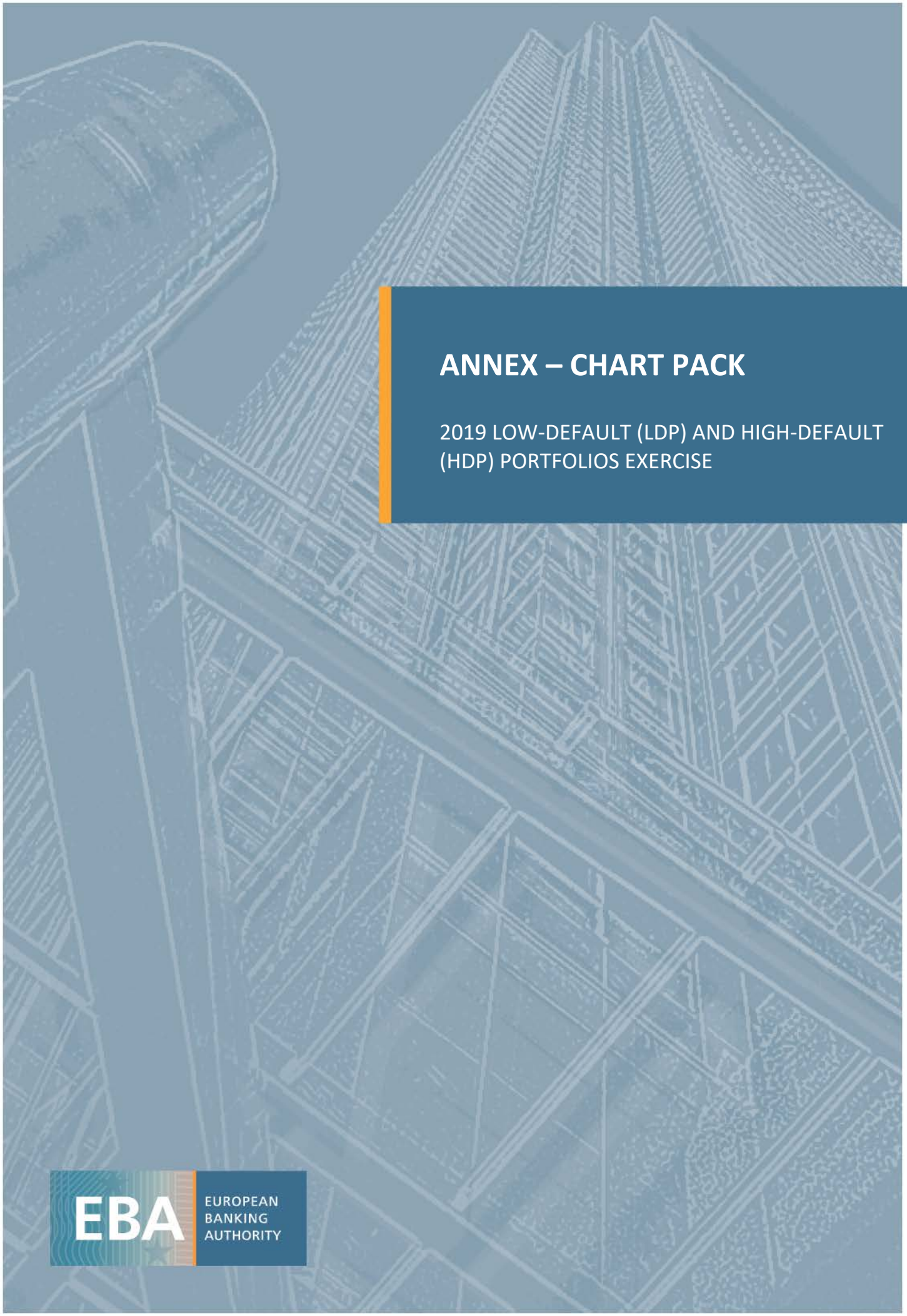

ANNEX – CHART PACK

2019 LOW-DEFAULT (LDP) AND HIGH-DEFAULT (HDP) PORTFOLIOS EXERCISE

EBA EUROPEAN BANKING AUTHORITY

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Abbreviations

AIRB	advanced internal ratings-based
CA	competent authority
CCF	credit conversion factor
CfA	call for advice
CGCB	central governments and central banks
COREP	common supervisory reporting
CORP	exposures to corporates other
CRD	Capital Requirements Directive
CRM	credit risk mitigation
CRR	Capital Requirements Regulation
DR	default rate
DR 1Y	default rate of last year
DR 5Y	Average default rate over the last five years
EAD	exposure at default
EBA	European Banking Authority
EL	expected loss
EU	European Union
FIRB	foundation internal ratings-based
GC	global charge
GL	guidelines
HDP	high-default portfolio
INST	exposures to institutions

IRB	internal ratings-based
ITS	implementing technical standards
LCOR	exposures to large corporates
LDP	low default portfolio
LEI	Legal Entity Identifier
LGD	loss given default
LR	loss rate
LR 1Y	loss rate observed on the defaults of last year
LR 5Y	Average loss rate observed on the defaults over the last five year
MoC	margin of conservatism
MORT	exposures to residential mortgages
PD	probability of default
PPU	permanent partial use
RW	risk weight
RWA	risk-weighted assets
SA	standardised approach
SLSC	specialised lending slotting criteria
SLXX	specialised lending exposure
SMEC	exposures to corporate small and medium-sized enterprises
SMER	exposures to retail small and medium-sized enterprises
SMEs	small and medium-sized enterprises
SVB	supervisory benchmarking
UL	unexpected loss

Introduction and legal background

1. This chart pack aggregates the results of the SVB exercise of the internal models used for both HDPs and LDPs across a sample of EU institutions. The reference date for the data is 31 December 2018. It is the second time that the results of the HDPs and LDPs are presented in a joint report, as the first study including both LDPs and HDPs was conducted last year.[1]

2. The main objectives of this report are to (i) provide an overview of the existing RWA variability and drivers of differences; (ii) summarise the latest results of the supervisory assessment of the quality of the internal approaches in use; and (iii) provide evidence to policymakers for future activities relating to RWA differences.

3. The data collection is based on technical standards specifically designed for annual SVB exercises and covers different breakdowns of portfolios by, for instance, country, type of collateral, loan-to-value ratio or sector to help to understand the impact of these factors on the different key risk drivers such as PD, LGD, CCF and RW estimates. In addition, some qualitative information and more in-depth information on specific aspects – such as institutions' modelling methodologies, data sources, lengths of time series, definitions of risk parameters, and number and scope of internal models – have been collected through interviews and a qualitative survey.

4. The chart pack is organised as follows:

    - The first section gives a general description and the main statistics on the data collected.

    - The second section contains a quantitative analysis of the variability of the collected data, replicating the three analyses conducted in the previous reports: starting from a high-level analysis with a top-down approach to the whole portfolio, before moving to a deeper analysis with the common counterparties analysis for LDP and the outturn analysis for HDP. A time perspective (comparison of the results with those of the previous reports) is given in each of the subsections.

    - The third section contains the qualitative analyses that have been performed on the institutions' estimates, i.e. the results from the CA assessments, interviews with the largest outlier institutions and the results of the survey on the different use of rating scales.

[1] https://eba.europa.eu/documents/10180/2087449/EBA+Report+results+from+the+2018+Credit+Risk+Benchmarking+Report.pdf

1. General description

1.1 Dataset and assessment methodology

1.1.1 Dataset

5. Altogether, 123 institutions from 16 EU Member States had approval for the use of credit risk internal models at 31 December 2018 and are therefore in the scope of the 2019 SVB exercise (the full list of institutions is presented in Appendix 1). In comparison with previous studies, the number of institutions in the sample is stable. The figures presented in this report are at the highest level of consolidation. Only 113 institutions submitted data for at least one counterparty or one portfolio (this is because the other institutions either did not report until 23 September 2019 or do not have exposures in scope of the SVB exercise, due to specialised business models, so they submitted empty templates), of which 111 submitted at least one valid record. The reference date for the data of this report is 31 December 2018. Due to data quality and data cleaning, the number of institutions differs depending on the template: the full presentation of the sample size and the different rules for data cleaning are in Appendices 2 and 3.

6. The underlying framework is designed by the EBA via the final draft ITS published by the EBA in June 2018[2] and published as Commission Implementing Regulation (EU) 2018/688 of 29 March 2019.[3] The report relies on data collected according to the ITS on SVB[4] (complemented by COREP data when necessary) through six different templates:

    - Template C 101.00 provides the information at counterparty level ('common sample') for a given list of counterparties. The common sample of counterparties was defined by the EBA, and institutions were requested to provide the PDs and LGDs, as well as the hypothetical senior unsecured LGDs, for those counterparties included in the 'common portfolio' on which they had an exposure or a valid rating at the reference date. In contrast to a hypothetical exercise, the analysis is therefore based on actual estimates of counterparties with a real exposures at the reference date.

[2] https://eba.europa.eu/regulation-and-policy/supervisory-benchmarking-exercises/its-package-for-2019-benchmarking-exercise

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2019:090:TOC

[4] Annex I of the ITS provides the definitions of the supervisory benchmarking portfolios that are required for the 2019 exercise. Annex III of the ITS provides the instructions and details on exposures, that is, the data collected. Annex III also provides further details of internal models and the mapping of internal models (templates C 105.1 and C 105.2, respectively) to portfolios (Annexes II and IV of the ITS).

- Template C 102.00 provides the information on various LDPs.[5] Similarly to previous exercises, there is no information on SA exposures (either on a roll-out plan or under the permanent partial use allowance) or on RWA calculated under the SA.

- Template C 103.00 provides the same kind of information as template C 102.00 with the addition of some backtesting parameters but for the HDPs.[6] In contrast to template C 102.00, the 2019 SVB exercise is the first time RWA calculated under SA have been collected in this template.

- Templates C 105.01, C 105.02 and C 105.03 contain details on the internal models and give the link between the EBA supervisory benchmark portfolios and the models concerned.

7. For risk parameters such as PDs and LGDs, the results of the exercise are based on the parameters used for the calculation of the institutions' own funds requirements, i.e. the comparison of institutions does not take into account whether or not some CAs have imposed supervisory corrective actions to increase RWs to correct any model deficiencies (e.g. add-ons).

1.1.2 Challenges encountered when analysing the variability of IRB models' outcomes

8. The most challenging part in comparative RWA studies is to distinguish the influence of risk-based and practice-based drivers. As shown in this report, the top-down analysis can explain a substantial percentage of the variability observed by some key drivers. However, the remaining variability needs to be approached differently. Specific challenges apply depending on the type of analysis:

    - LDP portfolios generally show so few data, and in particular defaults, that historical data may not provide statistically significant differentiation between different portfolio credit risks.[7] Instead, for these LDPs, IRB parameters and RWs can be compared for identical obligors to which the institutions have real exposures. The key limitation of this approach is the representativeness of the common sample compared with the actual portfolio of each institution.

    - On the other hand, and in contrast to the exercise for LDPs, for HDPs it is not possible to compare the same counterparties across institutions, but the large amount of available data, and defaults in general, allows a statistical backtesting approach that represents an important source of information on the portfolio risk (outturns approach). This approach is very useful, since the misalignment between estimates and observed parameters could

[5] LDPs consist of sovereigns, institutions and large corporates. The last are defined as firms with annual sales exceeding EUR 200 million and include in addition specialised lending exposures, which are collected separately as a sub exposure class.

[6] HDPs include residential mortgage, SME retail, SME corporate and corporate-other portfolios. In contrast to previous exercises, these exposure classes no longer contain specialised lending exposures, which are now considered low-default portfolios. It does not include the remaining HDPs portfolios, for instance credit card portfolios or consumer credits.

[7] Owing to low PD estimates in LDPs for non-defaulted exposures, the influence of every default on the GC could be relatively large.

suggest that differences in RWAs between institutions might be driven by differences in estimation practices (e.g. different levels of conservatism, adjustments to reflect long-run averages, different lengths of time series of the data available and included in the calibration of the cycle, assumptions underlying recovery estimates) and not only by differences in portfolio risk.

- Furthermore, a breakdown by country seems useful, since the risk profile of retail exposures is country driven to some extent. This is an important limitation and the reason why the outturn (backtesting) approach is a good and valuable process for comparison among institutions, despite this approach also having some shortcomings. The observed parameters reported by institutions are greatly influenced by the country characteristics, such as the macroeconomic cycle, accounting framework and judicial system. Realised losses on defaulted exposures are influenced by the wide variation in loss recognition practices across jurisdictions, which influence the timing and the amounts of recorded losses, as well as by the limitations in the data used for estimations. However, the breakdown by country (in this report, the country of counterparty) can lead to data shortage and statistically irrelevant results.

9. In addition, different regulatory or supervisory requirements, such as regulatory floors,[8] are also possible and could explain a substantial amount of differences per jurisdiction. In this context, it should be noted that the EBA has produced different regulatory products in order to harmonise the concepts and requirements of the IRB approach. This includes RTS on the assessment methodology,[9] RTS and guidelines on the definition of default,[10] guidelines on the estimations of risk parameters,[11] and RTS and guidelines on estimation and identification of an economic downturn in IRB modelling.[12]

10. Finally, as for any exercise with such a large scope, data quality issues are still present and suggest that the results of the analysis should be interpreted with caution.

1.1.3 Analyses performed

11. The data were used to perform three main types of analyses in this report:

- **Top-down and distribution analyses of institutions' actual portfolios (both LDP and HDP):** they mainly use the information collected via templates C 102 and C 103. This method

[8] For example, from Article 164(4) of the CRR, LGD floors for residential property are 10% and LGD floors for commercial property are 15%, and Article 164(5) of the CRR allows CAs to increase these regulatory floors.

[9] https://www.eba.europa.eu/documents/10180/1525916/Final+Draft+RTS+on+Assessment+Methodology+for+IRB.pdf/e8373cbc-cc4b-4dd9-83b5-93c9657a39f0

[10] RTS, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018R0171; GL, https://www.eba.europa.eu/regulation-and-policy/credit-risk/guidelines-on-the-application-of-the-definition-of-default

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

[12] https://eba.europa.eu/regulation-and-policy/model-validation/regulatory-technical-standards-on-the-specification-of-the-nature-severity-and-duration-of-an-economic-downturn

disentangles the impact of some key determinants of the GC variability. The top-down analysis is complemented by a distribution analysis, which makes it possible to identify extreme values and values below the first quartile or above the third quartile for important parameters of the sample. The main advantage is that it allows outliers to be easily identified, after controlling for some portfolio characteristics. Furthermore, the distribution analysis can be performed at different levels of aggregation and for different risk parameters. For instance, the comparison between regulatory approaches (e.g. FIRB and AIRB) at the EU level or at Member State level for a particular portfolio (e.g. SME retail for non-defaulted exposures, in the construction sector) may allow possible drivers to be highlighted if there are significant differences between the approaches.

- **Analysis of IRB parameters for common counterparties (LDP):** this allows a PD and LGD comparison on an individual obligor basis. However, the subset of common obligors is in most cases not fully representative of the total IRB portfolio of the individual institutions, so the results of this exercise may not be transferable to the total IRB portfolios and should be interpreted with care.

- **Outturns (backtesting) approaches (HDP):** this comparison uses the (backtesting) outturns approach (i.e. a comparison of observed values with estimated values for important parameters). It allows observed and estimated values to be compared and provides information about institutions' realised credit performance history (default rates, loss rates and actual defaulted exposures, as well as averages of the last 5 years for default and loss rates) and the corresponding IRB parameters (PD, LGD and RWA), as well as PD backtesting results (RWA-/+).[13] These comparisons allow an analysis to be conducted of possible misalignments between estimated and observed parameters for the same institution.

12. Based on the data collected, an analysis is performed in order to identify the relevant outlier institutions that deserve further investigation by the CA. In a first step, several outlier observations are generated individually depending on the available data (LDP, HDP or all). For both HDP and LDP, the portfolios for which at least 10 institutions reported exposures have been used to assess potential outliers. The values of PD, LGD, CCF and RW are assessed in terms of outliers, whereby a flag is generated for each metric below the 10th centile. For LDPs, another outlier rule is based on the common counterparties for which at least 10 institutions reported a rated exposure. The rule takes into account the PD, LGD, hypothetical unsecured LGD, CCF and RW, and flags are generated for the lowest 10% of metrics reported. For HDPs, another outlier rule assesses the ratios of DR1Y/PD, DR5Y/PD, LR1Y/LGD and LR5Y/LGD, if the ratio can be computed for at least 10 institutions. Outlier observations are generated for the ratios higher than the 90th centile. In a second step, a qualitative assessment is made, in order to determine the final list of institutions and portfolios that deserve an in-depth investigation by the CAs.

[13] The risk-weighted exposure amounts, after applying the SME supporting factor, that would result from the application of hypothetical PDs purely based on empirical default rates observed at grade level.

13. Although these quantitative analyses are essential in this kind of exercise, the assumptions and caveats behind them make it clear that they should be complemented by a qualitative evaluation. Three different assessments have been performed:

- A **qualitative survey on specific aspects of the rating scales of institutions** has been performed this year. In contrast to the other analyses in the report, the purpose is not to have a comprehensive view but rather to have a detailed view of the practices on one specific topic, in order to help policymakers in making choices. The focus of this year was decided in the light of the latest discussions related to the EBA's answer to the CfA for the purposes of revising the own fund requirements for credit, operational, market and credit valuation adjustment risk.[14]

- **CAs' assessments of individual institutions in their jurisdictions** have been shared with the EBA. CAs are requested to share the evidence they have gathered among colleges of supervisors, as appropriate, and to take appropriate corrective actions to overcome drawbacks when deemed necessary. Using additional bank- and model-specific information from regular ongoing supervisory functions and the benchmarks computed by the EBA on risk parameters at counterparty and portfolio levels helped to identify potential non-risk-based variability across institutions. The SVB exercise allows CAs to assess the outcomes of institutions' internal models compared with a wider scope of institutions.

- Finally, the EBA conducted **interviews** with seven institutions to gather additional information. The selection of institutions for the interviews was based on the computed benchmarks on risk parameters and portfolios, with a special focus on conspicuous results. The aim of those interviews was to better understand the approaches used by individual institutions to calculate own funds requirements and to identify key factors and drivers that can explain observed differences.

[14] The initial CfA can be found here: https://eba.europa.eu/documents/10180/2207145/Letter+from+Olivier+Guersent+on+the+CfA+the+purposes+of+revising+the+own+fund+requirements+for+credit%2C%20operational+market+%26+credit+valuation+adjustment+risk+040518.pdf/cf34493f-7ef7-4d07-a382-6a07b331103b. The EBA's final answer related to the credit risk part of the reform can be found here: https://eba.europa.eu/eba-advises-the-european-commission-on-the-implementation-of-the-final-basel-iii-framework

1.2 Portfolio composition and characteristics of institutions in the sample

14. This section describes the composition of the SVB sample on a number of dimensions (i.e. the use of regulatory approaches across SVB exposure classes, the distribution of exposures across SVB exposure classes as well as defaulted versus non-defaulted exposures, and the sample's representativeness).

1.2.1 Use of regulatory approaches

NB: Compared with previous SVB exercises, the specialised lending exposures have been isolated in a separate exposure class. As a consequence, the slotting approach no longer appears in other exposure class.

Table 1: Use of different regulatory approaches by SVB exposure class

Exposure class	AIRB	FIRB	SLSC	Number of participating banks
LCOR	55	47	0	85
SLXX	26	16	36	60
CGCB	25	30	0	45
INST	33	40	0	59
CORP	54	48	0	85
MORT	86	0	0	86
SMEC	51	48	0	83
SMER	70	0	0	70

1.2.2 Portfolio composition and representativeness

15. The following figures give key descriptions of the portfolio composition of the sample of banks, as well as insights into the representativeness of the exposures under the scope of the SVB exercise. The portfolio compositions (in term of exposure class and non-performing exposures) are very diverse among the institutions, and the SVB exercise covers the vast majority of the exposures of institutions.

16. Figure 1 shows that some institutions have none of their IRB exposures captured by this year's SVB exercise. This number should decrease for the next exercise since the scope of the 2020 exercise will be extended. There will, however, still be other exposures not covered by the SVB exercise, as they are under PPU (i.e. sovereign exposures, intragroup exposures, exposures belonging to an institutional protection scheme, etc.).

Figure 1: Proportion of exposures under LDP, under HDP or outside the scope of the SVB exercise (comparison with total IRB portfolio from COREP data, sorted by proportion under LDP from largest to smallest)

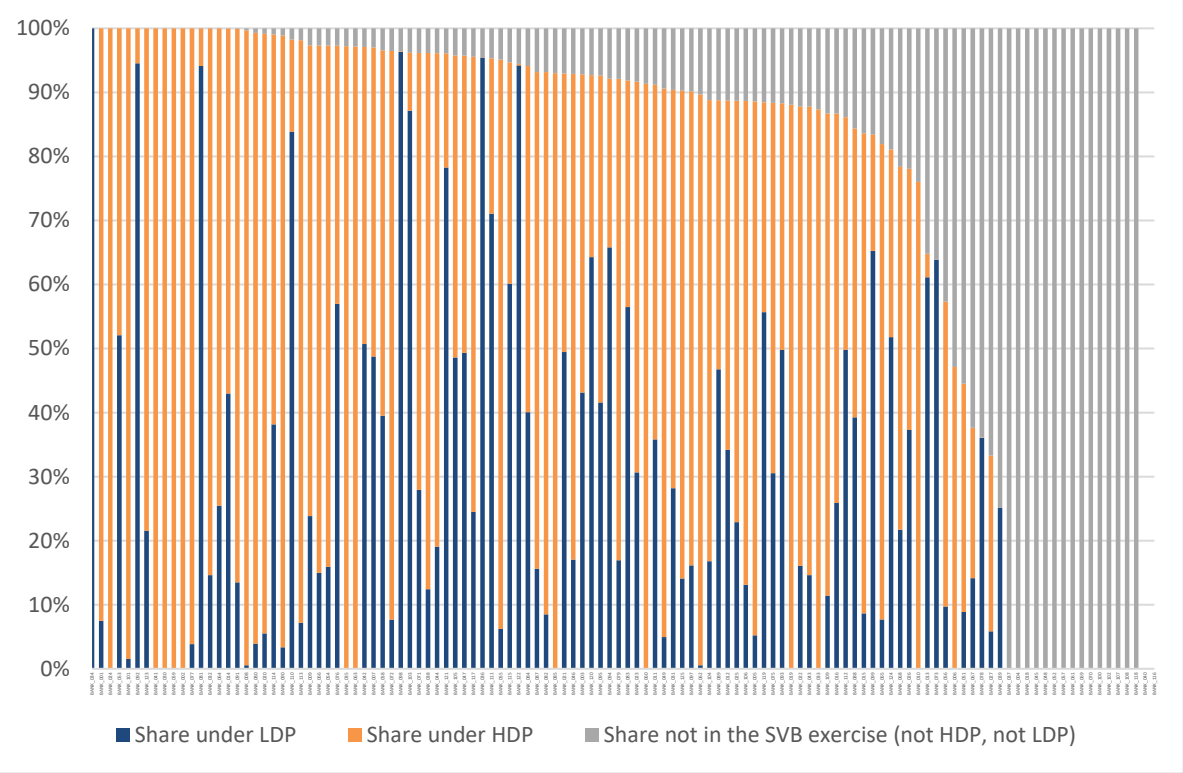


Table 2: Summary statistics on the proportion of exposures under LDP, under HDP or outside the scope of the SVB exercise (%)

	LDP	HDP	Other
Minimum	0	0	0
25th centile	13	41	3
50th centile	26	66	8
75th centile	50	85	17
Maximum	100	100	100

Figure 2: Portfolio composition of RWA (outer circle) and EAD (inner circle) for HDP and LDP portfolios (defaulted and non-defaulted)

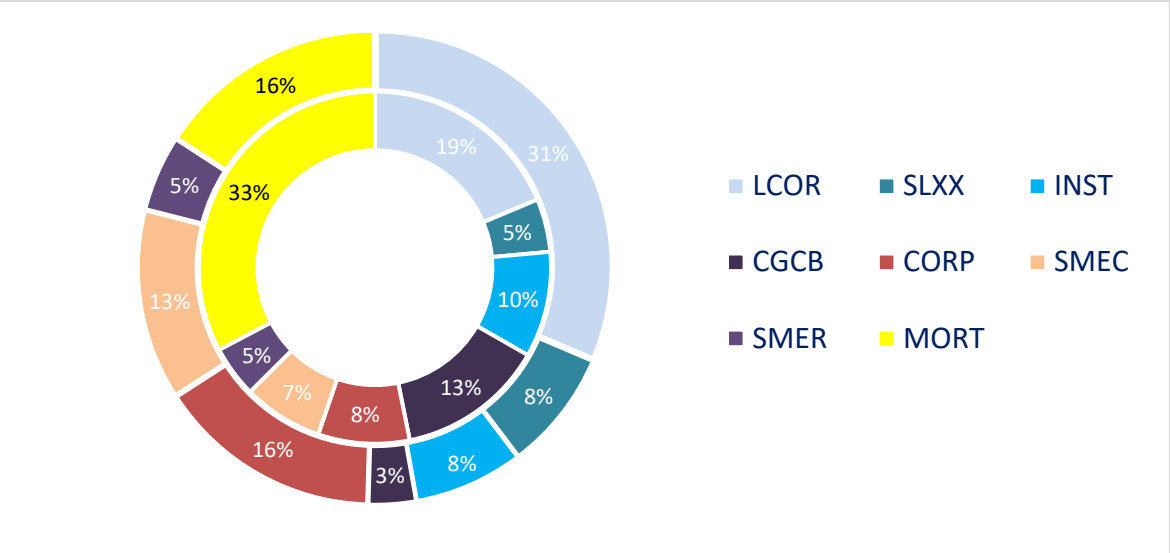


Figure 3: Portfolio composition of the LDP: proportions of large corporates, institutions and sovereigns in LDP (sorted by proportion of specialised lending exposures in LDP from largest to smallest)

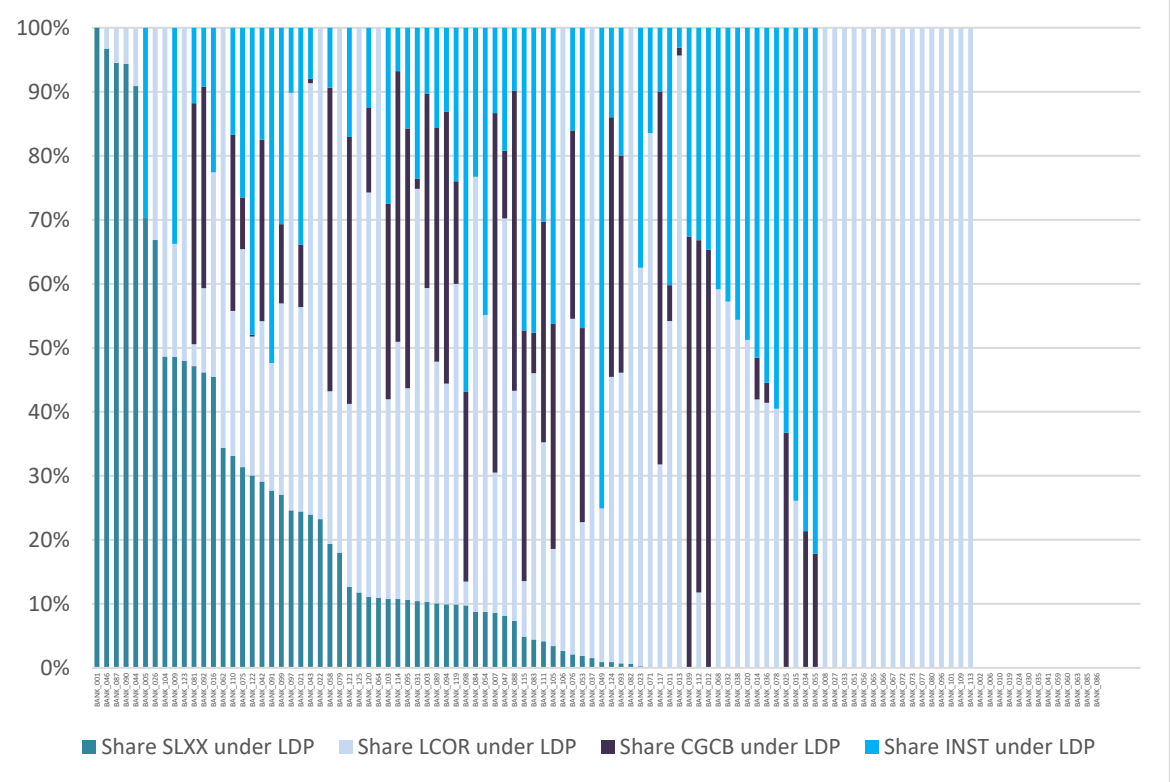
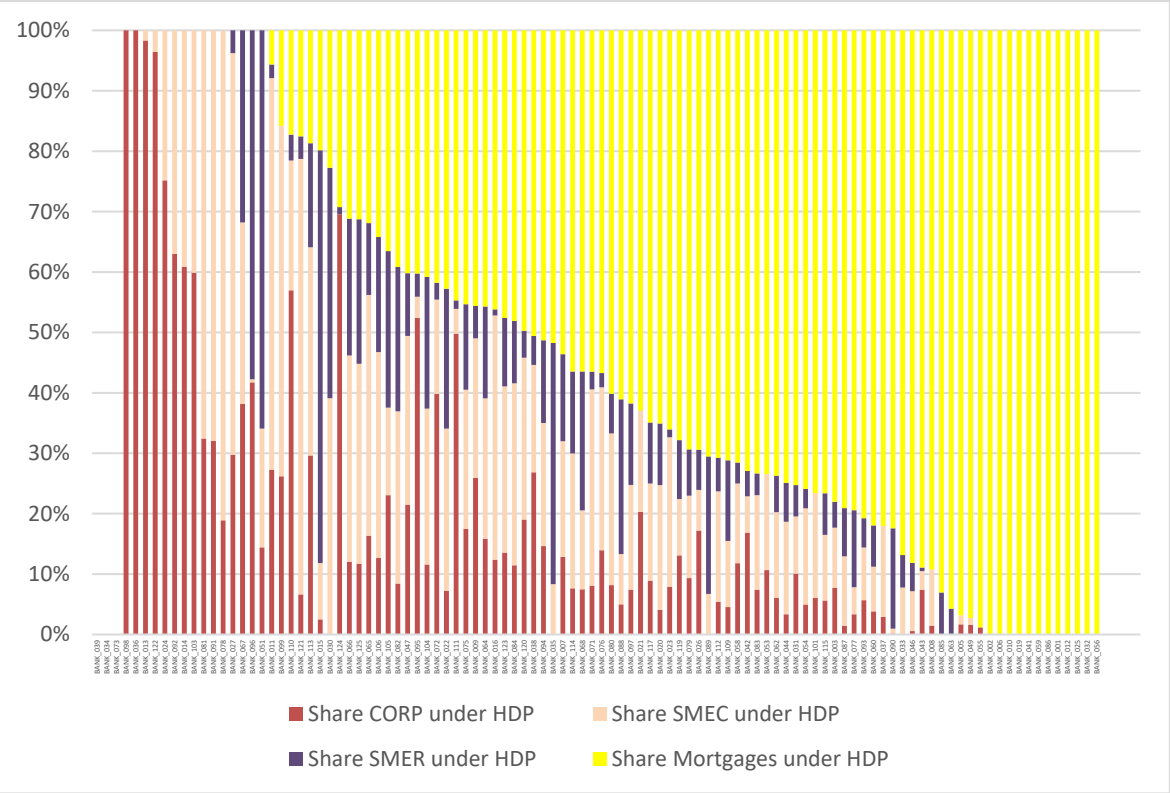


Figure 4: Portfolio composition of the HDP: proportions of residential mortgages, SME retail, SME corporate and corporate-other exposures in HDP (sorted by proportion of mortgages in HDP from smallest to largest)



Complementary statistics are given in Appendix 5.

