. Table 37 shows whether the LGDs are assigned to the secured part of the exposure, the unsecured part of the exposure or the whole exposure. In the vast majority of LGD and EL_{BE} models, the final parameter estimate is assigned to the whole exposure (77% of models and 79% of exposure values for the LGD non-defaulted).

Table 37: Assignment of LGD or EL_{BE} estimate to the whole exposure or only the (un)secured part of the exposure

	LGD non-defaulted			LGD non-defaulted			LGD non-defaulted		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**	**No.**	**%**	**% EAD**
Whole exposure	154	77	74	139	79	74	128	82	81
Secured part of the exposure	8	4	4	7	4	4	7	4	5
Unsecured part of the exposure	21	11	11	13	7	8	9	6	4
Other	17	9	11	16	9	14	12	8	10
Total	200	100	100	175	100	100	156	100	100

141. In relation to the average realised LGD and the average final LGD estimate, Table 38 reveals that the LGDs for the secured part of the exposures are significantly below the LGDs that are assigned to the unsecured part of the exposure, which is in line with expectations. The LGDs assigned to the whole exposure are between the average LGDs of the secured and unsecured parts.

Table 38: Average realised LGD and final LGD estimate, depending on whether the LGD is assigned to the secured part of the exposure, the unsecured part of the exposure or the whole exposure

	Average realised LGD					Average final LGD estimate				
	N	**mean (%)**	**mean (% EAD)**	**min**	**max**	**N**	**mean (%)**	**mean (% EAD)**	**min**	**max**
Secured part of the exposure	8	13.82	18.99	1.94	30.65	8	16.10	18.79	5.20	33.43
Unsecured part of the exposure	18	39.54	35.90	6.30	90.80	20	46.18	41.31	5.40	100.00
Whole exposure	136	27.10	24.01	0.79	81.13	150	30.25	23.61	0.42	99.27

142. Table 39 and Table 40 show which model components are used most often in LGD non-defaulted, LGD in-default and EL_{BE} models. The cure rate (i.e. the rating of return to performing portfolio) and the recovery rate with respect to the loan amount are used in more than half of the LGD models. In LGD in-default and EL_{BE} models, the time in-default and recoveries realised so far are already used in around half of the models.

Table 39: Model components used in the estimation of LGD non-defaulted

	N	**%**	**% EAD**
Rate of return to performing portfolio	197	58	58
Recovery rate conditional on returning to the living portfolio	197	22	17
Recovery rate with respect to the collateral value	197	47	58
Recovery rate with respect to the loan amount	197	57	48
Other	197	29	38

Note: this was a 'tick box' question, hence respondents could select several of the above answers.

Table 40: Use of time in-default and recoveries realised so far as model components in estimation of LGD in-default and EL_{BE}

	LGD in-default			ELBE		
	N	%	% EAD	N	%	% EAD
Time in-default	177	49	54	156	51	62
Recoveries realised so far	177	47	37	156	52	40

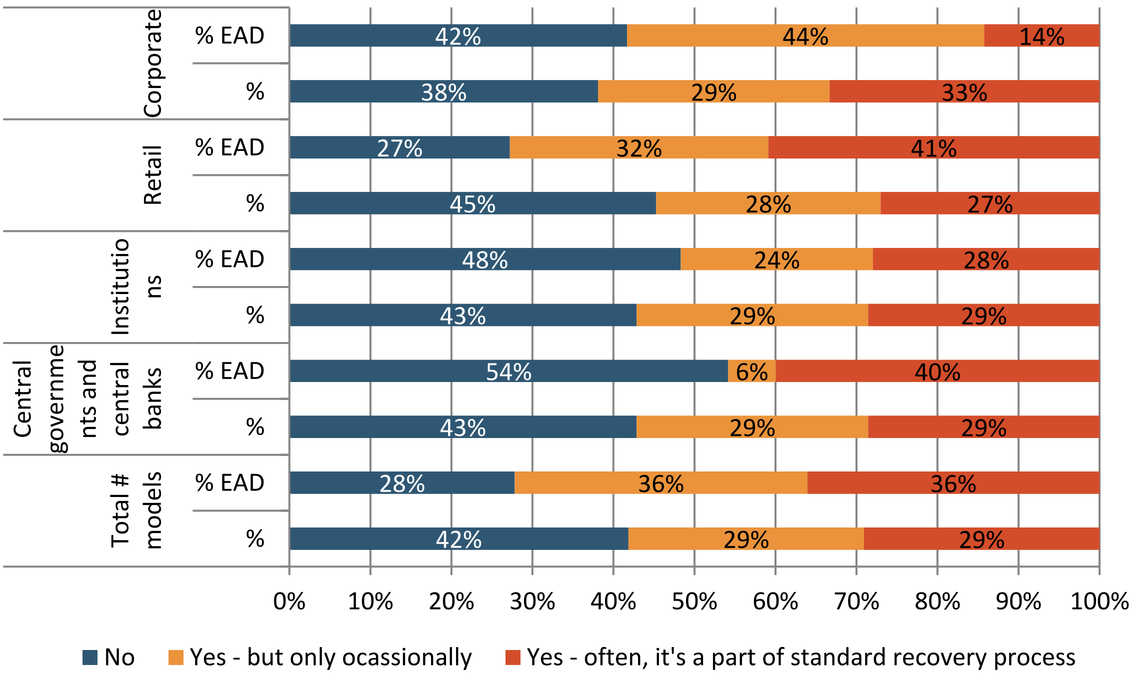
Note: this was a 'tick box' question, hence respondents could select several of the above answers.

5.2 Recoveries from collaterals

143. For the purpose of the GLs, repossession of collateral is understood as a situation where an institution realises collateral by taking it over and recording it on the balance sheet of the institution, and at the same time the amount of credit obligation is diminished by the value of the asset.

144. Figure 27 shows the distribution of practices when it comes to the repossession of collateral in the course of the recovery process. It can be seen that banks do not repossess in 42% of LGD models, whereas in 58% of LGD models institutions do repossess at least occasionally. In 29% of LGD models this practice is standard in the recovery process, whereas in the other 29% it occurs only occasionally.

Figure 27: Do you repossess collateral in the course of the recovery process? Retail, corporate, institutions, and central governments and central banks

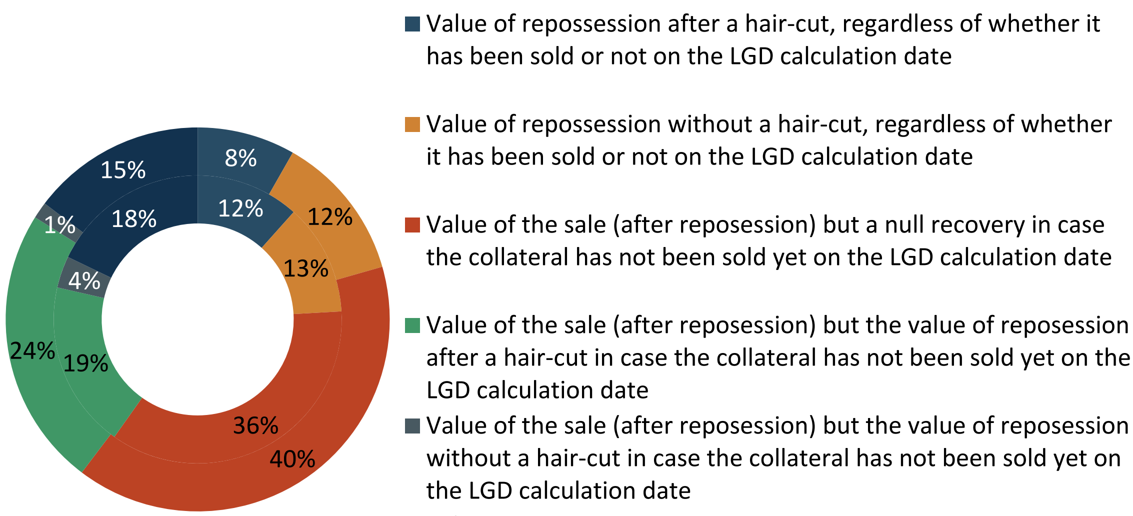


145. The GLs specify (in paragraph 116) that institutions should assess the value of the repossession at the date of repossession as the lower of (i) the value by which the credit obligation of the obligor has been diminished as a result of the repossession of the collateral and (ii) the value of the repossessed collateral as recorded on the balance sheet of the institution. In addition, it is specified (in paragraph 117) that institutions should apply an appropriate haircut to this value where there is significant uncertainty over whether or not the value of repossession adequately reflects the value of the repossessed collateral. Where sufficient past experience with regard to repossession of collaterals exists, the haircuts should be supported by historical observations and regularly back-tested (paragraph 117(c)). In the absence of such experience, the assessment will have to be performed on a case-by-case basis, but this will require more conservatism as such an assessment will be less reliable.

146. The IRB survey shows the institution’s current practices with respect to (i) whether or not the value of the sale or the value of the repossession is included in LGD estimation and (ii) whether or not a haircut is applied to this value. From Figure 28 it can be seen that taking the value of the sale (after repossession), but a null recovery where the collateral has not yet been sold on the LGD calculation date, is the most common approach, applied in 36% of the LGD models. Overall, the value of sale is used in 59% of LGD models in the sample

(representing 65% of the exposure values), whereas the value of repossession is used in 25% of models (representing 20% of exposures). When it comes to the application of a haircut (to the value of sale or the value or repossession), no haircut is applied in around 53% of LGD models, and a haircut is applied in only around 30% of LGD models.

Figure 28: Which recovery value is recognised in the calculation of the realised LGD?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

147. The approach included in the GLs (in paragraphs 116-117) corresponds to the option ‘value of repossession after a haircut, regardless of whether or not it has been sold on the LGD calculation date’, and represents the current approach in 12% of the LGD models in the sample. The most common approach in the IRB survey sample of LGD models is to take ‘the sale (after repossession), but a null recovery where the collateral has not yet been sold on the LGD calculation date’.

148. In this regard, two distinct options have been considered, each with their pros and cons:

(a) value of repossession: repossession of a collateral by an institution should be considered a recovery;

(b) value of sale: the recovery should be associated with cash payments only, and hence in this case only the final price for which the institution sells the repossessed collateral should be taken into account.

149. The latter approach would address the situations where institutions take over collaterals and then sell them with significant loss. In this case, LGD estimates based on the value of repossession would be underestimated, as they would not include the loss that was incurred by the institution on a sale. Furthermore, if the repossessed collateral is sold only after a long period of time, the discounting effects are not included in the LGD estimates. Another argument that was taken into account for this approach is that, where an institution repossesses illiquid collateral, the value cannot be established in a reliable manner. Therefore the real value can only be verified at the moment of sale.

150. However, in addition to the above argument, the following aspects have been taken into account:

(a) The value of the collateral that is subject to repossession decreases the obligation of the debtor at the moment of repossession; hence, even if the institution eventually realises a loss on a sale of this object or property, it can no longer be claimed from the obligor.

(b) Repossession is usually the choice of an institution, not an obligation. This could be understood as an investment decision on the part of an institution. In such a context, repossession of collateral is a situation equivalent to receiving cash recovery and then investing this money in a certain non-credit asset. In this situation, the results of an investment decision on the part of an institution should not influence the LGD estimates.

(c) The value of repossession is under the scrutiny of the financial auditor, as it affects the balance sheet of an institution and has to be set in accordance with the applicable legal framework. While the institution has an incentive to keep the value as low as possible, the obligor will not accept a value that is too low. This should ensure that the value of repossession is reasonable.

(d) Repossession is expected to be used more often in bad times than in good times, and therefore the value of collateral at the moment of repossession will most probably be relatively low. The argument that the value of the sale will usually be lower than the value of repossession, and lead to more conservative LGD estimates, may therefore not always be true.

(e) After the repossession the asset is recorded on the balance sheet of the institution and receives a risk weight that is adequate for non-credit assets. From that moment, the risk for the bank is not credit risk, and therefore it should not be included in the estimation of risk parameters for credit risk.

(f) Institutions that decide to repossess collateral may not have an intention to sell it subsequently. In this case, the effect of realising collateral would never be reflected in the estimates.

(g) In some cases, the sale of the repossessed collateral could only take place many years after the repossession. In this case also, the effect of realising collateral could never be reflected in the estimates, or would be reflected only with a significant delay.

(h) If institutions had to include in LGD estimates the loss or profit realised on collateral after the repossession, then the proper calculation would have to include not only the final sale price but also other cash flows related to this asset. For instance, in the case of repossessed immovable property the bank would have to include the maintenance costs (e.g. energy, security, insurance, etc.), possibly the rent received from tenants if the property is rented, discounting effects on any cash flows, and finally the sale price diminished by the cost of sale (e.g. intermediary, taxes, valuation, etc.). This would be a very complicated calculation but it would have no relation to the performance of the defaulted exposure.

151. After considering all these arguments, it has been decided that repossession should be treated as a recovery and that the value of repossession should be treated as an amount of recovery.

Table 41: Which recovery value is recognised in the calculation of the realised LGD? By COREP exposure class

	Value of repossession after a haircut, regardless of whether or not it has been sold on the LGD calculation date	Value of repossession without a haircut, regardless of whether or not it has been sold on the LGD calculation date	Value of the sale (after repossession), but a null recovery where the collateral has not been sold on the LGD calculation date	Value of the sale (after repossession), but the value of repossession after a haircut where the collateral has not been sold on the LGD calculation date	Value of the sale (after repossession), but the value of repossession without a haircut where the collateral has not been sold on the LGD calculation date	Other	Total
Total no. of models	13	14	40	21	4	20	112
%	12	13	36	19	4	18	100
% EAD	8	12	40	24	1	15	100
Central governments and central banks	1	0	2	0	0	1	4
%	25	0	50	0	0	25	100
% EAD	6	0	77	0	0	17	100
Institutions	**1**	**1**	**3**	**0**	**1**	**2**	**8**
%	**13**	**13**	**38**	**0**	**13**	**25**	**100**
% EAD	**4**	**29**	**54**	**0**	**11**	**3**	**100**

	Value of repossession after a haircut, regardless of whether or not it has been sold on the LGD calculation date	Value of repossession without a haircut, regardless of whether or not it has been sold on the LGD calculation date	Value of the sale (after repossession), but a null recovery where the collateral has not been sold on the LGD calculation date	Value of the sale (after repossession), but the value of repossession after a haircut where the collateral has not been sold on the LGD calculation date	Value of the sale (after repossession), but the value of repossession without a haircut where the collateral has not been sold on the LGD calculation date	Other	Total
Corporate — SME	5	5	7	3	4	6	30
%	17	17	23	10	13	20	100
% EAD	18	39	12	6	8	16	100
Corporate — specialised lending	0	1	0	1	1	1	4
%	0	25	0	25	25	25	100
% EAD	0	71	0	14	15	0	100
Corporate — other	4	4	11	3	4	10	36
%	11	11	31	8	11	28	100
% EAD	11	27	35	5	6	17	100
Retail — secured by immovable property SME	2	6	9	4	1	3	25
%	8	24	36	16	4	12	100
% EAD	1	22	52	11	1	14	100
Retail — secured by immovable property non-SME	6	8	23	15	0	9	61
%	10	13	38	25	0	15	100
% EAD	7	8	35	34	0	16	100
Retail — qualifying revolving	0	2	2	1	0	0	5
%	0	40	40	20	0	0	100
% EAD	0	19	76	4	0	0	100
Retail — other SME	0	4	7	4	1	2	18
%	0	22	39	22	6	11	100
% EAD	0	27	60	6	1	6	100
Retail — other non-SME	2	7	10	4	0	1	24
%	8	29	42	17	0	4	100%
% EAD	14	29	52	3	0	1	100%

152. Table 41 shows further that the chosen approach also differs according to COREP exposure class. It can be seen, for instance, that the value of repossession is most common (representing 60% of exposures covered) for LGD models covering corporate SME exposures, whereas the value of sale is the most common approach for LGD models covering retail exposures secured by immovable property SME and non-SME (representing respectively 64% and 69% of exposures covered).

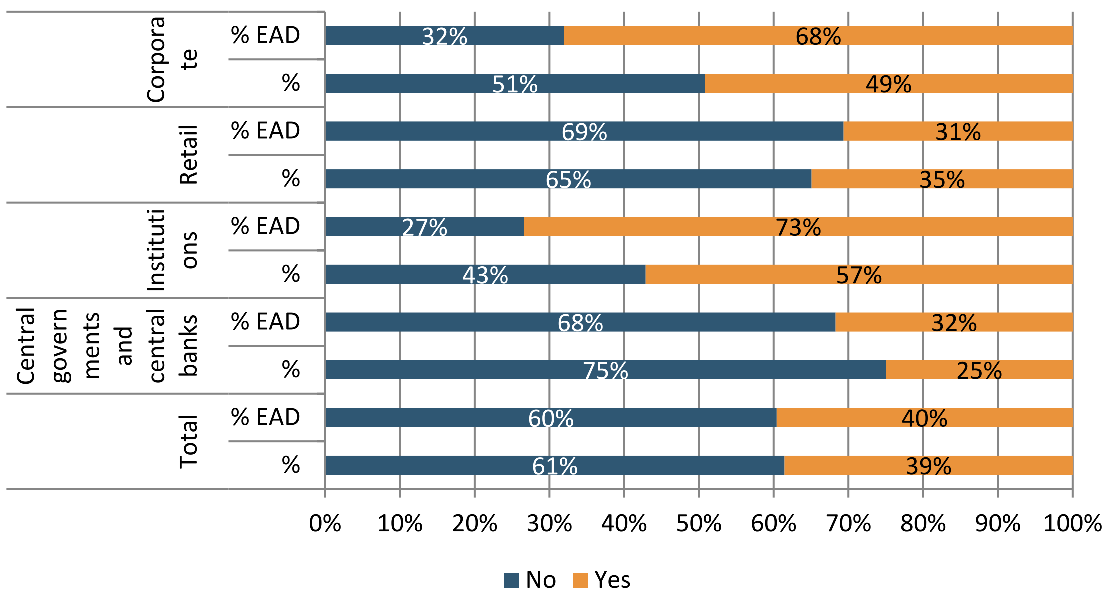
5.3 Eligibility of collaterals

153. The GLs clarify (in paragraph 124) that institutions may take into account any type of collateral in the LGD estimation as long as the requirement of Article 181(1)(f) of the CRR is met. This comes in addition to the clarification included in the RTS on IRB assessment methodology (Article 55), i.e. that to meet this requirement the institution's internal policies should be at least fully consistent with the requirements of section 3 of Chapter 4 of the CRR with regard to legal certainty and regular valuation of collateral.

154. Furthermore, it is also envisaged that, for the purpose of LGD estimation, institutions may use specific types of collaterals that are not explicitly described in Chapter 4 of the CRR. In these cases the policies and procedures relating to internal requirements for valuation and legal certainty should be appropriate to the respective type of collateral.

155. With a view to identifying which types of collateral (if any) are not included in the LGD estimation and the potential reasons for this, a question has been included in the IRB survey. The results are shown in Figures 29 and 30.

Figure 29: Are certain types of collateral not taken into account in the LGD estimates? Retail, corporate, institutions, and central governments and central banks



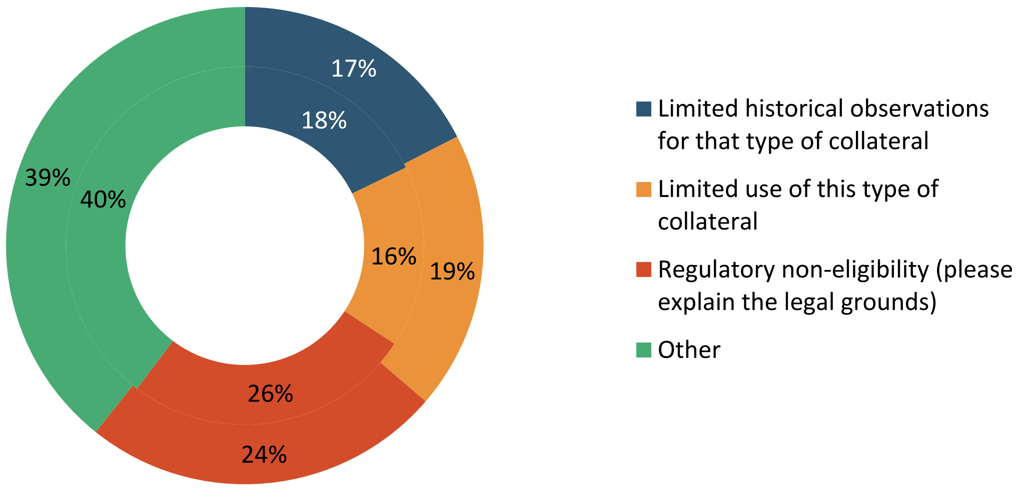
156. In 60% of the LGD models, on average, all collaterals are taken into account in the LGD estimation. For some of those models where all collaterals are included in the LGD estimation (i.e. where there are no exceptions), the respondents indicated that this is because (i) there is no collateral in the portfolio (because the LGD model applies only to the unsecured part of the exposure); (ii) the LGD model covers residential mortgages and therefore only residential real estate (houses) are accepted as collateral, with only a few immaterial exceptions; or (iii) the collateral is reflected in a form of recovery in the calculation, and therefore all collateral types that generate recovery for the given exposure in-default are considered.