1.3 Key risk metrics and temporal evolution

Table 3: Summary statistics of the key metrics observed for non-defaulted exposures, by SVB exposure class and regulatory approach

		LCOR		SLXX			INST		CGCB		CORP		SMEC		SMER	MORT
		AIRB	FIRB	AIRB	FIRB	SLSC	AIRB	FIRB	AIRB	FIRB	AIRB	FIRB	AIRB	FIRB	AIRB	AIRB
Sample size		54	47	26	15	17	32	40	24	29	53	47	50	47	70	86
GC (%)	Q1	41	40	34	54	76	14	18	3	2	45	51	42	46	29	10
	Median	50	58	45	71	87	19	27	6	7	61	70	57	72	39	14
	Q3	64	76	64	87	96	32	37	15	25	75	104	74	95	51	19
	Q3-Q1	**23**	**36**	**30**	**33**	**19**	**18**	**19**	**12**	**23**	**29**	**53**	**33**	**49**	**22**	**9**
RW (%)	Q1	38	39	31	52	70	13	18	3	2	42	48	36	42	21	9
	Median	46	56	41	64	79	19	26	6	7	55	65	47	65	28	12
	Q3	60	71	55	82	84	31	36	15	24	67	94	61	82	36	17
	Q3-Q1	**22**	**32**	**24**	**30**	**13**	**18**	**18**	**12**	**23**	**25**	**46**	**25**	**39**	**14**	**8**
PD (%)	Q1	0.5	0.3	1.2	0.5		0.1	0.1	0.0	0.0	1.0	0.6	1.6	0.5	1.9	0.5
	Median	0.8	0.5	1.5	0.6		0.2	0.1	0.1	0.0	1.6	1.1	2.1	1.9	2.8	0.9
	Q3	1.3	0.8	1.8	1.4		0.3	0.3	0.2	0.1	2.3	2.1	3.1	2.8	3.6	1.4
	Q3-Q1	**0.7**	**0.6**	**0.6**	**0.9**		**0.2**	**0.2**	**0.1**	**0.1**	**1.4**	**1.5**	**1.5**	**2.3**	**1.7**	**0.8**
LGD (%)	Q1	26	43	15	41		19	26	10	45	21	39	21	38	23	11
	Median	33	44	22	43		29	36	25	45	29	42	26	41	28	14
	Q3	40	45	29	45		41	45	42	45	36	44	36	43	38	19
	Q3-Q1	**14**	**2**	**14**	**4**		**22**	**19**	**32**	**0**	**15**	**4**	**15**	**5**	**15**	**9**

17. Figures 5-8 give insights into the evolution of risk parameters for each exposure class and regulatory approach. As for the 2018 report, 'previous' refers to the benchmarking exercise of 2017 for LDP exposure classes and 2016 for HDP exposure classes. However, the charts focus now on the non-defaulted portfolios only. This focus allows a better understanding of the trend of risk estimates (compared with statistics at the top portfolio level, which include PD for defaulted assets). Graphs at total level are nonetheless presented in Appendix 6.

Methodology and assumptions

For some exposure classes, a diminishing PD is not necessarily reflected in a diminishing RW, even though the average maturity and the average LGD remain constant. While this feature could be explained for the top portfolios by the diminishing percentage of defaulted assets in the recent year (defaulted assets typically exhibit high PD (PD = 1) but relatively low RW), a different set of explanations should be given for the non-defaulted portfolios:

- Some of the banks have introduced buffers used to neutralise the effect caused by cyclicality in their IRB models. (Some of the buffers are also introduced directly as RWA, and are therefore not observed in the statistics.)
- For some portfolios (in particular for mortgages in some jurisdictions), a risk weight floor has been put in place and protects the RW from any decrease.

In addition, the portfolios related to the corporate exposures are not defined with the same scope, since in the 2019 exercise the specialised lending exposures are only reported in the large corporate exposure classes.

It is worth noting that the metrics are calculated by means of exposure-weighted averages. By contrast, the metrics presented in Table 3 do not take into account the exposure value of the underlying exposures (all institutions are considered in the same manner for the calculation of the quartile). This difference in weighting explains differences for some exposure classes (such as CGCB for FIRB institutions).

The sample is the same as the one described in Table 1.

Figure 5: Change in EAD per regulatory approach (million EUR), non-defaulted exposures

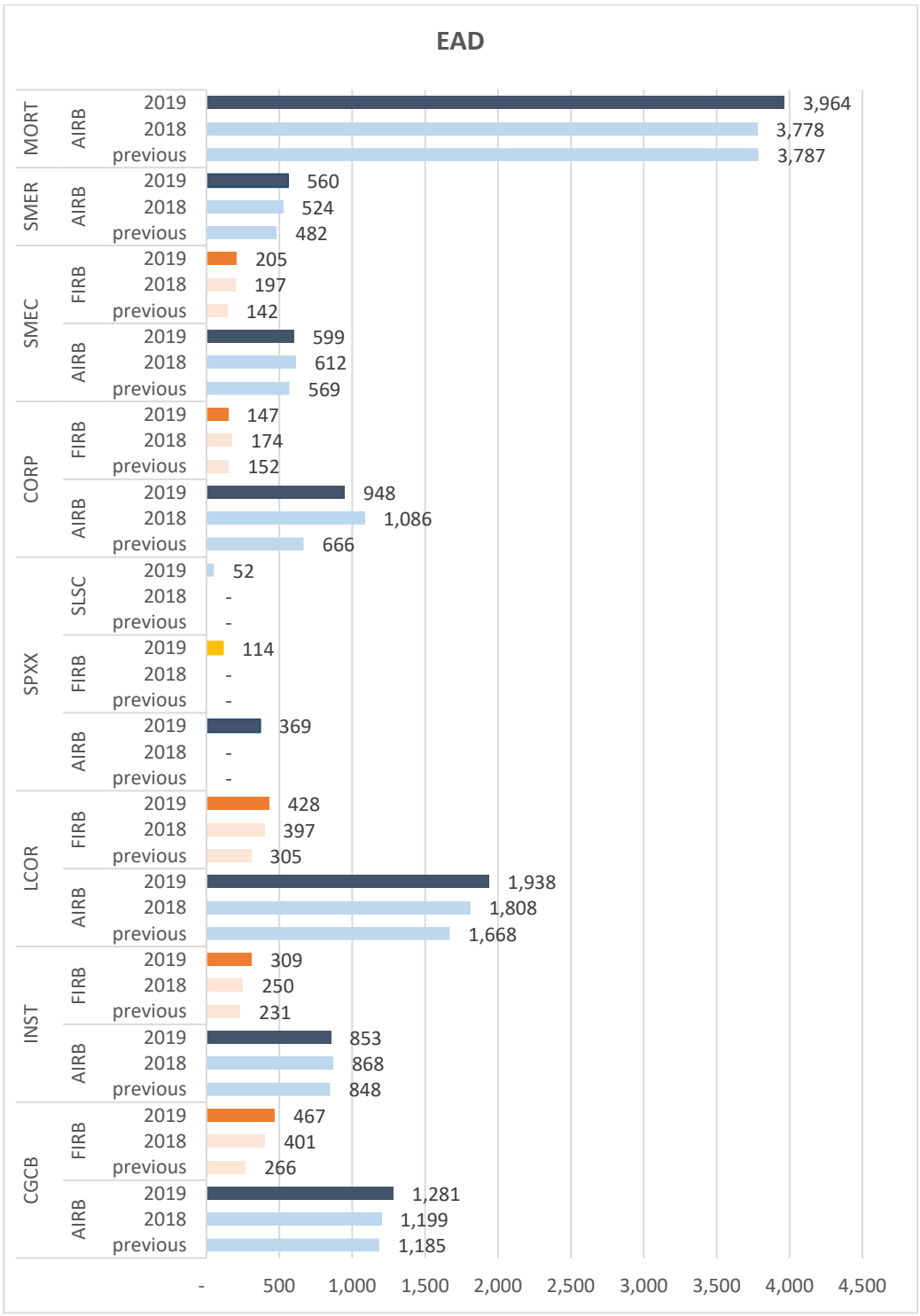


Figure 6: Change in EAD-weighted RW per regulatory approach, non-defaulted exposures

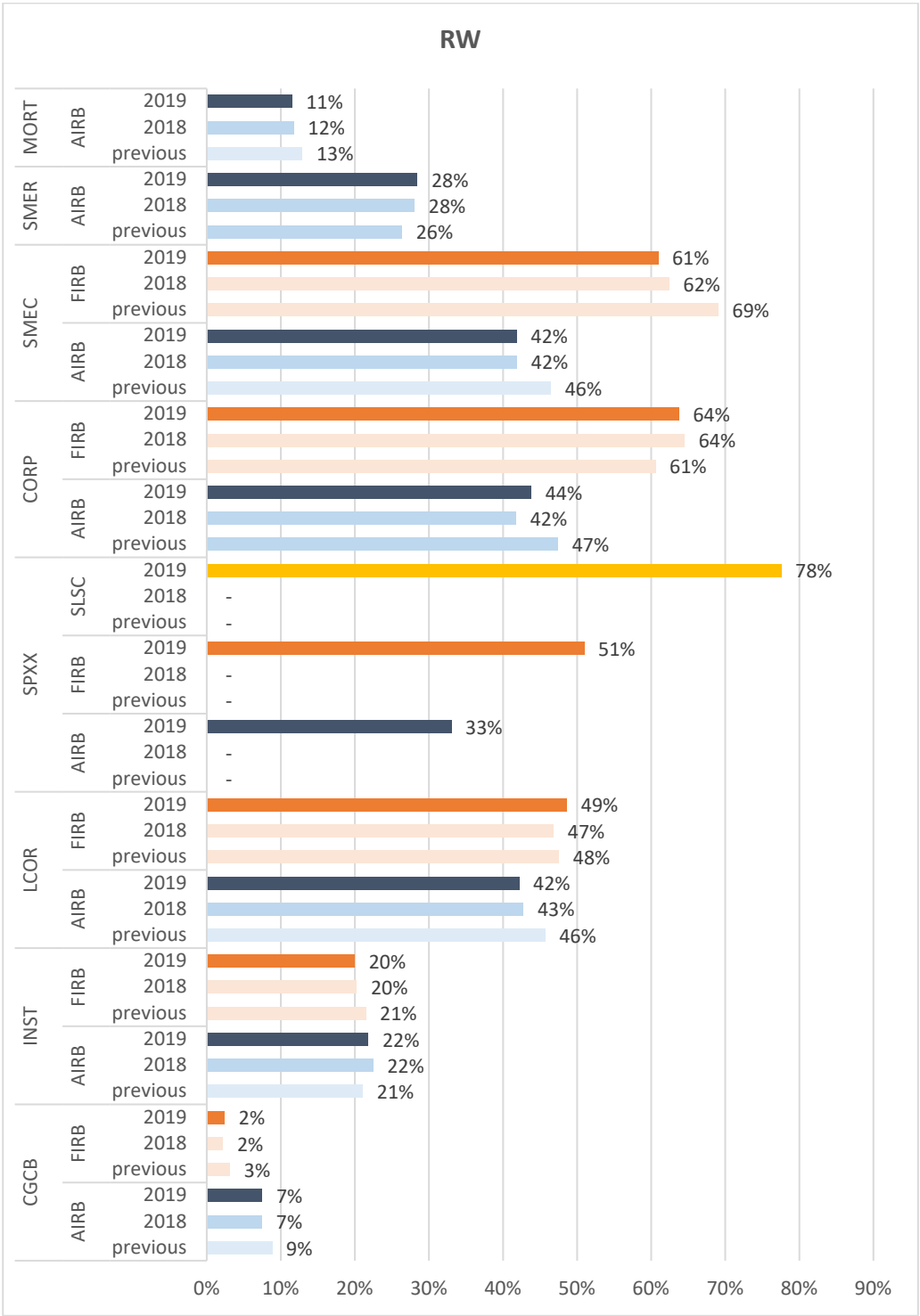


Figure 7: Change in EAD-weighted PD per regulatory approach, non-defaulted exposures

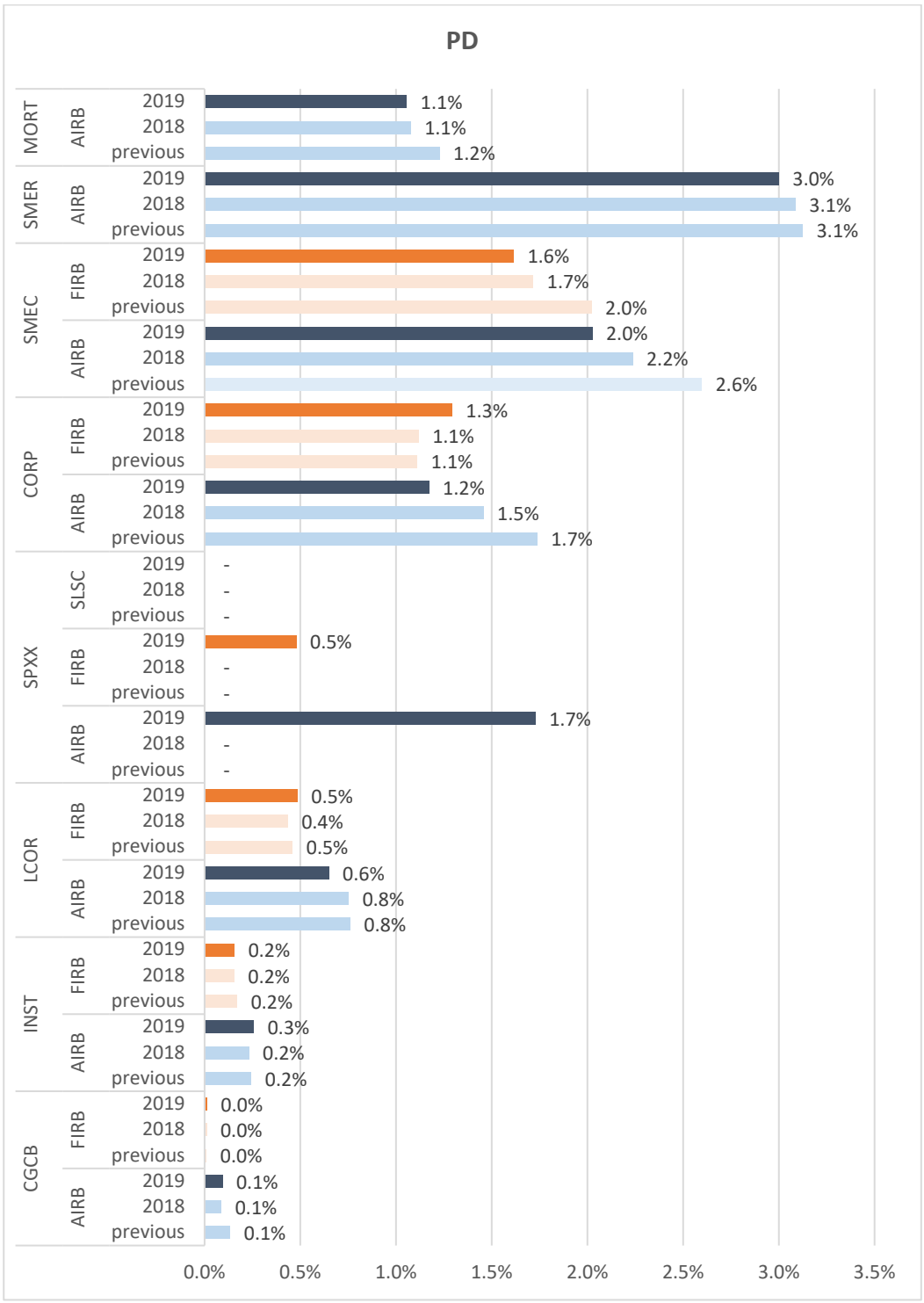
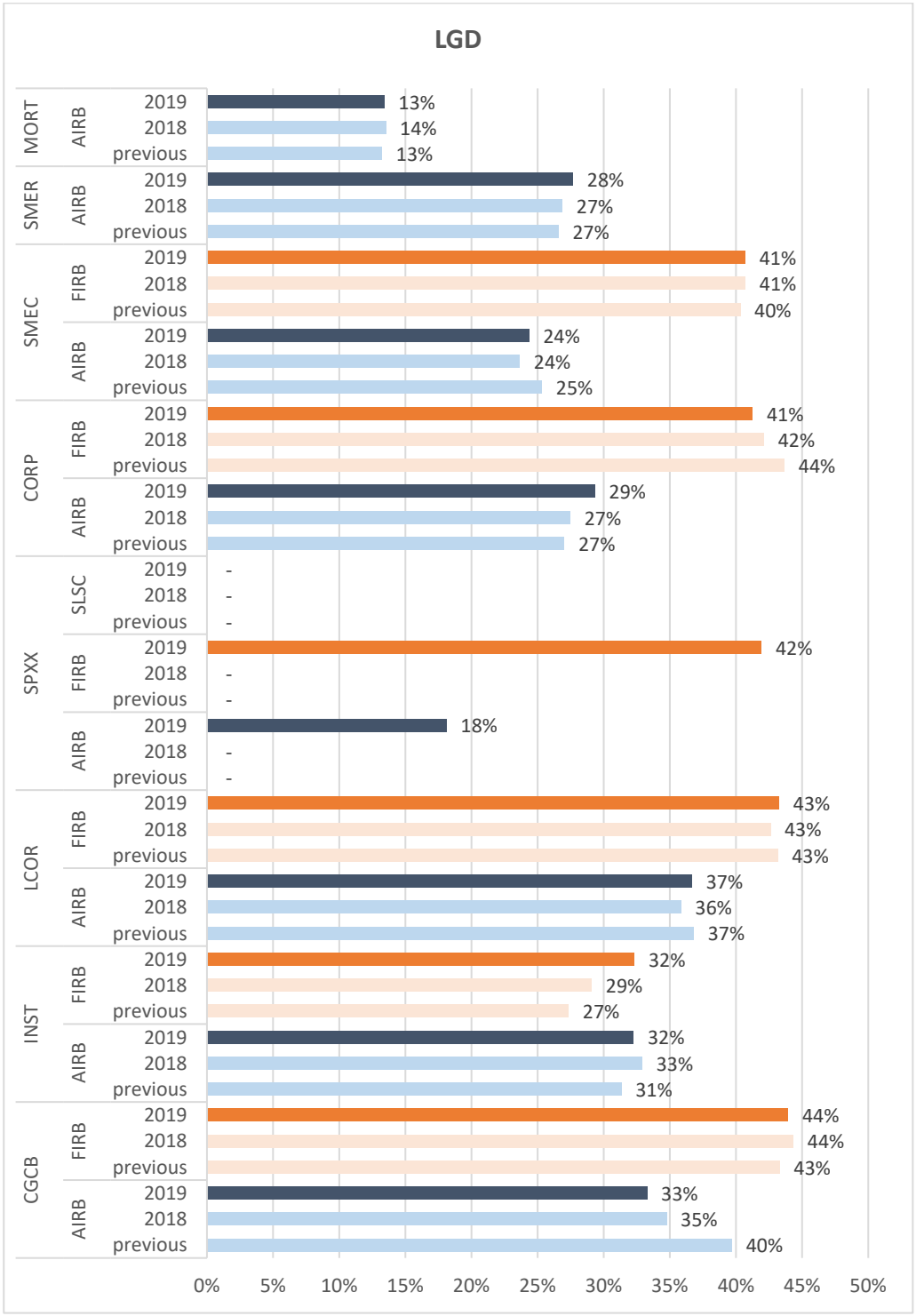


Figure 8: Change in EAD-weighted LGD per regulatory approach, non-defaulted exposures



2. Quantitative analysis

2.1 Top-down and distribution analysis (LDP and HDP)

18. This section aims to determine and analyse the drivers behind RW variability between the institutions. In this top-down approach, the variability is analysed along the GC (taking into account both EL and UL). EL is important for many institutions and is influenced by IRB risk parameters, especially for defaulted exposures treated under the FIRB approach. The present top-down analysis follows the following sequence:

- account for the different relative proportions of exposure classes (portfolio mix effect);
- account for the different proportions of defaulted exposures (default mix effect);
- account for both effects of different proportions of defaulted exposures and different relative proportions of exposure classes.

Methodology and assumptions

The methodology is broadly unchanged from previous years. Appendix 4 gives a comprehensive description of the analysis performed. This box briefly recalls the methodology through a simplified example.

The example in Table 4 shows the impact of controlling for the default mix on a sample of three institutions.

Table 4: Example of top-down approach

Example data	Institution 1	Institution 2	Institution 3	Total/average
GC_total (%)	10	20	30	
GC_def (%)	30	40	55	
GC_non def (%)	5	10	5	
EAD_total	50	120	20	
Of which, EAD_def	*10*	*40*	*10*	
Of which, EAD_non def	*40*	*80*	*10*	
Computations				
% EAD_def	20	33	50	60/190 = 32%
% EAD_non def	80	67	50	130/190 = 68%
GC_total DEF NON DEF (%)	13	20	21	

*(For the sake of clarity, the computation of GC_total DEF NON DEF (for example) for institution 1 is: 32% * 30% + 68% * 5% = 13%.)*

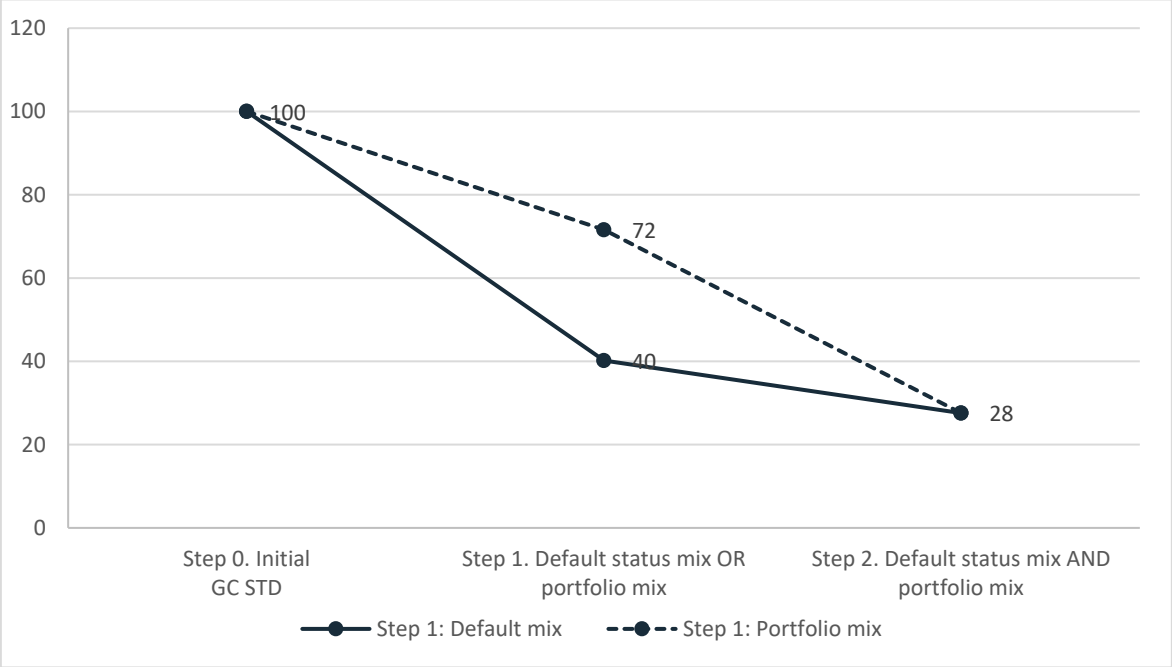
The standard deviations are computed using GC_total and GC_total DEF NON DEF. They are normalised by the standard deviation of GC_total to produce the graph with a 100 starting point.

This analysis is, however, subject to a number of caveats. In particular, a change in the GC standard deviation does not directly translate into a change (either improvement or deterioration) in the consistency of GC, since the GC standard deviation stems both from differences in institution's modelling practices and from risk-taking behaviour.

The top-down approach shows the extent to which the riskiness of portfolios (e.g. the portfolio composition) contributes to differences in average GC. However, a top-down approach does not explain the remaining differences, i.e. if these stem from individual practices, interpretations of regulatory requirements, business strategies or modelling choices or are caused by other effects, such as idiosyncratic variations in the riskiness within an exposure class, CRM (i.e. the business and risk strategy of the institutions) and the IRB risk parameters estimation (e.g. institutional and supervisory practices). The sample of banks has a strong impact on the result of the analysis; hence, the 2019 results differ when they are computed on the same sample as the 2018 exercise.

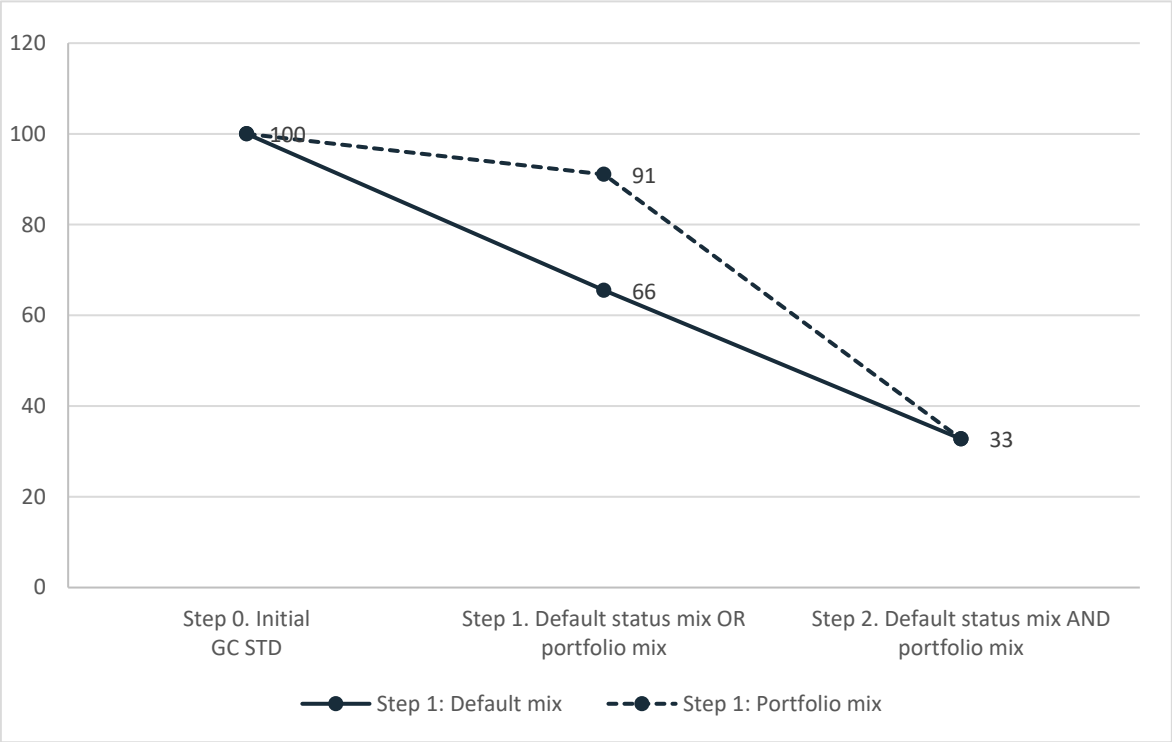
2.1.1 Results on the latest collected data

Figure 9: Decomposition of the GC standard deviation index – HDP and LDP



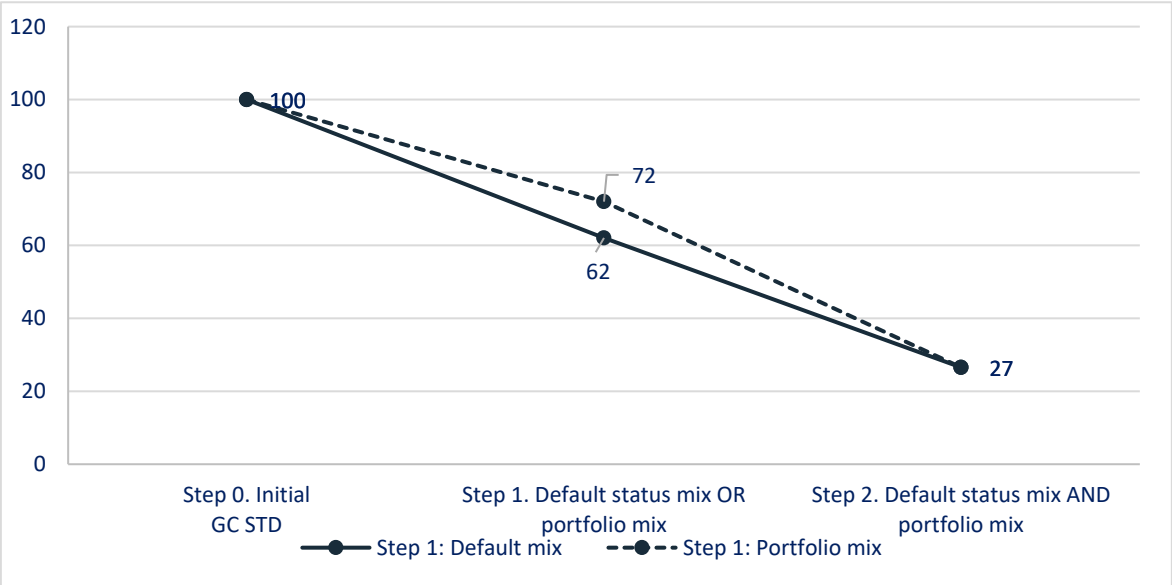
Sample: 88 institutions; for the missing variables the median values have been used.
Note: When the GC is missing, it is assumed to be equal to the value of the benchmark.

Figure 10: Decomposition of the GC standard deviation index – LDP



Sample: 91 institutions.
Note: When the GC is missing, it is assumed to be equal to the value of the benchmark.

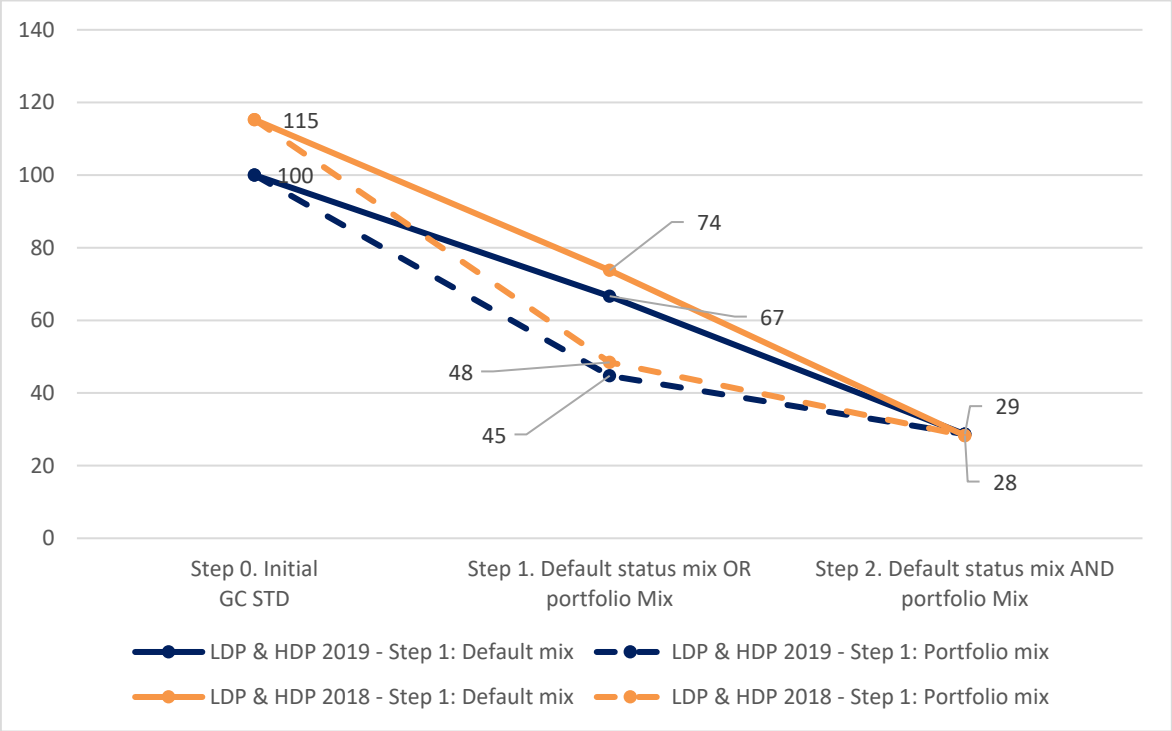
Figure 11: Decomposition of the GC standard deviation index – HDP



Sample: 101 institutions.
Note: When the GC is missing, it is assumed to be equal to the value of the benchmark.

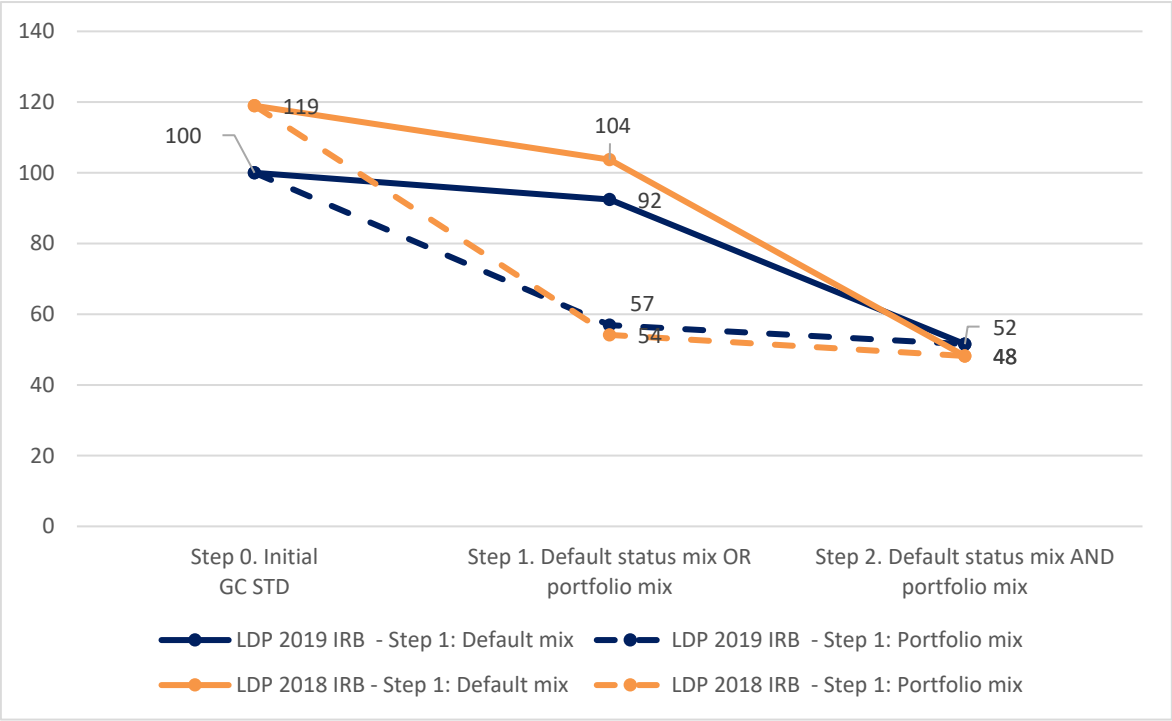
2.1.2 Results compared with previous exercise

Figure 12: Comparison of the top-down analysis, HDPs and LDPs, 2018 and 2019 exercises (common sample)



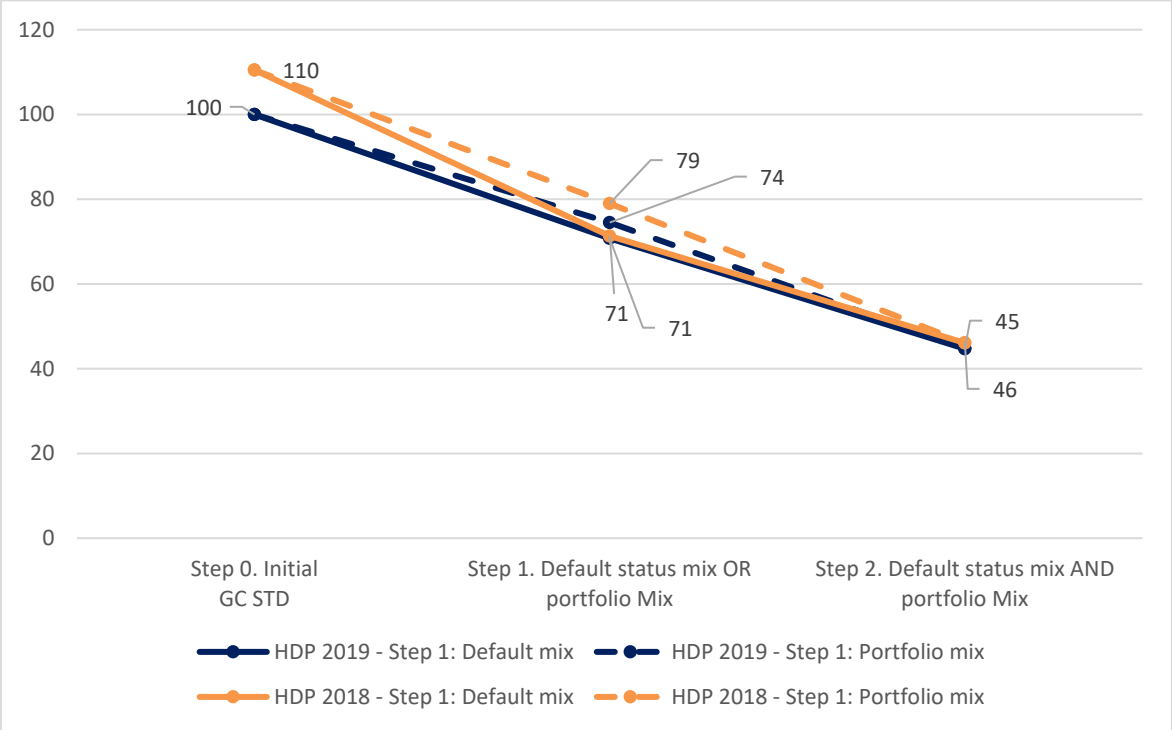
Sample: 64 institutions (only common institutions between 2018 and 2019 are kept).

Figure 13: Comparison of the top-down analysis, LDPs, 2018 and 2019 exercises (common sample)



Sample: 64 institutions (only common institutions between 2018 and 2019 are kept).

Figure 14: Comparison of the top-down analysis, HDPs, 2018 and 2019 exercises (common sample)



Sample: 72 institutions (only common institutions between 2018 and 2019 are kept).

2.2 Analysis of IRB parameters for common counterparties (LDP)

19. The purpose of this analysis is to compare institutions' IRB parameters on a set of common counterparties. Institutions have been instructed to provide risk parameters for a predefined list of obligors (where the institution has an exposure strictly positive for these obligors). The RW for each participating institution has been compared with the benchmark (the RW median for the group of institutions that apply the same regulatory approach to a specific common counterparty).[15]

20. To isolate the impact of each IRB parameter, the RWs are recalculated, at obligor level, using various combinations of actual and benchmark parameters. By replacing an institution's risk parameter with a benchmark parameter (median risk parameter), it is possible to disentangle the different effects of each parameter individually: the PD effect and maturity effect are analysed for obligors under both approaches (AIRB and FIRB), while the LGD effect and the hypothetical LGD effect are analysed for obligors under AIRB only, as the FIRB approach defines a regulatory LGD of 45% for senior unsecured exposures and hence no deviation from this level may be expected.

Methodology and assumptions

A comprehensive description of the analysis can be found in Appendix 4. For the reader's convenience, its main features are recalled here:

- **Deviation 1 (initial RW deviation):**

$$Dev1 = RW(M, PD, LGD) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

- **Deviation 2 (PD effect):**

$$Dev2 = RW(2.5, PD, LGD_{benchmark}) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

- **Deviation 3 (LGD effect):**

$$Dev3 = RW(2.5, PD_{benchmark}, LGD) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

- **Deviation 4 (Maturity effect):**

$$Dev4 = RW(M, PD_{benchmark}, LGD_{benchmark}) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

- **Deviation 5 (LGD effect without CRM effect, i.e. on hypothetical unsecured LGD):**

$$Dev5 = RW(2.5, PD_{benchmark}, LGD^{hyp\ unsec}) - RW\left(2.5, PD_{benchmark}, LGD_{benchmark}^{hyp\ unsec}\right)$$

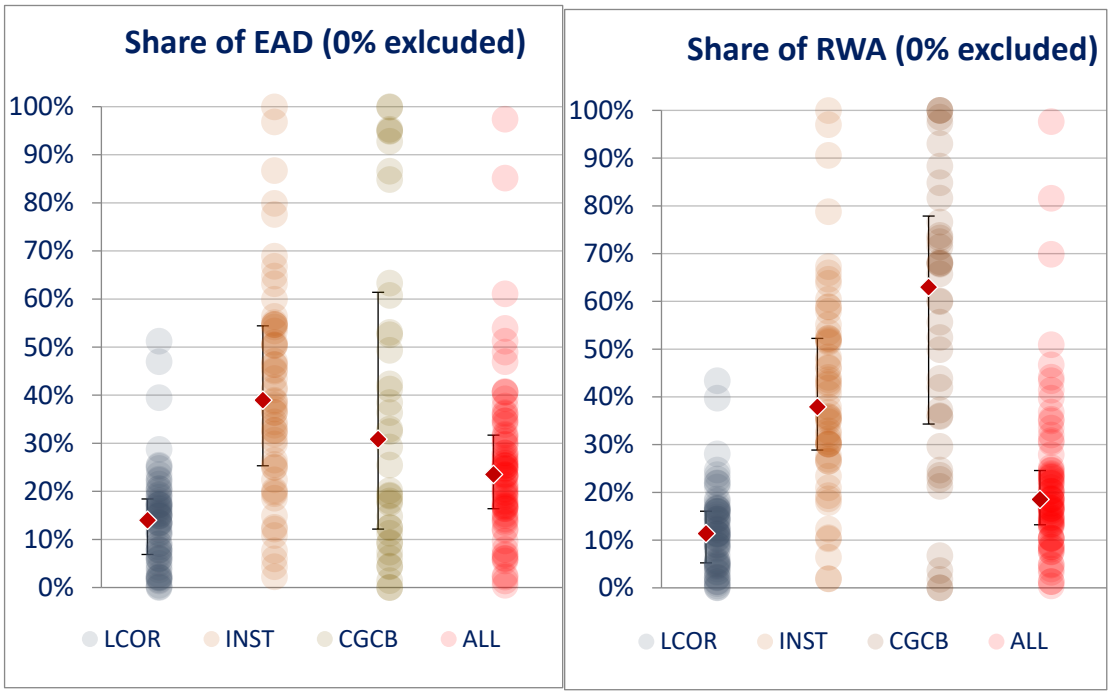
One limitation of this approach is that it does not take into account regulatory measures (such as add-ons) currently in place at RWA level. Hence, for some institutions in jurisdictions where such supervisory measures are in place, the recomputed RWAs are not directly comparable with the RWAs actually held and/or reported by the institutions.

Furthermore, the subset of common counterparties may not be fully representative of the total IRB portfolio of the individual institutions; therefore, the results of this exercise may not be

[15] An obligor under the FIRB approach is therefore compared with the FIRB benchmark, and an obligor under AIRB approach with the AIRB benchmark for that counterparty.

transferable to the total IRB portfolios and should be interpreted with care. **Figure** 15 shows that, generally speaking, the C 101.00 sample makes up a small part of the institutions' IRB EAD. This type of charts shows all observations as dots. The median is displayed as a red box and the whiskers denote the range between the first and third quartiles.

Figure 15: LDP common counterparties EAD and RWA compared with corresponding total IRB EAD and RWA



2.2.1 Results on the latest collected data

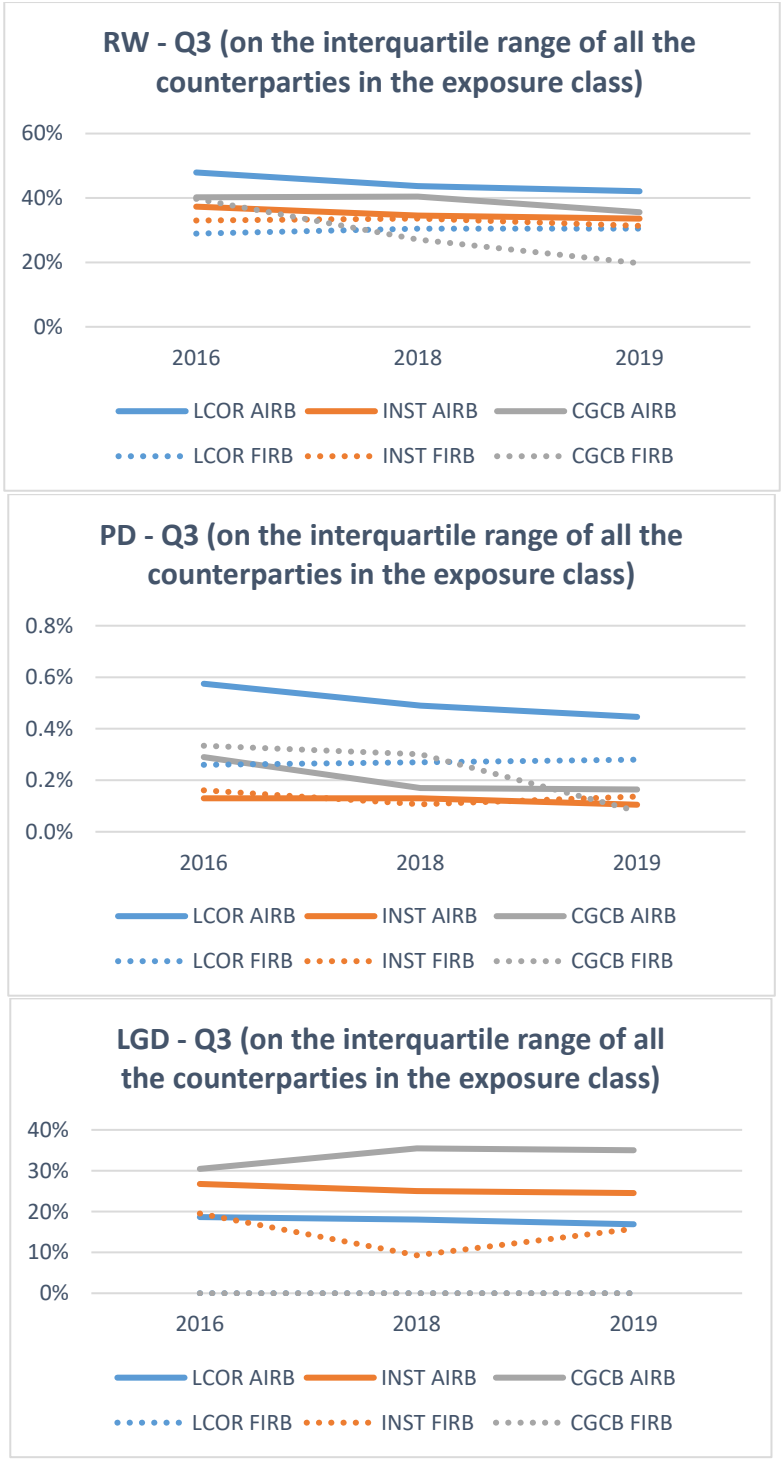
Table 5: Summary statistics on the RW deviations (first and third quartiles, median and interquartile range) by SVB exposure class and regulatory approach (%)

		AIRB					FIRB	
		Dev1 (ALL)	Dev2 (PD)	Dev3 (LGD)	Dev4 (Maturity)	Dev5 (LGD_{unsec})	Dev1 (ALL)	Dev2 (PD)
LCOR	Q1	-8	-4	-5	-4	-4	-2	-2
	Q3	5	4	3	2	1	6	5
	Median	0	0	0	0	0	0	0
	Q3-Q1	**13**	**8**	**8**	**6**	**5**	**8**	**7**
CGCB	Q1	-4	-2	-4	-4	-3	-4	-3
	Q3	3	3	2	1	1	2	2
	Median	-1	0	0	0	0	0	0
	Q3-Q1	**7**	**4**	**5**	**5**	**4**	**6**	**5**
INST	Q1	-9	0	-6	-8	-5	-7	-2
	Q3	-2	4	2	-4	1	0	3
	Median	-6	0	-1	-6	0	-3	0
	Q3-Q1	**8**	**4**	**9**	**5**	**7**	**7**	**5**

2.2.2 Results compared with previous exercise

21. For this section, the interquartile range of risk estimates (RW, PD and LGD) for one counterparty is used as a measure of the variability. Figure 16 shows the evolution of the variability for the worst counterparties, i.e. where the interquartile range of risk estimates is the highest.[16]

Figure 16: Evolution of the RW, PD and LGD variability



[16] The third quartile is used to select the counterparties.

2.2.3 Variability in the risk differentiation (ranking)

22. As highlighted by its name, one key component of the internal ratings-based approach is its capacity to rate and rank the obligors according to their relative level of risk. Thus, the variability can be analysed in two dimensions: first as the variability of the risk parameters in absolute terms,[17] and second as the variability of the ranking of the counterparties (i.e. variability of the risk parameters relative to each other).[18] This distinction of the variability coming from the risk differentiation and the risk quantification is very relevant to policymakers, as it triggers different corrective measures.[19] This section analyses the second dimension, i.e. the variability of the ranking.

Methodology and assumptions

The commonalities of ranking between institutions are measured using the Kendall tau coefficient. For two vectors of *n* obligors, this metric is defined as:

$$\boldsymbol{\tau} = \frac{(\boldsymbol{number\ of\ pairs\ with\ same\ rank}) - (\boldsymbol{number\ of\ pairs\ with\ different\ rank})}{\left(\frac{\boldsymbol{n}\cdot(\boldsymbol{n}-\boldsymbol{1})}{\boldsymbol{2}}\right)}$$

A Kendall tau equal to 1 means the institutions rank their common counterparties in the same manner, while a Kendall tau equal to -1 means the institutions rank their common counterparties in opposite manners. For example, this coefficient gives the following values for the simplified example presented in **Table 6**:

Table 6: example on the Kendall tau coefficient

PD estimates	Bank 1	Bank 2	Bank 3
Counterparty 1	1%	2%	4%
Counterparty 2	2%	3%	5%
Counterparty 3	3%	4%	2%
Counterparty 4	4%	5%	3%

The four estimates per bank give six pairs of rankings: [1-2], [1-3], [1-4], [2-3], [2-4], [3-4].

$$\boldsymbol{\tau_{bank\ 1-bank\ 2}} = \frac{6-0}{\frac{4\cdot3}{2}} = \mathbf{1};\ \boldsymbol{\tau_{bank\ 1-bank\ 3}} = \frac{2-4}{\frac{4\cdot3}{2}} = \mathbf{-0.3};\ \boldsymbol{\tau_{bank\ 2-bank\ 3}} = \frac{2-4}{\frac{4\cdot3}{2}} = \mathbf{-0.3}$$

[17] For example, for counterparties *X* and *Y*, institution *A* estimates PD(*X*) and PD(*Y*) differently from institution *B*.

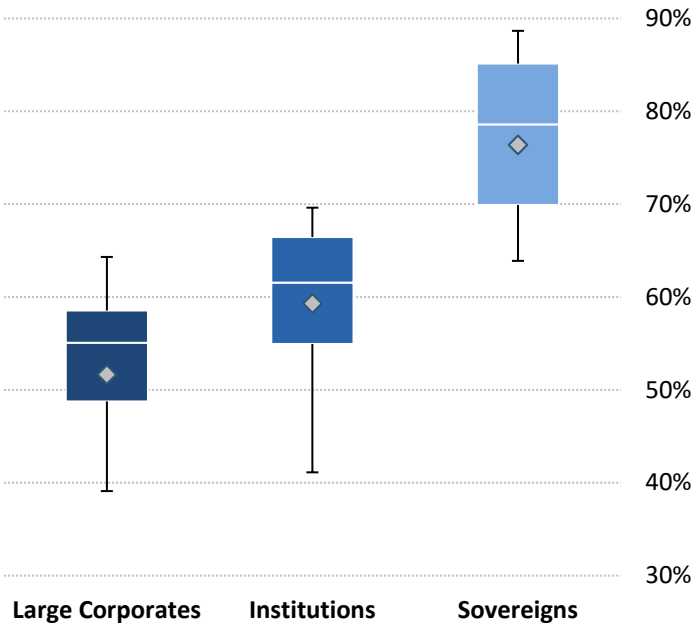
[18] For example, institution *A* assesses that PD(*X*) < PD(*Y*) while institution *B* assesses that PD(*X*) > PD(*Y*).

[19] For instance, the EBA believed the risk quantification part of the IRB framework was insufficiently detailed, and therefore focused its comprehensive review on this part of the framework.

Each institution has therefore one Kendall tau with each of the other institutions with a sufficient number of obligors in common (10 in the SVB exercise). These Kendall taus are then aggregated in a single metric at the institution level by taking the median.

23. Generally speaking, Figure 17 shows that the ranking of the counterparties is very consistent among institutions, with Kendall tau metrics at the institution level being positive for all asset classes, and generally above 50%.