157. In around 40% of the LGD models, there is at least one type of collateral that is not (always) taken into account. The respondents mentioned a variety of types of collaterals, but given the multitude of types and the lack of a specific question on the amount, and/or a structured list of collateral types, it is only possible to obtain a broad view of collaterals that were stated to be excluded in LGD estimation. In general, one can notice a significant heterogeneity in practices. Some institutions, for instance, consider only residential real estate as collateral (and discard commercial immovable property, cash and guarantees), whereas others take all immovable property collateral, cash and guarantees into account, discarding anything else. To give an overview of the comments, the following responses were submitted: (i) only property, cash and guarantees are included, and everything else is discarded; (ii) specialised equipment, computer equipment, intangible assets, money in other bank accounts, stocks of companies with low rating, stocks of non-public companies, shares in private limited companies, non-financial deposits and some types of receivables are not included in LGD estimation; (iii) guarantees are excluded from LGD estimation; (iv) insurances are excluded from LGD estimation; (v) motor vehicles, other collateral assignments with a nominal value < EUR 500 000 (e.g. non-domestic other collateral assignment, precious metals, computer software), other collaterals and other pledges are excluded from LGD estimation; (vi) only real estate collateral is included in the LGD estimation, and all other securities (e. g. financial collateral) are excluded; (vii) machinery and equipment, specific vessels, oil service-related collaterals, other aircraft, trains, unspecified and unlisted shares, specific financial collaterals and non-specified deposits, and specific inventories are excluded from LGD estimation.

158. From Figure 29 it can further be seen that it is more common to exclude certain types of collaterals from LGD estimation for exposures to institutions and corporates (57% and 49% of LGD models).Whereas this may be due to the lower number of LGD models for exposures to institutions (eight LGD models), which makes the results less reliable, it may be explained by the wider range of possible collaterals for exposures to corporates.

159. From the above list of collaterals stated to be excluded in LGD estimation it can be inferred that respondents understand that 'collateral' (as referred to in Article 181(1)(f) of the CRR) refers to the broad range of possible funded as well as unfunded credit protection, i.e. 'collateral' has not been understood as referring solely to physical or financial collateral.

Figure 30: What are the reasons for not recognising certain types of collateral in the LGD estimates?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value

160. Figure 30 shows that data-driven reasons (limited historical observations or limited use of a certain type of collateral) account for 37% of LGD models (34% of exposures covered), whereas around 25% stems from regulatory non-eligibility, and around 40% stems from other reasons.

161. Among the reasons for regulatory non-eligibility, the respondents mentioned (i) non-enforceability of the collateral; (ii) non-eligibility of certain guarantees; (iii) the assessment of the collateral values not being in line with the CRR; and (iv) that closed funds without daily market values cannot be included as collateral in the LGD estimation[26].

162. Among the many 'other' reasons mentioned are (i) that all of the other three reasons apply (limited observations, limited use and regulatory non-eligibility); (ii) that collateral is only used for the segmentation of debt, and in particular for senior secured securities; (iii) that personal guarantees linked to states and institutions are treated under the SA because there is no rating model validated for these types of counterparts (thereby making use of Article 183(4) of the CRR). Funded collateral not linked to real estate is treated under the SA because there is no market model validated to internally calculate the haircuts.

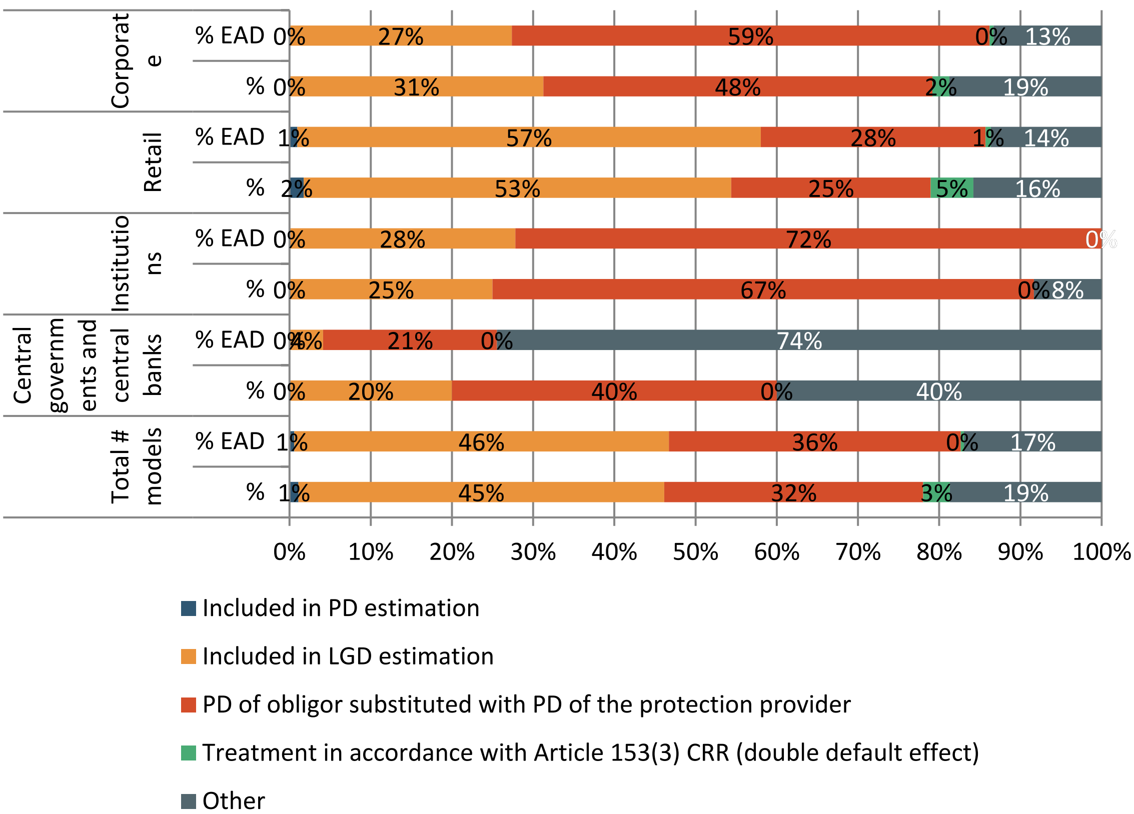
163. Figure 31 shows the current practices with respect to the inclusion of protection in the form of guarantees and credit derivatives in the LGD estimates. The responses therefore

[26] According to Article 197(5)(c) of the CRR, institutions may use units or shares in CIUs as eligible collateral only where the units or shares have a daily public price quote.

provide an overview of the practices that are set out in Article 60 of the RTS on assessment methodology, which specifies the eligibility and assessment of guarantees and credit derivatives in risk parameters.

164. Whereas this question did not apply to many LGD models (because there are no guarantees or credit derivatives), the results show that, for those remaining (91) LGD models, the most common approach (used in around 45% of LGD models and exposures) is to include the guarantee or credit derivative in the LGD estimation. However, this approach is more common in retail portfolios than in corporate portfolios (53% versus 31% of LGD models). In contrast, the substitution of the PD of the obligor with the PD of the protection provider is more common in corporate portfolios than in retail portfolios (48% versus 25% of LGD models), which can probably be explained by the fact that corporate obligors more often have regulatory PDs available than retail obligors. Finally, it should be noted that the treatment in accordance with Article 153(3) of the CRR (double default effect) is seldom applied; only three LGD models in the IRB survey make use of this approach.

Figure 31: How do you include in the LGD estimates protection in the form of guarantees and credit derivatives? Retail, corporate, institutions, and central governments and central banks



165. In relation to the GLs, clarification is included with respect to the requirements that apply to treating ‘third parties’ in PD estimation (section 5.2.3.). In particular, it is specified that institutions should have clear policies stating the conditions under which the rating of a third

party that has a contractual or organisational relation with an obligor of the institution may be taken into account in the assessment of risk of the considered obligor. This is relevant in particular to a rating transfer, the use of a rating of a third party serving as input to the PD model reflecting potential support for the obligor, or the use of the rating of a third party as an indication for an over-ride of the PD of the obligor.

5.4 Inclusion of collaterals in the LGD estimation

Table 42: How is collateral included in the LGD estimation?

	N	No.	%	% EAD
As a segmentation criterion (to an LGD model)	68	17	25	21
As a pooling criterion	68	10	15	13
As a risk driver	68	27	40	25
As a model component (separate recovery rates)	68	45	66	72
Other	68	2	3	0

166. Table 42 shows how institutions incorporate collaterals in their LGD estimates. It should be noted that the IRB survey was designed such that institutions could indicate multiple options: (i) as a segmentation criterion; (ii) as a pooling criterion; (iii) as a risk driver; and (iv) as a model component (separate recovery rates). These are not mutually exclusive[27]. It should be noted that collaterals are included as a separate model component in 66% of the LGD models, i.e. this is the most common approach, followed by including collateral as a risk driver (40%) and as a segmentation criterion (25%). Regarding the inclusion of collateral through separate recovery rates, the GLs include additional clarification on how this should be undertaken (in section 6.2.3.). In particular, it is specified that (i) institutions should avoid a bias that may stem from including in the estimation sample the observations where the exposure was secured by only a part of the value of the collateral; (ii) they should recognise and include in this estimation direct costs related to the collection on these types of collaterals; and (iii) they should include all recoveries realised, including those where the realisation of the collateral has been completed but the overall recovery process is not yet closed.

5.5 Calculation of economic loss and realised LGD

167. One of the main aspects included in the GLs with regard to LGD estimation is a detailed specification of the definition of economic loss and realised LGD. As these are the main concepts underlying the estimation process, the harmonisation of these definitions is a prerequisite for comparable LGD estimates. The GLs therefore contain specific provisions

[27] It should be noted that there were also another options, i.e. 'not applicable — there are no collaterals'. The results in Table 42 cover only those models where the option 'not applicable' was not chosen by the institution, and where the institution chose at least one of the other options (covering 68 models in total).

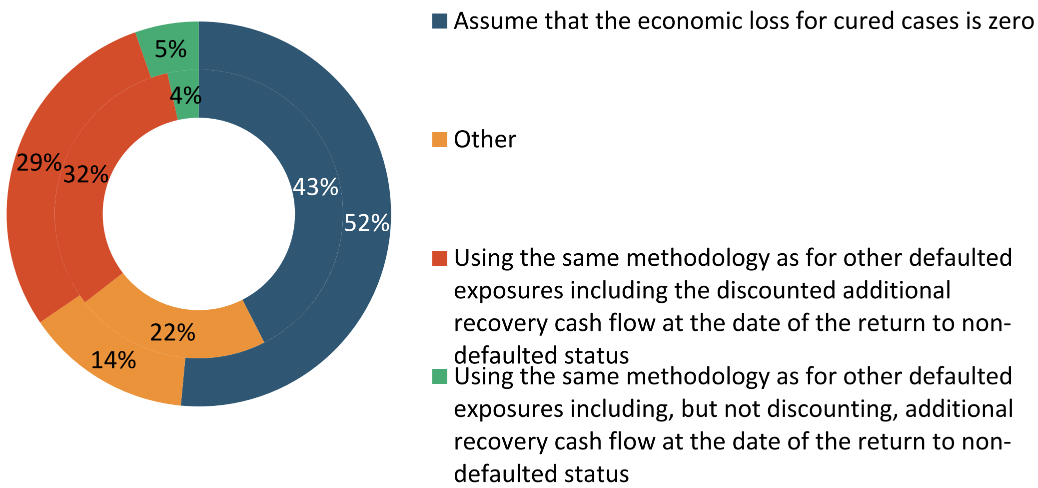
with regard to the treatment of additional drawings after default, unpaid late fees and interest after default, direct and indirect costs, and discounting factor.

5.5.1 Definition of economic loss and realised LGD

168. The question here is how additional recovery cash flows stemming from exposures that return to non-defaulted status should be treated in the realised LGD. In the IRB survey, respondents were asked to indicate how economic loss for a cured case is measured. Whenever this report refers to 'cures' it means exposures that returned to non-defaulted status (this specification was also included in the instructions to the survey). In practice, institutions use various definitions of cures, and sometimes additional criteria are specified relating, for instance, to the length of time in-default or to the level of loss.

169. The CP on the GLs specified that the economic loss for exposures that return to non-defaulted status should be calculated as for all other defaulted exposures, with the only difference being that the additional recovery cash flow is added to the calculation as if the payment was made by the obligor in the amount that was outstanding at the date of the return to non-defaulted status, including any principal, interest and fees.

Figure 32: How is economic loss of a cured case measured?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

170. The responses shown in Figure 32 illustrate that such guidance is necessary to eliminate undue RWA variability stemming from the treatment of cures.

171. Whereas the respondents to the CP asked for clarity on these provisions in the GLs, it was also suggested that the amount that was still outstanding at the moment of return to non-

defaulted status (principal, interest and/or fees), i.e. the additional artificial cashflow, should also be discounted.

172. Hence, the following policy options have been considered:

(a) approach proposed in CP – no discounting of artificial cash flow;

Pros	Cons
Avoids potential overestimation of realised loss where all obligations were repaid, including any penalty fees and interest.	Creates possibility for regulatory arbitrage. Where an obligor is planning to repay the obligation, institutions could change the status to non-defaulted before the payment, to avoid discounting of the cash flow, and decrease the calculated realised loss.
Avoids potential discounting of the part of exposure that was never past due (this exposure may have been past due before, however, especially in the case of restructuring).	Would require a change in currently applied practices to a larger extent than the alternative. It may not be appropriate to introduce a less conservative approach and force institutions to change the current approach to a less prudent one.
	The IRB survey results show that this approach is applied in only around 4% of LGD models.

(b) artificial cash flow should be discounted as all other cash flows.

Pros	Cons
Consistent with the understanding of the concept of discounting factor (i.e. that it reflects uncertainty around the cash flows on defaulted exposures at the moment of default). At the moment of default, the whole exposure was in-default and there was uncertainty regarding the payments and potential subsequent cure. The artificial cash flow should therefore also be discounted, as at the moment of default it was uncertain whether or not it was going to return to non-defaulted status. All	If the loan was not terminated at or after the moment of default, the part of the exposure that returned to non-defaulted status may never have been past due. Discounting this part of the exposure may therefore be considered overly conservative.

cash flows are comparable as they are all discounted at the same moment – the moment of default.	
Ensures equal treatment of cases that return to non-defaulted status with those that are paid in full by the obligor (and which do not return to non-defaulted status because no outstanding obligation remains).	The impact may be significant in particular in the following cases: (a) exposures that have been in defaulted status for a considerable time, especially in the case of exposures subject to distressed restructuring where the probation period before the return to non-defaulted status, as specified in the GLs on default definition, is at least 1 year; (b) exposures with long maturities, and in particular mortgage loans, as the value of exposure that returns to non-defaulted status would be a large part of the exposure at the moment of default.
More commonly used in practice by the industry than the alternative option (around 32% of models compared with 4% for the alternative, according to the results of IRB survey).	May create an incentive to repossess early instead of cooperating with the obligor to allow the cure (if the effect of discounting of the artificial cash flow would lead to loss higher than that expected as a result of collection process).

173. The results shown in Figure 32 indicate that the proposal included in the CP on the GLs is applied in only 4% of the LGD models (i.e. using the same methodology as for other defaulted exposures but not discounting additional recovery cash flows at the date of the return to non-defaulted status). The most common approach (applied in 43% of LGD models, accounting for 52% of exposures under LGD models in the sample) is to assume that the economic loss for cured cases is zero. This, however, may result from the different definitions of cure that are currently used by institutions. This approach may also be imprudent, since there may still be a considerable loss associated with some cured cases, in particular when significant costs have been incurred to recover the collaterals. The application of the same methodology as for other defaulted exposures where the additional cash flows are also discounted is applied in 32% of LGD models (29% of exposures).

174. Based on a review of the pros and cons of both options, option (b) was chosen as a compromise proposal. The GLs specify (in paragraph 135) that for exposures that return to non-defaulted status, institutions should calculate economic loss as for all other defaulted exposures, with the only difference being that additional recovery cash flows are added to

the calculation as if a payment was made by the obligor for the amount that was outstanding at the date of the return to non-defaulted status, including any principal, interest and fees ('artificial cash flow'). The artificial cash flow should be discounted at the moment of default, in the same manner as all observed cash flows.

5.5.2 Unpaid late fees and capitalised interest

175. The approach specified in the GLs (in paragraphs 137 and 138) is that unpaid late (after default) fees and capitalised interest (after default) should not increase the amount of economic loss or the amount outstanding at the moment of default[28].

176. However, in the CP on the GLs it was proposed that capitalised fees and interest after default should be included only in the numerator of the realised LGD, i.e. they should be added to the economic loss but the value of the outstanding obligation at default should remain unchanged. Although the option proposed in the CP appears to be the most common approach based on the survey results (used in 51% of models for late fees, and in 44% of models for capitalised interest) (see Table 43), the feedback to the CP on the GLs showed considerable disagreement with this proposal.

Table 43: Treatment of unpaid late fees and capitalised interest in the calculation of realised LGD

	Unpaid late fees (after default)			Capitalised interest (after default)		
	No.	%	% EAD	No.	%	% EAD
Add to the outstanding amount at default (denominator of realised LGD)	11	5	4	16	8	4
Both include in economic loss and add to outstanding amount at default	16	8	8	21	10	9
Include only in the economic loss (numerator of realised LGD)	104	51	50	88	44	49
Do not include	41	20	22	52	26	28
Other	30	15	15	25	12	10
Total	202	100	100	202	100	100

177. The following policy options have been considered:

(a) Capitalised fees and interest after default included only in the numerator of realised LGD (proposal included in the CP): capitalised fees and interest after default are added to the economic loss in the numerator of the realised LGD, but the value of outstanding obligation at the moment of default remains unchanged. The underlying assumption is that fees and interest after default have economic meaning similar to costs, and hence they are treated similarly. Fees that are meant to cover costs already incurred by an institution are only included in the calculation once (as costs).

[28] Note that, for LGD in-default and EL_{BE} estimation, the GLs specify (in paragraph 178) that institutions should include all fees and interest capitalised before the reference date in the calculation of the realised LGD, and that they should discount all subsequent cash flows and drawings at the reference date.

Pros	**Cons**
Does not require separate definitions of costs, fees and interest, as all these items are included in the economic loss in the same way.	Does not take into account the fact that interest and fees are not related to real cash flow from banks and are hence different from costs in this sense.
More prudent approach, which prevents underestimation of risk where the discounting rate is lower than the actual charges by the institution, and negative realised LGDs are largely prevented.	May be overly conservative, as the value of money in time is reflected twice, through discounting effect and through including interest and fees in economic loss.
The most popular of the approaches currently in use (43-51% of models, according to the IRB survey).	Approach frequently criticised by the industry as incorrect in the consultation process.
	May be operationally burdensome to implement, as information on fees and interest capitalised after default would be required, and may not be available for historical observations.
	May lead to different results depending on applicable accounting standards (if different rules on recognising profit from fees and interest after default are applied).

(b) Only fees and interest before default included: fees and interest after default are not added to the economic loss, but the recovery cash flows are still included. The underlying assumption is that fees and interest after default have a different economic meaning to costs, because they are not related to outgoing cash flow and hence should not increase economic loss. In addition, it is assumed that the unrealised gains from fees and interest should not be considered losses if they are unrelated to any expenses incurred by the institution. However, recoveries on those items are profits realised by the institution, and hence can decrease the economic loss.

Pros	**Cons**

Takes into account non-cash character of fees and interest, and accurately reflects the exposure value at the moment of default.	Does not take into account the increases of the exposure value based on accrued interest and fees.
Recognises additional gains related to recoveries of interest and fees, in accordance with final effect on CET1.	Does not take into account that capitalised fees and interest increase CET1.
Negative realised LGDs are not a problem, as these will be floored to zero in accordance with the relevant provision proposed in the GLs.	May lead to underestimation of risk where the discounting rate is lower than actual charges, and may lead to negative realised LGDs.
Independent of the accounting framework and the applicable rules for capitalising fees and interest, and of the principles for the order of allocation of payments (to fees, interest and principal).	Consistency with Article 181(1)(i) of the CRR is based on the interpretation that unpaid late fees referred to in this article only refer to fees before default.
Operationally the easiest to implement, and does not require data on values of fees and interest capitalised after default.	Approach not broadly used at present (20- 25% of models, according to the IRB survey).

(c) Capitalised fees and interest after default included in both numerator and denominator of realised LGD: capitalised fees and interest after default are added to the economic loss and to the exposure value at the moment of default; recovery cash flows are also still included. The underlying assumption is that unrealised gains are considered losses. The treatment is different from the treatment of costs, however, as costs do not increase the value of exposure at the moment of default.

Pros	**Cons**
Full consistency with Article 181(1)(i) of the CRR	May be operationally burdensome to implement, as information on fees and interest capitalised after default would be required, and may not be available for historical observations.
Takes into account the increases of the exposure value based on accrued interest and	May lead to different results depending on applicable accounting standards (if different

fees.	rules on recognising profit from fees and interest after default are applied).
Negative realised LGDs are not a problem, as these will be floored to zero in accordance with the relevant provision proposed in the GLs.	May lead to underestimation of risk where the discounting rate is lower than the actual charges, and may lead to negative realised LGDs.
Consistent with the treatment of interest and fees before default (which are also included in the exposure value at the moment of default).	The least popular of the considered approaches in the current practices (only 8-10% of models, according to IRB survey).

178. Based on a review of the pros and cons of these options, option (b) was retained in the final GLs, i.e. not including late (i.e. after default) fees and capitalised interest in the numerator and denominator. This approach is currently applied in 20% (late fees) and 26% (capitalised interest) of LGD models.

5.5.3 Additional drawings

179. The GLs specify (in paragraph 142) that additional drawings after default should be included in the calculation of economic loss, and at the same time that all recoveries should be taken into account, including those that relate to additional drawings. In addition, it is specified that the treatment of additional drawings after default in the calculation of realised LGD should be consistent with their treatment in the CCF estimation, to ensure meaningful calculation of RWA. Where the estimation of CCF takes into account additional drawings after default, therefore, these are also to be included in the denominator of the realised LGD, i.e. institutions should increase the amount outstanding at the moment of default by the amount of additional drawings by the obligor after the moment of default, discounted at the moment of default (paragraph 140 of the GLs). Where additional drawings are not included in the estimation of CCF, those additional drawings should not be included in the denominator of the realised LGD (paragraph 141 of the GLs).