Figure 17: Interquartile range, median and average of Kendall tau metrics



2.3 Outturns (backtesting) approaches (HDP)

24. Historical data on defaulted exposures, i.e. default rates and loss rates, are an important source of information on the portfolio risk, since they allow a kind of backtesting (outturns approach). This approach is very useful, since the misalignment between estimates (PDs and LGDs) and observed parameters (default rates and loss rates) could suggest that differences in RWAs between institutions might be driven by differences in estimation practices (different levels of conservatism, adjustments to reflect long-run averages, different lengths of time series of the data available and included in the calibration of the cycle, assumptions underlying recovery estimates, etc.) and not only by differences in portfolio risk.

Methodology and assumptions

A comprehensive description of the analysis can be found in Appendix 4. For the reader's convenience, its main features are recalled here.

Using the information provided by institutions according to the ITS, it is possible to compare, for the same institution and between institutions, the estimated parameters with the observed parameters, namely the following indicators:

- estimated parameters (IRB parameters)[20] – PD and LGD;
- observed[21] parameters – the default rate (DR) of the latest year, the average DR of the last 5 years, the loss rate (LR) of the latest year and the average LR of the last 5 years.

However, there are several caveats that should be kept in mind when doing this comparison, in particular for the comparison at the risk parameters level (see comprehensive list in Appendix 4):

- The observed risk parameters used for prudential purposes may be different from the data collected (default weighted versus exposure weighted).
- There may be differences between the rates collected and the long-run averages. PD and LGD estimates are required by Articles 180 and 181 of the CRR to be representative (PD) or at least equal (LGD) to the long-run average. However, the collected observed average values are not fully adequate for a comparison with the risk estimates, first because they are not necessarily representative of the variations of the cycle, second as they are based on an exposure-weighted average and not an arithmetic average and third because they are calculated at EBA benchmarking top portfolio level and not at grade level.
- The long-run averages and the risk parameters (MoC, downturn) may differ.
- They may lack representativeness due to the computation on non-homogeneous pools:

[20] Parameters used for RWA calculation excluding the effect of potential measures introduced in accordance with Article 458 of Regulation (EU) No 575/2013.

[21] In contrast to the default rate, the loss rate is not purely observed, as it includes credit risk adjustments that have been estimated by the institution.

- For the 1-year rates, the data collected allowed only the comparison of PDs (and LGDs) at the reference date (2018) with the default rate (and loss rate) observed during the same year (2018), whereas it would be more consistent to compare this default rate (and loss rate) with the PD (and LGD) at the beginning of the observation period.
- For the 5-year rates, the average may not be statistically well grounded, since the portfolio quality may have significantly changed over the years. This is especially true in the context of the significant improvement in the portfolios of institutions observed in some EU Member States.

- There are weaknesses in the backtesting of the LGD with the loss rates: unlike the default rate, the loss rate is not truly observed, since it accounts for both observed losses and estimated credit risk adjustments. Accordingly, an LR/LGD ratio higher than 100% does not reflect per se a lack of conservatism but could be due to a difference in the estimation of LGD and credit risk adjustments.

As a result of these weaknesses, an additional analysis is presented, based on observed (obligor-weighted average) default rate observed at the grade or pool level, via four additional data points:

- RWA- and RWA+, which are the hypothetical RWA resulting from the application of *p*- and *p*+. For each obligor grade:

  $\mathbf{p}^{-}$ shall be the smallest positive value satisfying the equation

  $$\mathbf{p}^{-} + \mathbf{\Phi^{-1}(q)} \cdot \sqrt{\frac{\mathbf{p}^{-} \cdot (\mathbf{1} - \mathbf{p}^{-})}{\mathbf{n}}} \geq \mathbf{DR_{1y}}$$

  $\mathbf{p}^{+}$ shall be the largest positive value satisfying the equation

  $$\mathbf{p}^{+} - \mathbf{\Phi^{-1}(q)} \cdot \sqrt{\frac{\mathbf{p}^{+} \cdot (\mathbf{1} - \mathbf{p}^{+})}{\mathbf{n}}} \leq \mathbf{DR_{1y}}$$

  NB: $\mathbf{DR_{1y}}$ is the obligor-weighted default rate.
- RWA-- and RWA++, which are similar to RWA- and RWA+, but using $\mathbf{DR_{5y}}$ instead of $\mathbf{DR_{1y}}$.

For this the position of the RWA of the bank in the interval [RWA- ; RWA+] is normalised using the following formula:

$$\boldsymbol{Position_{normalised}} = \frac{\boldsymbol{RWA} - \frac{(\boldsymbol{RWA^{+}} + \boldsymbol{RWA^{-}})}{\mathbf{2}}}{\frac{(\boldsymbol{RWA^{+}} + \boldsymbol{RWA^{-}})}{\mathbf{2}}}$$

This normalised position can be interpreted in the following manner:

- If $\boldsymbol{Position_{normalised}} < -\mathbf{1}$, $\boldsymbol{RWA} < \boldsymbol{RWA^{-}} (< \boldsymbol{RWA^{+}})$ **: the PD estimates are calibrated in an aggressive way.**

- If $\boldsymbol{Position_{normalised} \in [-1; 1]}$, **at** $\boldsymbol{RWA^- < RWA < RWA^+}$**: the PD estimates are generally consistent with the observed default rates.**
- If $\boldsymbol{Position_{normalised} > 1}$, $\boldsymbol{(RWA^- <) RWA^+ < RWA}$ **: the PD estimates are calibrated in a conservative way.**

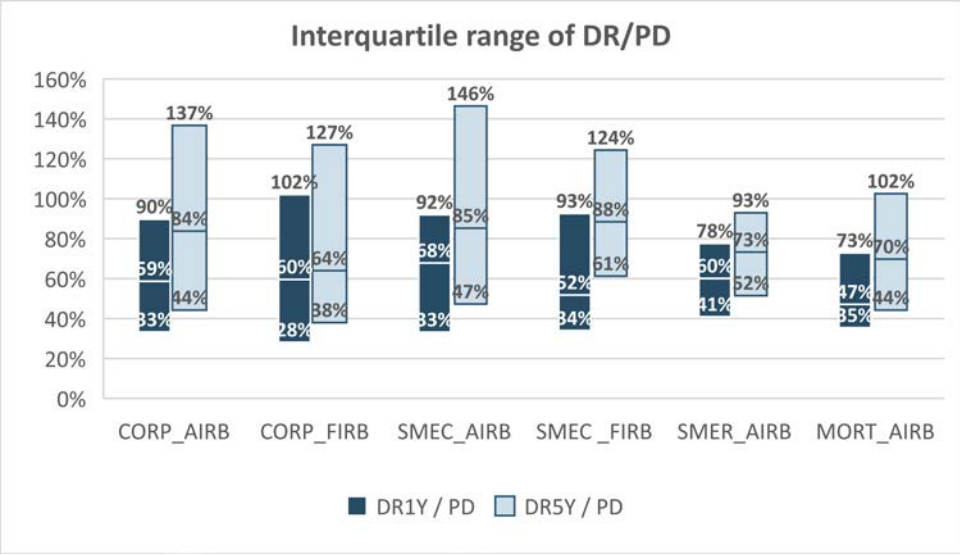
This analysis still relies on approximations:

- The four metrics do not reflect regulatory measures or corrective actions in place that are having an impact on institutions' capital requirements.
- Extrapolations to the total IRB credit risk portfolio cannot be made, because of the specific nature of HDP exposures.

2.3.1 Results on the latest collected data

25. Since the backtesting results are relevant for only portfolios with enough data, the results based on all the data collected are complemented with additional charts for which only records with more than 100 obligors are selected.[22] Generally speaking, the former show lower backtesting ratios (i.e. more conservative calibration), which is consistent with the general margin of conservatism (MoC) principle (the fewer data an institution has, the more conservative it must be in its estimation).

Figure 18: Interquartile range of the ratio of the DR 1Y to PD and the ratio of the DR 5Y to PD, for non-defaulted exposures, by SVB exposure class and regulatory approach



[22] As a consequence, the following percentages of portfolios are excluded from the analysis: 15% for CORP AIRB, 30% for CORP FIRB, 4% for SMEC AIRB, 9% for SMEC FIRB and 1% for both MORT and SMER.

Figure 19: Interquartile range of the ratio between the LR 1Y and LGD and the ratio between the LR 5Y and LGD, for non-defaulted exposures, by portfolio and regulatory approach

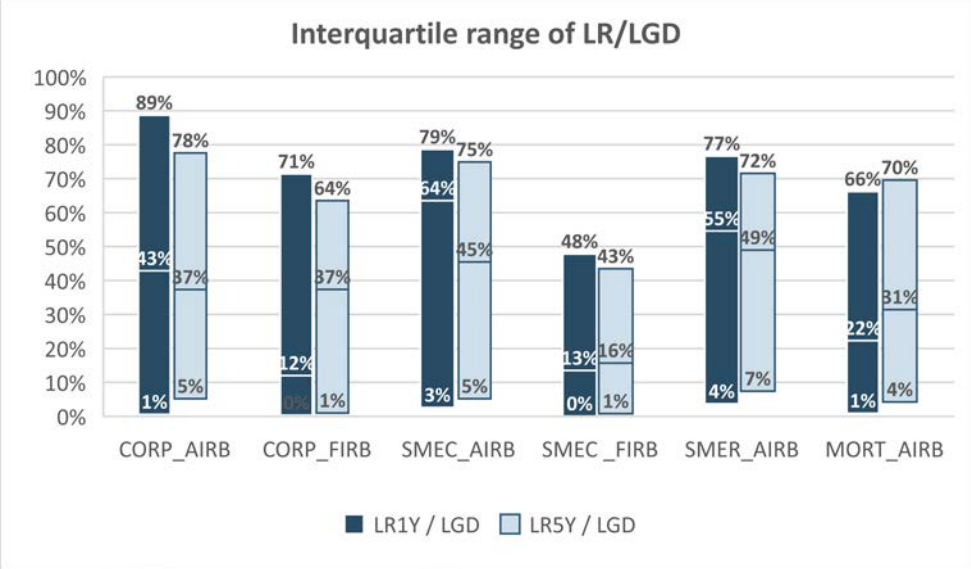


Table 7: Key backtesting metrics at portfolio level

		CORP		SMEC		SMER	MORT
		AIRB	FIRB	AIRB	FIRB	AIRB	AIRB
Position normalised 1– based on RWA+ and RWA-, i.e. DR1Y	Q1	-0.7	-0.5	1.4	-0.4	1.4	0.0
	Median	**0.3**	**0.1**	**3.3**	**0.9**	**3.3**	**4.0**
	Q3	1.8	1.0	6.7	2.0	6.7	8.5
	Sample size	40	31	62	40	62	77
Position normalised 2– based on RWA++ and RWA--, i.e. DR5Y	Q1	-0.7	-0.4	0.8	-0.4	0.8	-0.2
	Median	**0.1**	**0.2**	**2.7**	**0.7**	**2.7**	**2.2**
	Q3	1.1	1.1	9.7	1.6	9.7	8.9
	Sample size	43	32	63	41	63	76

Below -1
Between -1 and 0
Between 0 and 1
Above 1

2.3.2 Results compared with previous exercise

26. Figures 20 and 21 show the evolution of the backtesting ratios for the worst institutions, i.e. where the ratio is the highest.[23] The evolution of the normalised position cannot be shown, as it was not collected in previous years.

[23] The third quartile is used to select the institutions.

Figure 20: Default rate to PD ratio trends

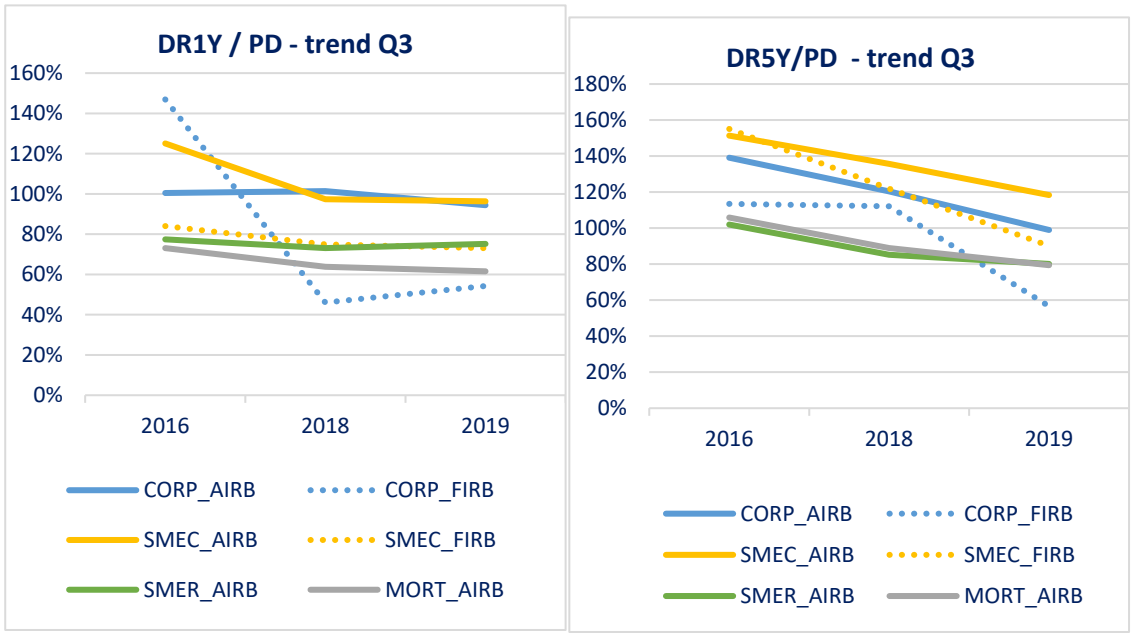
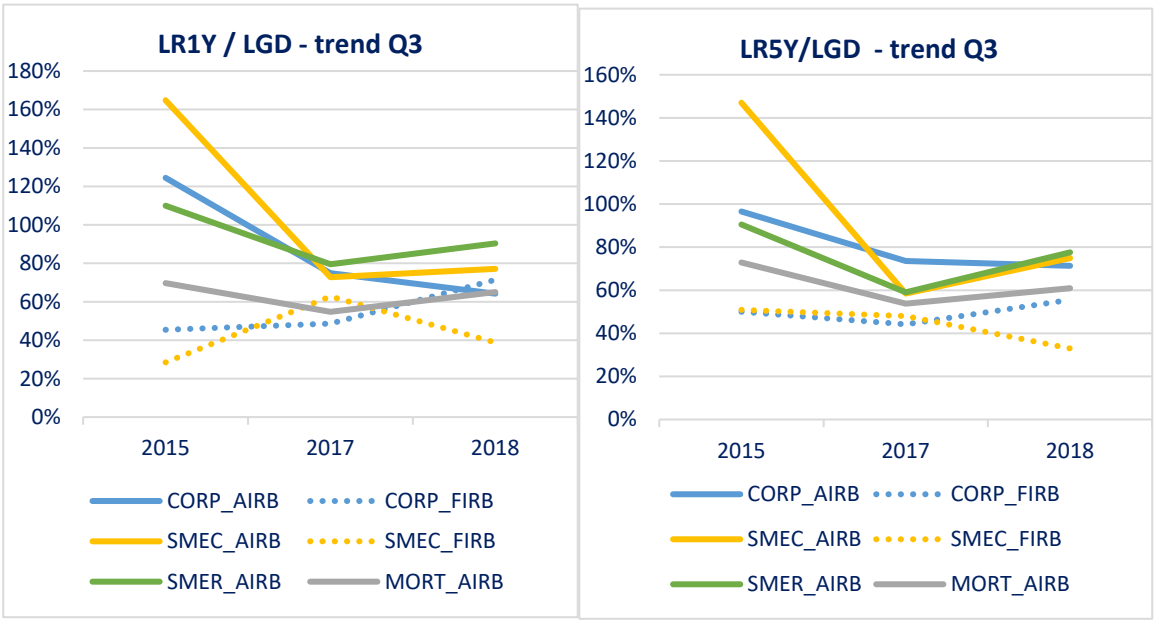


Figure 21: Loss rate to LGD ratio trends



2.4 Comparison of variability under the IRB approach and the standardised approach (HDP)

27. The SVB exercise allows a comparison of the different measures of risk, i.e. based on the IRB approach and the SA. This comparison is especially interesting in the context of the finalisation of the Basel III framework, which constrains the IRB approach with the SA via the output floor.

Methodology and assumptions

Under the IRB approach, the cost of capital of an exposure is twofold: first, the expected loss triggers deductions in capital,[24] and, second, the unexpected loss implies own fund requirements measured via the risk weighting of the exposures. This aggregated cost, the global charge (GC), is especially important to consider when assessing the variability at the institution level, since the cost of capital of defaulted assets under the FIRB approach comes entirely from the expected loss (hence, only looking at the RW variability would strongly overestimate the variability of cost in capital). Although a similar concept can be defined for the standardised approach, via a sum of the RWA and the accounting provisions, the latter is not collected in the SVB exercise. Therefore:

- in the section 'Variability analysed across exposure classes', where the variability is assessed at the institution level, the **variability** of the RW under SA will be compared with the **variability** of the GC under the IRB. However, the two metrics are not fully comparable in absolute terms.

- In the section 'Variability analysed within the exposure classes', where the total costs of capital are compared between the different approaches for non-defaulted exposures only, the RW metric will be used for both approaches.

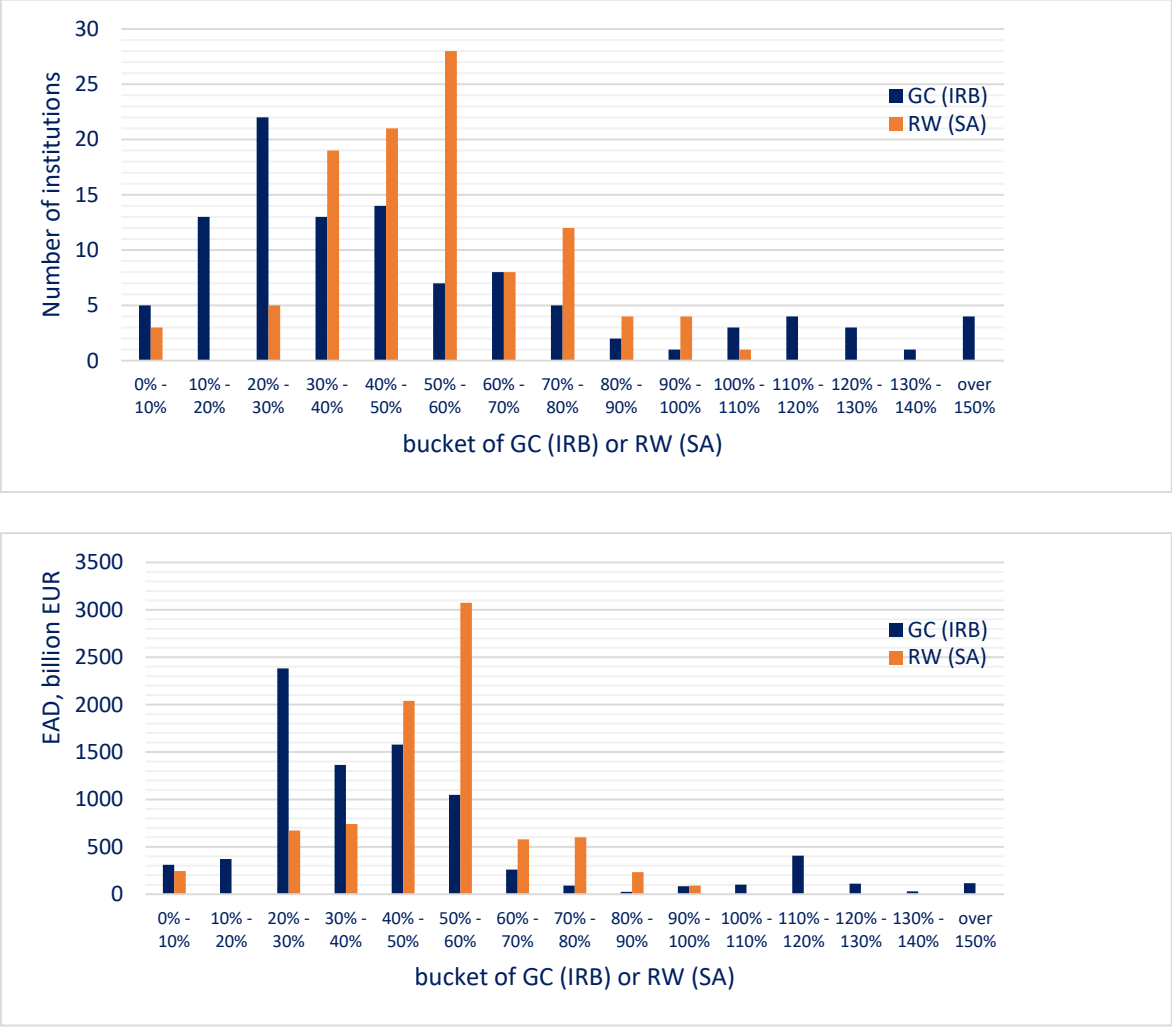
With respect to the calculation of the RW under the SA, it should be noted that it is based on the division of the RWA calculated under the SA with the exposure value used under the IRB approach. Given this, the 'RW under SA' is not exactly the RW given by Chapter 2 of the CRR, as the exposure value under the IRB approach is gross of specific provisions. The 'RW under SA' is rather the 'adjusted RW under SA', in order to be able to make a comparison with the RW under the IRB approach.

2.4.1 Variability analysed across exposure classes

28. A first visualisation of the distribution of weights applied to the exposures already gives a hint of the variability under the different approaches. At the EU level, the aggregate of the distribution (at institution level) of the total GC (IRB) and total RW (SA) is shown in Figure 22.

[24] Via the calculation of an EL in Article 158 of the CRR and its deduction via the shortfall of Article 159 and accounting provisions.

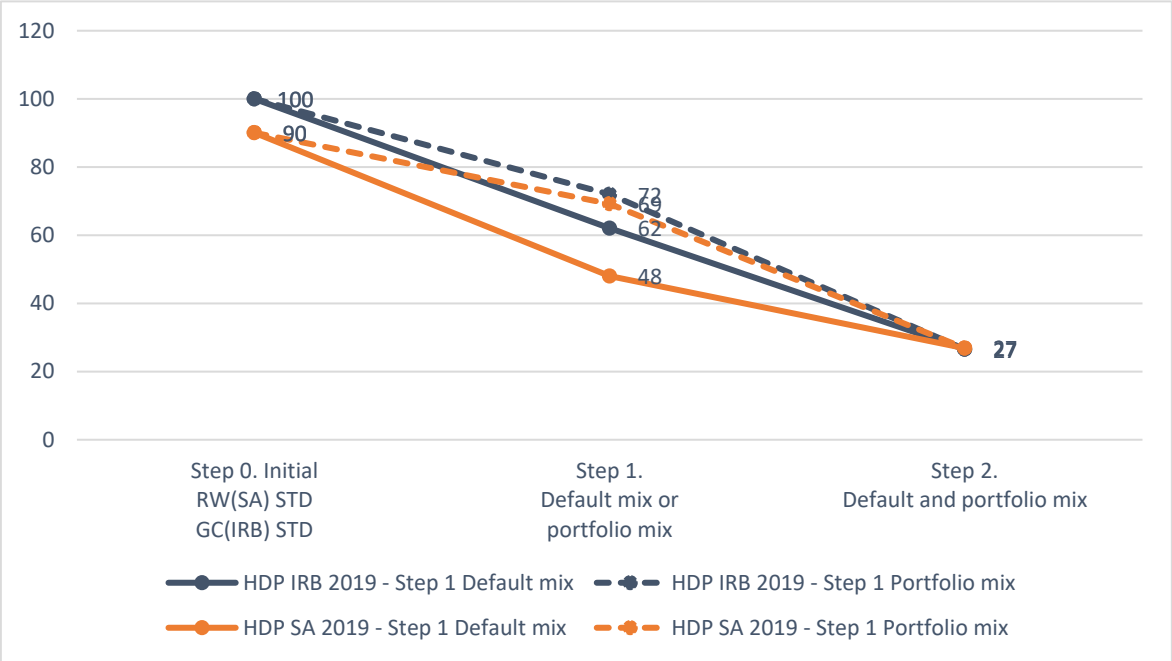
Figure 22: Distribution of GC (IRB) and RW (SA), number weighted (top) and exposure weighted (bottom)



NB: Each institution is allocated to one bucket based on its average GC (IRB) and RW (SA). The upper chart is based on the simple sum of the institutions per bucket; the lower chart adds up the exposure value of each institution per bucket.

29. Figure 22 allows the embedded variability of each approach to be visualised at the aggregate level, but without any considerations of the riskiness of the portfolio. Leveraging on the top-down analysis performed in the previous reports, the EBA ran the analysis on the same exposures (i.e. risk weighted with the IRB approach), but with the two different regulatory approaches, the IRB approach and the SA. This makes it possible to quantify the proportion of variability that can be explained by (i) the proportion of defaulted exposures and (ii) the portfolio mix effect. All the variability measures are normalised with the initial IRB variability (hence, the initial IRB variability is arbitrarily set at 100).

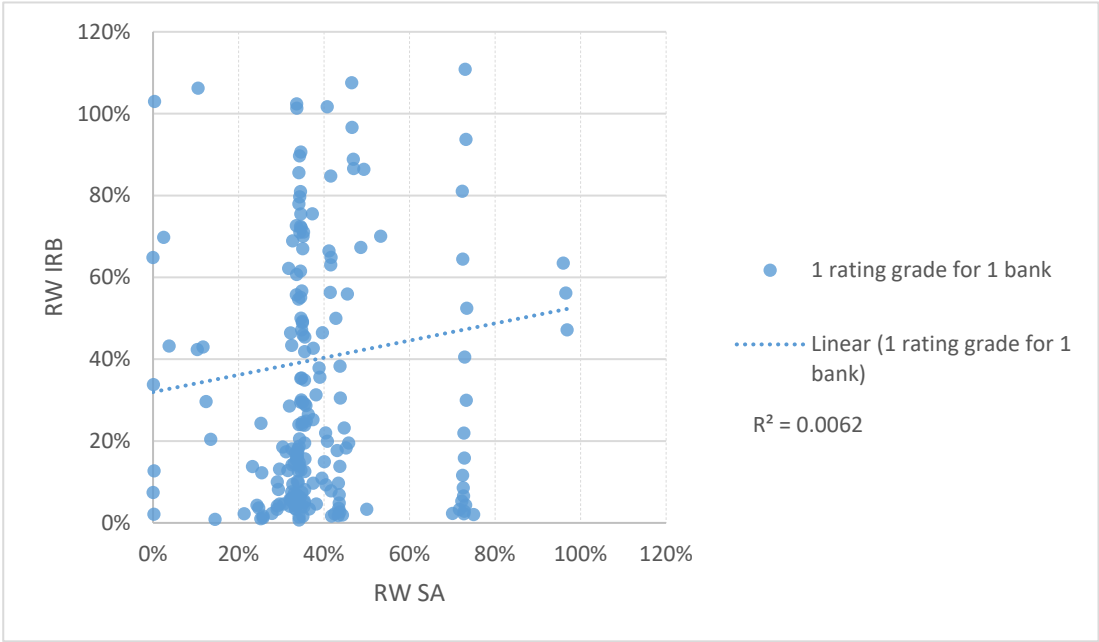
Figure 23: Top-down analysis – SA versus IRB



2.4.2 Variability analysed within the exposure classes

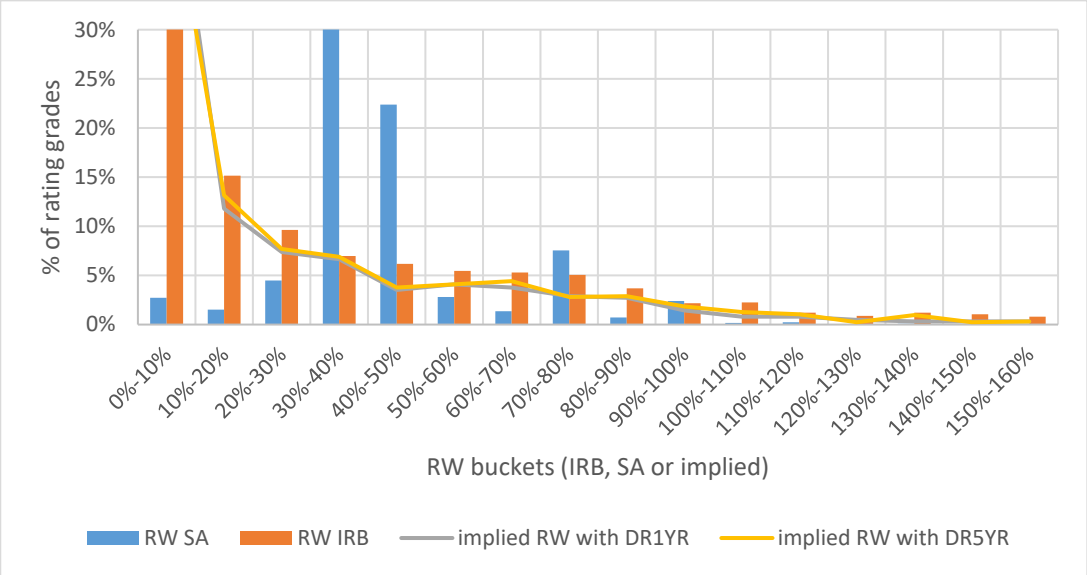
30. The values of the RW calculated under the SA and the RW calculated under the IRB can be compared at the rating grade level. Figure 24 to Figure 27focus on mortgages, where the highest number of data points is observed, although the same conclusions can be drawn for the other exposure classes. The charts for the other SVB exposure classes can be found in Appendix 10.

Figure 24: RW (IRB) versus RW (SA) at the grade level, mortgages portfolio



31. In order to assess the appropriateness of the approaches, it is therefore relevant to add to this analysis a proxy for the level of risk. One simple and convenient way to visualise how the RW under the IRB approach and the RW under the SA relate to the underlying level of risk is to compare their related distributions with the distributions of 'implied RW', defined as the average RW recalculated using the observed default rates[25] at the grade level (Figure 25).

Figure 25: Distribution of RW (IRB), RW (SA) and implied RW, mortgage portfolio

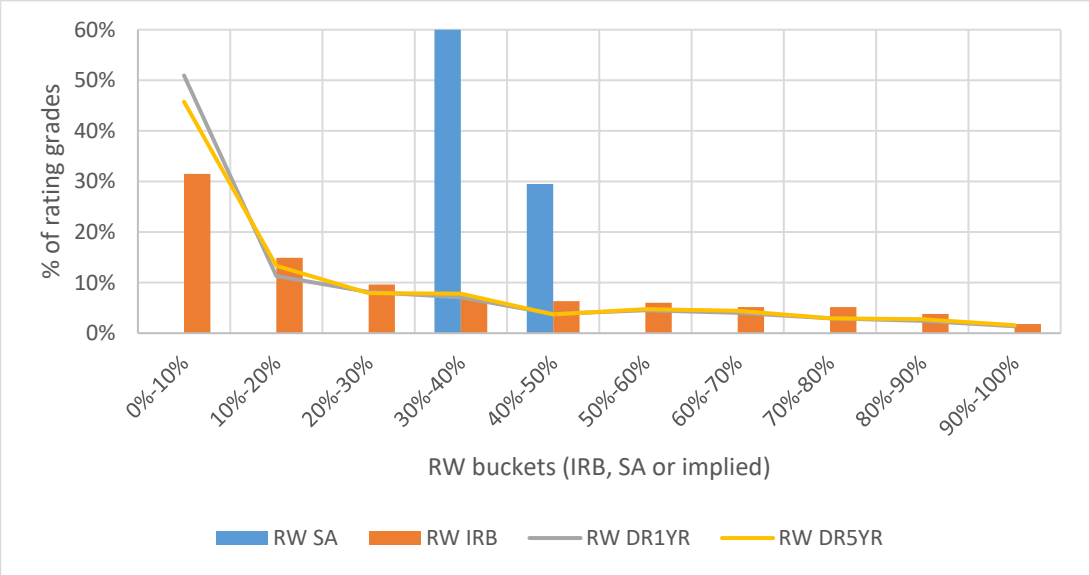


Missing values due to y-axis capped at 30%: (i) RW (IRB) between 0% and 10%, 47%; (ii) RW (SA) between 30% and 40%, 53%; (iii) RW (DR1Y) between 0% and 10%, 52%; RW (DR1Y) between 0% and 10%, 47%..

32. The dispersion of the RW calculated under the IRB for a given SA RW band can be illustrated for selected RW bands, for instance the 30%-50% SA bucket. Figure 26 replicates Figure 25, but only keeping the rating grades with RW (SA) between 30% and 50%.

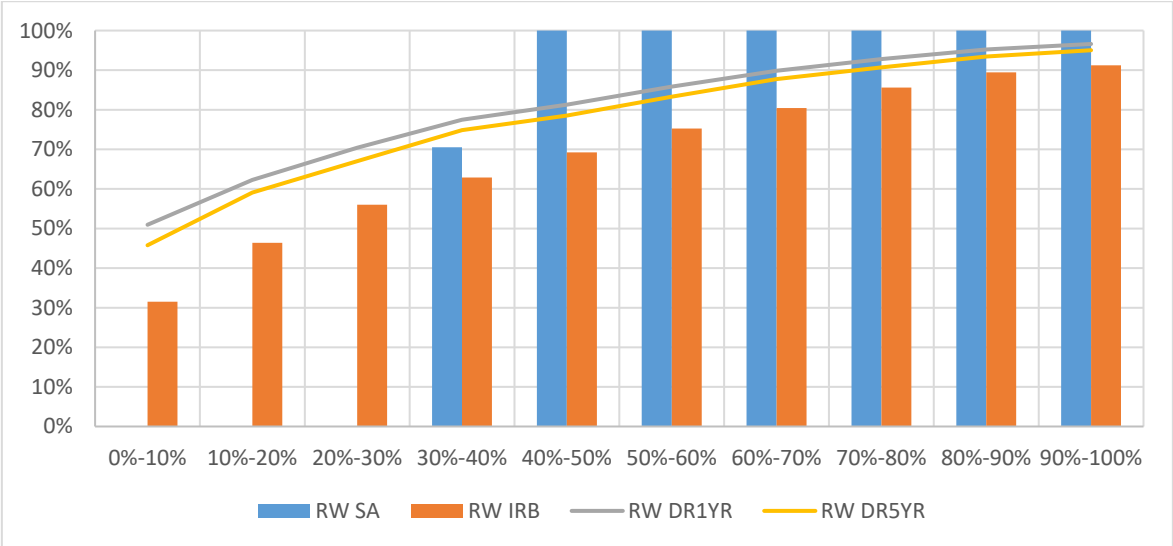
[25] The data collected allow the use of both a 1-year and a 5-year exposure value-weighted average default rate. These data points are complemented by the average LGD and maturity at the grade level to calculate the implied RW.

Figure 26: Distribution of RW (IRB) for exposures with RW (SA) between 30% and 50%



33.This distribution analysis can be complemented by the cumulative distribution (Figure 27).

Figure 27: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 30% and 50%



3. Qualitative analysis

3.1 Competent authorities' assessments

34. Article 78(4) of the CRD requires CAs to make an assessment where institutions diverge significantly from the majority of their peers or where there is little commonality in approaches, leading to a wide variance of results. In this case, the CA should investigate the reasons, and take corrective action if the institution's approach leads to an underestimation of own funds requirements that is not attributable to differences in the underlying risks. In order to facilitate the transfer of information from these assessments from the CAs to the EBA, the EBA issued a questionnaire to the CAs, which had to be completed for each institution participating in the SVB exercise. The EBA received the responses for 100 institutions. This section summarises the key information derived from these assessments.

35. In order to allow comparison of the numbers, the same graphs as the ones presented last year are depicted in this report.

Figure 28: CAs' overall assessment of the level of institutions' own funds requirements, taking into account benchmark deviations

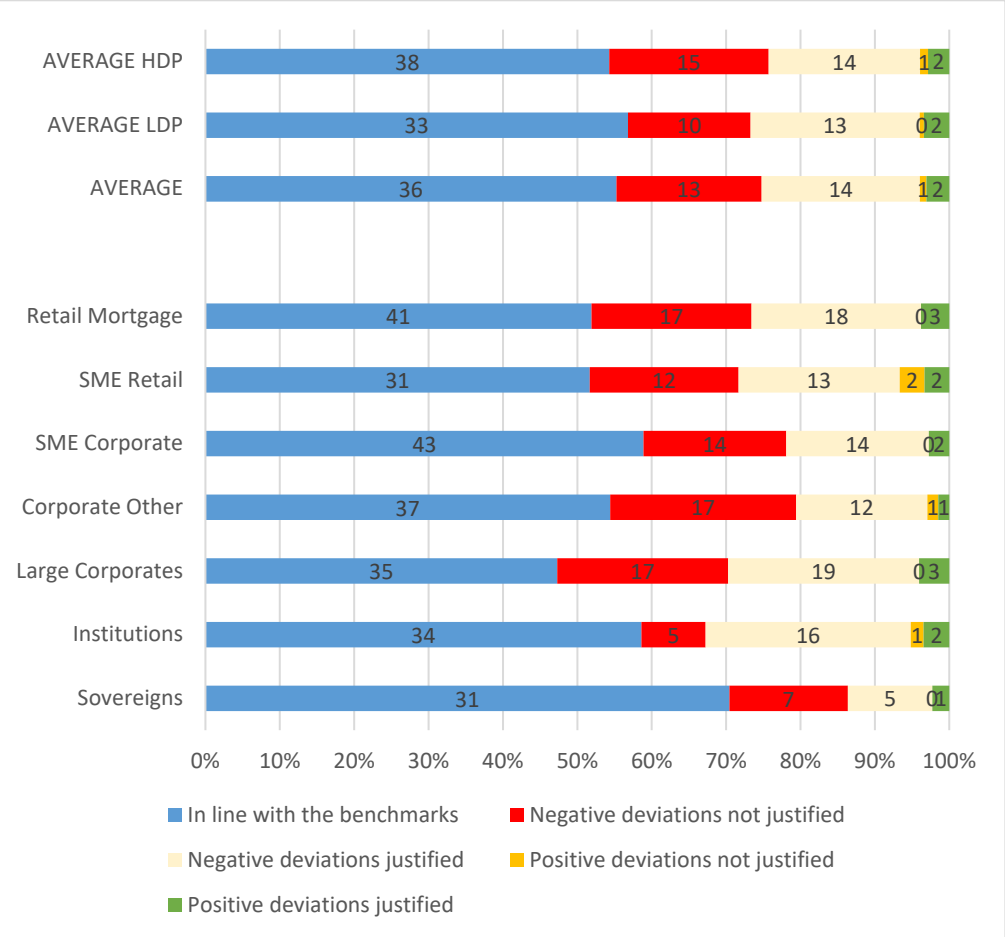


Figure 29: Common reasons for positive and negative deviations justified (at least one parameter)

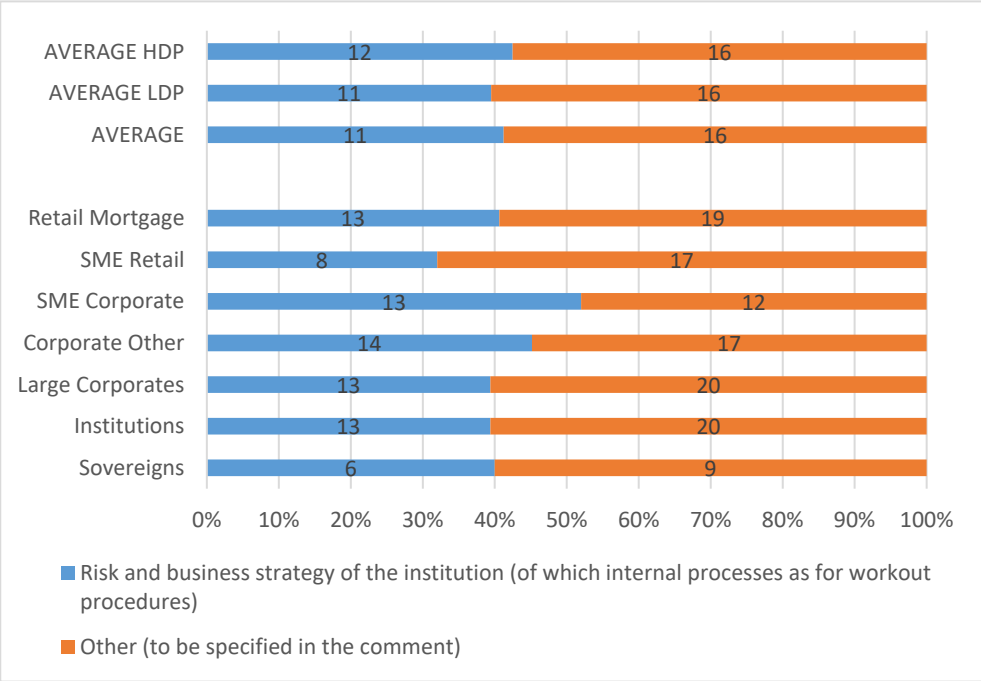


Figure 30: Common reasons for negative deviations not justified (at least one parameter)

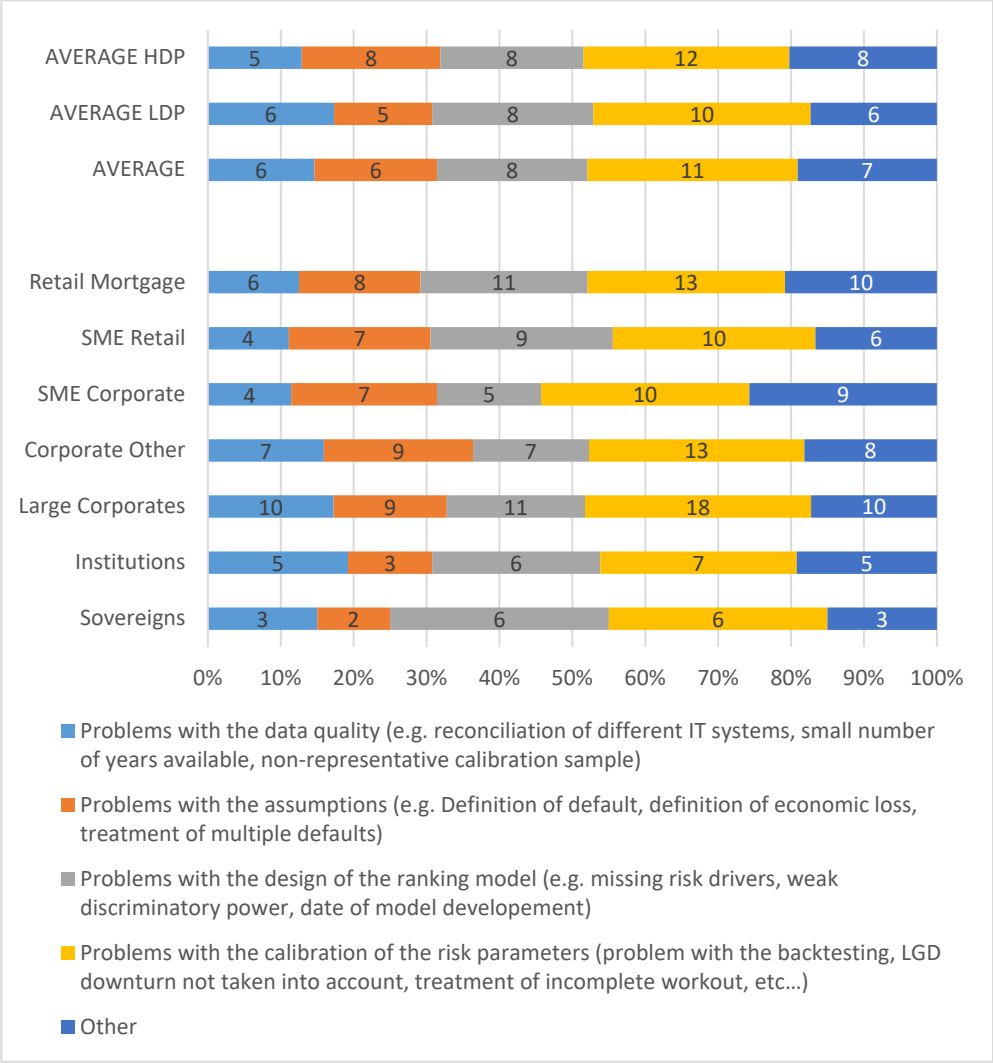


Figure 31: Has the institution's internal validation of the model identified the most relevant possible negative deviations not justified?

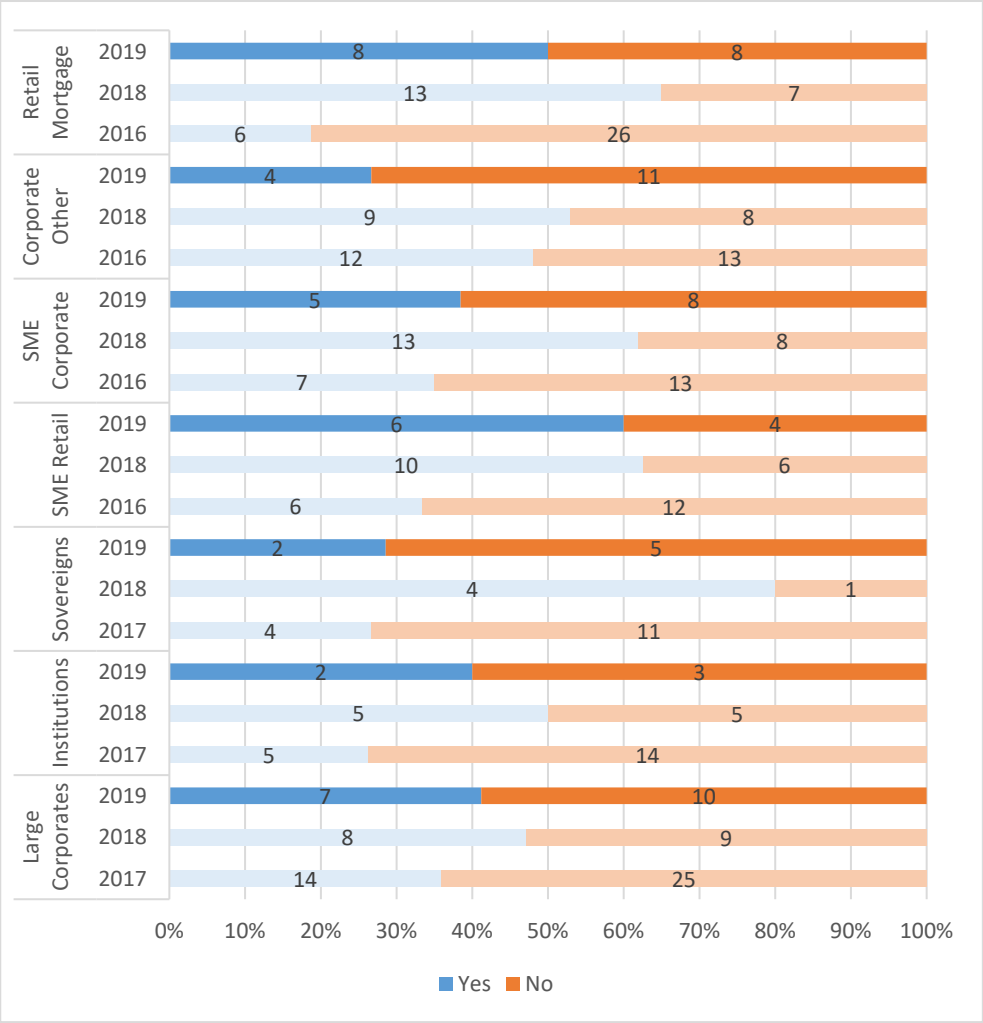
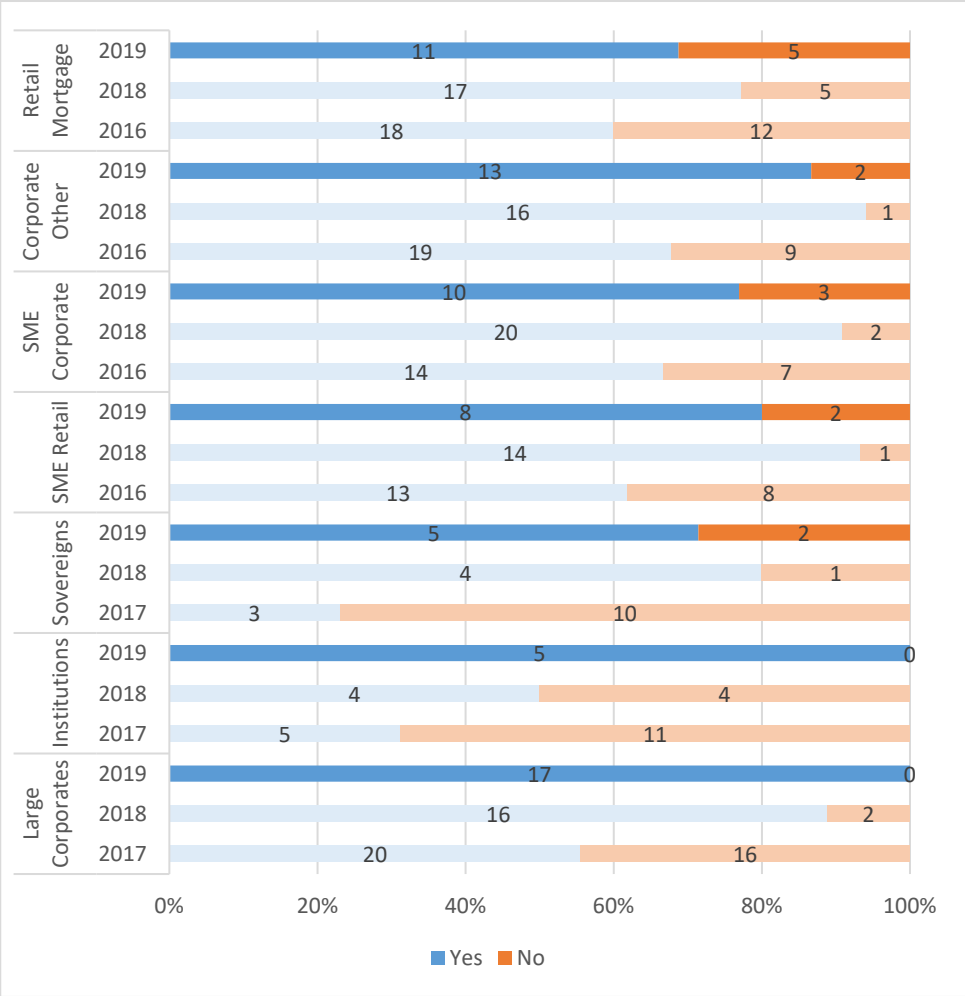
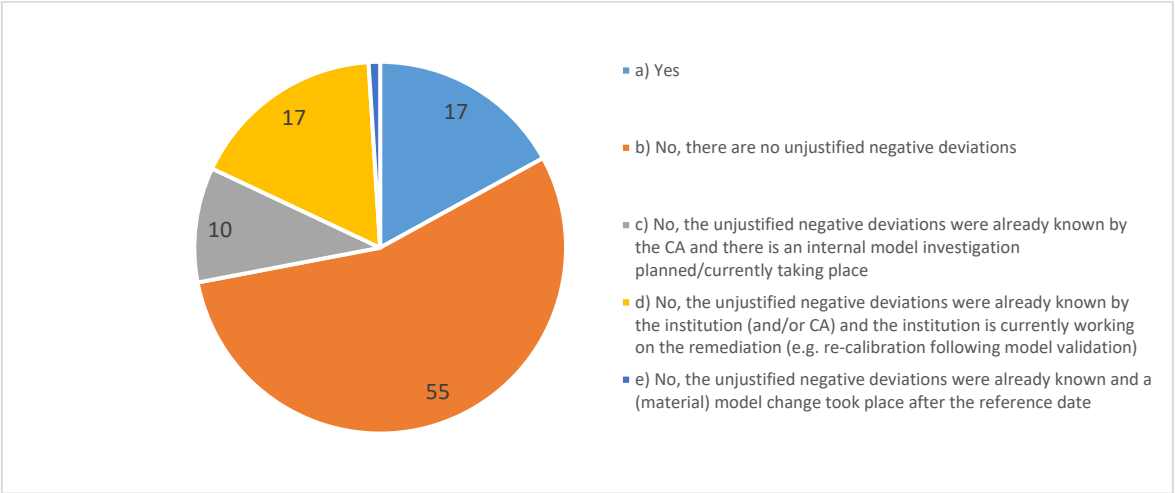


Figure 32: Have the CA monitoring activities (ongoing or on-site) of the internal models identified the most relevant possible negative deviations not justified?



The questionnaire further enquired whether or not any actions are planned by the CA following the SVB results (Figure 33).

Figure 33: Are any actions planned by the CA following the SVB results?



3.2 Result of the interviews

36. The EBA conducted interviews with seven institutions where significant numbers of negative deviations were spotted.[26] The interview teams were mainly composed of representatives from the CAs, members of the EBA subgroup on supervisory benchmarking and EBA staff. The findings are generally consistent with those of previous years.

- **LDP:** the main challenge is to overcome the scarcity of data, and many issues come directly from the use of approaches to overcome this lack of data.
    - Some institutions use extrapolation techniques to obtain a representative dataset with a mix of bad and good years (extrapolation performed most of the time at portfolio level), but it is difficult to prove the representativeness of these additional data. The quantification of the MoC is not always clear, with either banks having no (sound) MoC framework implemented or the implemented techniques not being transparent.
    - Some institutions use calibration techniques at portfolio level without any check at rating grade level, but it is difficult to prove the representativeness of past data at this level (e.g. some institutions experience massive changes in their portfolios, and it is therefore not clear to what extent the fluctuation of the default rates are due to systemic fluctuation or portfolio composition). The quantification of the MoC is also not always clear (see previous point).
    - *If the modelling is done via a pooling network, additional difficulties may arise, such as the consistent application of the definition of default or the rating methodology between the different members. If the model builds on external ratings, the default definition might deviate or the mapping between the internal and the external rating scale may be subject to different assumptions made during the model developments that are not always justified. [not observed this year]*
    - However, given the lack of default observations for LDP, any backtesting or quantitative validation techniques are challenging. In some cases the performance of the model itself cannot be assessed with certainty.
- **HDP:** Apart from general data quality issues, common reasons for negative deviation are:
    - no check of the homogeneity at the grade level (when the quantification is done at the grade and pool levels);
    - no clear MoC quantification, and in particular for MoC category C,[27] although most of the time there is an 'implicit MoC' following conservative assumptions made during the model's development;
    - *no treatment of incomplete workouts (in particular for residential mortgages) [not observed this year];*

[26] Institutions invited for an interview one year are not invited the following year. This is because the interviews occur in September and the reference date for the following benchmarking exercise is in December, hence making any significant changes in the data reported very unlikely (in particular due to the necessary time for supervisory approval of the model).

[27] This concept of MoC category C to account for statistical error is introduced in the GL on PD and LGD estimation and the treatment of defaulted exposures (https://www.eba.europa.eu/documents/10180/2033363/Guidelines+on+PD+and+LGD+estimation+%28EBA-GL-2017-16%29.pdf/6b062012-45d6-4655-af04-801d26493ed0), which apply from 1 January 2021.

- sensitivity to the definitions used for the SVB exercise (parameters are exposure weighted and not obligor weighted), as well as to the cycle effects (in particular for the backtesting results with the 5-year default rates, where an increase in the credit quality of some portfolios makes the old default rates not representative at the portfolio level).

37. Several general data quality issues and problems in the reporting also explain the deviations. In addition to the weaknesses observed last year, another source of variability that was identified and observed relates to the change in the definition of default: some institutions have reported in the default rate the (one-off) flow of new defaults coming from the adoption of a more sensitive new definition of default. This approach biases the results, since the definition of default used to assess the non-defaulted status 1 year before the reporting data is not consistent with the one used for the trigger of this one-off flow of default.

38. Last, some of the deficiencies are already known but are still reported in the SVB exercise due to a pending approval of the model changes. The EBA notes in particular a significant timespan between the observation of the weakness and its (validated) correction, with some of the issues detected (2 years ago) in the previous benchmarking exercise still observed this year.

39. In general, the interviews with the institutions were helpful for the EBA, the CAs and the institutions, to clarify the practices within each institution and gain a better understanding of its risk assessment compared with its peers.

3.3 Results of the qualitative survey

40. Since the 2018 exercise, the EBA has conducted an annual survey on a selected topic, in order to gain a better understanding of the variability of the results reported. Whereas the treatments of guarantees and derivatives were analysed in the previous report, the survey of the 2019 SVB exercise was focused on the different practices in terms of rating scales, and the impact of using a supervisory master scale.