Table 44: Treatment of additional drawings after default in the calculation of realised LGD

	No.	%	% EAD
Add to the outstanding amount at default (denominator of realised LGD)	22	11	10
Both include in economic loss and add to outstanding amount at default	30	15	16
Include only in the economic loss (numerator of realised LGD)	85	42	43
Do not include	29	14	15
Other	35	17	15
Total	201	100	100

180. As shown in Table 44, the results of the IRB survey confirm that, in the case of additional drawings after default, inclusion in the economic loss without correcting the outstanding amount at default in the denominator is the most popular solution. As described at the beginning of this section, and in accordance with the GLs, this approach is proposed where additional drawings after default are not included in CCF estimation. If CCF estimation includes such drawings, it is proposed that the denominator of realised LGD should also be corrected. The results of the survey should therefore be analysed taking into account the approach to CCF calculation. This analysis is presented in Table 45.

Table 45: Are additional drawings after default included in the estimation of the CCF?

	No.	%	% EAD
Yes	33	17	12
No	134	67	72
Other	32	16	16
Total	199	100	100

Table 46: Are additional drawings after default included in the calculation of realised LGD (non-defaulted)?

	Additional drawings are included in the CCF estimation			Additional drawings are not included in the CCF estimation		
	No.	%	% EAD	No.	%	% EAD
Add to the outstanding amount at default (denominator of realised LGD)	4	12	5	12	9	11
Both include in economic loss and add to outstanding amount at default	20	61	92	9	7	7
Include only in the economic loss (numerator of realised LGD)	7	21	2	68	51	52
Do not include	0	0	0	28	21	21
Other	2	6	1	17	13	9
Total	33	100	100	134	100	100

181. These results further confirm that the approach presented in the GLs is the most common approach, with the majority of institutions correcting both economic loss and outstanding amount at default where CCF estimates include additional drawings after default (see Table 46). The sample of models where corresponding CCF estimates do not include additional drawings after default is much larger, and therefore this is mostly reflected in the overall results. The detailed split here confirms that the approach proposed in the GLs is already incorporated into the majority of models.

5.5.4 Discounting rate

182. The discounting rate has been recognised as one of the major drivers of the lack of RWA comparability across institutions, and for this reason specific guidance on this topic has been included in the GLs.

183. As shown in Table 47, the average level of discounting rate in the RDS for the non-defaulted LGD model is 6.54%. The average level of the discounting rate for LGD in-default and EL_{BE} estimation is similar, although the sample of models for which this variable has been reported is much smaller. In general, great variability is observed across and within countries. Whereas part of this variability is probably warranted because it is risk driven, the variance in practices and the level of granularity with which the discount rate is specified logically leads to non-risk-driven RWA variability.

Table 47: Average level of the discounting rate (%) in the RDS

	N	mean (%)	mean (% EAD)	min	max
LGD non-defaulted	161	6.54	6.19	0.45	25.00
LGD in-default	133	6.58	6.41	0.45	25.00
EL_{BE}	102	5.78	4.88	0.45	25.00

184. Table 48[29] further shows that part of these differences in the level of discounting rate are driven by the different methodologies chosen to determine the discounting rate. In particular, it can be seen that the average discounting rate is higher when the original and current effective interest rate is used. For these approaches, one can infer from the 90th percentile and the maximum values that these higher averages are driven by several high discounting rates. When the risk-free rate plus add-on approach is used, one notices fewer outlier values.

Table 48: Summary statistics of the discounting rate, differentiated by chosen methodology

	N	mean (%)	mean (% EAD)	min	p10	p50	p90	max
Total	156	6.46	5.91	0.45	2.56	5.35	10.00	25.00
Risk-free rate + add-on	51	5.71	5.36	0.45	3.05	5.34	9.55	15.39
Original effective interest rate	20	8.98	5.36	2.46	4.38	5.60	18.19	22.29
Current effective interest rate	14	7.19	5.46	3.06	3.32	5.02	13.82	25.00
Funding rate	9	5.25	2.86	1.40	1.40	2.77	10.45	10.45
Funding rate + add-on	23	5.66	6.16	2.92	3.22	6.00	9.00	10.00
Other	39	6.62	7.56	0.67	2.30	7.30	10.00	17.23

[29] Note that Table 51 on page 109 shows the levels of the discounting rate, where this rate is specified as the funding rate or risk-free rate (plus add-on), separately for exposures to corporates, retail and non-retail.

185. The broad variety of practices therefore requires clear guidance on what should be reflected by the discounting factor, and how it should be applied. In this regard, the following options have been considered:

(a) Euribor (or comparable interbank rate in countries outside the eurozone) plus fixed add-on: the add-on reflects the risk premium for the uncertainty related to the recoveries;

Pros	Cons
Consistent with the current guidance provided by CEBS and BCBS.	Not risk sensitive — may not be accurate for some portfolios.
May be understood as reflecting funding cost of potential investor (average of the market) + risk premium for uncertainty of cash flows at the moment of default.	A proxy for the average funding cost of the investor, in practice Euribor is available, as funding cost for prime institutions may underestimate the discounting rate (unless addressed in an add-on); however, if understood as risk-free rate + add-on then Euribor may be considered a proxy for risk-free rate.
Ensures simplicity, comparability and independence from the own-credit standing of the institution.	Three-month Euribor rate not liquid in small countries outside eurozone; other or shorter term rates have to be used instead.
Independent from the funding structure and credit standing of the institution, which may be seen as favourable since it is an anti-cyclical model component.	Fixed add-on may require future revisions.

(b) funding cost plus add-on: discounting factor reflects the funding costs of the institution and an appropriate risk premium reflecting the uncertainties associated with the receipt of recoveries with respect to a defaulted exposure;

Pros	Cons
Consistent with the current guidance provided by CEBS and BCBS.	Depends on the funding structure of an institution, and may therefore be more prone to heterogeneity in the assessment of the correct funding cost + add-on, which could generate additional RWA variability.
Aims at reflecting the shareholders' loss experienced by the institution.	Reflects own-credit standing of the institution, and may therefore be overly penalising for some institutions and jurisdictions, and may induce pro-cyclical capital requirements.

Pros	Cons
	Fixed add-on may require future revisions.

(c) original effective interest rate: discounting factor is derived from facility-specific interest rates.

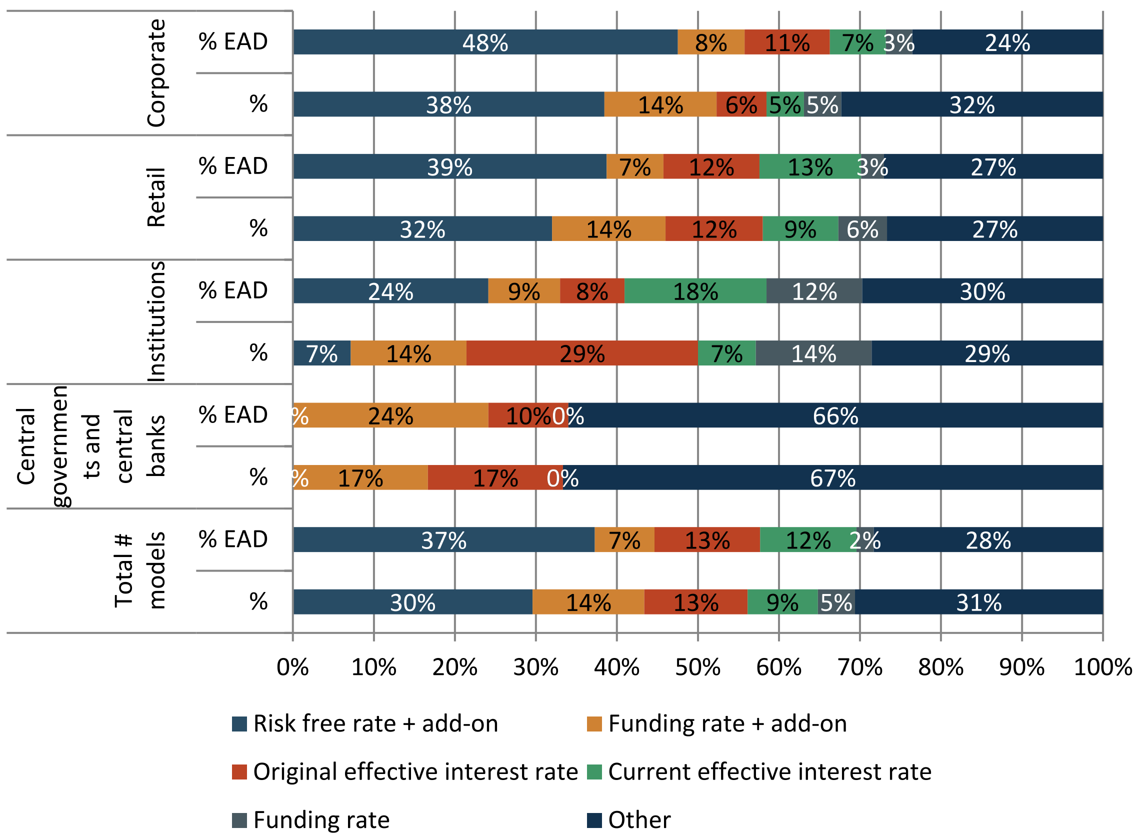
Pros	Cons
Consistency with international accounting standards – comparability between expected loss and provisions.	Alignment with accounting standards not necessary, as the calculation of IRB shortfall/excess aims at eliminating the effect of provisions.
Reflects funding cost (of a performing and not defaulted exposure) + risk premium + profit	If the aim is to reflect the finding cost of a defaulted asset, an add-on would be necessary.
Highly risk sensitive — exposure specific.	Lack of comparability of losses within and across institutions — rates may vary significantly between the types of obligor and types of products.
	Depends on pricing policy and marketing strategies of an institution, which should not necessarily affect capital requirements, and which may lead to non-risk-driven RWA variability.
	May be overly conservative, as it includes a margin for profit.
	Substantial complexity.
	May not be adequate to the market and economic conditions at the time of default.

186. In the GLs, option (a) was chosen as a compromise solution. In particular, the GLs specify (in paragraph 143) that the annual discounting rate should be composed of a primary interbank offered rate, applicable at the moment of default and increased by an add-on of five percentage points. The primary interbank offered rate should be considered as the three-month Euribor, or a comparable liquid interest rate in the currency of the exposure. Given the current average level of the discounting rate identified for the models surveyed (6%), and the current low interest rate environment, the add-on of 5% is not expected, across institutions, to cause major cliff effects in LGD calculations.

187. The responses to the IRB survey confirm, furthermore, that the risk-free rate plus add-on is the most common approach, and this approach is closest to that specified in the GLs. As shown in Figure 33, risk-free rate plus add-on is currently applied in around 30% of LGD models (37% of exposures under LGD models). For models with retail exposures or exposures to corporates, these shares are even higher: risk-free rate plus add-on is used in 39% of exposures to retail models, and 48% of exposures to corporates.

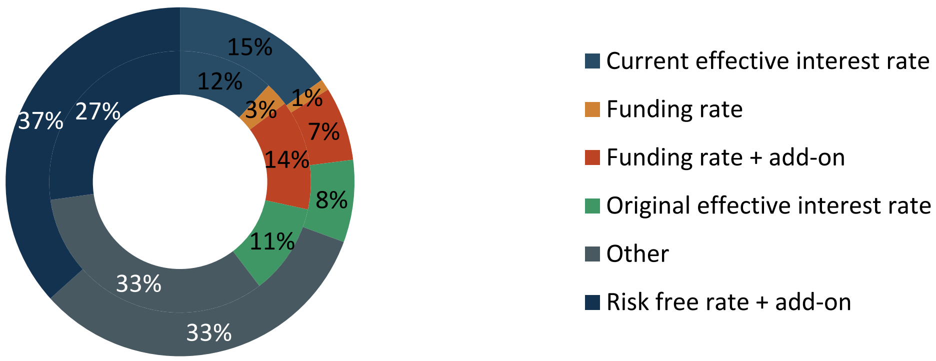
188. Therefore, the option of specifying the discounting rate as the Euribor (or a comparable interbank rate in countries outside the eurozone) plus fixed add-on will rule out a significant share of variability in practices, and it is also the policy that will lead to the fewest number of model changes. It will, however, require a change in practice in around 70% of LGD models.

Figure 33: Methodologies used to determine the discounting rate (LGD non-defaulted) — retail, corporate, institutions, and central governments and central banks



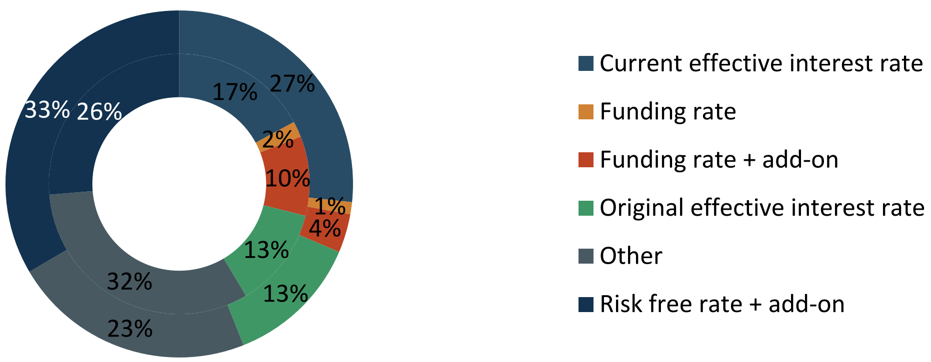
189. These results are generally consistent with those for the LGD in-default models (shown in Figure 34), where the use of risk-free rate plus add-on represents 27% of LGD models, or 37% of exposure values. In EL_{BE} models, the use of current effective interest rates is more popular, and is applied in 17% of EL_{BE} models, or 27% of exposures under EL_{BE} models.

Figure 34: Methodologies used to determine the discounting rate (LGD in-default)



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

Figure 35: Methodologies used to determine the discounting rate (EL_{BE})



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

190. Whereas the draft GLs proposed a level of 5% for the add-on, possible increased granularity of an add-on between retail and non-retail exposures has been considered, as suggested by some respondents to the draft GLs. In particular, respondents in the consultation process suggested increasing the discount factor for retail (higher uncertainty) and decreasing it for non-retail.

191. Table 49 shows the distribution of the levels of the discounting rate across the exposure classes. Overall, it is difficult to identify a significantly different level of the discounting rate between retail and non-retail exposure classes. It should be kept in mind, however, that the classification across COREP exposure classes in Table 49 is not mutually exclusive, i.e. institutions could indicate the applicable exposure classes in their LGD models. This being the

case, some of the LGD models in the IRB survey sample apply to both retail and non-retail (for more details, see Table 8).

Table 49: Average level of the discounting rate (%), by COREP exposure class

	N	mean (%)	mean (% EAD)	min	max	median
Total	161	6.54	6.19	0.45	25.00	5.40
Central governments and central banks	3	7.33	9.61	5.00	11.00	6.00
Institutions	11	5.65	6.86	2.02	11.00	5.00
Corporate — SME	49	5.43	4.84	0.45	15.39	5.00
Corporate — specialised lending	7	6.08	4.36	3.84	10.00	5.00
Corporate – other	48	5.43	5.15	0.45	15.39	5.00
Retail — secured by immovable property SME	41	6.00	4.85	0.45	15.85	5.00
Retail — secured by immovable property non-SME	92	5.84	6.07	0.45	15.85	5.14
Retail — qualifying revolving	26	6.50	4.33	0.45	22.29	5.00
Retail — other SME	45	6.33	4.54	0.45	25.00	5.00
Retail — other non-SME	61	5.91	4.08	0.45	25.00	4.48

192. Table 50 therefore shows the average discounting rate for those models that cover only retail, only corporate or only non-retail exposures (i.e. exposures to corporates, institutions, or central governments and central banks). These data indicate levels of discounting rate for retail exposures higher on average than those for all other exposure classes. However, the difference between the mean and the median already suggests that this may be driven by some outlier observations. Further analysis on the approach used to determine these discounting rates suggests that these higher discounting rates stem largely from the application of (current or original) effective interest rate as a discounting rate.

Table 50: Average level of the discounting rate (%), for models with exposures only to corporates, retail and non-retail

	N	mean (%)	mean (% EAD)	min	max	p50
Corporate	28	5.68	5.43	2.09	11.00	5.11
Retail	101	7.05	6.46	0.67	25.00	6.00
Non-retail	36	6.11	6.53	2.09	11.00	5.27

193. This effect is presented also in Table 51, where the models using original or current effective interest rate were eliminated. As a result, the extreme observations were eliminated and the large difference in discounting rate between retail and non-retail exposures disappears.

Table 51: Average level of the discounting rate (%), for models with exposures only to corporates, retail and non-retail and where the discounting rate is specified as funding rate or risk-free rate plus add-on

	N	mean (%)	mean (% EAD)	min	max	p50

	N	mean (%)	mean (% EAD)	min	max	p50
Corporate if funding rate or risk-free rate (+ add-on)	15	5.42	5.46	2.09	10.00	5.01
Retail if funding rate or risk-free rate (+ add-on)	47	6.00	5.99	1.80	10.45	5.42
Non-retail if funding rate or risk-free rate (+ add-on)	16	5.40	5.44	2.09	10.00	5.01

194. Although the results of the survey show discounting rates higher on average for retail exposures, the difference may not be significant enough to justify differentiation of the add-on.

In addition to the methodology used to specify the discounting rate, the IRB survey further revealed significant variation in practices with respect to the level of granularity of the discounting rate, i.e. whether the discounting rate is specified at institutional level, at portfolio level, by product type or at single-exposure level (see Figure 36). Given the decision to retain the specification of the discounting rate as the risk-free rate plus add-on at the moment of default, this will entail a change in practice for the majority of models, since currently only 30% of models use a specific discounting rate at the level of the single exposure, and this even includes models where the discounting rate is specified as the original or current effective interest rate, where the discounting rate is by definition exposure specific. These results are broadly consistent for the LGD in-default models (as shown in Figure 37).

Figure 36: Level of granularity at which the discounting rate is specified (LGD non-defaulted) — retail, corporate, institutions, and central governments and central banks

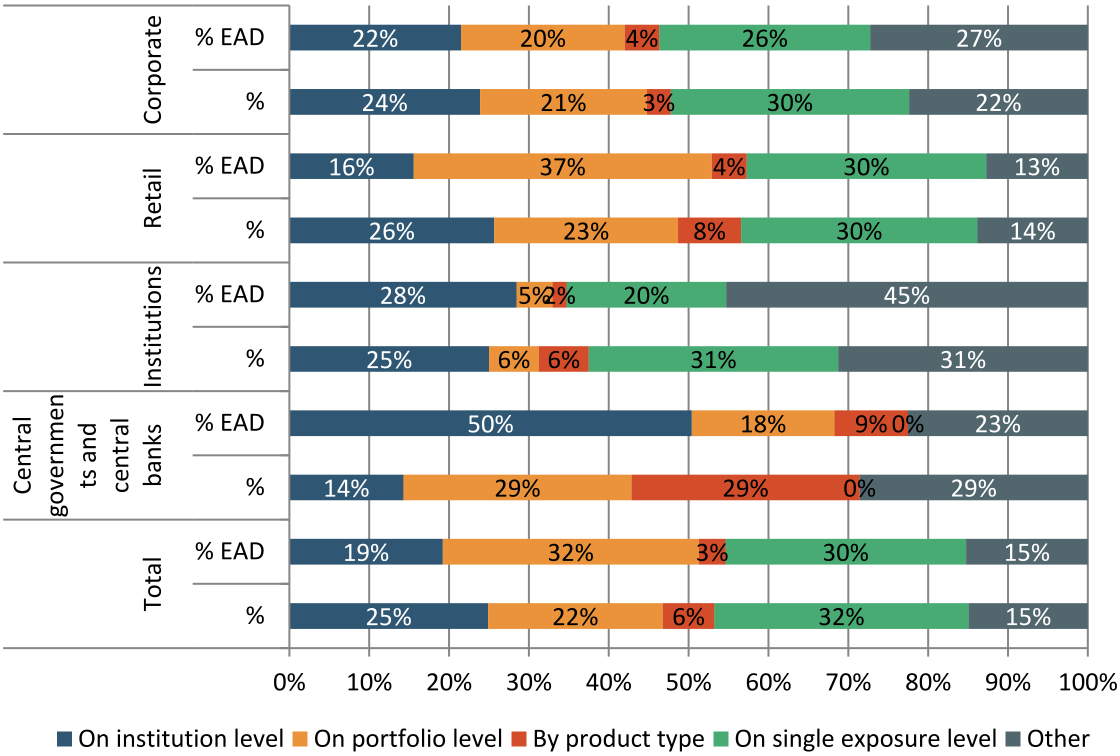
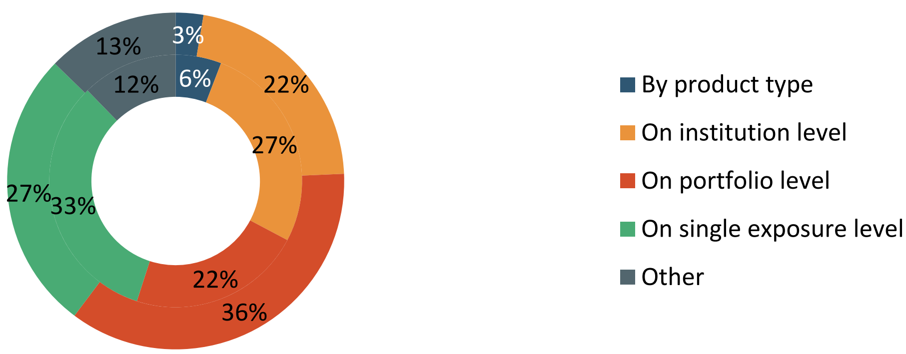


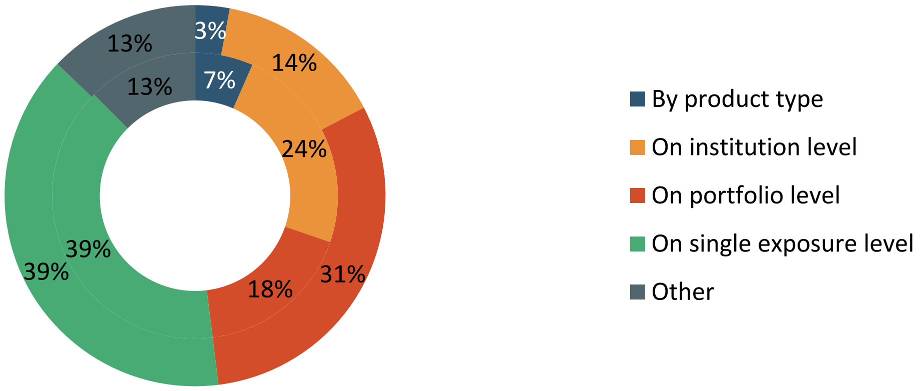
Figure 37: Level of granularity at which the discounting rate is specified (LGD in-default)



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

As shown in Figure 38, it is most common to specify the discounting rate at the single-exposure level in EL_{BE}. As reported in Figure 35, the majority of the EL_{BE} models use the original or current effective interest rate, which is by definition exposure specific.

Figure 38: Level of granularity at which the discounting rate is specified (EL_{BE})



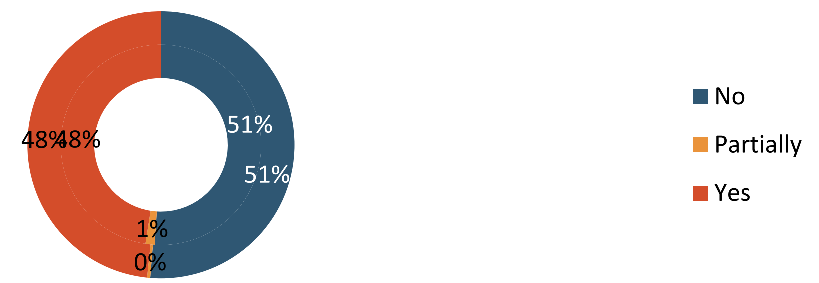
Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

5.5.5 Direct and indirect costs

195. The GLs specify (in paragraph 144) that all material direct and indirect costs should be taken into account in the calculation of realised LGD. In addition, a clear description of direct and indirect costs is provided in the GLs (paragraphs 145 and 146). It is specified that all direct costs should be considered as material and, for the indirect costs, a wide definition is provided.

196. The responses to the IRB survey confirm the need for guidance on this aspect, in particular for the inclusion of direct costs, where these costs are included in less than half of the models (see Figure 39). Indirect costs are not included in around 75% of LGD models (85% of exposures). However, the CRR definition in Article 5(2) specifies loss as 'economic loss, including material discount effects, and material direct and indirect costs associated with collecting on the instrument'. Therefore, this requirement has been strengthened in the GLs, since the GLs specify that all direct costs should be included, rather than material direct costs only. A change in practice will be required for 50% (inclusion of direct costs) and 75% (inclusion of indirect costs) of LGD models.

Figure 39: Are direct costs incurred before default included in the calculation of the realised (non-defaulted) LGD?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

Figure 40: Are indirect costs incurred before default included in the calculation of the realised (non-defaulted) LGD?

Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

5.6 Long-run average LGD

5.6.1 Historical observation period

Table 52: Length of the historical observation period (years)

	N	mean (%)	mean (% EAD)	min	p10	p50	p90	max
Long-run average LGD	158	11.35	10.88	2.33	6.00	10.51	18.91	32.77
LGD non-defaulted	165	10.54	10.99	2.00	5.00	9.75	17.51	32.77
LGD in-default	149	10.64	11.16	1.08	5.00	10.01	17.01	32.77
EL_{BE}	123	9.92	9.13	0.00	4.33	9.02	16.09	32.77

197. It should be noted that the length of the historical observation period is not available for all LGD models (202). Several institutions mentioned that the reason for this is that the long-run average LGD is not calculated, although this would appear to contradict the CRR

requirements. Some of the other explanations are (i) that no defaults have occurred in the historical database and that therefore the long-run average LGD is not estimated, and (ii) that no internal data are available for the estimation of unsecured LGD.

198. It should also be noted that the length of the historical observation period for the estimation of the long-run average, LGD, LGD in-default and EL_{BE} estimates is shorter than five years for some models, which would appear to contradict the CRR requirements in Article 180(1)(j) and 181(2) subparagraph 2 of the CRR. For some institutions, explanations could be found in the comments. The most common explanation is that the institutions specified the length of the development sample instead of the length of the historical observation period (this misunderstanding also applies to the specification of the historical observation period for PD estimation as mentioned in paragraph 100). Another explanation given is that the institution reviews the performance of each component of the model over time, and picks the most conservative period for that component.

199. It should be emphasised, however, that explanations justifying a length of the historical observation period shorter than five years are not in line with the CRR.

200. The use of non-consecutive time periods in the historical observation period is exceptional; only one institution uses non-consecutive periods for the calculation of the long-run average LGD, LGD and LGD in-default estimation[30]. In this regard, the GLs specify (in paragraph 147(c)) that the historical observation period should be composed of consecutive periods, hence this would require a change in practice for this institution.

201. Few institutions specified the length of the historical observation period stemming from external data (16-17 models for the long-run average and the LGD non-defaulted models), but its average length (around 15 years) is longer than that based on internal data (on average, around 10-11 years). For most models where the use of external data is specified, these external data are used in addition to the internal data. This is not the case in a few instances, where (i) the model applies only to sovereign exposures, or (ii) the institution specified that the long-run average LGD is not calculated. In this regard, the GLs specify (in paragraph 102) that LGD estimates should not be exclusively based on external data. This will therefore require a change in practice in the models mentioned above, which rely solely on external data in the historical observation period.

202. The use of pooled data seldom occurs; only around 6-7 models specified the length of the historical observation period for data stemming from pooled data for the long-run average LGD and LGD in-default estimation. The length of the historical observation period based on these pooled data is on average around 15 years.

203. Table 53 shows the length of the historical observation period of LGD non-defaulted (based on internal data), expressed in years and across exposure classes.

[30] This institution is not included in the figures below visualising the historical observation period.

Table 53: Length of the historical observation period for LGD non-defaulted, expressed in years (internal data) and by exposure class

	N	mean (%)	mean (% EAD)	min	p10	p50	p90	max
Total	165	10.54	10.99	2.00	5.00	9.75	17.51	32.77
Central governments and central banks	1	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Institutions	10	10.45	12.98	5.00	5.00	10.51	16.22	19.01
Corporate — SME	42	12.04	12.35	2.00	5.00	10.67	19.01	32.77
Corporate — specialised lending	5	10.87	14.14	4.00	4.00	11.34	19.01	19.01
Corporate — other	44	12.47	12.84	2.00	5.00	10.92	19.01	32.77
Retail — secured by immovable property SME	43	10.93	10.27	2.00	4.59	10.84	19.01	32.77
Retail — secured by immovable property non-SME	91	11.10	10.79	2.00	5.00	10.50	17.01	32.77
Retail — qualifying revolving	25	10.51	9.71	6.00	7.01	10.59	15.88	19.01
Retail — other SME	40	10.77	10.12	3.00	5.00	10.30	18.01	32.77
Retail — other non-SME	62	10.46	9.91	2.00	5.00	9.00	16.09	32.77

Figure 41: Historical observation period for LGD non-defaulted — retail exposures secured by immovable property SME (internal data)

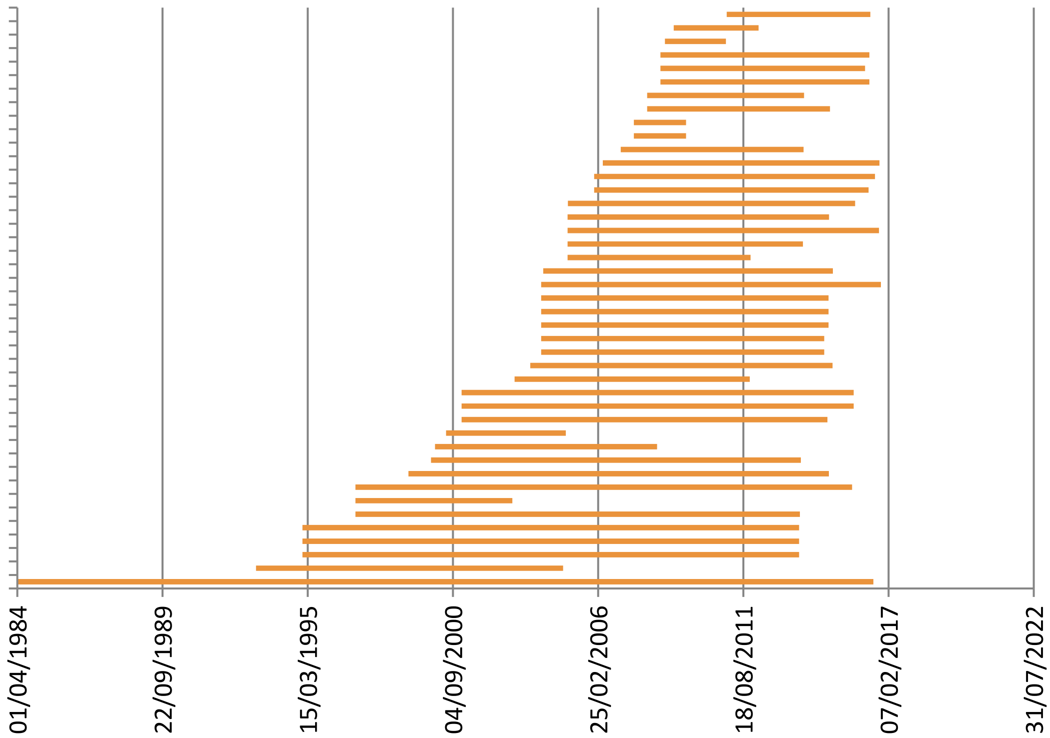


Figure 42: Historical observation period for LGD non-defaulted — retail exposures secured by immovable property non-SME (internal data)

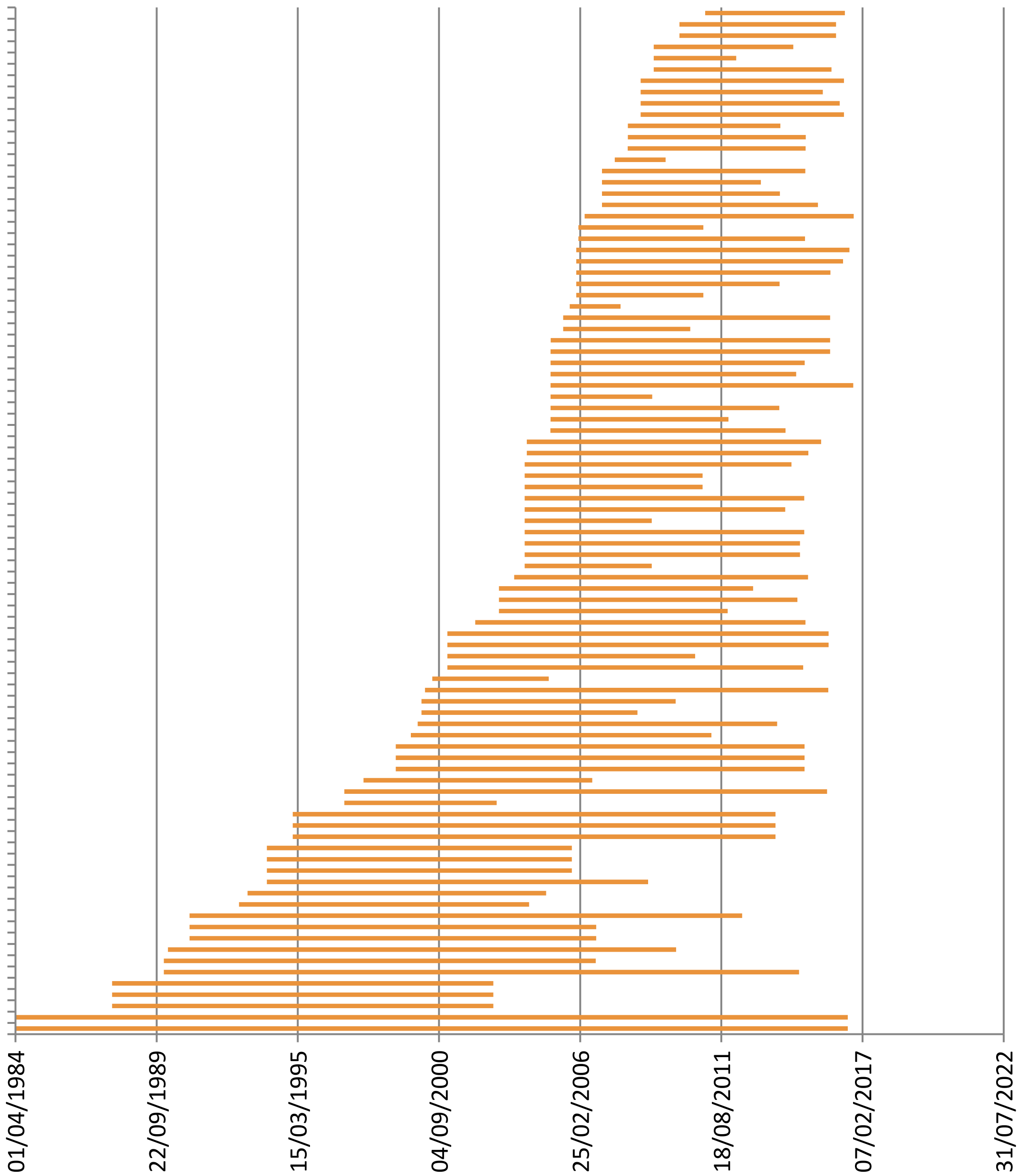


Figure 43: Historical observation period for LGD non-defaulted — corporate exposures (SME, specialised lending and corporate other) (internal data)

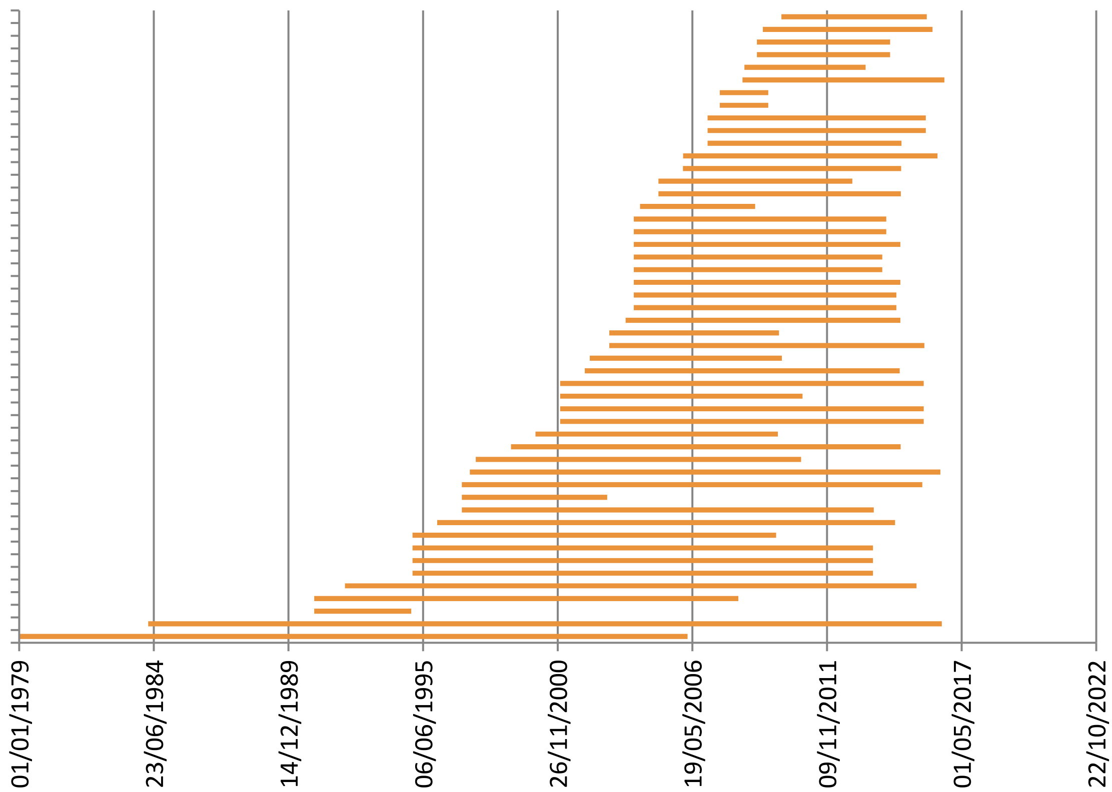
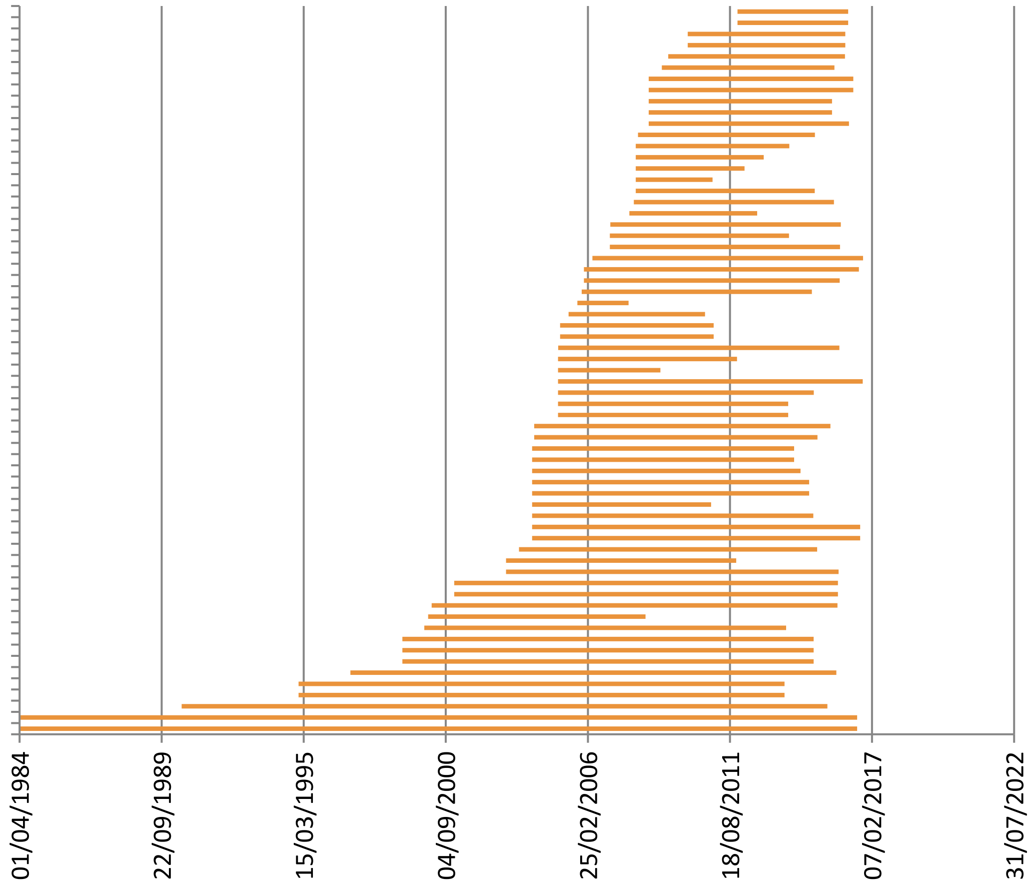


Figure 44: Historical observation period for LGD non-defaulted — retail other non-SME and qualifying revolving (internal data)



204. With respect to the specification of the historical observation period, the GLs specify (in paragraph 147(e)) that all available internal data should be considered 'relevant' (in relation to Article 181(1)(j) and 181(2) subparagraph 2 of the CRR) and should be included in the historical observation period. On this aspect, the survey enquired whether or not institutions discard some of the available historical data for the historical observation period. The results show that some historical data is discarded in around 46% of LGD models. This would appear to contradict the CRR, which specifies that all defaults should be used for the purpose of estimating the LGDs, in Article 181(1)(a) of the CRR. However, as also noted in paragraphs 201 and 202, some institutions understood the historical observation period as the period used for model development. This may explain the large share of data exclusions from the historical observation period.

Table 54: Did you exclude some of the available historical data from the specification of the historical observation period?

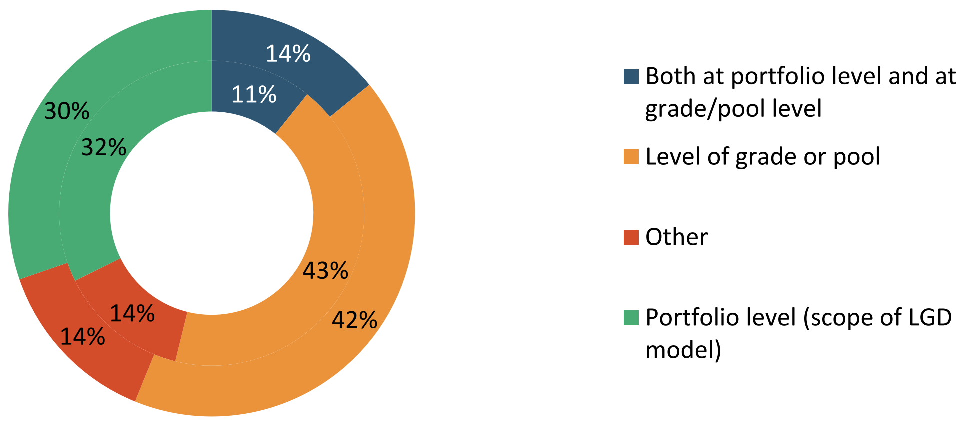
	LGD non-defaulted			LGD in-default			EL_{BE}		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**	**No.**	**%**	**% EAD**
No	107	54	62	84	52	57	73	53	61

	LGD non-defaulted			LGD in-default			EL_{BE}		
Yes	91	46	38	77	48	43	64	47	39
Total	198	100	100	161	100	100	137	100	100

5.6.2 Calculation of long-run average LGD

205. With respect to the level at which the long-run average LGD should be calculated, the GLs specify (in paragraph 149) that the long-run average LGD should be calculated separately for each grade or pool, as well as at the level of the portfolio covered by the LGD model. On this aspect, the responses to the IRB survey show that this is currently the case only in 11% of all LGD models (covering 14% of exposures). Most often (in 43% of LGD models and 42% of exposures), the institution calculates the long-run average LGD only at grade or pool level, in line with the requirement in Article 181(1)(a) of the CRR. In 32% of LGD models, the long-run average LGD is calculated only at portfolio level, which would not appear to be in line with the CRR requirement. It follows that a change in practice will be required for the majority of LGD models, although these changes stem not only from the policy prescribed in the GLs (which accounts for a change in practice in around 43% of LGD models), but also from a correct interpretation of the CRR (accounting for a change in practice in around 32% of LGD models).