41. Institutions were asked to provide information for two models, selected as being the most representative for the large corporates exposures and the mortgage portfolio. In addition to various questions on the type of calibration and rating scale they were using, institutions had to populate several backtesting data fields,[28] using first their internal rating scale and then a harmonised benchmarking rating scale. Participation in the survey was voluntary and a total of 81 institutions submitted answers.

3.3.1 General descriptive statistics

42. This first section presents the results of the practices observed in term of calibration, depending on the type of scales used for the large corporates and the mortgage portfolios. These two

[28] Four data points were collected: 1-year and 5-year default rates, using both obligor- and EAD-weighted average schemes.

portfolios were selected based on the assumption that they are largely representative of practices for LDPs and HDPs respectively.

43. The first set of questions was used to differentiate between three main types of calibration techniques:

a. **Continuous direct estimates of PD:** the PD estimates used for capital requirements calculation result from a continuous modelling approach leading to a direct PD estimate, by converting the score into a direct PD estimate. An additional calibration step in order to achieve a calibration target (which potentially leads to adjustments of PDs) may or may not be applied.

b. **Discrete direct estimates of PD:** this category uses a continuous modelling approach; however, in this case the continuous PDs are not used directly for capital requirements calculation, but instead mapped to a discrete rating scale (either a master scale used across different portfolios or a grade scale specific to the portfolio). The PD estimates of each grade are derived not from the long-run average default rate by grade but from the average of obligor/facility PDs assigned to each grade or a fixed PD per grade (e.g. the average of the upper and lower bounds of each grade), as set out in Article 180(1)(g) of the CRR.

c. **Grade-based estimation of PD:** the PDs used for capital requirements calculation result from the long-run average default rate calculated at pool or grade level.

Table 8: Calibration type per SVB portfolio (sample of models) (%)

Calibration type	LCOR	MORT
Continuous direct estimates of PD	12	22
Discrete direct estimates of PD	**46**	30
Grade-based estimation of PD	40	**45**
Other	3	3

Figure 34: Number of grades per type of rating scale and SVB portfolios (sample of models)

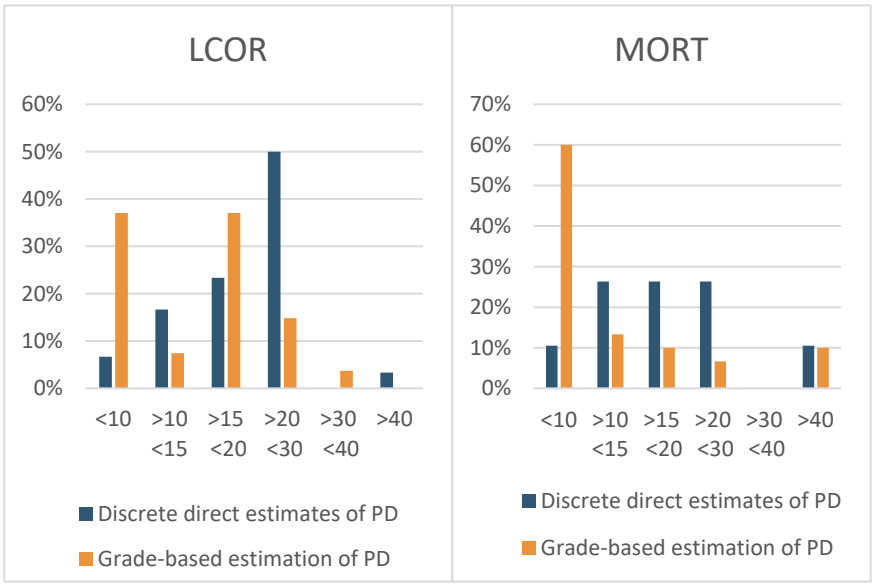


Table 9: Definition of the PD values – constant over time? (%)

Are the PD values (associated with the grades) constant over time?	LCOR		MORT	
	Discrete direct estimates	Grade-based estimation	Discrete direct estimates	Grade-based estimation
Change over time	23	48	35	40
Constant over time	**77**	**52**	**65**	**60**

Table 10: Definition of the buckets – constant over time? (%)

Are the definitions of the buckets defining the grades constant over time?	LCOR	MORT
Definition constant over time	**93**	**89**
Definition not constant over time	7	11

Table 11: Frequency of recalibration of the PD model (%)

What is the frequency of the recalibration of the PD model?	LCOR		MORT	
	Discrete direct estimates	Grade-based estimation	Discrete direct estimates	Grade-based estimation
More than once per year	0	4	10	0
Every year	**32**	**46**	**35**	**48**
Every 2 years	13	0	10	7
Every 3+ years	16	23	25	21
No recalibration	**39**	27	20	24

44. Apart from one institution, all the respondents with continuous direct estimates map the continuous PD scale to grades for internal risk management purposes, e.g. in reports as specified in Article 189(2) of the CRR.

Table 12: Methodology of construction of the master scale (%)

If you use a master scale, how do you construct this master scale? *By fixing for each grade and pool …*	LCOR			MORT		
	Continuous direct estimate of PD	**Discrete direct estimates**	**Grade-based estimation**	**Continuous direct estimate of PD**	**Discrete direct estimates**	**Grade-based estimation**
boundaries and PD values	13	**75**	6	7	**82**	27
boundaries	**75**	13	33	**57**	9	**60**
PD values	13	13	**61**	36	9	13

Table 13: Use of the master scale across exposure classes (%)

Do you use a master scale?	LCOR		MORT	
	Discrete direct estimates	**Grade-based estimation**	**Discrete direct estimates**	**Grade-based estimation**
Across all non-retail PD models	25	47	10	0
Across all PD models	**75**	**53**	**80**	**92**
Across all retail PD models	0	0	10	8

Table 14: Use of master scales in reporting, disclosure, setting risk appetite and calibration

If you use a master scale, do you use it …	LCOR	MORT
For reporting (% yes)	96	93
For disclosure (% yes)	90	76
For setting risk appetite (% yes)	81	55
For calibration (%yes)	56	45

3.3.2 Analysis of the use of a supervisory master scale

45. The following metrics provide an indication of the different biases coming from the use of a supervisory master scale:

a. **Num of banks**: number of banks, after applying data cleaning.[29]

b. **Average 'nb obligors':** average number of obligors.

c. **Average 'PD - EAD weighted':** EAD-weighted average across rating grades of the EAD-weighted PD estimates at grade level.

d. **Average 'PD - obligor weighted':** obligor-weighted average across rating grades of the obligor-weighted PD estimates at grade level.

e. **Average 'DR1Y - EAD weighted':** EAD-weighted average across rating grades of the EAD-weighted default rate of the last year.

f. **Average 'DR1Y - obligors weighted':** obligor-weighted average across rating grades of the obligor-weighted default rate of the last year.

g. **Average 'DR5Y - EAD weighted':** EAD-weighted average across rating grades of the EAD-weighted default rate averaged over the last 5 years.

h. **Average 'DR5Y - obligors weighted':** obligor-weighted average across rating grades of the obligor-weighted default rate averaged over the last 5 years.

i. **Average 'EBA scale, PD - EAD weighted':** EAD-weighted average across rating grades of the EAD-weighted PD estimates at grade level, using EBA rating scale.

j. **Average 'EBA scale, PD - obligors weighted':** obligor-weighted average across rating grades of the obligor-weighted PD estimates at grade level, using EBA rating scale.

k. **Average 'EBA PD and scale, PD - EAD weighted':** EAD-weighted average across rating grades of the PD values associated with the rating scale, using EBA rating scale. The PD values are defined as the average of the lower and higher boundaries of the given grade.

l. **Average 'EBA PD and scale, PD - obligors weighted':** obligor-weighted average across rating grades of the PD values associated with the rating scale, using EBA rating scale (same PD values used as in the previous point).

[29] The number of obligors and the total EAD should be equal for the internal and benchmarking rating scales (tolerance 1%), all rates should be between 0% and 100% (tolerance 1%), all RWs should be below 1 250%, and the PD EAD weighted and PD obligor weighted should be similar at the grade level for grade-based models (tolerance 3%) and broadly similar for others (tolerance 30%).

Table 15: Key risk metrics using internal rating scale

LCOR	Num of banks	Average 'nb obligors'	Average 'PD - EAD weighted' (%)	Average 'PD - obligors weighted' (%)
Continuous direct estimates of PD	8	6 057	2.36	4.72
Discrete direct estimates of PD	23	4 362	0.87	1.21
Grade-based estimation of PD	23	4 136	1.22	1.81

Table 16: Default rate metrics using internal rating scale (%)

LCOR	Average 'DR1Y- EAD weighted '	Average 'DR1Y - obligors weighted'	Average 'DR5Y- EAD weighted'	Average 'DR5Y - obligors weighted'
Continuous direct estimates of PD	0.67	1.11	1.05	1.02
Discrete direct estimates of PD	0.45	0.50	0.49	0.61
Grade-based estimation of PD	0.77	0.69	1.19	1.10

Table 17: Key risk metrics using benchmarking rating scale and benchmarking rating scale with benchmarking PD values (%)

LCOR	Average 'EBA scale, PD - EAD weighted '	Average 'EBA scale, PD - obligors weighted'	Average 'EBA PD and scale, PD - EAD weighted '	Average 'EBA PD and scale, PD - obligors weighted'
Continuous direct estimates of PD	2.37	4.74	2.08	4.46
Discrete direct estimates of PD	0.87	1.21	0.91	1.27
Grade-based estimation of PD	1.25	2.00	1.31	2.03

Table 18: Key risk metrics using internal rating scale

MORT	Num of banks	Average 'nb obligors'	Average 'PD - EAD weighted' (%)	Average 'PD - obligors weighted' (%)
Continuous direct estimates of PD	7	386 501	1.00	0.97
Discrete direct estimates of PD	14	355 829	1.06	1.16
Grade-based estimation of PD	23	435 260	1.62	1.67

Table 19: Default rate metrics using internal rating scale (%)

MORT	Average 'DR1Y- EAD weighted '	Average 'DR1Y - obligors weighted'	Average 'DR5Y- EAD weighted'	Average 'DR5Y - obligors weighted'
Continuous direct estimates of PD	0.38	0.40	0.41	0.46
Discrete direct estimates of PD	0.64	0.72	0.81	0.87
Grade-based estimation of PD	1.22	1.12	1.26	1.16

Table 20: Key risk metrics using benchmarking rating scale and benchmarking rating scale with benchmarking PD values (%)

MORT	Average 'EBA scale, PD - EAD weighted'	Average 'EBA scale, PD - obligors weighted'	Average 'EBA PD and scale, PD - EAD weighted'	Average 'EBA PD and scale, PD - obligors weighted'
Continuous direct estimates of PD	1.04	0.97	1.05	0.96
Discrete direct estimates of PD	1.00	1.12	1.05	1.17
Grade-based estimation of PD	1.79	1.85	1.81	1.89

Appendix 1: List of participating institutions

The participant institutions in scope of the SVB exercise are the ones that at 31 December 2018 had approval for the use of the credit risk internal models.[30]

Table 21: List of institutions participating in this exercise

Institution name	Country	Submits credit risk?
BAWAG Group AG	Austria	Yes
Erste Group Bank AG	Austria	Yes
Raiffeisen Bank International AG	Austria	Yes
Volkskredit Verwaltungsgenossenschaft reg.Gen.m.b.H.	Austria	Yes
AXA Bank Europe SA	Belgium	Yes
Belfius Banque SA	Belgium	Yes
Crelan	Belgium	Yes
Dexia NV	Belgium	Yes
Euroclear SA	Belgium	Yes
Investar	Belgium	Yes
KBC Group NV	Belgium	Yes
Danske Bank A/S	Denmark	Yes
DLR Kredit A/S	Denmark	Yes
Jyske Bank A/S	Denmark	Yes
Lån og Spar Bank A/S	Denmark	Yes
Nykredit Realkredit A/S	Denmark	Yes
Sydbank A/S	Denmark	Yes
Aktia Bank Abp	Finland	Yes
Ålandsbanken Abp	Finland	Yes
Nordea Bank Abp	Finland	Yes
OP Osuuskunta	Finland	Yes
BNP Paribas SA	France	Yes
CARREFOUR BANQUE	France	Yes
Crédit Mutuel Group	France	Yes
GOLDMAN SACHS PARIS INC ET CIE	France	Yes
Groupe BPCE	France	Yes
Groupe Credit Agricole	France	Yes
HSBC France (*)	France	Yes
Oney Bank	France	Yes
RCI banque (Renault Crédit Industriel)	France	Yes
SFIL (Société de Financement Local)	France	Yes

[30] This information is published on the EBA website: https://eba.europa.eu/documents/10180/15926/EBA+list+of+institutions+for+the+purpose+of+supervisory+benchmarking++%282019+Update%29.pdf/bdfedc3f-b225-4737-a20e-95d90ad7df1d

Institution name	Country	Submits credit risk?
Société Générale SA	France	Yes
Aareal Bank AG	Germany	Yes
ALTE LEIPZIGER Bauspar AG	Germany	Yes
Bayerische Landesbank	Germany	Yes
BMW Bank GmbH	Germany	Yes
Commerzbank AG	Germany	Yes
Degussa Bank	Germany	Yes
DekaBank Deutsche Girozentrale	Germany	Yes
Deutsche Apotheker- und Ärztebank eG	Germany	Yes
Deutsche Bank AG	Germany	Yes
Deutsche Bausparkasse Badenia AG	Germany	Yes
Deutsche Pfandbriefbank AG	Germany	Yes
Deutsche Zentral-Genossenschaftsbank AG	Germany	Yes
Erwerbsgesellschaft der S-Finanzgruppe mbH & Co. KG	Germany	Yes
HSH Nordbank AG (Hamburg Commercial Bank from Feb 2019)	Germany	Yes
KfW Beteiligungsholding	Germany	Yes
Landesbank Baden-Württemberg	Germany	Yes
Landesbank Hessen-Thüringen Girozentrale	Germany	Yes
Landesbank Saar	Germany	Yes
LBS Bayerische Landesbausparkasse	Germany	Yes
Münchener Hypothekenbank eG	Germany	Yes
NORD/LB Norddeutsche Landesbank Girozentrale	Germany	Yes
Oldenburgische Landesbank AG	Germany	Yes
Süd-West-Kreditbank Finanzierung GmbH	Germany	Yes
TOYOTA Kreditbank GmbH	Germany	Yes
Wüstenrot Bausparkasse AG	Germany	Yes
Alpha Bank AE	Greece	No
Eurobank	Greece	Yes
National Bank of Greece SA	Greece	Yes
AIB Group plc	Ireland	Yes
Bank of America Merrill Lynch International DAC (*)	Ireland	No
Bank of Ireland Group plc	Ireland	Yes
Barclays Bank Ireland plc (*)	Ireland	Yes
Permanent TSB Group Holdings Plc	Ireland	Yes
Ulster Bank Ireland Designated Activity Company (*)	Ireland	Yes
Banca Monte dei Paschi di Siena SpA	Italy	Yes
Banco BPM	Italy	Yes
BPER Banca SpA	Italy	Yes
Credito Emiliano Holding SpA	Italy	Yes
Credito Valtellinese	Italy	Yes
Intesa Sanpaolo SpA	Italy	Yes
Mediobanca – Banca di Credito Finanziario S.p.A.	Italy	Yes
UniCredit SpA	Italy	Yes
Unione di Banche Italiane SCpA	Italy	Yes
Banque et Caisse d'Epargne de l'Etat, Luxembourg	Luxembourg	Yes

Institution name	Country	Submits credit risk?
Banque Internationale à Luxembourg	Luxembourg	Yes
ABN AMRO Group N.V.	Netherlands	Yes
Coöperatieve Rabobank U.A.	Netherlands	Yes
ING Groep N.V.	Netherlands	Yes
LP Group B.V.	Netherlands	Yes
NIBC Holding N.V.	Netherlands	Yes
Van Lanschot Kempen N.V.	Netherlands	Yes
Volksholding B.V.	Netherlands	Yes
DNB BANK ASA	Norway	Yes
Sparebank 1 Nord-Norge SPA	Norway	Yes
Sparebank 1 SMN SPA	Norway	Yes
SPAREBANK 1 SR-BANK ASA	Norway	Yes
Sparebanken Hedmark SPA (SpareBank 1 Østlandet SPA)	Norway	Yes
Sparebanken Møre SPA	Norway	Yes
Sparebanken Vest SPA	Norway	Yes
Banco Comercial Português SA	Portugal	Yes
LSF Nani Investments S.à.r.l.	Portugal	Yes
Banco Bilbao Vizcaya Argentaria, SA	Spain	Yes
Banco de Sabadell, SA	Spain	Yes
Banco Santander SA	Spain	Yes
Bankinter SA	Spain	Yes
BFA Tenedora De Acciones, S.A.	Spain	Yes
CaixaBank, S.A	Spain	Yes
Landshypotek Bank AB (publ)	Sweden	Yes
Länförsäkringar Bank AB (publ)	Sweden	Yes
SBAB Bank AB - group	Sweden	Yes
Skandiabanken Aktiebolag (publ)	Sweden	Yes
Skandinaviska Enskilda Banken - group	Sweden	Yes
Svenska Handelsbanken - group	Sweden	Yes
Swedbank - group	Sweden	Yes
Volvofinans Bank AB (publ)	Sweden	Yes
Barclays Plc (**)	United Kingdom	Yes
Citigroup Global Markets Europe Limited (**)	United Kingdom	No
Clydesdale Bank Plc (CYBG) (**)	United Kingdom	Yes
Coventry Building Society (**)	United Kingdom	Yes
Credit Suisse International (**)	United Kingdom	Yes
Credit Suisse Investments (UK) (**)	United Kingdom	Yes
Goldman Sachs Group UK Limited (**)	United Kingdom	Yes
HSBC Holdings Plc (**)	United Kingdom	Yes
ICBC Standard Bank Plc (was Standard Bank Plc) (**)	United Kingdom	No
J P Morgan Capital Holdings Limited (**)	United Kingdom	No
LEEDS BUILDING SOCIETY (**)	United Kingdom	Yes
Lloyds Banking Group Plc (**)	United Kingdom	Yes
Merrill Lynch UK Holdings Ltd (**)	United Kingdom	No
Mitsubishi UFJ Securities International PLC (**)	United Kingdom	No

Institution name	Country	Submits credit risk?
Morgan Stanley International Ltd (**)	United Kingdom	Yes
Nationwide Building Society (**)	United Kingdom	Yes
Nomura Europe Holdings PLC (**)	United Kingdom	No
Principality Building Society (**)	United Kingdom	Yes
Skipton Building Society (**)	United Kingdom	Yes
Standard Chartered Plc (**)	United Kingdom	Yes
Sumitomo Mitsui Banking Corporation Europe Limited (**)	United Kingdom	Yes
The Co-operative Bank Plc (**)	United Kingdom	Yes
The Royal Bank of Scotland Group Public Limited Company (**)	United Kingdom	Yes
Virgin Money Plc (**)	United Kingdom	Yes

Data are provided by the CAs, and reflect the situation at 31 December 2018.
(**) Representing the highest level of consolidation in the EU/EEA as of 31 December 2018 in the UK.
(*) Additional institutions representing the highest level of consolidation in the EU/EEA as of 30 March 2019 if the UK leaves the EU/EEA (to be confirmed in the course of 2019 and depending on the final UK-EU withdrawal agreement). ➔ *These institutions were not used in this year's exercise.*

Appendix 2: Data quality

The LDP and HDP information constitutes a subset of the SVB exercise related to credit risk, as laid down in the ITS drafted by the EBA, pursuant to Article 78 of Directive 2013/36/EU (CRD IV) from the European Commission. This represents the second official data collection with full scope for credit risk. Some constraints that emerged during this data collection (and were confirmed during interviews with institutions) can be summarised as follows:

- It was difficult to implement the ITS due to its late publication.
- There were challenges in mapping the counterparties.
- Due to the yearly changes in the ITS, not all the institutions are able to implement automatic extraction of the figures. In particular some figures need to be calculated outside the IT systems, e.g. RWA-/+ or the loss rate according to the benchmarking definition.
- Different practices have been mentioned during the interviews:
    - some of them have implemented automatic checks for the portfolio breakdown;
    - others did the collection manually with Excel files;
    - some of them have created a dedicated database for the SVB (the ones that have COREP databases or risk databases); others have integrated the SVB templates into the same databases.
- Data were unavailable as a result of incomplete submissions (incomplete submissions for templates, e.g. buckets, breakdowns and data relationships, as well as at total portfolio level).
- Data quality was poor and figures were implausible (e.g. percentage values multiplied by 100, against existing guidance, due mainly to merging figures from different systems or from different entities).

Appendix 3: Data cleaning

Of the institutions that have had the internal models approved (Appendix 1), some may not have had exposures, as described in Annex I of the ITS and the information collected under templates C 101.00, C 102.00 and C 103.00, on their balance sheet at the reference date of Q4 2018.

The cut-off date for the extraction of the data for this report was 19 September 2019.

The records with a portfolio ID or counterparty code not in the list in Annex 1 were excluded from the analyses throughout this report. In general, the records with PDs not between 0% and 100% (extremes included) were excluded from the analysis. The only exception was the PD missing for the regulatory approach 'specialised lending slotting criteria', for which the missing PD has been accepted. Incoherent combinations of default status and PD values were also excluded (example: non-defaulted exposure with PD = 100%).

In all the analyses, seven banks have been excluded because they reported exposures for the benchmarking that were significantly greater than the ones that they reported in COREP.

Template C 101

For template C 101, exposures to a predefined list of common counterparties are gathered, and split by regulatory approach and type of risk. Table 21 gives the main statistics on the sample of counterparties (considering only one type of risk[31]). Note that specialised lending exposures are not included in template C 101.00 in Annex 1.

Table 22: Number of counterparties in the common counterparty analysis, by regulatory approach

Exposure class	Count			With LEI		
	Total	AIRB	FIRB	Total	AIRB	FIRB
LCOR	3 516	1 758	1 758	3 230	1 615	1 615
INST	296	148	148	274	137	137
CGCB	126	63	63	4	2	2

For the purpose of ensuring sufficient **data quality**:

- records with negative LGD, maturity and RWA have been excluded;
- if an institution submitted the same counterparty ID more than once with different rating grades (see Q&A 2017_3635), that counterparty ID has been excluded for that institution.

[31] Hence, the number of observations collected should be multiplied by 3.

For the purpose of the computation of the **benchmarks** (median of the values) at counterparty level:

- only counterparty codes submitted by at least five institutions have been considered;
- all the counterparties that have been classified as in default by at least one institution have been excluded (no benchmarks have been computed for them);
- the counterparties of any particular institution have been considered only if the institution has submitted at least 10 counterparties with EAD greater than zero;
- counterparties reported with LGD greater than 150% or RW greater than 1 250% have been excluded.

Table 23: Sample of institutions, countries and counterparties in the common counterparty analysis (LDP)

Exposure class	Number of institutions	Number of countries of the institutions	Number of different counterparties reported	Number of counterparties with a benchmark computed	Number of countries with counterparties reported
INST sample	64	14	848	656	35
LCOR sample	78	15	7 279	2 360	33
CGCB sample	44	11	353	170	54

Templates C 102 and C 103

With these templates the total amount and risk parameters of all the SVB exposure classes in the LDP (102) and HDP (103) that are under the IRB approach and are real exposures for the institution are collected. The different portfolios have different features to enable homogeneous portfolios to be compared between institutions.

For the purpose of ensuring sufficient **data quality**:

- records with negative LGD, maturity and RWA were excluded.

For the purpose of the computation of the **benchmarks** (median of the values) at portfolio level:

- only portfolio IDs not related to the rating breakdown were considered (those portfolios have been used to analyse the risk concentration in the tool provided to the CAs);
- only portfolios submitted by at least five institutions were considered;

- only portfolio IDs with at least five obligors were considered (the portfolio IDs where the institution has fewer than five obligors have been considered for the quality check, top-down and all other analyses but not for the computation of the benchmarks);
- only portfolio IDs with EAD of at least EUR 10 000 were considered (the portfolio IDs where the institution has less than EUR 10 000 EAD have been considered for the quality check, top-down and all other analyses but not for the computation of the benchmarks);
- records reported with LGD greater than 150% or RW greater than 1 250% have been excluded for the computation of the benchmarks.

For template C 102, which covers the various portfolios related to the LDP SVB exposure classes (institutions, large corporates and sovereigns), only 97 out of 123 institutions returned the template.

Table 24: Sample of institutions, countries and counterparties in the portfolio analysis (LDP) (C 102)

Exposure class	Number of institutions	Number of countries of the institutions	Number of different portfolios reported	Number of portfolios with a benchmark computed
CGCB	45	11	962	51
INST	59	14	1 289	154
LCOR	87	16	660	218
LCOR Sample (101 in 102)	71	15	239	25

For template C 103, which covers HDP (corporate-other, residential mortgages, SME retail and SME-corporate), only 107 out of 123 institutions returned the template.

Table 25: Sample of institutions, countries and counterparties in the portfolio analysis (HDP) (C 103)

Exposure class	Number of institutions	Number of countries of the institutions	Number of different portfolios reported	Number of portfolios with a benchmark computed
CORP	85	16	9 459	309
MORT	86	16	4 936	414
SMEC	83	16	9 449	250
SMER	70	16	4 757	239

Appendix 4: Methodologies used

Top-down analysis

The methodology for presenting the percentage of total GC variability that can be explained once its main drivers are controlled for (for each, some interdependency is possible) is based on the standard deviation (% total GC standard deviation). This analysis can be performed on the LDP and HDP portfolio either separately or combined.

As a starting point, the total GC for each participating institution is computed as:[32]

$$\%\ total\ GC\ bank_i = \frac{\left(12.5 \cdot EL_{bank_i} + RWA_{bank_i}\right)}{EAD_{bank_i}}$$

The standard deviation of the total GC is:

$$Standard\ deviation\ of\ \%\ total\ GC\ = \sqrt{\frac{\sum\left(\%\ total\ GC_{bank_i} - \%\ total\ GC_{average}\right)^2}{N}}$$

where

- $\%\ total\ GC_{bank_i}$ represents each institution's GC (as a percentage);
- $\%\ total\ GC_{average}$ is the mean of the GC in the sample;
- *N* is the number of institutions in the sample.

The standard deviation of the total GC is then broken down successively to control for the characteristics of the exposures. For example, for defaulted exposures, a % GC at the institution level is calculated (% $GC_{i,\ DEF}$). The GC of each institution is then weighted by the proportion of EADs that were reported as defaulted exposures in the sample:

$$\%\ total\ GC_{bank_{i,def}} = \frac{\left(12.5 \cdot EL_{bank_{i,def}} + RWA_{bank_{i,def}}\right)}{EAD_{bank_{i,def}}}$$

$$\%\ total\ GC_{bank_{i,non\ def}} = \frac{\left(12.5 \cdot EL_{bank_{i,non\ def}} + RWA_{bank_{i,nn\ def}}\right)}{EAD_{bank_{i,non\ def}}}$$

[32] Note, however, that those observations where the GC is higher than 150% have been removed from the sample.

A weighted average (but based on the average proportion of EAD_{def} and $EAD_{non\ def}$ for the sample) is then calculated, assuming that the percentages of defaulted and non-defaulted exposures are the same across institutions and equal to the sample averages:

$$\%\boldsymbol{EAD}_{\boldsymbol{sample,non\ def}} = \frac{\sum \left(\boldsymbol{EAD}_{\boldsymbol{bank_i,non\ def}}\right)}{\sum \left(\boldsymbol{EAD}_{\boldsymbol{bank_i,def}}\right) + \sum \left(\boldsymbol{EAD}_{\boldsymbol{bank_i,nNon\ def}}\right)}$$

$$\%\boldsymbol{EAD}_{\boldsymbol{sample,def}} = \frac{\sum \left(\boldsymbol{EAD}_{\boldsymbol{bank_i,def}}\right)}{\sum \left(\boldsymbol{EAD}_{\boldsymbol{bank_i,def}}\right) + \sum \left(\boldsymbol{EAD}_{\boldsymbol{bank_i,nNon\ def}}\right)}$$

$$\%GC_{bank_i,DEF,NON\ DEF} = \%\boldsymbol{EAD}_{\boldsymbol{sample,def}} \cdot \%GC_{bank_i,def} + \%\boldsymbol{EAD}_{\boldsymbol{sample,non\ def}} \cdot \%GC_{bank_i,non\ def}$$

This allows effects derived from specific EADs for each institution to be controlled for and parameters of the GC, i.e. EL and RWs, to be focused on. In other words, this approach allows a GC to be computed for each institution, based on its own estimates of the risk parameters, but assuming that the percentages of defaulted and non-defaulted exposures are the same across institutions and equal to the sample averages.