Figure 45: Level at which the long-run average LGD is calculated



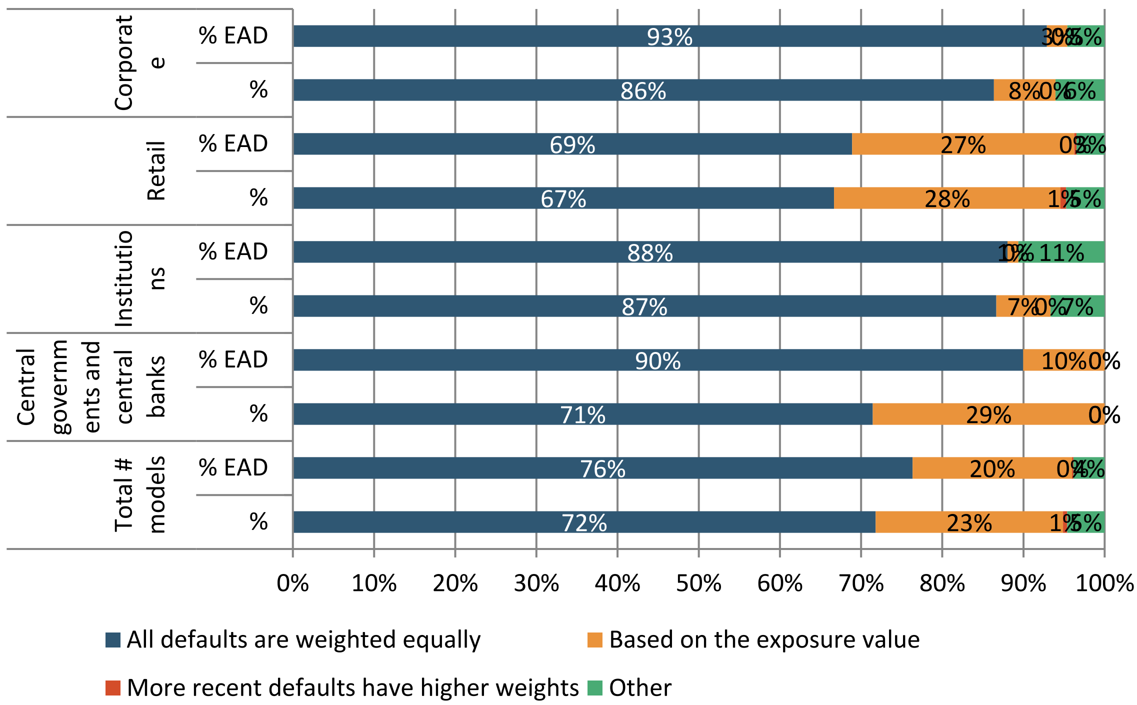
Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value

206. With respect to the calculation of the long-run average LGD, it is clarified in the GLs (in paragraph 150) that the long-run average LGD should be calculated as an arithmetic average of realised LGDs over an historical observation period weighted by the number of defaults. In line with the CRR requirement in Article 181(2), institutions are allowed to give a higher weight to more recent data for retail exposures, if they demonstrate in a documented manner that the use of higher weights for more recent data is justified by better prediction

of loss rates (paragraph 151 of the GLs). Based on the responses from the IRB survey (Figure 46), it is known that the option to weight all defaults equally is most common, and is used in 72% of models across all exposure classes. In 23% of LGD models, the long-run average calculation is weighted based on the exposure value. In only one (of out 195 LGD models), it was indicated that a higher weight is given to more recent data.

207. Across exposure classes, however, some differences may be noted. In particular, weighting by exposure value is more popular in the retail models, where this method is applied on average in 28% of all LGD models, as compared with only 8% in LGD models for exposures to corporates.

Figure 46: Type of weighting used in the calculation of the long-run average LGD — retail, corporate, institutions, and central governments and central banks



208. The GLs (in paragraph 150) further disallow that the long-run average LGD is calculated on a subset of observations, for instance as the average of yearly LGDs. This policy is necessary and warranted as explained in paragraph 227 of this report in section 5.6.3, ‘Treatment of incomplete recovery processes’.

5.6.3 Treatment of incomplete recovery processes

209. In the context of the calculation of long-run average LGD, differences in the treatment of incomplete recovery processes have been identified as one of the main sources of unjustified

variability of LGD estimates[31]. Detailed requirements in that regard are therefore included in the GLs (paragraphs 153-159).

210. In particular, the GLs specify (in paragraph 156) that institutions should define the maximum average expected period of the recovery process for a given type of exposures, and during which the institution realises the vast majority of the recoveries. All exposures that remain in defaulted status for a period of time longer than the maximum period of the recovery process should be treated as closed for the purpose of the calculation of the observed average LGD, and institutions should calculate the 'observed average LGD' taking into account realised LGDs only on those defaults that are related to closed recovery processes and those that reached a certain threshold in terms of the time in-default, both at grade or pool, and at portfolio level.

211. In addition, the GLs specify (in paragraph 158) that institutions should obtain the long-run average LGD by adjusting the observed average LGD, taking into account the information related to incomplete recovery processes, and the estimated future costs and recoveries on these exposures[32]. The adjustment can be estimated at the level of the single exposure, grade or pool, or LGD model (paragraph 159(e) of the GLs).

212. The following pros and cons have been identified for this policy option:

- ✓ pro: addresses the problem that institutions cannot present reliable estimates for further periods due to insufficient data;
- ✓ pro: where the collateral has not been realised within the specified period, it may indicate some problems with the collateral that could prevent its realisation;
- ✓ con: less flexible and hence in some cases less accurate, as it is not possible to include future expected cash flows even if there is high probability they will be realised (but if the maximum period is defined appropriately this inaccuracy should not be significant);
- ✓ con: cash flows from collaterals, if they exist, are usually more significant than other cash flows, and at advance stages of recovery processes can be predicted on an individual basis.

213. As an alternative to this policy option, the EBA has considered allowing institutions to estimate future recoveries for periods beyond the maximum length of the recovery process only if these recoveries will stem from the realisation of the existing collaterals. The following pros and cons have been identified for this policy option:

[31] EBA, *Third interim report on the consistency of risk-weighted assets*, 2013, p. 91 (https://www.eba.europa.eu/documents/10180/15947/20131217+Third+interim+report+on+the+consistency+of+risk-weighted+assets+-+SME+and+residential+mortgages.pdf).

[32] Note that any recoveries realised after the moment of default should be included in the calculation of the economic loss for the purpose of obtaining the realised LGD for each exposure (as specified in paragraph 133 of the GLs under the section on the definition of economic loss).

- ✓ pro: more accurate in some cases, especially where individual case-by-case assessment is applied and there is high probability that the recovery on a given exposure will be realised;
- ✓ con: often not enough data to estimate recoveries for further periods;
- ✓ con: less strict approach that allows more subjective and less comparable estimates, and may lead to disregarding in practice the effect of the maximum length of the recovery process.

214. To assess current practices on incomplete recovery processes, institutions were asked to indicate for each LGD model how incomplete recovery processes are incorporated into the LGD estimates: (i) incomplete recovery processes are not included; (ii) only with recoveries realised so far; (iii) with recoveries realised so far and estimated future recoveries; (iv) as an adjustment at grade or pool level; (v) as an adjustment at portfolio level; or (vi) any other treatment. The results of the IRB survey confirm the existence of various practices with regard to the treatment of incomplete recovery processes in the LGD estimation.

Table 55: How are incomplete recovery processes incorporated into the LGD estimation?

	LGD non-defaulted			LGD in-default			EL_{BE}		
	No.	%	% EAD	No.	%	% EAD	No.	%	% EAD
As an adjustment at portfolio level	7	3	5	7	4	6	6	4	6
As an adjustment at grade or pool level	1	1	1	0	0	0	0	0	0
Incomplete recovery processes are not included	59	29	28	49	30	27	36	25	20
Only with recoveries realised so far	38	19	10	35	21	11	34	24	12
With recoveries realised so far and estimated future recoveries	78	39	44	52	32	39	51	36	49
Other	16	8	8	19	12	13	15	11	13
Not applicable	3	1	4	2	1	4	0	0	0
Total	202	100	100	164	100	100	142	100	100

215. The most frequent approach is consistent with the GLs, i.e. that incomplete recovery processes should be included in the estimation with recoveries realised until the moment of estimation, as well as estimated future recoveries (39% of LGD non-defaulted models and covering 44% of exposure values). Models where only recoveries realised so far are included in the estimation, however, represent around 20% of all LGD models, and models where incomplete recovery processes are not included represent around 30% of all LGD models. For these models, therefore, the requirement to estimate also future recoveries will require a change in modelling practices.

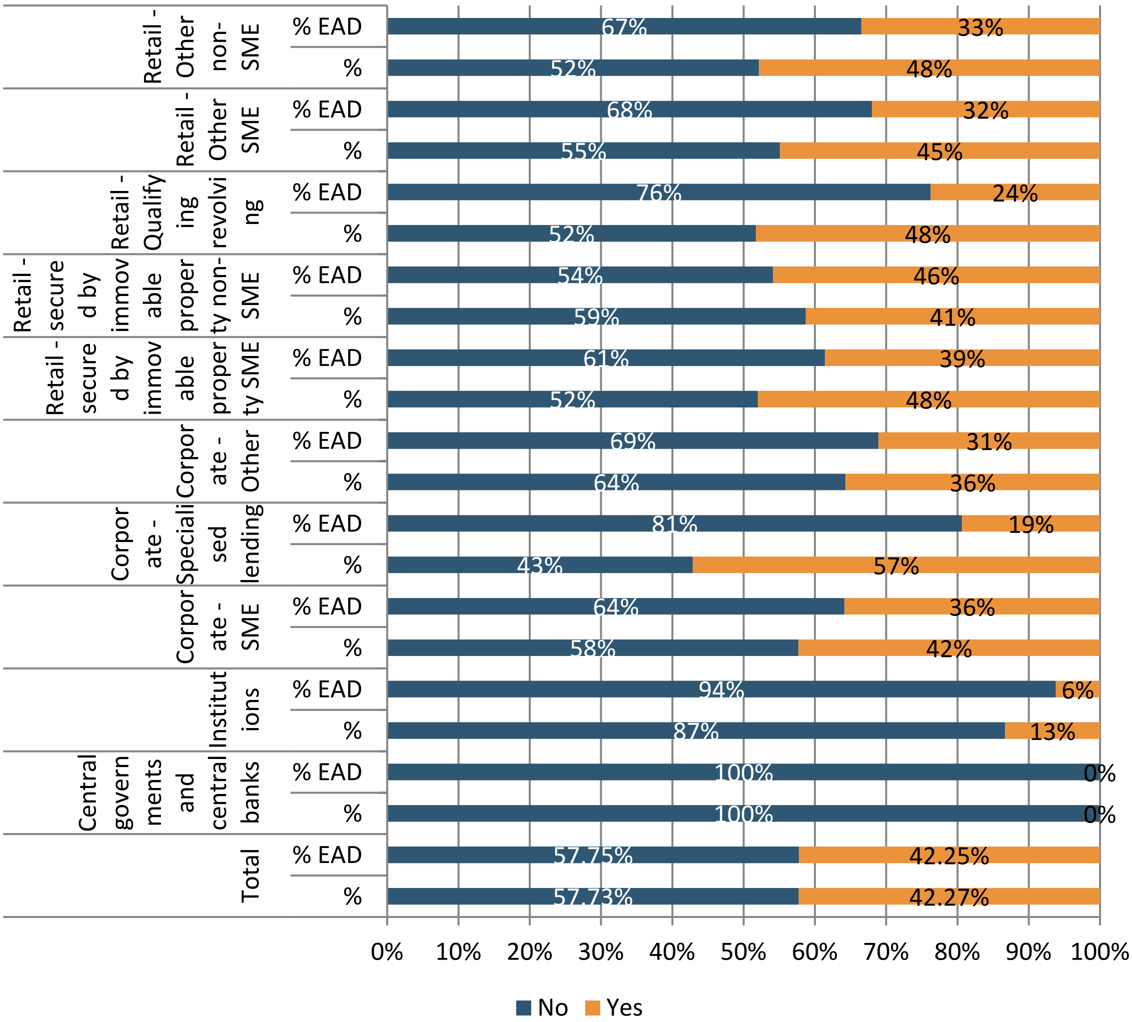
216. The response 'other' was selected in several models. The main reasons mentioned were (i) that a different approach is used for secured versus unsecured exposures; (ii) that incomplete cases are forced as cure or repossession; and (iii) that whether or not incomplete recovery processes are included is dependent on the estimation and calibration step. One

institution mentioned that incomplete recovery processes are included in the estimation only when these are provisioned. After reviewing the responses, the additional category ‘not applicable’ has been created, because some respondents mentioned that there are no incomplete recovery processes (because they use external data or because all historical recovery processes are closed).

217. However, across countries and institutions a wide variety of practices can be observed, which indicates the need for harmonisation. Balancing the pros and cons of the policy included in the GLs, and given the confirmation that this policy option is the most common approach currently used by institutions, this policy decision has been included in the final GLs (in paragraphs 158(b) and 159).

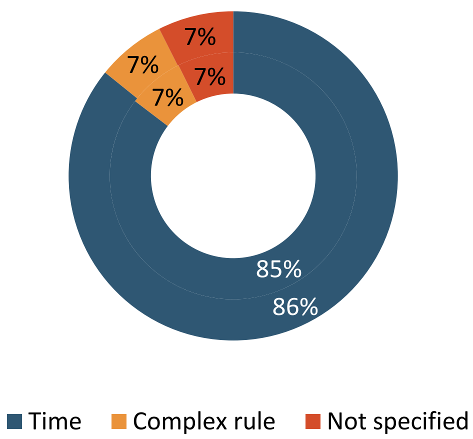
218. The survey further investigated approaches with regard to the specification of the maximum length of the recovery process. According to the results presented in Figure 47, less than half of the models currently incorporate a specification of the maximum length of the recovery process, with a much smaller share in the case of models for low default portfolios such as central governments and institutions (only six models). For other portfolios the split is more or less equal, indicating the need for harmonisation. The requirement in the GLs to set a maximum period after which incomplete recovery processes are closed will therefore entail a change in modelling practices for more than half of the LGD models.

Figure 47: Is a maximum period defined after which incomplete recovery processes are treated as closed for the purpose of the average realised LGD? By COREP exposure class



219. Figure 48 shows, for those models where a maximum period of the recovery process is specified, how this maximum is determined. For around 85% of models (70 LGD models), a maximum time period is set, whereas in 7% of models a more complex rule is used. The following rules were mentioned: (i) incomplete work-outs that are treated as closed are those positions fully provisioned, or whose vintage is greater than 10 years without mortgage or bankruptcy procedures, or whose vintage is greater than 10 years, with mortgage or bankruptcy but a coverage > 90%; (ii) incomplete work-outs that are treated as closed are those where the recovery process takes more than five years and the last payment was more than two years ago; (iii) incomplete work-out processes are treated as closed if the vintage is greater than eight years and they have a provision coverage > 80%; and (iv) recovery processes are treated as closed at the point where, on average, 90% of the exposure value is recovered.

Figure 48: Where a maximum period for the recovery process is specified, how is this defined?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

220. Based on those models where the maximum period is specified on a time dimension, the maximum period specified for the recovery process is five years and eight months (average based on 70 models). However, a wide variety can be observed across countries.

221. Regarding the average time of recovery processes and, related to it, the share of incomplete recovery processes in the observations included in the RDS, significant differences are observed between countries, which may be related to different legal environments, among other things. The average time of the recovery process is two years and eight months across all LGD models in the sample, but this average hides conservable heterogeneity, with a maximum of 20 years and 5 months. It should be noted, however, that the definition of a closed case was not harmonised at the time the survey was conducted, in particular with respect to cases where the collateral has been recollected but not sold. The share of incomplete recovery process in the LGD model is 20% on average across all EU countries.

Table 56: Average time of the recovery process in the RDS (expressed in months) and average share of incomplete recovery processes (calculated in terms of the number of defaulted exposures) regarding all defaults occurring during the historical observation period (LGD non-defaulted, internal data)

	Average time of the recovery process					Share of incomplete recovery processes				
	N	mean (%)	mean (% EAD)	min	max	N	mean (%)	mean (% EAD)	min	max
Total	164	32.76	29.20	2.00	245.00	156	20.51	21.43	0.00	100.00

222. The GLs specify, in relation to the treatment of incomplete recovery processes, how the long-run average LGD should be calculated, i.e. based on all defaults observed during the historical observation period, weighted by the number of defaults and by adjusting the observed average LGD, taking into account the estimated future recoveries (paragraphs 150 and 158-159). The responses to the IRB survey show a variety of practices, but confirm that

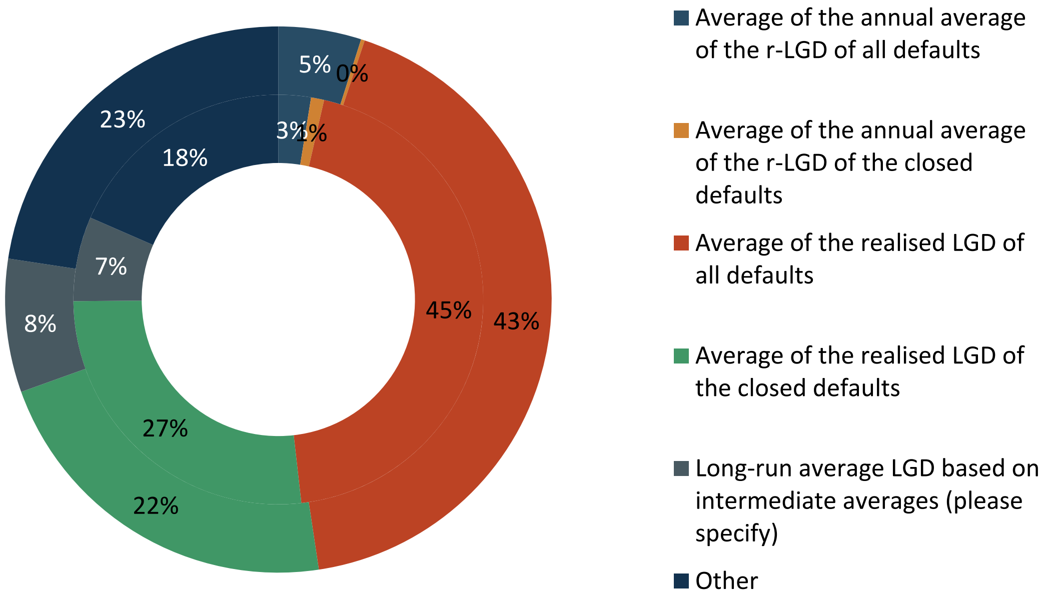
the most common approach is to calculate the long-run average LGD based on the realised LGD of all defaults (applied in 45% of all models and 43% of all exposures).

223. The calculation based on the average of the realised LGD of all defaults is used most often (45% of all LGD models), followed by the average of the realised LGD of all closed defaults (27%). The calculation based on the average of the annual average of the realised LGD of all defaults is applied in nearly 3% of all LGD models. The option to consider all defaults (not only closed but also some open cases) is more common (48%) than considering closed defaults only (28%).

224. Furthermore, the methodology used to calculate the average of the annual average of the realised LGD (based on all cases or on closed cases only) is rare (4%) in comparison with the methodology used to calculate the long-run average as the average of the realised LGDs (based on all cases or on closed cases only) (72%). This finding supports the policy in the GLs (in paragraph 150) that specifies that institutions should not use any averages of LGDs calculated on a subset of observations, and in particular any yearly average LGDs, unless they use this method to reflect higher weights of more recent data on retail exposures, in accordance with Article 181(2) of the CRR.

225. The option to calculate the long-run average LGD based on intermediate averages is only used in 13 LGD models (7%), where institutions have given a variety of explanations: (i) one institution mentions that long-run average LGD is calculated as the quarterly average of the realised LGD of all defaults that occurred in each quarter; (ii) another institution mentions that an exposure-weighted average LGD is calculated based on all defaults that occurred in that month, and that the long-run average LGD is calculated as the default-weighted average of these monthly averages of LGD; (iii) another institution mentions that long-run averages are calculated at model component level; and (iv) another institution mentioned that the long-run average LGD is calculated with reference to the underlying scenario.