The new GC standard deviation (% GC standard deviation $_{DEF,\ NONDEF}$), after controlling for defaulted and non-defaulted exposures, is the following:

$$Standard\ deviation\ of\ \%\ GC\ (DEF, NONDEF) = \sqrt{\frac{\sum \left(\%GC_{bank_i,DEF,NON\ DEF} - \%\ GC\ average\right)^2}{N}}$$

The difference between the standard deviation of the % total GC and the standard deviation of the % GC standard deviation $_{(DEF,\ NONDEF)}$ gives the impact of the contribution of defaulted and non-defaulted exposures to the total GC variability.

The same methodology is repeated for controlling for additional dimensions seen as drivers of GC variability:

- step 1a: default mix;
- step 1b: portfolio mix (SVB exposure class level);
- step 2: combined portfolio mix and default mix.

The methodology does not intend to estimate the specific variability for each cluster or dimension at the individual level (e.g. it does not intend to make comparisons at the portfolio level), but instead intends only to provide the general contribution of the main drivers as a whole, i.e. the total GC variability. This breakdown was justified by the significant differences in RW of the different buckets.

Analysis of IRB parameters for common counterparties

Institutions were instructed to provide risk parameters for a predefined list of counterparties, of which most are identified using the LEI[33] as a unique and internationally accepted identifier. The starting point for the analysis is the initial RW deviation, which provides an overall estimated deviation from the institution's peers:

- Deviation 1 represents the initial RW deviation: RWs computed with the real parameters provided by the institutions (real maturity, real PD, real LGD) are compared with RWs computed with the benchmark values (median PD of peers' reported PD and median LGD of peers' reported LGD) and the maturity fixed at 2.5 years. The deviation of a given institution is set as the median of each single deviations computed at the obligor level, which is computed as follows:

$$Dev1 = RW(M, PD, LGD) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

To isolate the impact of the individual parameters, the following effects can be identified:

- Deviation 2 represents the PD effect. RWs for a specific institution are computed with the benchmark values for all the parameters, excluding the PD, and these are compared with RWs computed with the benchmark values (median PD of peers' reported PDs). The deviation of a given institution is set as the median of each single deviation computed at the obligor level, which is computed as follows:

$$Dev2 = RW(2.5, PD, LGD_{benchmark}) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

- Deviation 3 represents the LGD effect. The RWs are computed with all the benchmark values, excluding the LGD, and are compared with RWs computed with the benchmark values reported by the institution. The deviation of a given institution is set as the median of each single deviation computed at the obligor level, which is computed as follows:

$$Dev3 = RW(2.5, PD_{benchmark}, LGD) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

- Deviation 4 represents the maturity effect. The RWs are computed with all the benchmark values, excluding the maturity, and they are compared with RWs computed with the values reported by the institution. The deviation of a given institution is set as the median of each single deviation computed at the obligor level, which is computed as follows:

$$Dev4 = RW(M, PD_{benchmark}, LGD_{benchmark}) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

Since the regulatory LGD estimated by the institution is used in the computation of these differences, the LGD effect also includes the impact of CRM. Therefore, the analysis has been repeated using the hypothetical senior unsecured LGD (without negative pledge) for the AIRB

[33] The LEI is a 20-character alphanumeric code that connects to key reference information that enables clear and unique identification of companies participating in global financial markets.

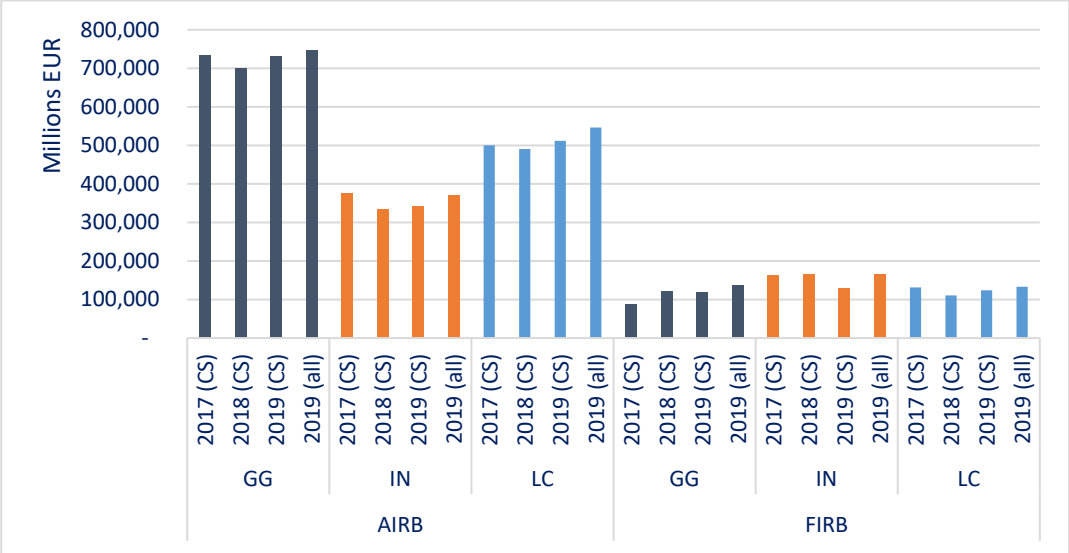
institutions only, where the values were provided assuming that the exposure to a given obligor was a senior unsecured exposure.

- Deviation 5 represents the hypothetical LGD effect. RWs are computed with maturity fixed at 2.5 years and PD fixed at benchmark values. This is the hypothetical LGD effect, not taking into account the underlying collateral to achieve a uniform comparison. The deviation of a given institution is set as the median of each single deviation computed at the obligor level, which is computed as follows:

$$Dev5 = RW\left(2.5, PD_{benchmark}, LGD^{hyp\ unsec}\right) - RW\left(2.5, PD_{benchmark}, LGD_{benchmark}^{hyp\ unsec}\right)$$

The list of counterparties has not been updated from that used in the 2018 LDP exercise. The following graphs show the evolution of the counterparty size, due to the change in exposures of institutions.

Figure 35: Evolution of EAD by SVB portfolio and regulatory approach



For this analysis, a common subsample of 73 institutions has been identified (i.e. institutions that participated in both exercises with an exposure in at least one SVB exposure class). It should, however, be noted that the number of institutions for each SVB exposure class is not the same, and neither is the number of counterparties (see Figure 36 below). The comparison focused on a subset of counterparties that were reported by at least five institutions in the three exercises.

Figure 36: Proportion of EAD in the common subsample

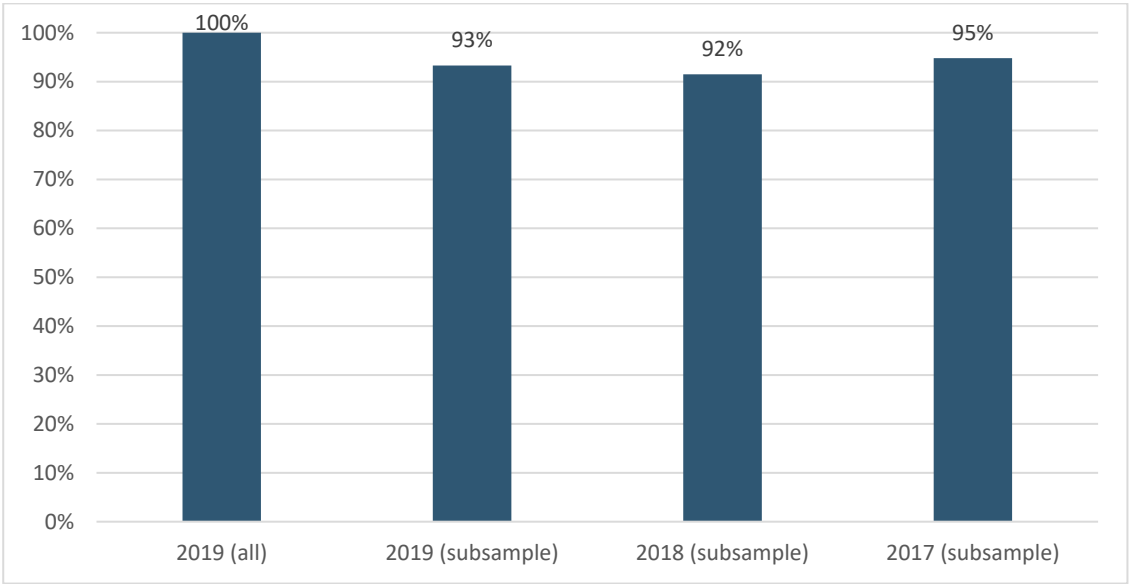
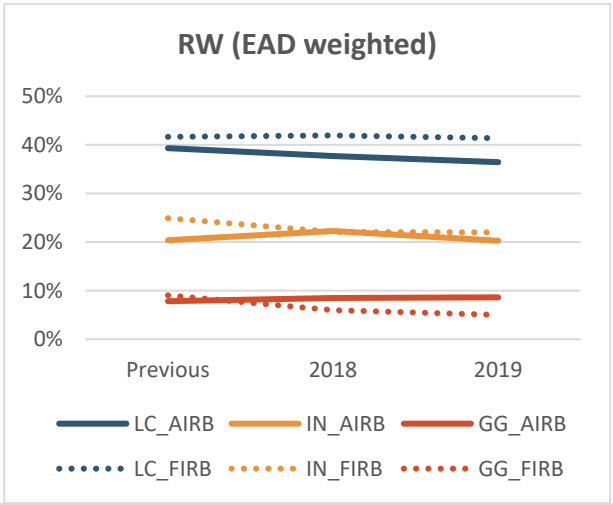
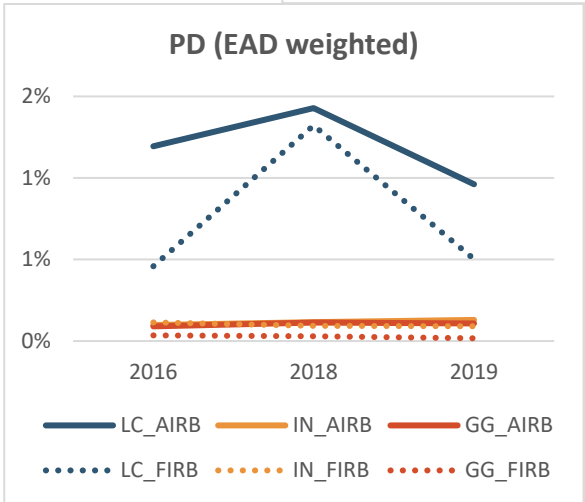
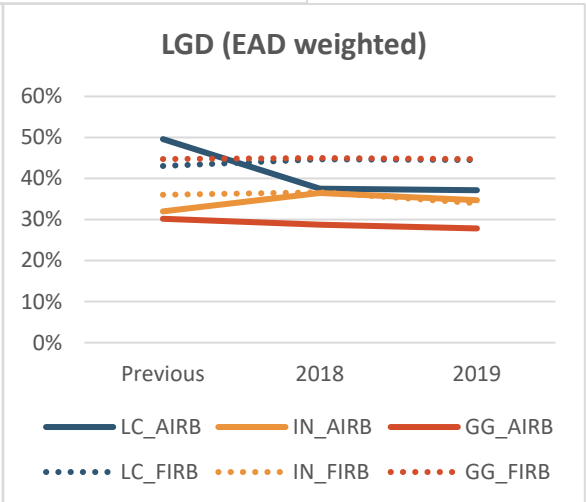


Figure 37: Evolution of the common subsample from the 2015 LDP exercise to the 2017 LDP exercise, by SVB exposure class







Outturns (backtesting) approach

The analyses present ratios between observed values and the estimated ones for comparable parameters. A result above 1 indicates an institution with an observed value higher than the institution's estimate for the same (comparable) parameter. These ratios are calculated at the portfolio level[34] for each institution. The complete definition of the data points collected can be found in Annex IV, template C 103.00, of the ITS. In short, they were:

- PD (column 60): the PD used in the calculation of the RWA, excluding the effect of potential measures introduced in accordance with Article 458 of Regulation (EU) No 575/2013.
- LGD (column 130): the EAD-weighted own estimates of LGD or EAD-weighted regulatory LGD applied by the institution to the exposures to each portfolio. The effect of measures introduced in accordance with Article 458 of Regulation (EU) No 575/2013 shall be excluded.
- DR1Y (column 190): the ratio between (i) the sum of the exposures (original exposure before applying the conversion factor measured at the reference date minus 1 year) that defaulted between the reference date minus 1 year and the reference date and (ii) the sum of the exposures (original exposure before applying the conversion factor measured at the reference date minus 1 year) that were non-defaulted at the reference date minus 1 year.
- DR5Y (column 200): the weighted average of the default rates observed in the last 5 years preceding the reference date (the weights to be used are the non-defaulted exposures).
- LR (column 210): the sum of credit risk adjustments and write-offs applied, within the year preceding the reference date, to exposures that were non-defaulted exactly 1 year before the reference date and that defaulted during the year preceding the reference date, divided by the sum of the EAD, measured exactly 1 year before the reference date, of the exposures that were non-defaulted exactly 1 year before the reference date and that defaulted during the year preceding the reference date.
- LR5Y (column 220): the EAD-weighted average of the loss rates observed in the last 5 years preceding the reference date.
- RWA- and RWA+ (columns 250 and 260): the hypothetical risk-weighted exposure amount, after applying the SME supporting factor, that results from the application p^- (for RWA-) or p^+ (for RWA+):

  p^- shall be the smallest positive value satisfying the equation

$$p^- + \Phi^{-1}(\mathrm{q}) \cdot \sqrt{\frac{p^- \cdot (1 - p^-)}{n}} \geq \mathrm{DR}_{1\mathrm{y}}$$

  p^+ shall be the largest positive value satisfying the equation

$$p^+ - \Phi^{-1}(\mathrm{q}) \cdot \sqrt{\frac{p^+ \cdot (1 - p^+)}{n}} \leq \mathrm{DR}_{1\mathrm{y}}$$

[34] Using portfolio ID (Annex I, template C 103.00, of the ITS).

NB: $\boldsymbol{DR_{1y}}$ is not DR1Y but the case-weighted default rate of the year preceding the reference date.

- RWA-- and RWA++ (columns 270 and 280): defined in a similar way to RWA- and RWA+, but using $\mathbf{DR_{5y}}$ instead of $\mathbf{DR_{1y}}$ (similarly to RWA*, $\mathbf{DR_{5y}}$ is not equal to DR5Y).

The persistence of institutions as outliers in both periods, i.e. 1-year rate and the average of 5 years, and across comparable parameters can be examined by the CAs. However, there are a couple of caveats that should be kept in mind when doing this comparison, in particular for the comparison at the risk parameter level:

- Differences between the observed risk parameters used for prudential purposes and the data collected.
    - The default rate collected is an exposure-weighted ratio, whereas the default rate used for the PD estimation should be an obligor ratio (further details are available in section 5.3.2 of the Guidelines on PD and LGD estimation[35]).
    - The loss rates collected use accounting data as input. However, the loss used for prudential purposes should be the economic loss and include considerations of collection-related costs, appropriate discounting, etc. (further details are available in section 6.3.1 of the Guidelines on PD and LGD estimation).
- Differences between the rates collected and the long-run averages. PD and LGD estimates are required by Articles 180 and 181 of the CRR to be representative (PD) or at least equal (LGD) to the long-run average. However:
    - The past (5) year(s) might not be representative of the long term (further details are available in section 5.3.4 of the Guidelines on PD and LGD estimation).
    - The long-run average should be the arithmetic yearly average for the PD and a default-weighted average for the LGD. The data collected are an exposure-weighted average of the DR for DR5Y and an EAD-weighted average of the yearly LR for LR5Y (further details are available in sections 5.3.3 and 6.3.3.2 of the Guidelines on PD and LGD estimation).
    - The averages are not necessarily performed at the grade and pool levels or at the calibration segment level, resulting in a potential lack of homogeneity across time.
- Differences between the long-run averages and the risk parameters.
    - Both PD and LGD should incorporate a margin of conservatism (further details are available in section 4.4.3 of the Guidelines on PD and LGD estimation).
    - LGD estimates should be appropriate for downturn conditions as per Article 181. The loss rates collected are not necessarily representative of downturn conditions.
- Potential lack of representativeness due to the computation on non-homogeneous pools.

35 https://www.eba.europa.eu/documents/10180/2033363/Guidelines+on+PD+and+LGD+estimation+%28EBA-GL-2017-16%29.pdf/6b062012-45d6-4655-af04-801d26493ed0

- For the 1-year rates, the data collected allowed only the comparison of PDs (and LGDs) at the reference date (2018) with the default rate (and loss rate) observed during the same year (2018), whereas it would be more consistent to compare this default rate (and loss rate) with the PD (and LGD) at the beginning of the observation period.

- For the 5-year rates, the average may not be statistically well grounded, since the portfolio quality may have significantly changed over the years. This is especially true in the context of the significant improvement in the portfolios of institutions observed in some EU Member States.

The RWA-/+ impact analysis also has a number of caveats, and the comparison with the RWA should be handled carefully:

- The four metrics do not reflect regulatory measures or corrective actions in place that have an impact on institutions' capital requirements.
- Extrapolations to the total IRB credit risk portfolio cannot be made, because of the specific nature of HDP exposures.

Appendix 5: Complementary RW statistics

RW dispersion:

Figure 38: GC dispersion (delta Q3-Q1), split by default status, for LDP and HDP exposures

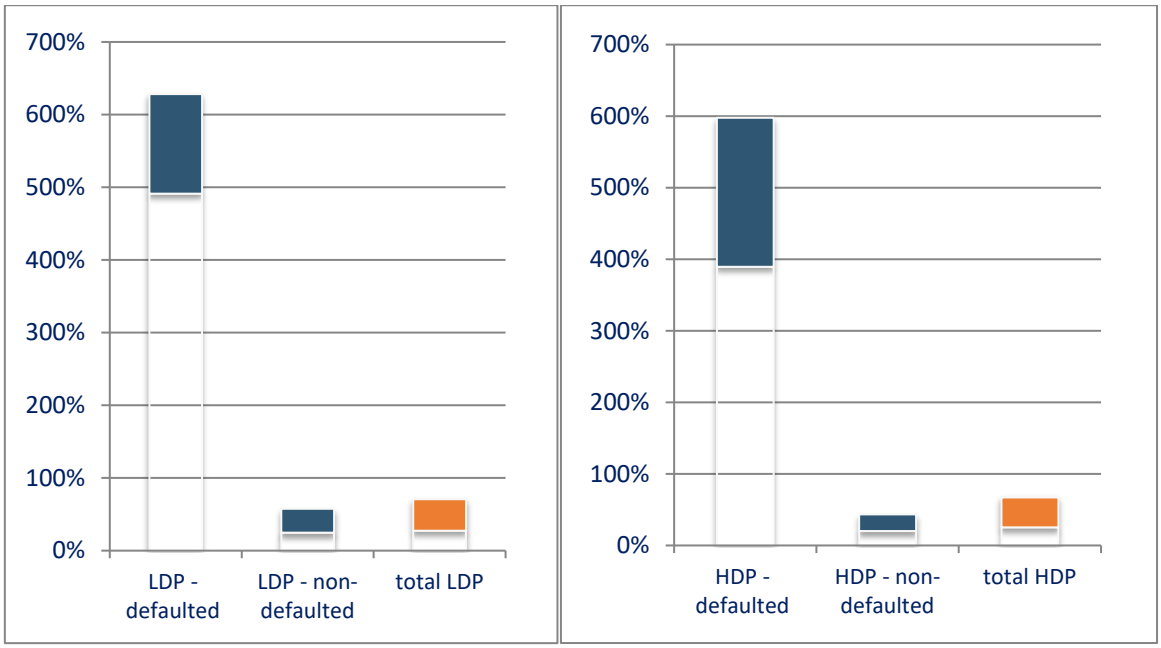


Figure 39: RW dispersion (delta Q3-Q1) of the different SVB exposure classes (defaulted and non-defaulted exposures)

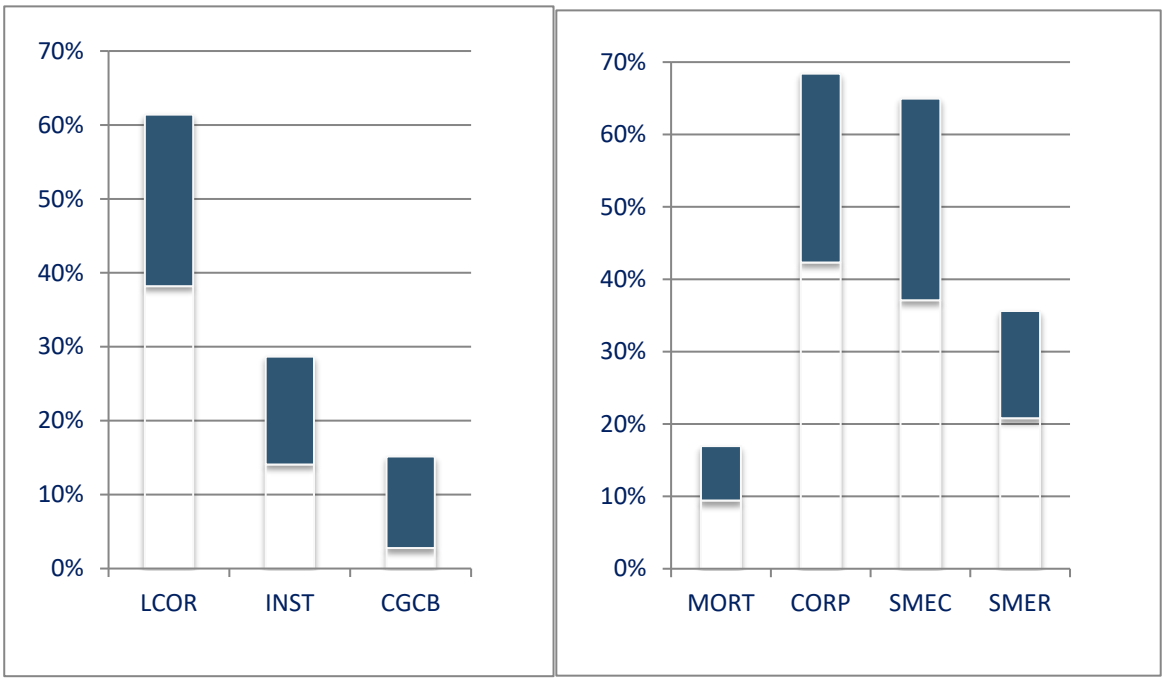
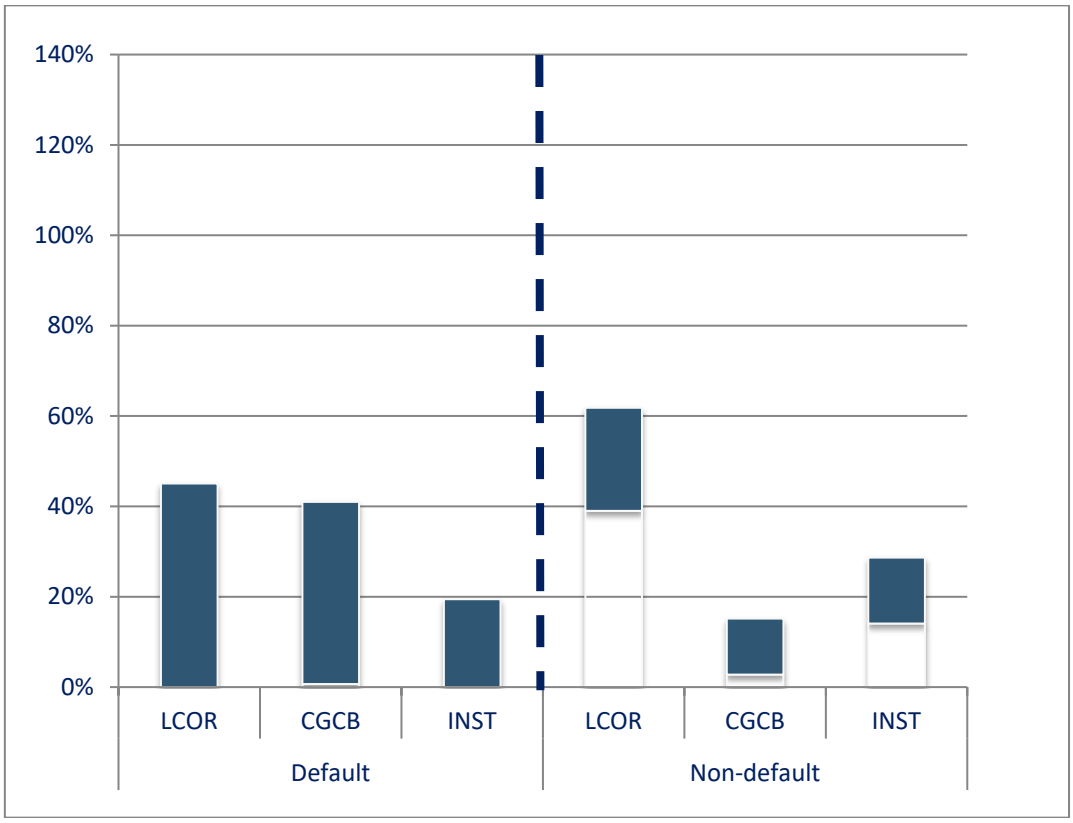
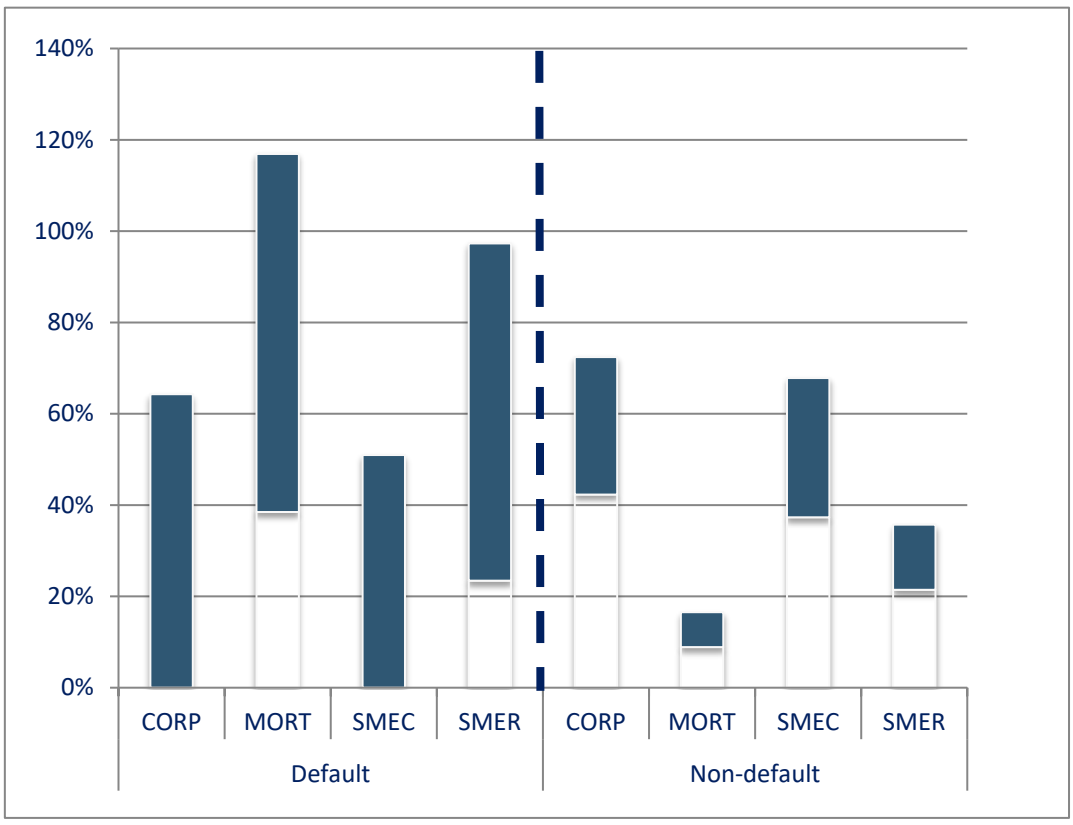