Figure 49: Method used to calculate the long-run average LGD



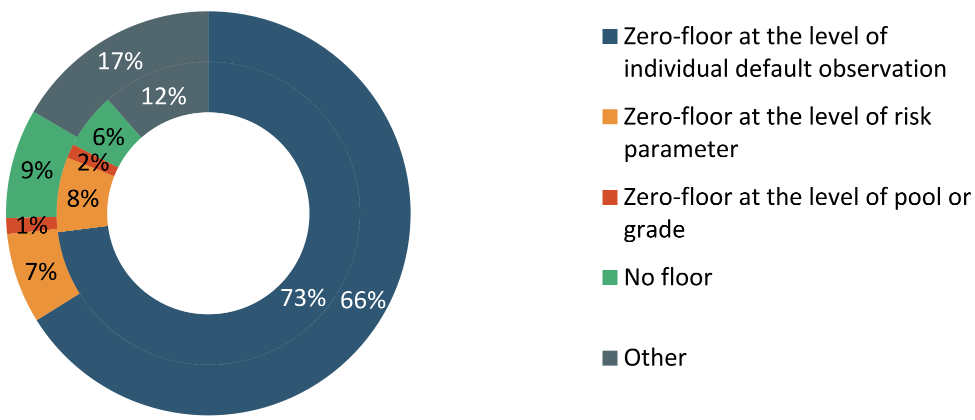
Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

226. The significant share of models for which the category 'other' was selected (18% of models or 36 LGD models) indicates the general confusion around the different possible approaches to calculating the long-run average LGD. The most common explanation given for those 'other' models (in 9 of these 36) is that no long-run average LGD is calculated, which would not be in line with the CRR and the GLs.

5.6.4 Treatment of cases with no loss or positive outcome

227. The GLs prescribe (in paragraph 160) that wherever institutions realise profit on their observations of defaults, the realised LGD on these observations should equal zero for the purpose of calculating the observed average LGD and the estimation of long-run average LGD. The evidence collected in the IRB survey supports this requirement, and shows that a zero-floor at the level of the individual default observation is applied in 73% of LGD models.

Figure 50: How are cases with no loss or positive outcome treated?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

228. When this requirement was considered, the following two options have been considered:

(a) Option 1: 0% floor on LGD estimates. This would be the continuation of policy applied in GL 10 i.e. no obligatory floor at the level of individual realised LGD. Netting of gains and losses would be allowed, but only where this is consistent with the business model of the institution (subject to the assessment of the competent authority).

- ✓ Pro: no change in modelling practices.
- ✓ Con: application of netting between gains and losses on various exposures would only have an effect on models based on grades or pools, whereas for many LGD models that are estimated based on a continuous rating scale, this effect would not be reflected. This would contribute to non-comparability of the estimates.
- ✓ Con: according to the definition of LGD included in point (55) of Article 4(1) of the CRR, this parameter should measure potential losses but not gains on defaulted exposures, and therefore this asymmetry is already included in the LGD definition. The concept of capital requirements is to cover potential losses but not gains, and therefore the calculation should be focused on losses.
- ✓ Con: gains achieved in a particular period of time may not be available to cover losses experienced in a different period, and hence the netting over the observation period would not be appropriate. In particular in the case of estimates sensitive to economic conditions, the losses over the bad years would be compensated by gains over the good years.

- ✓ Con: the EBA GLs will be subject to a 'complain or explain' mechanism (which was not the case for GL 10). The repetition of requirements of GL 10 in a stronger legal tool is expected to lead to a decrease of LGD estimates in the majority of cases, which would not be prudent.

(b) Option 2: 0% floor on realised LGD for the computation of the long-run average. This was the option specified in the CP on the GLs, and which broadly reflects current practice. In addition, it would be clarified that while realised LGDs floored to zero would have to be used in the calculation of long-run average LGD, institutions would be allowed to use any information available in the model development (risk differentiation). MoC for general estimation error would also be calculated on the basis of full distribution before the application of floor.

- ✓ Pro: broadly consistent with current practices.
- ✓ Pro: harmonisation of practices and hence reduction in undue RWA variability.
- ✓ Con: the estimation of the risk parameters at pool or grade level is key in the IRB approach; therefore the risk parameter estimates should reflect the actual economic loss of these grades or pools. Where gain is achieved on some exposures and loss on others, this effect is netted at the portfolio level. Elimination of these netting effects would not be justified if that netting reflects real outcomes. Under this argument, real netting effects should be allowed.
- ✓ Con: if the realised LGDs are floored to zero, the realised distribution of losses is truncated. This increases the methodological challenges in LGD estimation where data is already scarce.
- ✓ Con: for estimation based on total losses, netting of profits and losses within a pool is allowed, indirectly. If netting effects in LGD estimation were not allowed, it might incentivise banks to use the approach based on total losses, if they wanted to reflect their actual economic loss in the IRB parameters.

229. Based on these considerations, option 2 has been chosen in the final GLs, i.e. the zero-floor applies for the calculation of the observed average LGD and the estimation of long-run average LGD. Irrespective of this requirement, however, all relevant information may be used in the model development for the purpose of risk differentiation.

5.7 Downturn adjustment

Table 57: How is a downturn period defined?

	No.	%	% EAD
Based on historical macroeconomic and credit factors	95	47	41
The year(s) with the highest observed realised LGD	34	17	15

	No.	%	% EAD
The year(s) with the highest observed DR	17	8	12
Based on macroeconomic and credit factors, both historical and forward-looking	16	8	6
Expert judgement	6	3	2
Not applicable (downturn adjustment is not necessary because downturn is already reflected in the data)	6	3	3
Based on supervisory guidance	5	2	4
Based on a correlation analysis between PD and LGD	4	2	1
Not applicable (downturn is not reflected in the estimates)	3	1	1
Other	16	8	15
Total	202	100	100

230. Table 57 shows how institutions define downturn periods across all LGD models. In 47% of all LGD models, the downturn period is defined on the basis of historical macroeconomic and credit factors, and in an additional 8% of LGD models the downturn is defined based on a combination of historical and forward-looking macroeconomic and credit factors. Several respondents specified which credit factors are used: based on the years/months with the highest litigation rates, based on the years/months with the highest loss rates (some banks mention that they calculate these as the multiplication of observed DRs and observed LGDs), or based on insolvency rates. Some of the macroeconomic factors are time series of real estate prices, interest rates, GDP and unemployment rates.

231. In 8.5% of LGD models, the downturn period is defined based on the year(s) with the highest DR. This approach is somewhat similar to that based on macroeconomic and credit factors, where the period is defined based on loss rates.

232. Several other respondents (16.83%) indicated that the downturn period is defined on the basis of the year(s) with the highest observed realised LGD. A few institutions also mentioned that they then selected defaults to obtain an annual average realised LGD: by vintage on a three-year window, or in accordance with the complete recovery processes.

233. In almost 3% of models, the downturn adjustment is reflected based on supervisory guidance given by the competent authority (in one case, it was mentioned that a stressed scenario is applied to the loan-to-value risk driver and the discount factor).

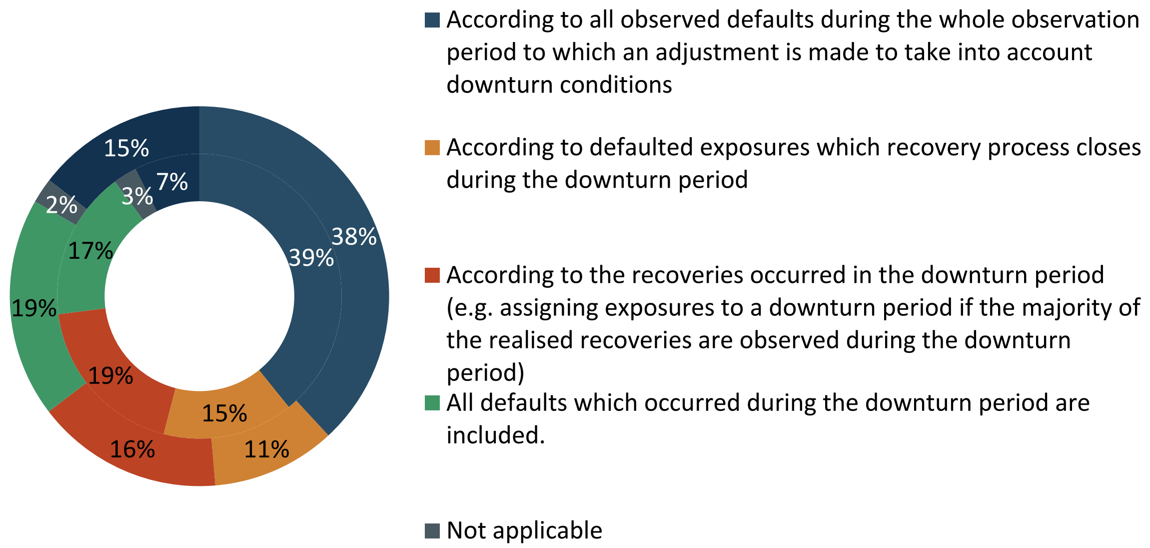
234. The answer ‘not applicable (downturn adjustment is not necessary because downturn is already reflected in the data)’ was chosen in a few cases, for instance for sovereign exposures, where it was argued that loss data always stem from downturn periods; for municipalities, where it was mentioned that a downturn adjustment is not applicable; and for a shipping portfolio and a portfolio of insurance products, where it was mentioned that this segment has no risk of lower recovery rate during downturn periods.

235. Around 8% of responses could not be grouped in a specific category and are therefore represented in the category ‘other’. While not all comments were entirely clear, the

following methods were mentioned: selecting the most conservative periods for each model component over time; using the distance from each annual LGD from the long-run average; using the volatility of loss rates over a seven-year period; and selecting the worst month-on-month recoveries observed during the 2009 recession. In several cases, the approach is a combination of several aspects. In one model, for instance, it was mentioned that the downturn period was defined as the period with the maximum LGD selected from a PIT LGD with buffer, long-run LGD (default-weighted average across five years), and stressed default LGD (highest LGD at time when default peaked, +/- 9 months).

236. In four models, the downturn period is defined based on a correlation analysis between PD and LGD estimates. The principle of downturn is seen as the correlation between PD and LGD, which is lacking in the regulatory formula, as the unexpected aspect is only taken through the PD. Therefore a stressed LGD was computed based on the correlation notion between PD and LGD (Tasche approach).

Figure 51: How are data selected used in downturn estimation?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

237. The IRB survey then enquired how institutions select data once the downturn period is established to compute the long-run average LGD. Based on the responses, however, it appears that this question was not properly understood, since nearly 50% of original responses were for the category ‘other’ and provided a wide range of explanations not answering the question. As a result, many of the responses have been discarded because the explanations given responded to a different question. This was the case when it was mentioned, for instance, that the data used in downturn estimation are selected based on

expert judgement, or based on historical time series, etc. The results shown in Figure 51 are therefore based on a much smaller sample of LGD models than those represented in Table 57 (148 instead of 202).

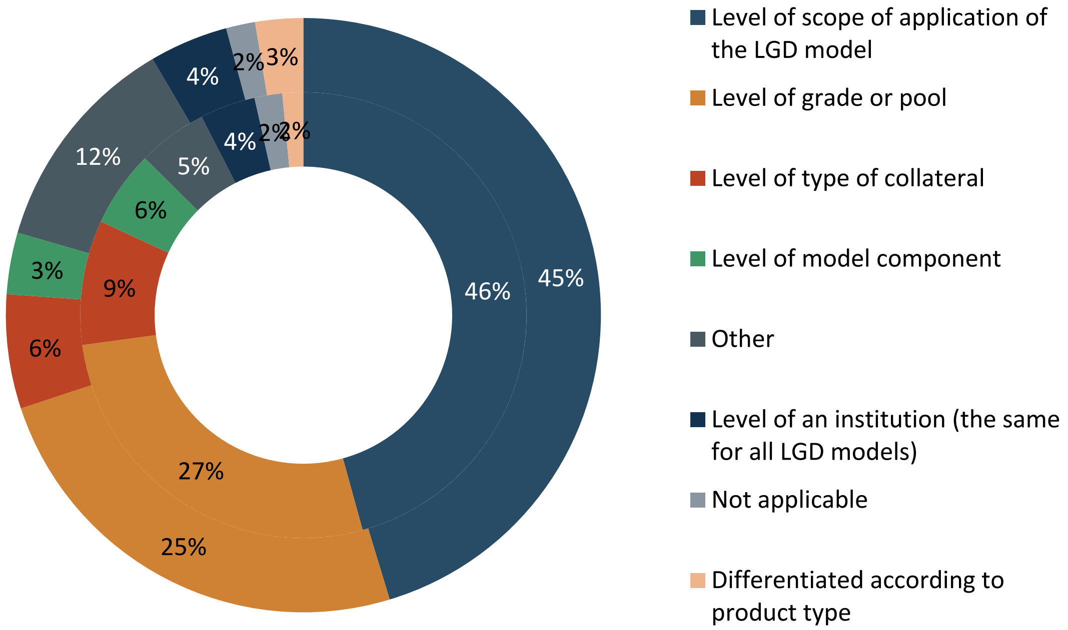
238. In nearly 40% of LGD models, the data used in downturn estimation are selected based on all observed defaults during the whole observation period to which an adjustment is made, to take into account downturn conditions, whereas in 17% of models all defaults that occurred during the downturn period are included.

239. In 19% of models, those exposures for which the recoveries occurred in the downturn period are selected (e.g. assigning exposures to a downturn period if the majority of the realised recoveries are observed during the downturn period). In two institutions, the data are selected according to defaulted exposures for which the recovery process starts during the downturn period. However, in around 15% of models defaulted exposures are selected for which the recovery process closes during the downturn period.

240. Among the responses in the category 'other', one institution mentioned that it selects the data used in downturn estimation according to exposures that default during the downturn period. One institution mentioned a three-step approach: (1) downturn periods are identified if the house price index has decreased; (2) the average house price decline during the downturn period is calculated; and (3) the recovery rate under downturn periods is computed by subtracting the average house price decline from the usual recovery rate. Other institutions mentioned a combination of selecting all exposures that defaulted during the downturn period for the unsecured part of the exposure, and selecting all exposures for which the recovery process ends during the downturn period for the secured part of the exposure.

241. In some cases, the respondent mentioned that the question is not applicable. This was the case for a sovereign portfolio and an aviation portfolio, and in one case it was mentioned that no downturn period could be identified.

Figure 52: At which level is the downturn adjustment specified?

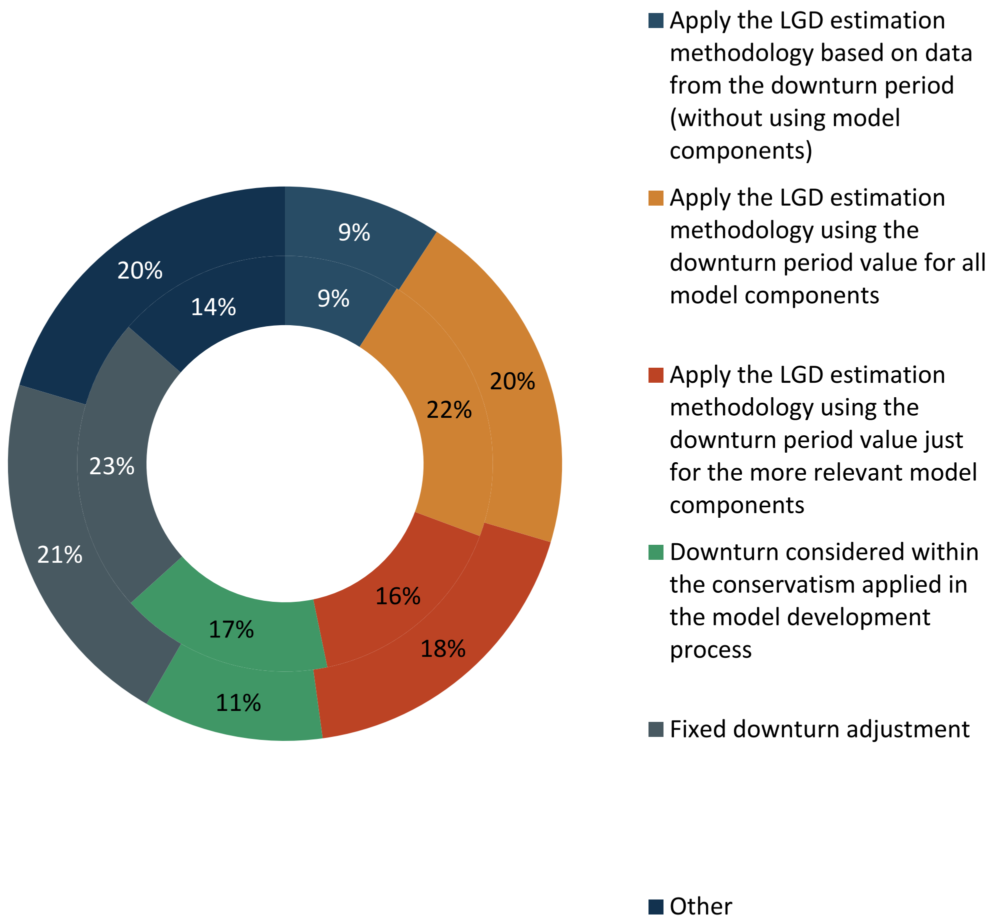


Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

242. In nearly half of the LGD models, the downturn adjustment is specified at the level of the LGD model, whereas in smaller shares of models, the downturn adjustment is specified at a lower level: at the level of the grade or pool (in 27% of models), differentiated according to the type of collateral (9%) or differentiated by product type (2%) (see Figure 52). In around 4% of models, the downturn adjustment is specified uniformly in the institution. Some respondents (around 6%) mentioned that the downturn adjustment is applied at model component level, in which case it is not entirely clear whether this leads to a different adjustment by grade or pool, collateral, or product type, or whether this leads to a uniform adjustment for all exposures under the scope of application of the LGD model.

243. Some of the responses mentioned in the category ‘other’ are (i) that a different downturn adjustment is performed for each individual value, or for each asset class, at the level of the pool or at the level of the collateral (depending on whether or not significant downturn effects are observable) and (ii) that adjustments are differentiated according to the level of the collateral and applied at the level of the model component. In one model, the adjustment is determined at portfolio level and then applied to each obligor.

Figure 53: What is the main methodology used to determine LGD estimates that are appropriate for an economic downturn?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

244. When it comes to the methodologies that institutions use to determine downturn LGD estimates, a wide variety of practices can be observed (see Figure 53). However, in 38% of LGD models, the downturn period value is used for all model components (22%), or for the most relevant components (16%). In 23% of LGD models, a fixed downturn adjustment is applied, and in 9% of models the LGD estimation is based on data from the downturn period without using model components.

245. Around 17% of respondents indicate that they use conservatism in the model development process to reflect downturn LGD estimates.

5.8 Summary of model changes in LGD estimation

246. From the above results of the survey it was possible, for selected questions, to directly assess the number of models (in the IRB survey sample) and the exposure amounts that would be affected by the chosen policy, and for which therefore a change in modelling practice will be required once the GLs enter into force. For those questions for which it is possible to directly assess whether or not there will be an impact, Table 58 provides an overview of the resulting model changes, both in terms of the share of LGD models (%) in terms of the share of exposure values covered by these LGD models (% EAD).

Table 58: Summary of selected policy choices for LGD (non-defaulted) estimation and the number of model changes

			No model change		Model change		Not known	
Paragraph (s) in the GLs	**Policy choice**	**No.**	**%**	**% EAD**	**%**	**% EAD**	**%**	**% EAD**
102	LGD estimates should be based on institution's own loss and recovery experience, and market-implied LGD estimates are not allowed.	197	59	53	2	4	40	42
116-117	The recovery value that should be recognised in the calculation of the realised LGD should be the value of repossession after a haircut, regardless of whether or not it has been sold on the LGD calculation date.	112	12	8	71	77	18	15
135	Institutions should calculate economic loss for cured cases (i.e. cases where the exposure returns to non-defaulted status) as for all other defaulted exposures, with the only difference that additional recovery cash flows are added to the calculation at the date of return to non-defaulted status in the amount that was outstanding, and should apply any discounting effects until the moment of default.	200	32	29	46	57	22	14
137	Unpaid late (i.e. after default) fees should not be included in the outstanding amount in the denominator of the realised LGD.	202	20	22	65	63	15	15
138	Capitalised interest (i.e. after default) should not be included in the outstanding amount in the denominator of the realised LGD.	202	26	28	62	62	12	10
140-141	If additional drawings are included in the CCF, they should also be included in the outstanding amount in the denominator of the realised LGD. If additional drawings are not included in the CCF, they should not be included in the denominator.	167	53	58	36	35	11	8
143	The annual discounting rate should be composed of a primary interbank offered rate applicable at the moment of default, increased by an add-on of five percentage points. The primary interbank offered rate should be considered the three-month Euribor or a comparable liquid interest rate in the currency of the exposure.	196	30	37	40	34	31	28

			No model change		Model change		Not known	
144-145	Direct costs incurred before default should be included in the calculation of the realised LGD.	202	48	48	52	52	0	0
144, 146	Indirect costs incurred before default should be included in the calculation of the realised LGD.	202	25	15	75	85	0	0
147(e)	All available data should be considered as relevant (in relation to Article 181(1)(j) and 181(2) of the CRR) and should be included in the historical observation period.	198	54	62	46	38	0	0
149	The long-run average LGD should be calculated separately for each grade or pool, and at the level of the portfolio covered by the LGD model.	195	11	14	43	42	46	44
150-151	The long-run average LGD should be calculated as an arithmetic average of realised LGDs over an historical observation period weighted by the number of defaults, and for retail exposures, institutions are allowed to give a higher weight to more recent data in case of retail exposures, if they demonstrate in a documented manner that the use of higher weights to more recent data is justified by better prediction of loss rates.	195	72	77	23	20	5	4
158	Institutions should obtain the long-run average LGD by adjusting the observed average LGD, taking into account the information related to incomplete recovery processes and the estimated future costs and recoveries on these exposures.	199	39	45	49	40	12	15
156	Institutions should define the maximum average expected period of the recovery process for a given type of exposures, during which the institution realises the vast majority of the recoveries.	194	42	42	58	58	0	0
150, 158	The long-run average LGD should be calculated based on all defaults observed during the historical observation period, weighted by the number of defaults and by adjusting the observed average LGD, taking into account estimated future recoveries.	195	45	43	30	27	25	30
160	Wherever institutions realise profit on their observations of defaults, the realised LGD on these observations should equal zero for the purpose of calculation of the observed average LGD and the estimation of long-run average LGD.	200	73	66	16	17	12	17

247. Table 59 further shows how many aspects will at least need to be changed in the LGD models. It can be seen, for instance, that none of the models in the IRB survey would be

unaffected by all of the policy aspects listed above. In 29% of the models, at least seven policy aspects would need to be changed.

248. It should again be mentioned, however, that these statements concern only the aspects of LGD models on which explicit questions were included in the survey, described above, whereas the area where guidance is given on LGD models is very broad and likely to affect many more modelling aspects. In addition, these calculations include only the models for which a model change is expected, and not those for which it is unknown whether or not a model change will be necessary. Therefore, these estimates below are a lower bound to the true number of affected models. In practice, one may assume that all models will probably have to be changed in one or more dimension.

Table 59: Summary of number of aspects to be changed in LGD estimation

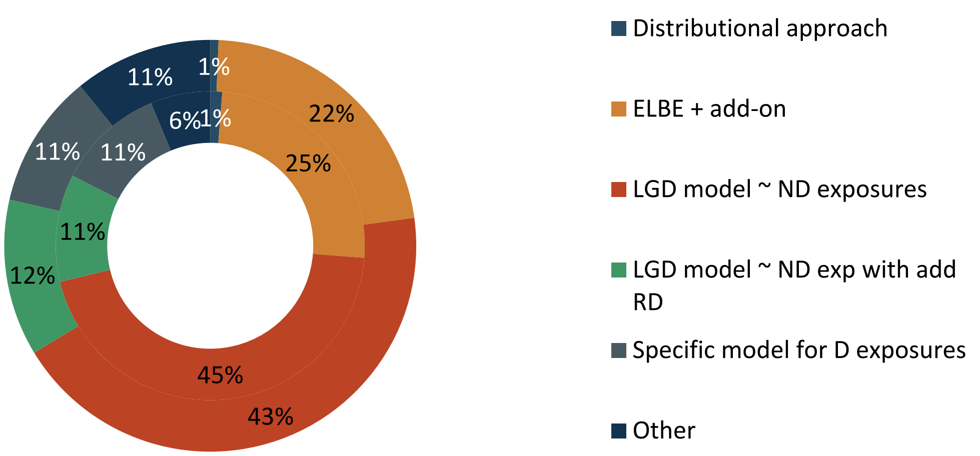
No. of aspects to be changed	No.	%	% EAD
2	3	1	1
3	6	3	3
4	18	9	10
5	27	13	14
6	27	13	13
7	58	29	20
8	33	16	27
9	19	9	10
10	11	5	2
Total	202	100	100

6. Estimation of risk parameters for defaulted exposures

6.1 General requirements specific to LGD in-default and EL_{BE} estimation and risk drivers

249. The treatment of defaulted assets was identified as one of the drivers of variability of the own funds requirements across institutions. Clarification has already been provided in the RTS on IRB assessment methodology, in particular Article 54(2)(c), that the direct estimation of LGD in-default should be consistent with the LGD for non-defaulted exposures, to avoid potential cliff effects. Following this approach, it has been further clarified in the GLs (in paragraph 167) that, for the purpose of estimating EL_{BE} and LGD in-default, institutions should use the same estimation methods as for estimating LGD on non-defaulted exposures, as they are in fact part of the LGD model, unless otherwise specified. Paragraph 168 then further clarifies that institutions should take into account all relevant post-default information in their LGD in-default and EL_{BE} estimates in a timely manner, and paragraph 176 specifies that the information on the time in-default and recoveries realised so far may be taken into account directly, as a risk driver, or indirectly, by setting the reference dates for estimation.

Figure 54: What is your approach to the estimation of LGD in-default?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

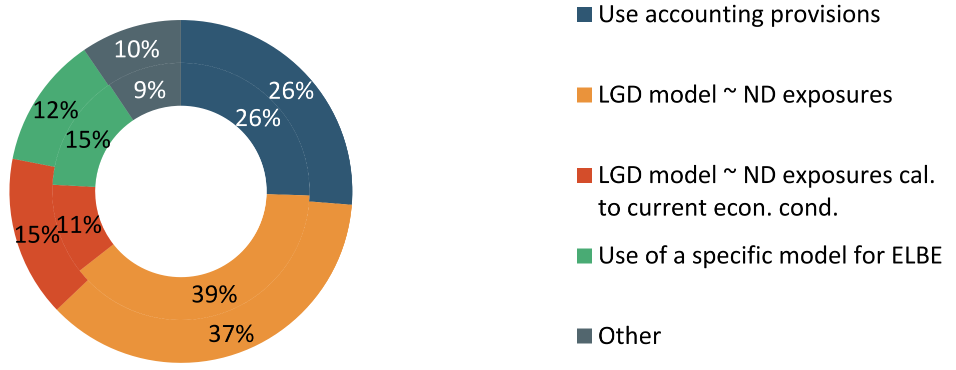
250. Based on the IRB survey, 56% of the current LGD in-default models are similar to the LGD model for non-defaulted exposures, either with or without additional risk drivers (see Figure

54). It can reasonably be assumed that if changes need to be made to these models, these will be limited. Where LGD in-default is estimated as EL_{BE} plus add-on[33], whether or not the approach will be in line with the CRR depends on how the add-on is estimated, since the CRR requires the add-on to reflect additional unexpected loss during the recovery period (Article 181(1)(h) of the CRR). For the models where a distributional approach[34] is currently applied, it is expected that some changes will be needed to comply with the requirement specified in these GLs.

251. In the IRB survey another option was also provided in the drop-down menu, i.e. where LGD in-default and EL_{BE} are 'not specified — risk weight is derived directly', which referred to where institutions determine the risk weight as a fixed percentage of the exposure at default. This option was not chosen in any of the models in the sample.

252. For EL_{BE} estimation, it should be noted that the use of accounting provisions for the EL_{BE} estimate represents 26% of the models and exposures. For these models, these GLs will require a change in modelling practices. It should further be noted that in 50% of models (52% of exposures), the EL_{BE} estimate is obtained based on a similar model to that used for the LGD non-defaulted, calibrated to current economic conditions (11% of models), or not calibrated to current economic conditions (39% of models). However, it could be argued that the requirement for EL_{BE} estimates to reflect current economic conditions (see also Figure 56, which focuses on this aspect) is already included in the CRR, in Article 181(1)(h). Therefore, any change in practice on this aspect would not stem from the entry into force of these GLs.

Figure 55: What approach is used for EL_{BE} estimation?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

[33] The 'EL_{BE} plus add-on' approach is where the add-on is estimated in a different way to under the 'distributional approach', and reflects adjustment in economic conditions considered (e.g. downturn conditions rather than current economic conditions) or any other possible sources of unexpected loss or margin of conservatism.

[34] The 'distributional approach' is where the LGD in-default is estimated as EL_{BE} plus an add-on, where the add-on reflects the uncertainty (for a given confidence interval) around the EL_{BE} as a function of the distribution of past errors (i.e. differences between estimated EL_{BE} and the observed losses at the end of the recovery period).

6.2 Reference dates

Table 60: What is the reference date for estimation?

	LGD in-default			EL_{BE}		
	No.	%	% EAD	No.	%	% EAD
Current date for a defaulted exposure	48	28	12	58	38	25
Date of default	71	42	38	44	29	22
Reference date (as specified in the GLs)	32	19	33	32	21	37
Other/use multiple reference dates	19	11	18	20	13	16
Total	170	100	100	154	100	100

253. The difference between the LGD in-default and the EL_{BE} is used for computing the risk weight in accordance with Article 153(1)(ii) of the CRR, which is then applied to the current outstanding exposure amount to obtain the risk-weighted exposure amount. Moreover, the EL_{BE} is compared with credit risk adjustments for IRB shortfall/excess purposes, where credit risk adjustments are again computed with respect to the current value of exposures. Thus, for the purpose of computing realised LGDs for defaulted exposures, institutions should use reference points in time that will be relevant for the current outstanding obligations of defaulted exposures.

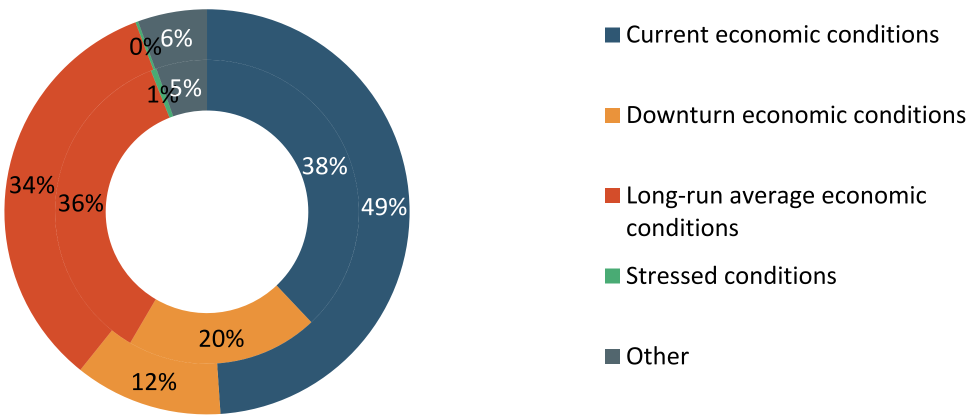
254. The concept of current outstanding exposure is clearly defined in Article 166(1) of the CRR and should also be used for defaulted exposures in the application of the EL_{BE} and LGD in-default. However, given data limitations, the continuous concept of current exposure amount may not be suitable for estimation purposes. The GLs therefore specify (in paragraph 171) that institutions should set discrete relevant reference dates to be used for grouping defaulted exposures in accordance with the recovery patterns observed. These reference dates should be used instead of the date of default in the estimation of EL_{BE} and LGD in-default. In this way, it should be feasible to estimate the parameters for defaulted exposures that are appropriate for their current status. To ensure the adequacy of the estimates, institutions should set reference dates in accordance with the recovery pattern observed on a specific type of exposures, where such reference dates may either be event based, e.g. linked with the realisation of collateral, or reflect certain time periods during which exposures have been in-default.

255. From the responses to the IRB survey it can be seen that the reference date approach specified in the GLs is used only in around 20% of LGD in-default and EL_{BE} models (see Table 60). For the other models, the entry into force of the GLs will entail a change in practice.

6.3 The requirement to reflect current economic circumstances in EL_{BE} estimates

256. The EL_{BE} estimates already reflect current economic conditions in 38% of models (49% of exposures) (see Figure 56), and for the other approaches, a change in practice will be required, unless the downturn or stressed economic conditions coincide with the current economic conditions. However, it could be argued that such change would not stem from the introduction of the GLs, since the requirement for EL_{BE} estimates to reflect current economic conditions is already included in the CRR (Article 181(1)(h) of the CRR).

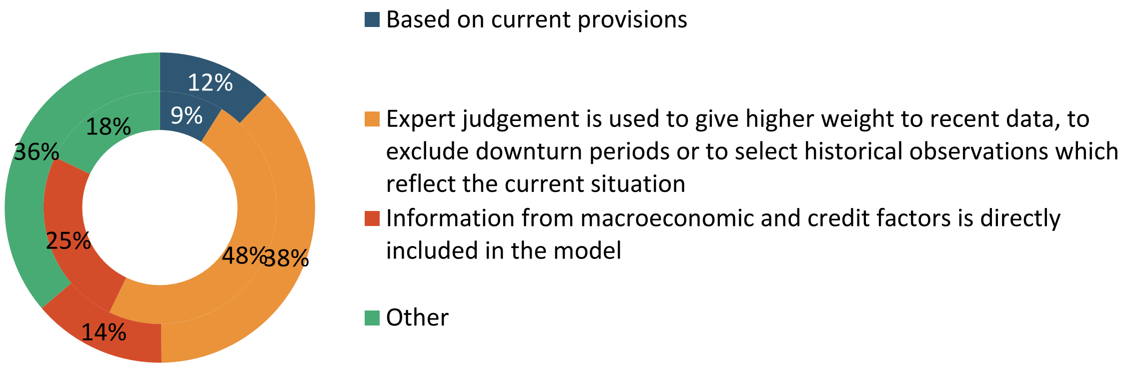
Figure 56: Which economic conditions are reflected in EL_{BE} estimates?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

257. The GLs specify (in paragraphs 184-185) how institutions should reflect the current economic conditions in their EL_{BE} estimates. In particular, institutions are allowed to estimate EL_{BE} on the basis of the long-run average LGD if certain conditions are met (among others, that the model should directly include at least one macroeconomic factor as a risk factor, as well as one material risk driver that is sensitive to economic conditions). Institutions may also adjust the long-run average LGD for defaulted exposures to reflect current economic conditions, if this adjustment is documented.

Figure 57: If you incorporate current economic conditions in EL_{BE}, how are these incorporated?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

258. Figure 57 shows the distribution of the methodologies used to reflect the current economic conditions in the EL_{BE} estimates. This information was available for 56 EL_{BE} models[35]. In almost half of the models, the approach used to reflect current economic conditions is based on expert judgement either to give higher weight to recent observations, to exclude certain downturn periods, or to select the historical periods that are deemed to reflect current economic conditions. In 27% of those EL_{BE} models, the approach is based on macroeconomic and credit factors in the model. The category 'other' was selected in nine EL_{BE} models, and based on the comments, these refer to approaches that rely on the current exposure value and a calibration based on a PIT LGD, or a situation in which EL_{BE} is calculated based on long-run average LGD but calibrated to a specific point in time.

259. Whereas those EL_{BE} models that are currently based on provisions (9% of models, or 12% of exposures) will have to be changed after the introduction of the GLs, it is difficult to assess *ex ante* whether or not those models that rely expert judgement or directly include information from macroeconomic or credit factors in the model will have to be changed to comply with the GLs.

6.4 Relation of LGD in-default and EL_{BE} to credit risk adjustments

260. The GLs specify (in paragraphs 186-188) that the use of specific credit risk adjustments (SCRA) as EL_{BE} estimates should be limited to those cases where provisions models meet, or could be adjusted to meet (e.g. by modifying the discounting rate in use), the prudential

35 This information was not available for all 63 models where current economic conditions are reflected in ELBE estimates (representing the 38% in), because the answer was not available for all models.

requirements for own LGD estimates and the requirements specified in these GLs. An exception to this rule is made allowing institutions to use individually assessed provisions as a possible reason for over-ride where they are able to prove that they provide a more accurate estimation than the EL_{BE} estimated by facility grade or pool. For this purpose, individually assessed provisions should be adjusted to be consistent with the requirements on economic loss set out in the GLs.

261. The responses in Table 61 show that, in most of the EL_{BE} models (more than 80%), the SCRA calculated on portfolio basis and SCRA assessed individually (in almost 70% of EL_{BE} models) are not used for the purpose of EL_{BE} estimation. For those EL_{BE} models where SCRA is automatically used as EL_{BE} (15% for SCRA at portfolio basis and 25% if assessed individually), the policy prescribed in the GLs would entail a change in practice, because it should be verified that those models meet the prudential requirements for LGD estimates.

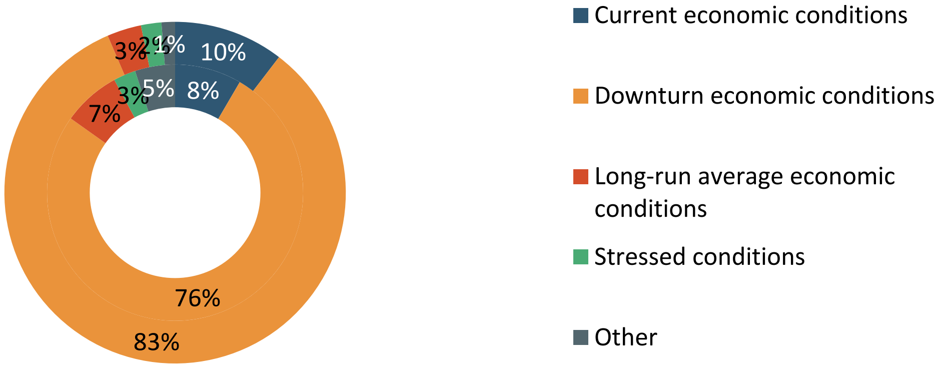
Table 61: Do you use the information on SCRA in the EL_{BE} estimation?

	SCRA calculated on a portfolio basis			SCRA assessed individually		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**
No, these are not used for the purpose of EL_{BE}	134	82	87	111	68	63
Yes, these are automatically recognised as EL_{BE}	25	15	12	42	26	29
Yes, these are used as a possible reason for over-ride	2	1	1	5	3	2
Other	3	2	0	5	3	5
Total	164	100	100	163	100	100

6.5 Specific requirements for LGD in-default estimation

262. From the GLs (paragraph 189) it should be clear that LGD in-default estimates should also reflect economic downturn conditions if these are more conservative than the long-run average LGD estimates. The survey confirms (see Figure 58) that this understanding is already applied in most of the models (76%), and in an additional 3% of models these LGD in-default estimates reflect stressed conditions.

Figure 58: Which economic conditions are reflected in LGD in-default?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

263. For LGD in-default estimations, the GLs specify (in paragraphs 191-192) that institutions should analyse and correct the LGD in-default in those situations where the EL_{BE} obtained using SCRA is above the LGD in-default obtained through direct estimation. Furthermore, the GLs also clarify that individually assessed SCRA may also be used to over-ride the LGD in-default, but it should be ensured that the add-on to the EL_{BE} covers for any increase of loss rate due to potential additional losses during the recovery period.

264. The results on these aspects of the survey are presented in Table 62. In line with the findings for EL_{BE}, SCRA is not used for the purpose of LGD in-default in the majority of LGD models (96% for SCRA at portfolio basis and 84% for SCRA assessed individually). The use of SCRA assessed individually to over-ride LGD in-default estimations happens only in around 6% of models.

Table 62: Do you use the information on SCRA in the LGD in-default estimation?

	SCRA calculated on a portfolio basis			SCRA assessed individually		
	No.	**%**	**% EAD**	**No.**	**%**	**% EAD**
No, these are not used for the purpose of LGD in-default	167	97	99	142	84	77
Yes, these are automatically recognised as LGD in-default	1	1	0	10	6	8
Yes, these are used as a possible reason for over-ride	2	1	1	4	2	1
Other	3	2	0	14	8	14
Total	173	100	100	170	100	100

6.6 Summary of model changes in LGD in-default and EL_{BE} estimation

Table 63: Summary of selected policy choices for LGD (in-default) estimation and the number of model changes

			No model change		Model change		Not known	
Paragraph(s) in the GLs	**Policy choice**	**No.**	**%**	**% EAD**	**%**	**% EAD**	**%**	**% EAD**
102	LGD estimates should be based on institution's own loss and recovery experience, and market-implied LGD estimates are not allowed.	170	56	52	2	5	41	43
143	The annual discounting rate should be composed of a primary interbank offered rate applicable at the moment of default, increased by an add-on of five percentage points. The primary interbank offered rate should be considered the three-month Euribor or a comparable liquid interest rate in the currency of the exposure.	169	27	37	40	31	33	33
147(e)	All available data should be considered as relevant (as referred to in Article 181(1)(j) and 181(2) of the CRR) and should be included in the historical observation period.	161	52	57	48	43	0	0
158	Institutions should obtain the long-run average LGD by adjusting the observed average LGD, taking into account the information related to incomplete recovery processes, and the estimated future costs and recoveries on these exposures.	162	32	41	52	39	16	20
171	Institutions should set the reference dates to be used for grouping defaulted exposures in accordance with the recovery patterns observed.	170	19	33	70	50	11	18
176	For the purposes of taking into account the information on the time in-default and recoveries realised so far, institutions may take into account this information either directly as risk drivers or indirectly, for instance by setting the reference date for estimation.	160	11	12	46	44	43	44
189	LGD in-default estimates should be appropriate for an economic downturn.	178	76	83	19	16	5	1

Table 64: Summary of number of aspects to be changed in LGD in-default estimation

No. of aspects to be changed	No.	%	% EAD
0	7	4	7
1	35	20	32
2	46	26	27
3	44	25	19
4	31	18	11
5	13	7	4
6	1	1	1
Total	177	100	100

Table 65: Summary of selected policy choices for EL_{BE} estimation and the number of model changes

			No model change		Model change		Not known	
Paragraph in the GLs	**Policy choice**	**No.**	**%**	**% EAD**	**%**	**% EAD**	**%**	**% EAD**
102	LGD estimates should be based on institution's own loss and recovery experience, and market-implied LGD estimates are not allowed.	148	55	53	1	0	44	47
143	The annual discounting rate should be composed of a primary interbank offered rate applicable at the moment of default, increased by an add-on of five percentage points. The primary interbank offered rate should be considered the three-month Euribor or a comparable liquid interest rate in the currency of the exposure.	152	26	33	41	44	32	23
147(e)	All available data should be considered as relevant (as referred to in Article 181(1)(j) and 181(2) of the CRR) and should be included in the historical observation period.	137	53	61	47	39	0	0
158	Institutions should obtain the long-run average LGD by adjusting the observed average LGD, taking into account the information related to incomplete recovery processes and the estimated future costs and recoveries on these exposures.	142	36	49	49	32	15	19
171	Institutions should set the reference dates to be used for grouping defaulted exposures in accordance with the recovery patterns observed.	154	21	37	66	47	13	16
167-168	Institutions should use an LGD model as for non-defaulted exposures, calibrated to current economic conditions and taking into all relevant post-default information.	149	11	15	64	63	24	22

			No model change		Model change		Not known	
183-184	EL_{BE} estimates should reflect current economic conditions.	166	38	49	57	46	5	6
184-185	Institutions should estimate EL_{BE} on the basis of the long-run average LGD if certain conditions are met (among others, the model should directly include at least one macroeconomic factor as a risk factor, as well as one material risk driver that is sensitive to economic conditions), or institutions may adjust the long-run average LGD for defaulted exposures to reflect current economic conditions, if this adjustment is documented.	56	25	14	9	12	66	74

Table 66: Summary of number of aspects to be changed in EL_{BE} estimation

No. of aspects to be changed	No.	%	% EAD
0	9	6	8
1	14	9	16
2	31	20	23
3	44	28	28
4	28	18	16
5	26	17	6
6	4	3	2
Total	156	100	100

7. Application of risk parameters

265. In the section on application of risk parameters, a requirement is included (in paragraph 194) that specifies that where institutions receive new information with respect to a relevant risk driver or rating criterion, they should take this information into account in the rating assignment in a timely manner. The same section also requires that the relevant IT systems and the corresponding rating or LGD assignment be updated and reviewed as soon as possible, and where the new information relates to the default of an obligor, that the PD of the obligor be set to 1 in all relevant IT systems in a timely manner.

266. In the IRB survey, institutions were asked (for their PD models only) whether or not they already have a policy or practice regarding the inclusion of newly available rating-relevant information to be incorporated into the rating assignment.

267. In around 90% of the PD models, the institutions reported having a specific policy to include new available information, but for the remaining 10% there is no such policy. While not all respondents mentioned the frequency at which new information is incorporated into the rating assignment, for those who did, the rerating including the most recent information is stated to be performed at least monthly in 73% of PD models; in 21% of the relevant PD models this is performed at least annually or at least quarterly (8%). However, most respondents also indicated that besides these regular calculations, the ratings are updated more often where relevant information becomes available immediately, for instance based on available delinquency data, based on an online link to databases of external credit bureaus, because there are indications of a significant improvement or deterioration in the obligor’s risk situation, when a trigger of default is identified or no longer applicable, or when new appraisals are obtained.

268. In the CP on the GLs, it was proposed specifying that such new information should be incorporated within three months. However, the industry argued that this requirement would be particularly burdensome for corporate portfolios and would lead to distorting seasonal effects (as a result of information updated only once a year). It was further mentioned that qualitative components of a rating cannot be reviewed in such a short time. Based on this feedback, and the overview of the current practices, it has been decided to relax the wording to ‘as soon as possible’.

269. The GLs specify (in paragraphs 195-196) that institutions should apply additional conservatism to the outcomes of the assignment of exposures to grades or pools, in case of any identified deficiencies related to the implementation of the model in the IT system, or in the process of assignment of risk parameters to obligors of facilities in the current portfolio (application of risk parameters). The GLs mention in more detail that institutions should consider at least the triggers mentioned in Table 67.

Table 67: What are the main triggers for including additional conservatism in the application of the PD model?

	sum	No.	%	% EAD
Missing data in the current portfolio	84	252	33	37
Missing updates of financial statements or credit bureau data as referred to in paragraph 66(h) of the CP of the GLs	42	252	17	13
Outdated ratings in the current portfolio, where outdated rating should be understood as specified in Article 25(2)(b) of Regulation (EU) No xxx/xxxx [RTS on Assessment methodology]	63	252	25	20
Missing ratings, whereby an exposure is considered as being within the scope of application of the IRB model but is not rated by it	89	252	35	36
Other	82	252	33	37

Note: this was a 'tick box' question, hence respondents could select several of the above answers.

270. The results in Table 67 show that these reasons are a common justification for applying additional MoC in the application. There is a share of 33% of PD models where the category 'other' was selected for the question above. In most cases, the respondents indicated that no additional MoC was applied or that such additional MoC is 'not applicable'. Others referred to a supervisory imposed additional MoC, additional MoC for statistical uncertainty, general estimation errors, low-default portfolios, or reflection of uncertainty around the calibration target/long-run average measurement.

271. Based on this feedback, the non-exhaustive list of triggers for additional MoC in application has been maintained in the GLs.

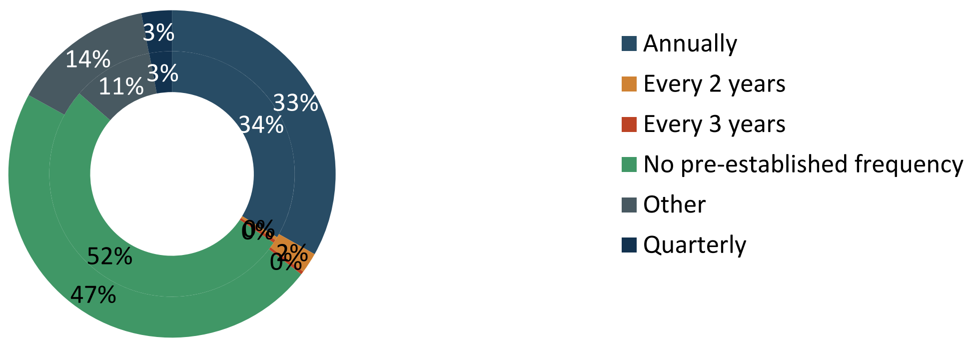
8. Review of estimates

272. The GLs specify (in paragraphs 218-219) that institutions should perform an annual review of the estimates in accordance with Article 179(1)(c) of the CRR, by establishing a framework that includes the minimum scope of the analyses, predefined metrics and standards, and predefined actions in case deviations from those standards are observed.

273. For PD estimates, it is specifically required (in paragraph 218(c)(i)) to analyse whether or not including the most recent data leads to a significant change in the long-run average DR, including an assessment of the period of likely range of DR and the mix of good and bad years.

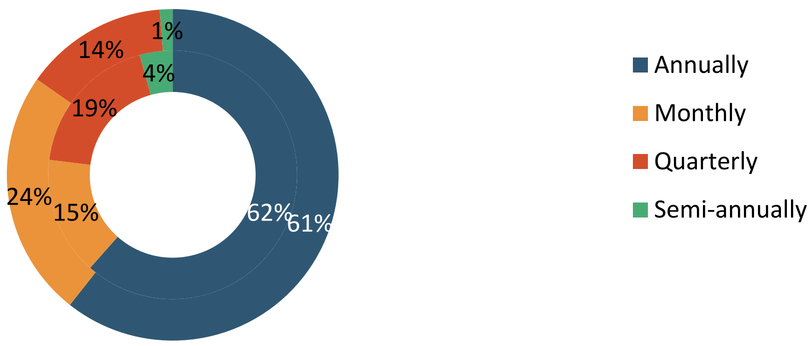
274. Based on the responses from the IRB survey shown in Figure 59, there is no pre-established frequency for redeveloping or recalibrating the PD model in more than half of the PD models. In 34% of PD models, the model recalibration is developed annually, and in 3% of PD models this is done quarterly. The option 'other' was selected in around 10% of PD models, in which case the most common explanation is that an annual review of the estimates is performed, without this review necessarily leading to a (re)calibration of the model, i.e. the model is only (re)calibrated where the monitoring of the model indicates that an earlier redevelopment/recalibration is necessary. Some respondents mentioned that the model is only (re)calibrated where the metrics exceed fixed tolerance thresholds, where back-testing indicates that (re)calibration is necessary, or where changes in the economic environment or credit policies have been observed.

Figure 59: Do you have a pre-established frequency for developing a (re)calibration of the PD model? If yes, what is that frequency?



Note: the inner circle shows the share of each option where all PD models are weighted equally, whereas the outer circle shows the share of each option where PD models are weighted by their corresponding exposure value.

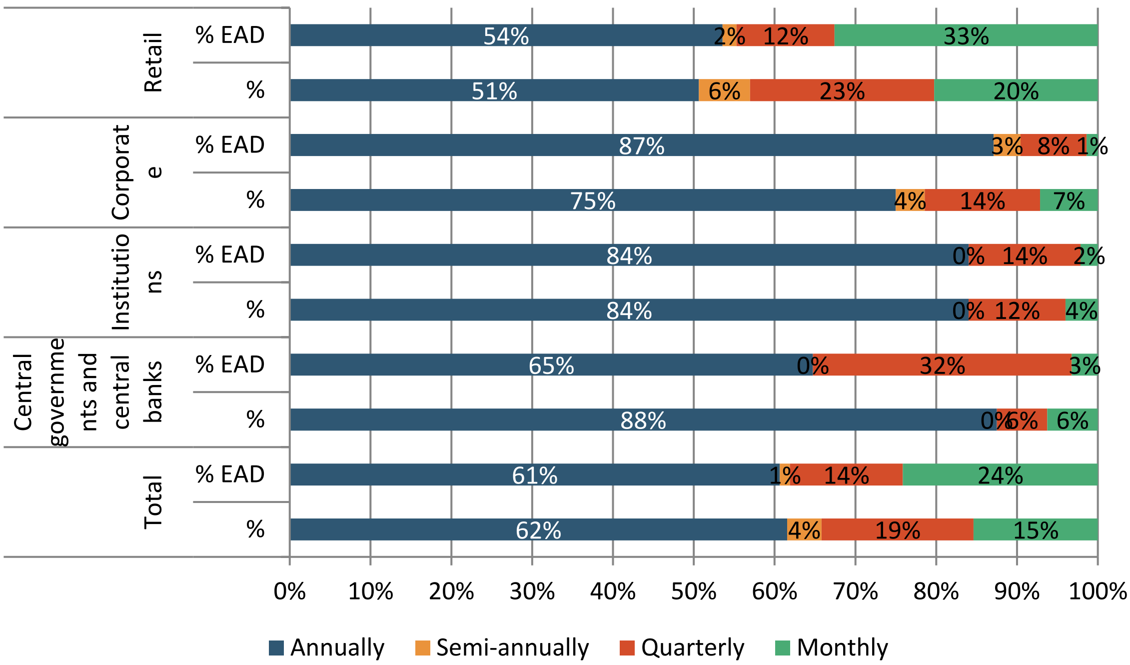
Figure 60: What is the frequency at which the observed average DRs are calculated?



Note: the inner circle shows the share of each option where all LGD models are weighted equally, whereas the outer circle shows the share of each option where LGD models are weighted by their corresponding exposure value.

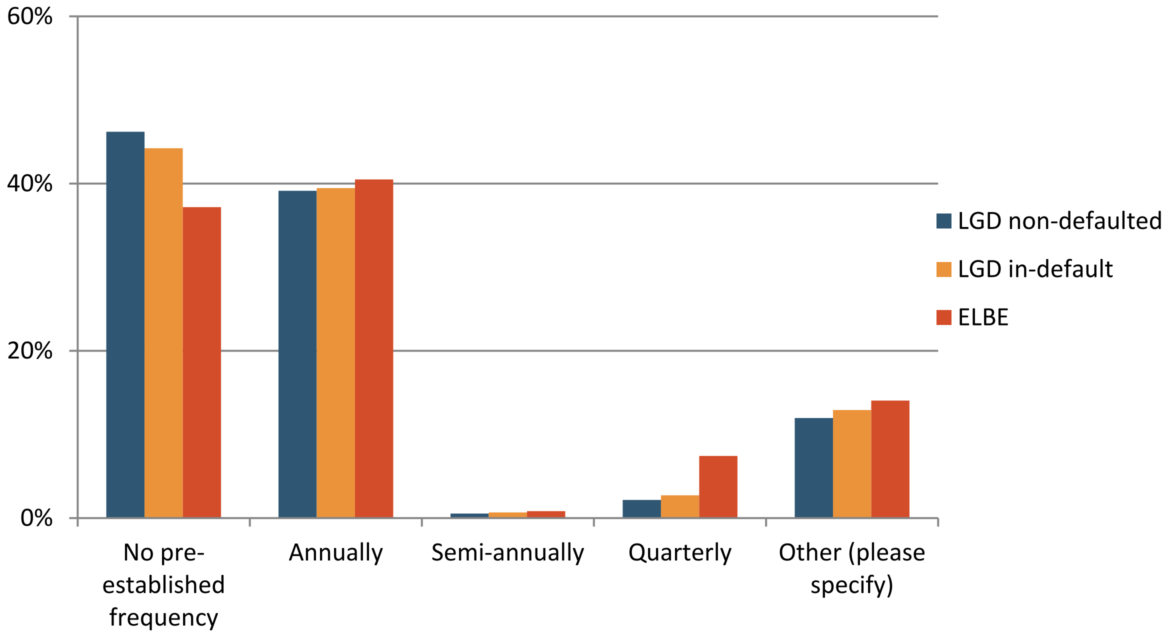
275. Related to this requirement, the IRB survey enquired about the usual frequency at which the observed average DRs are calculated, because these calculations would be the starting point to indicate whether or not the PD estimates should be re-estimated or recalibrated. For the majority of PD models (61.54%), the observed average DR is calculated annually, whereas it is calculated monthly and quarterly in 15.38% and 18.80% of the PD models respectively (see Figure 60). Figure 61 shows the split of these statistics across exposure classes. Some significant deviations can be observed. More specifically, it can be seen that the share of corporate models that recalculate the observed DR annually is higher (75%) than for the retail models (58%). In retail models, the option to recalculate the observed average DR monthly is more common (15% on average) than for the corporate models (only 6%).

Figure 61: Frequency for calculating the observed average DRs, by exposure class



276. Similarly to the requirements for the annual review of PD estimates, institutions are also required to perform an annual review of the LGD estimates, and should in particular verify whether or not the inclusion of the most recent data leads to a significant change in the long-run average LGD or downturn LGD (paragraph 218(c)(i) of the GLs). On that aspect, institutions have been asked to indicate whether or not they have a pre-established frequency for the redevelopment or re-estimation of the LGD model. Figure 62 shows the responses, which are in line with the findings in Figure 559. However, as compared with the PD models, it seems that there is a higher share of LGD (and EL_{BE}) models (around 40% as compared with 34% for PD models) that are redeveloped or re-estimated on an annual basis, and a slightly lower share of LGD models (also around 40% as compared with around 50% for PD models) for which there is no pre-established frequency for redevelopment or re-estimation.

Figure 62: Do you have a pre-established frequency for redeveloping or re-estimating the LGD model? If yes, what is that frequency?



Appendix

Table 68: Classification of answers from the survey with respect to the policy chosen in the GLs – PD models

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
53-54	Are there any obligors who are in the scope of application that do not receive an individual PD estimation?	No	Yes, but only obligors benefiting from unfunded credit protection are excluded Yes, for other reasons (please specify)	
78	Frequency at which one-year DRs are evaluated	Quarterly Monthly Daily	Annually Semi-annually	
80	Was any specific analysis done to justify the choice for overlapping versus non-overlapping windows for the calculation of the observed average DR?	Yes	No	
89	Do you conduct calibration before or after the application of MoC?	Before application of MoC	No MoC is applied After application of MoC	MoC is applied during calibration
89	Do you conduct calibration before or after the application of the PD floor?	Before application of the PD floor	After application of the PD floor	No PD floor is applied

Table 69: Classification of answers from the survey with respect to the policy chosen in the GLs – LGD (non-defaulted) models

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
102	Which type of LGD model is this?	LGD based on total losses and PD estimates Work-out LGD	Market-implied LGD (based on market data)	Multivariate regression analysis/sophisticated statistical model Other or any combination of the above

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
116-117	If you repossess collaterals at least occasionally, which value of recovery do you recognise in the calculation of realised LGD?	Value of repossession after a haircut, regardless of whether or not it has been sold on the LGD calculation date	Value of the sale (after repossession), but a null recovery in case the collateral has not yet been sold on the LGD calculation date Value of the sale (after repossession), but the value of repossession without a haircut where the collateral has not yet been sold on the LGD calculation date Value of repossession without a hair-cut, regardless of whether or not it has been sold on the LGD calculation date Value of the sale (after repossession), but the value of repossession after a haircut where the collateral has not been sold yet on the LGD calculation date	Other (please specify)
135	How is economic loss of a cured case measured?	Using the same methodology as for other defaulted exposures, including the discounted additional recovery cash flow at the date of the return to non-defaulted status	Assume that the economic loss for cured cases is zero Using the same methodology as for other defaulted exposures including, but not discounting, additional recovery cash flow at the date of the return to non-defaulted status	Other
137	How do you incorporate unpaid late fees (late meaning after default) into the calculation of realised LGD?	Do not include	Add to the outstanding amount at default (denominator of realised LGD) Both include in economic loss and add to outstanding amount at default Include only in the economic loss (numerator of realised LGD)	Other (please specify)

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
138	How do you incorporate capitalised interest (meaning interest after default) into your calculation of realised LGD?	Do not include	Add to the outstanding amount at default (denominator of realised LGD) Both include in economic loss and add to outstanding amount at default Include only in the economic loss (numerator of realised LGD)	Other (please specify)
140-141	Are additional drawings after default included in the calculation of realised LGD?	Include only in the economic loss (numerator of realised LGD) if additional drawings are not included in the CCF Both include in economic loss and add to outstanding amount at default if additional drawings are included in the CCF	If additional drawings are not included in the CCF: Add to the outstanding amount at default (denominator of realised LGD) Both include in economic loss and add to outstanding amount at default Don't include If additional drawings are included in the CCF: Include only in the economic loss (numerator of realised LGD) Add to the outstanding amount at default (denominator of realised LGD) Do not include	Other (please specify)
143	What methodology do you use to determine the discounting rate (LGD non-defaulted)?	Risk-free rate + add-on	Funding rate + add-on Original effective interest rate Current effective interest rate Funding rate	Other
144-145	Do you include direct costs incurred before default in the calculation of realised LGD?	Yes	No Partially	
144, 146	Do you include indirect costs incurred before default in the calculation of realised LGD?	Yes	No Partially	

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
147(e)	Did you exclude some of the available historical data from the specification of the historical observation period (LGD non-defaulted)?	No	Yes (please provide an explanation)	
149	At which level do you calculate long-run average LGD?	Both at portfolio level and at grade/pool level	Level of grade or pool	Portfolio level (scope of LGD model) Other (please specify)
150-151	What type of weighting do you use in the calculation of long-run average LGD?	For retail exposures: All defaults are weighted equally More recent defaults have higher weights For all other exposures: All defaults are weighted equally	For retail exposures: Based on the exposure value For all other exposures: Based on the exposure value More recent defaults have higher weights	Other (please specify)
158	How do you incorporate incomplete recovery processes in your LGD estimates?	With recoveries realised so far and estimated future recoveries	Incomplete recovery processes are not included Only with recoveries realised so far	As an adjustment at grade or pool level As an adjustment at portfolio level Other (please specify)
156	Do you define a maximum period after which incomplete recovery processes are treated as closed for the purpose of calculating the average realised LGD?	Yes (please specify the length of this period)	No	
150, 158	How do you calculate the long-run average LGD?	Average of the realised LGD of all defaults occurred in the historical observation period	Average of the annual average of the realised LGD of all defaults occurred in a year Average of the annual average of the realised LGD of the closed defaults occurred in a year Average of the realised LGD of the closed defaults occurred in the historical observation	Long-run average LGD based on intermediate averages (please specify) Other (please specify)

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
			period	
160	How do you treat cases with no loss or positive outcome?	Zero-floor at the level of individual default observation	No floor Zero-floor at the level of pool or grade Zero-floor at the level of risk parameter	Other (please specify)

Table 70: Classification of answers from the survey with respect to the policy chosen in the GLs – LGD (in-default) models

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
102	Which type of LGD in-default model is this?	LGD based on total losses and PD estimates Work-out LGD	Market-implied LGD (based on market data)	Multivariate regression analysis/sophisticated statistical model Other or any combination of the above
143	What methodology do you use to determine the discounting rate (LGD in-default)?	Risk-free rate + add-on	Funding rate + add-on Original effective interest rate Current effective interest rate Funding rate	Other
147(e)	Did you exclude some of the available historical data from the specification of the historical observation period (LGD in-default)?	No	Yes (please provide an explanation)	
158	How do you incorporate incomplete recovery processes in your LGD estimates?	With recoveries realised so far and estimated future recoveries	Incomplete recovery processes are not included Only with recoveries realised so far	As an adjustment at grade or pool level As an adjustment at portfolio level Other (please specify)

Paragraph(s) in the GLs	Question	No model change if answer is	Model change if answer is	Not known if answer is
171	What is the reference date for estimation?	Reference date (as specified in the GLs)	Current date for a defaulted exposure Date of default	Other/if you use multiple reference dates, please specify
176	Please indicate your approach to the estimation of LGD for defaulted exposures?	Use of an LGD model as for non-defaulted exposures with additional risk drivers	Distributional approach Use of an LGD model as for non-defaulted exposures LGD in-default not specified — risk weight derived directly (please specify how)	EL_{BE} + add-on (please specify how the add-on is estimated) Use of a specific model for defaulted exposures Other (please specify)
189	Which economic conditions are reflected in LGD in-default?	Downturn economic conditions	Current economic conditions Long-run average economic conditions Stressed conditions	Other (please specify)

Table 71: Classification of answers from the survey with respect to the policy chosen in the GLs — EL_{BE} models

Paragraph(s) in the GLs	No model change if answer is	Model change if answer is	Not known if answer is
102	LGD based on total losses and PD estimates Work-out LGD	Market-implied LGD (based on market data)	Multivariate regression analysis/sophisticated statistical model Other or any combination of the above
143	Risk-free rate + add-on	Funding rate + add-on Original effective interest rate Current effective interest rate Funding rate	Other
147(e)	No	Yes (please provide an explanation)	

Paragraph(s) in the GLs	No model change if answer is	Model change if answer is	Not known if answer is
158	With recoveries realised so far and estimated future recoveries	Incomplete recovery processes are not included Only with recoveries realised so far	As an adjustment at grade or pool level As an adjustment at portfolio level Other (please specify)
171	Reference date (as specified in the GLs)	Current date for a defaulted exposure Date of default	Other/if you use multiple reference dates, please specify
167-168	Use of an LGD model as for non-defaulted exposures, calibrated to current economic conditions	Use of accounting provisions Use of an LGD model as for non-defaulted exposures EL_{BE} not specified — risk weight derived directly (please specify how)	Use of a specific model for EL_{BE} Other (please specify)
183-184	Current economic conditions	Long-run average economic conditions Downturn economic conditions Stressed conditions	Other (please specify)
184-185	Information from macroeconomic and credit factors is directly included in the model	Based on current provisions	Expert judgement is used to give higher weight to recent data, to exclude downturn periods or to select historical observations that reflect the current situation Other (please specify)