Figure 40: RW dispersion (delta Q3-Q1) for the different SVB exposure classes and default statuses (HDP and LDP)





Proportion of RWA:

Figure 41: Proportions of EAD and RWA of defaulted and non-defaulted exposures

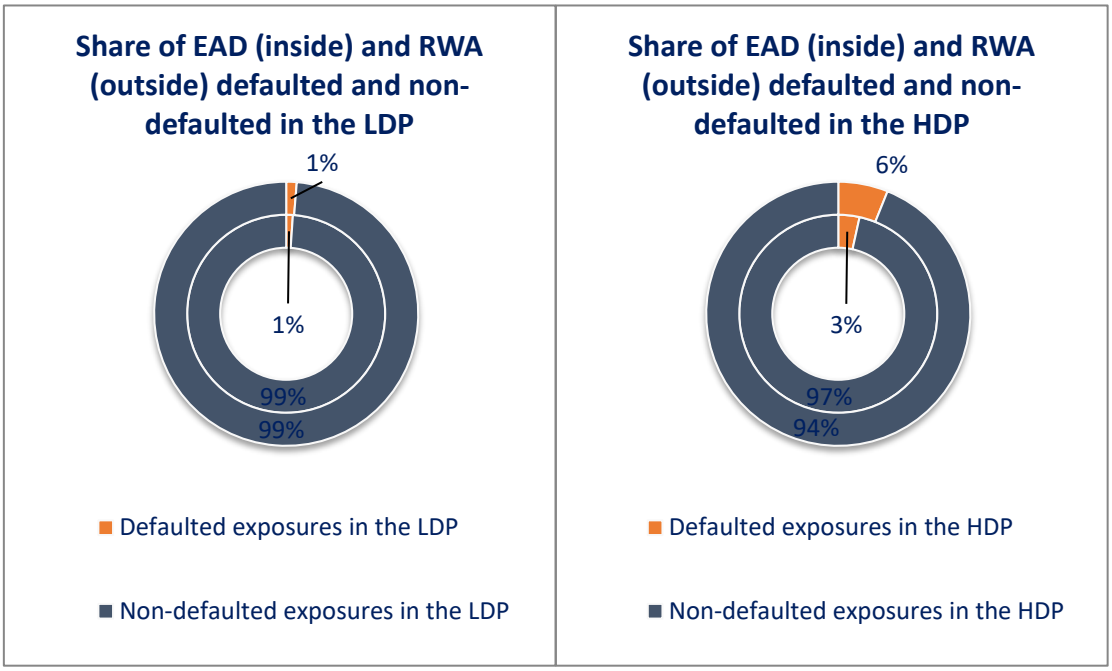


Figure 42: Proportions of EAD and RWA of defaulted exposures per SVB exposure class

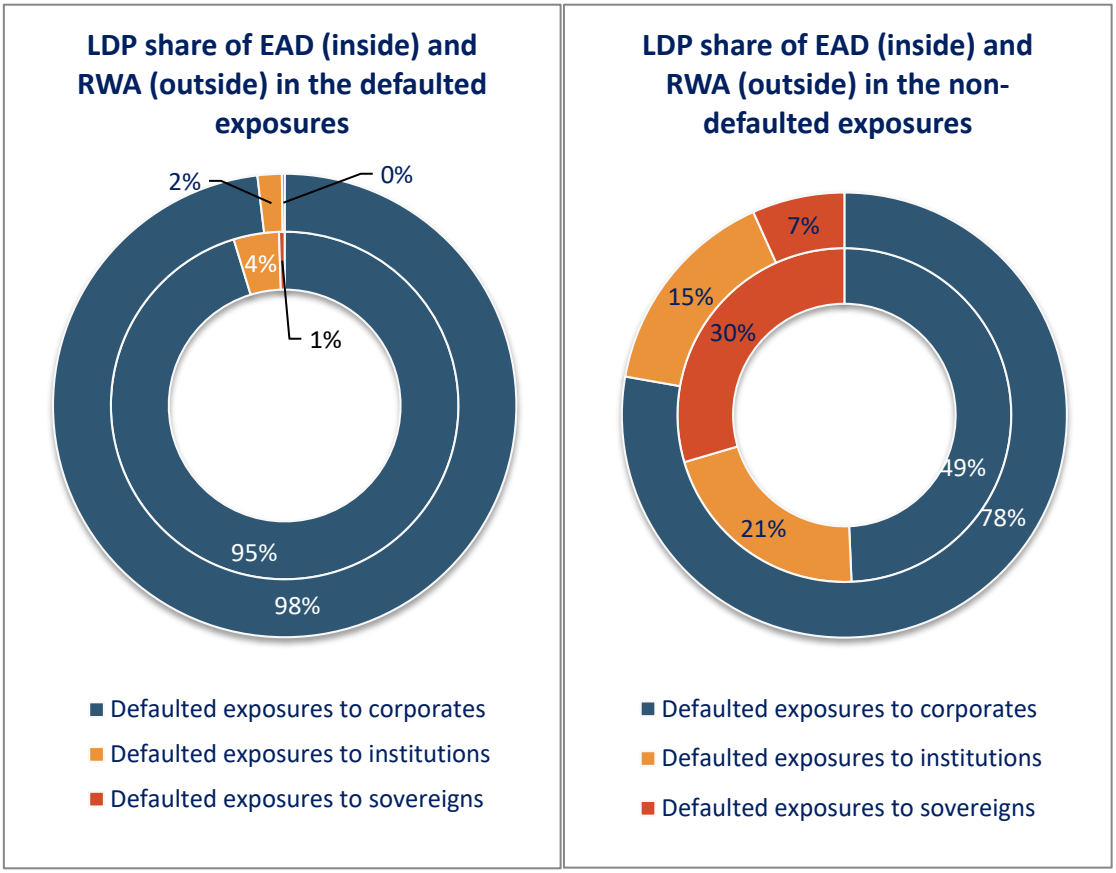
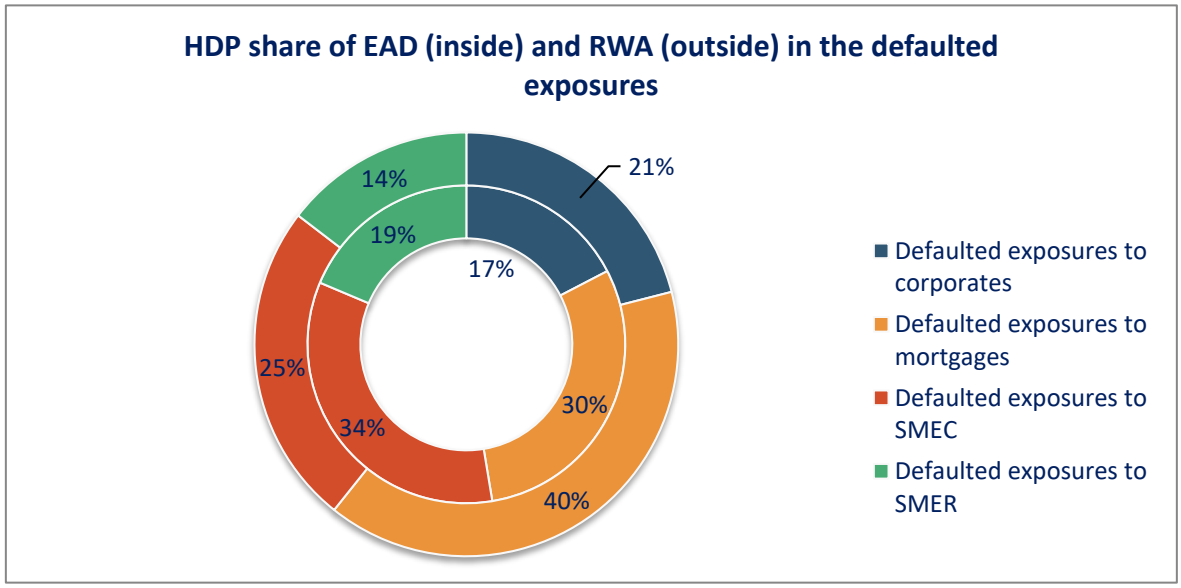
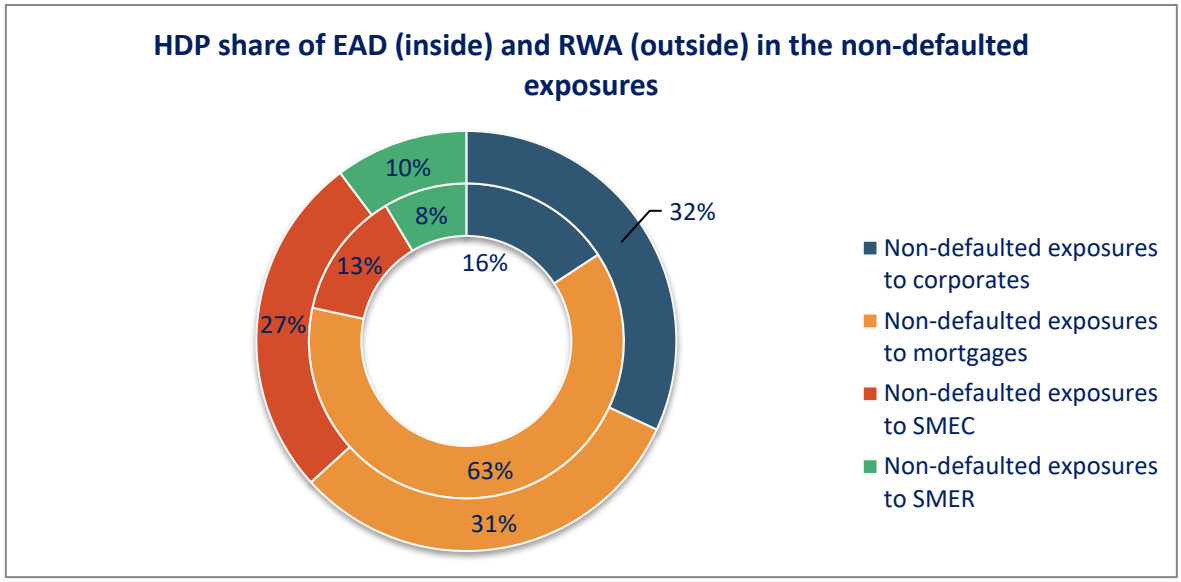


Figure 43: Proportions of EAD and RWA of non-defaulted exposures per SVB exposure class





Appendix 6: Complementary graphs on the evolution of the portfolios

This appendix shows the evolution of the portfolios of the institutions in terms of both volume (change in EAD) and risk estimates (EAD-weighted average of the RW, PD and LGD). **This evolution is observed at the total portfolio level, i.e. including defaulted assets. Therefore, the high decrease in observed PD values is significantly driven by the diminution in the share of NPLs.**

Figure 44: Common EAD in the 2016/2017, 2018 and 2019 SVB exercises (million EUR)

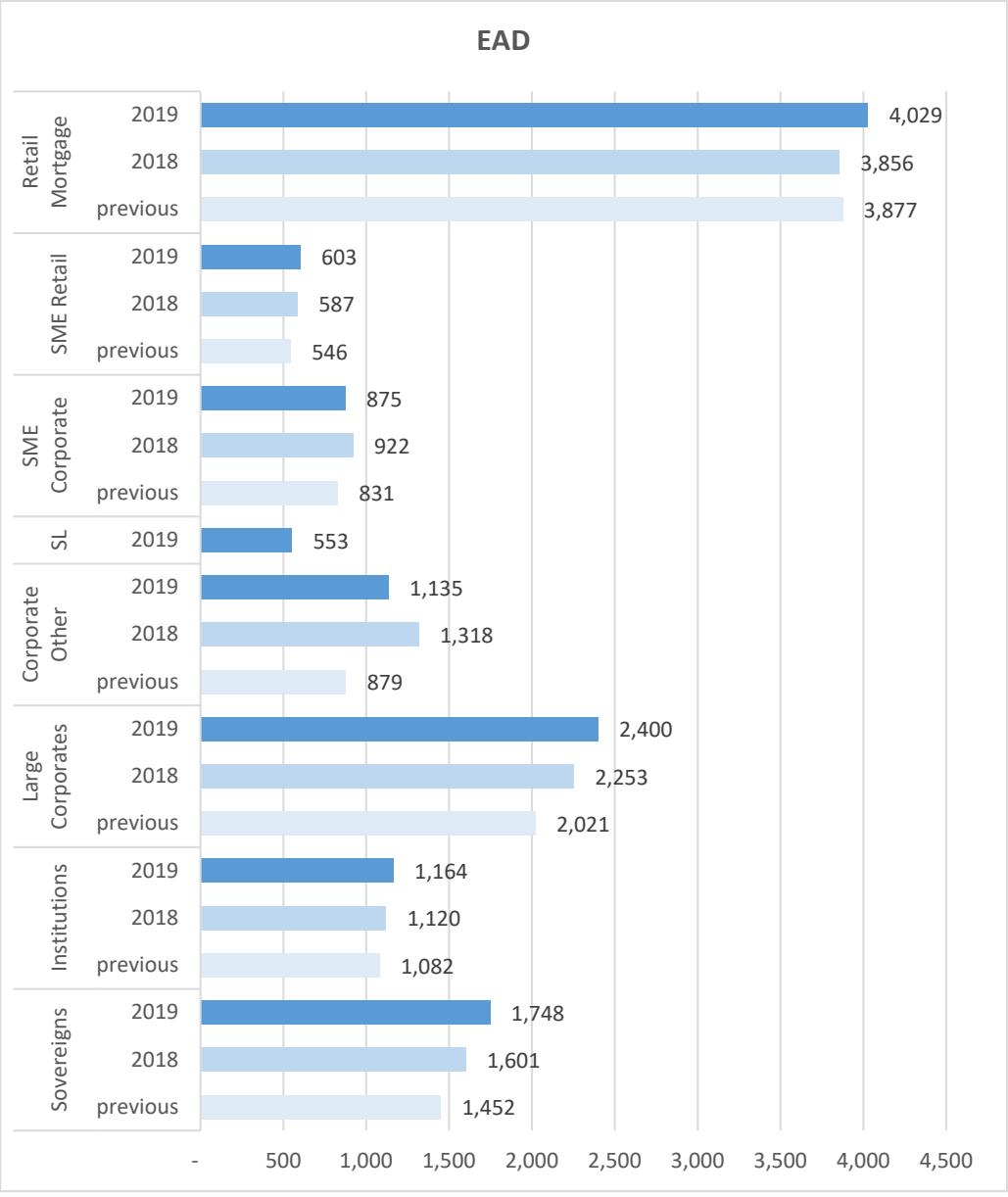


Figure 45: Comparison of risk weights, PD and LGD between current and previous SVB exercises (defaulted and non-defaulted exposures)

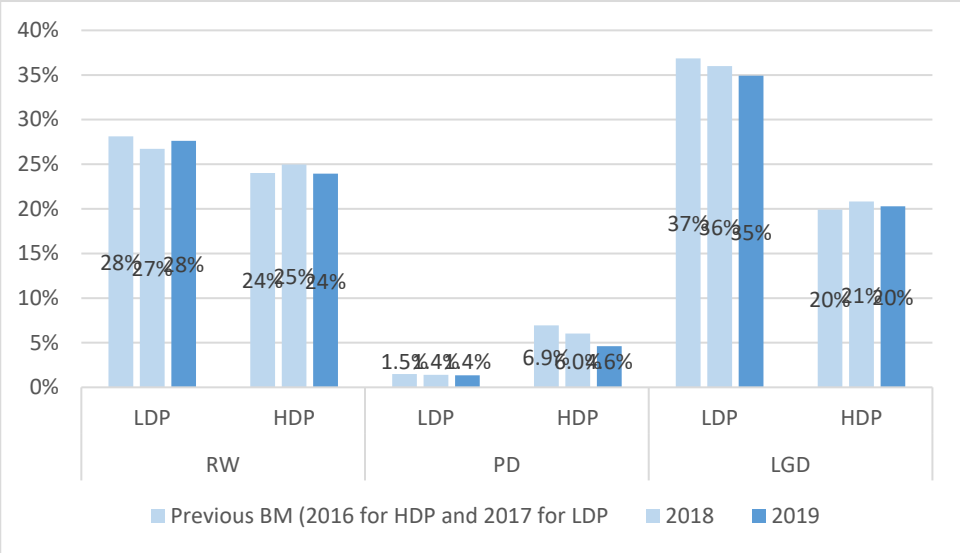


Figure 46: Comparison of risk weights by SVB exposure class between current and previous SVB exercises (defaulted and non-defaulted exposures)

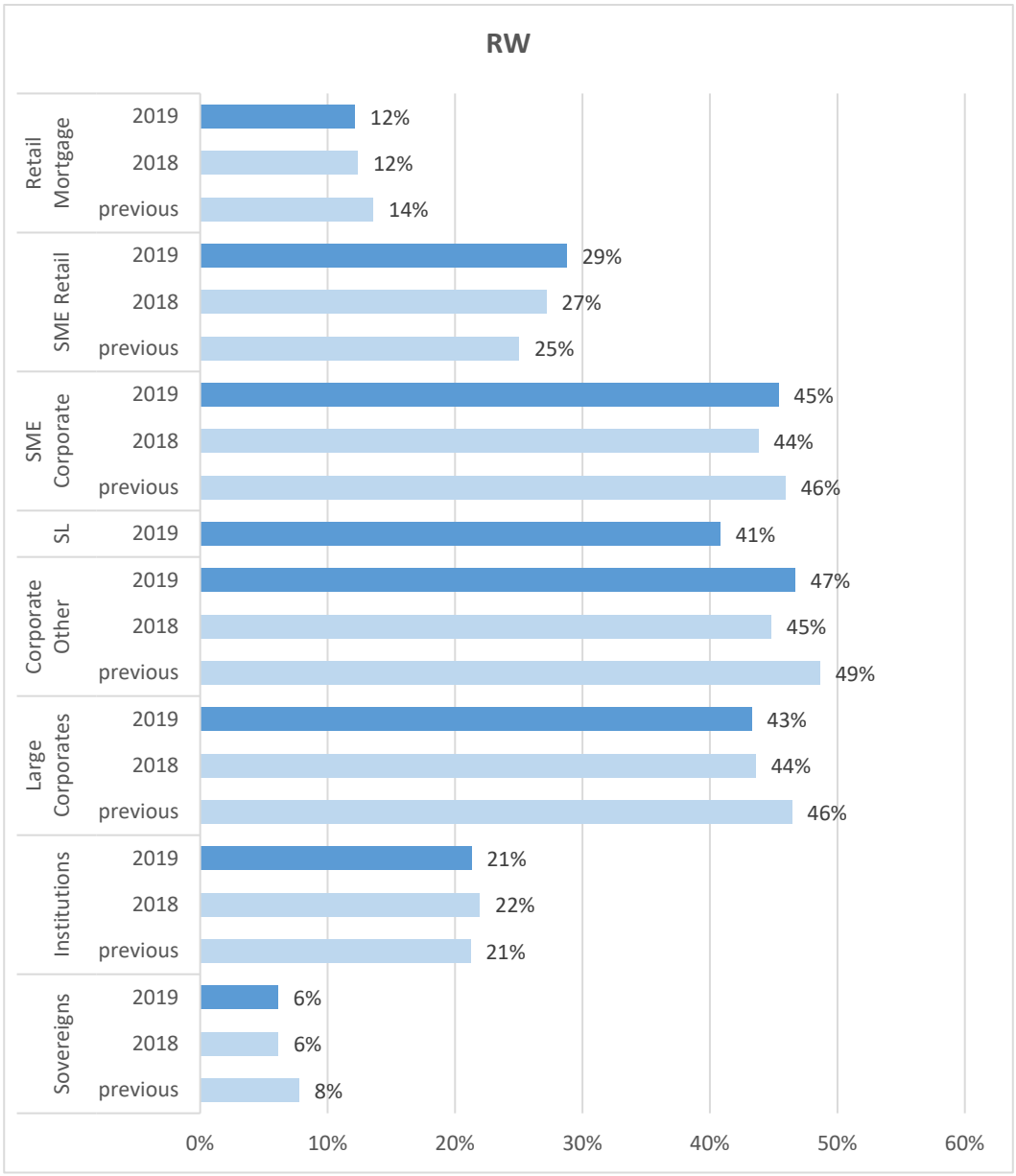


Figure 47: Comparison of PDs by SVB exposure class between current and previous SVB exercises (defaulted and non-defaulted exposures)

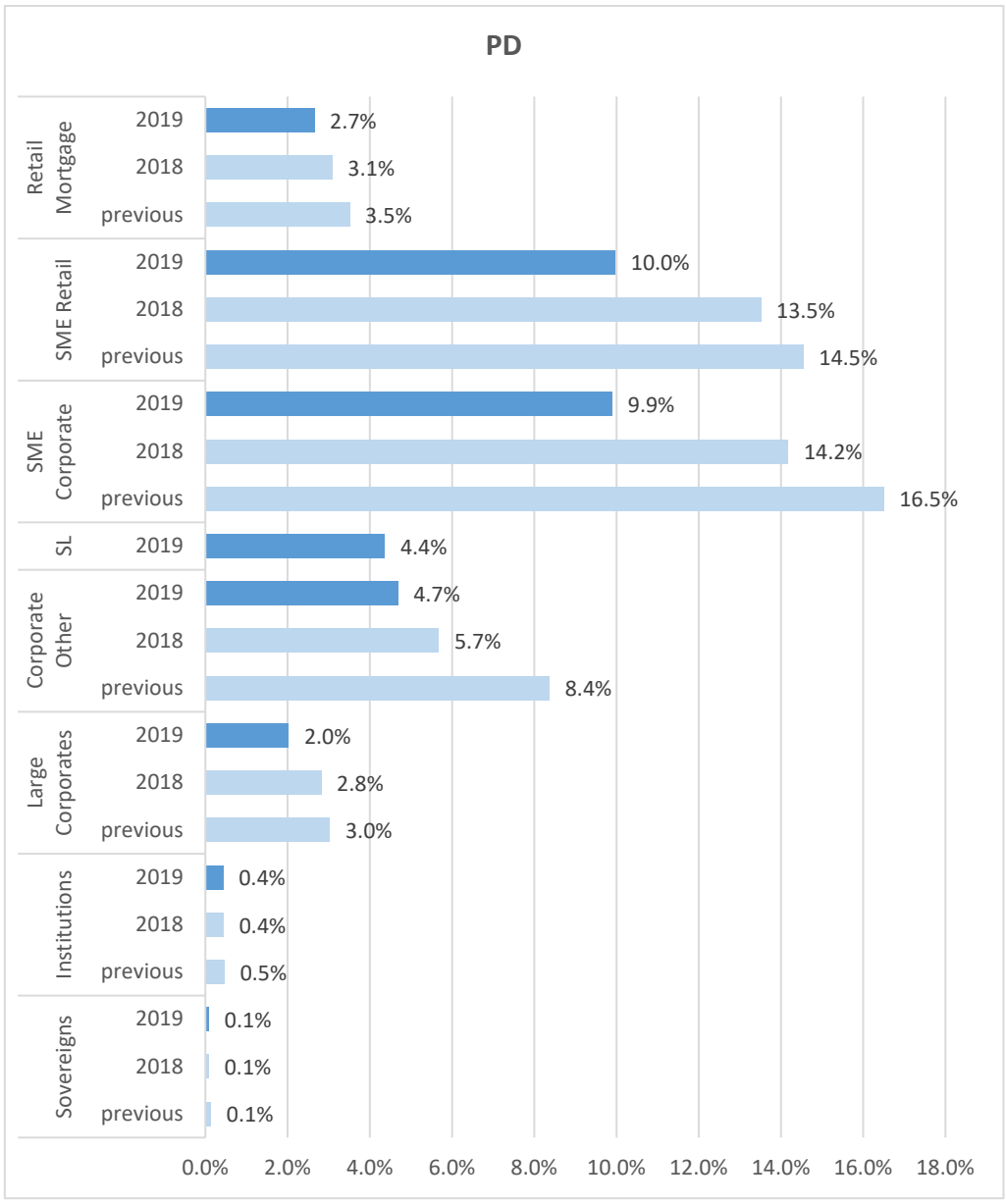
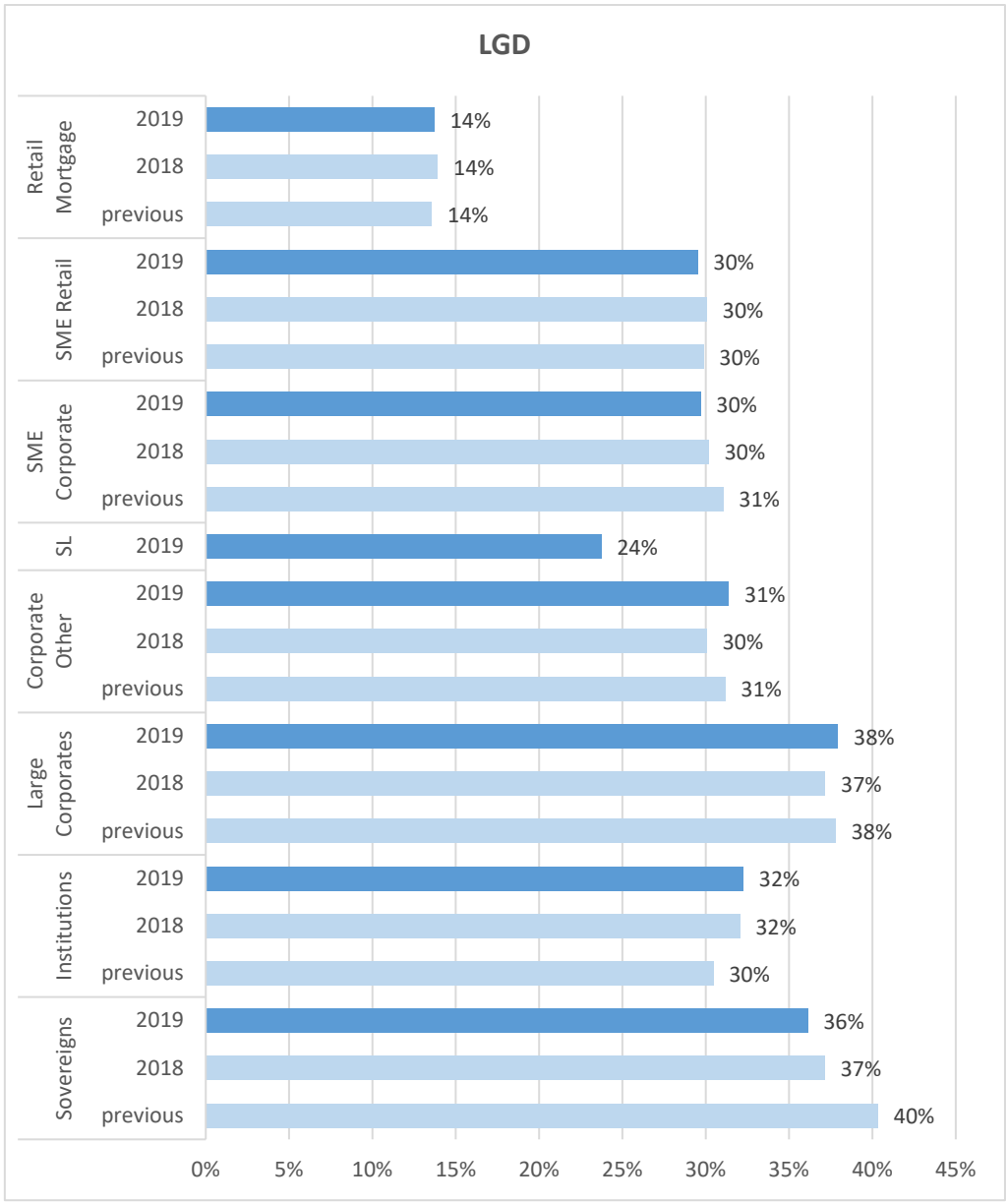


Figure 48: Comparison of LGDs by SVB exposure class between current and previous SVB exercises (defaulted and non-defaulted exposures)



Appendix 7: Complementary graphs on the top-down analysis

Figure 49 shows the GC and RW for the total LDP and HDP, and Figure 50 shows the adjusted figures after the top-down transformation (at step 2, i.e. controlling for portfolio and default mix). The reduction in variability in the GC and RW by controlling for the default status mix and the portfolio mix is visible by comparing Figure 49 with Figure 50

Figure 49: GC and RW, for defaulted and non-defaulted exposures, per institution, LDP and HDP

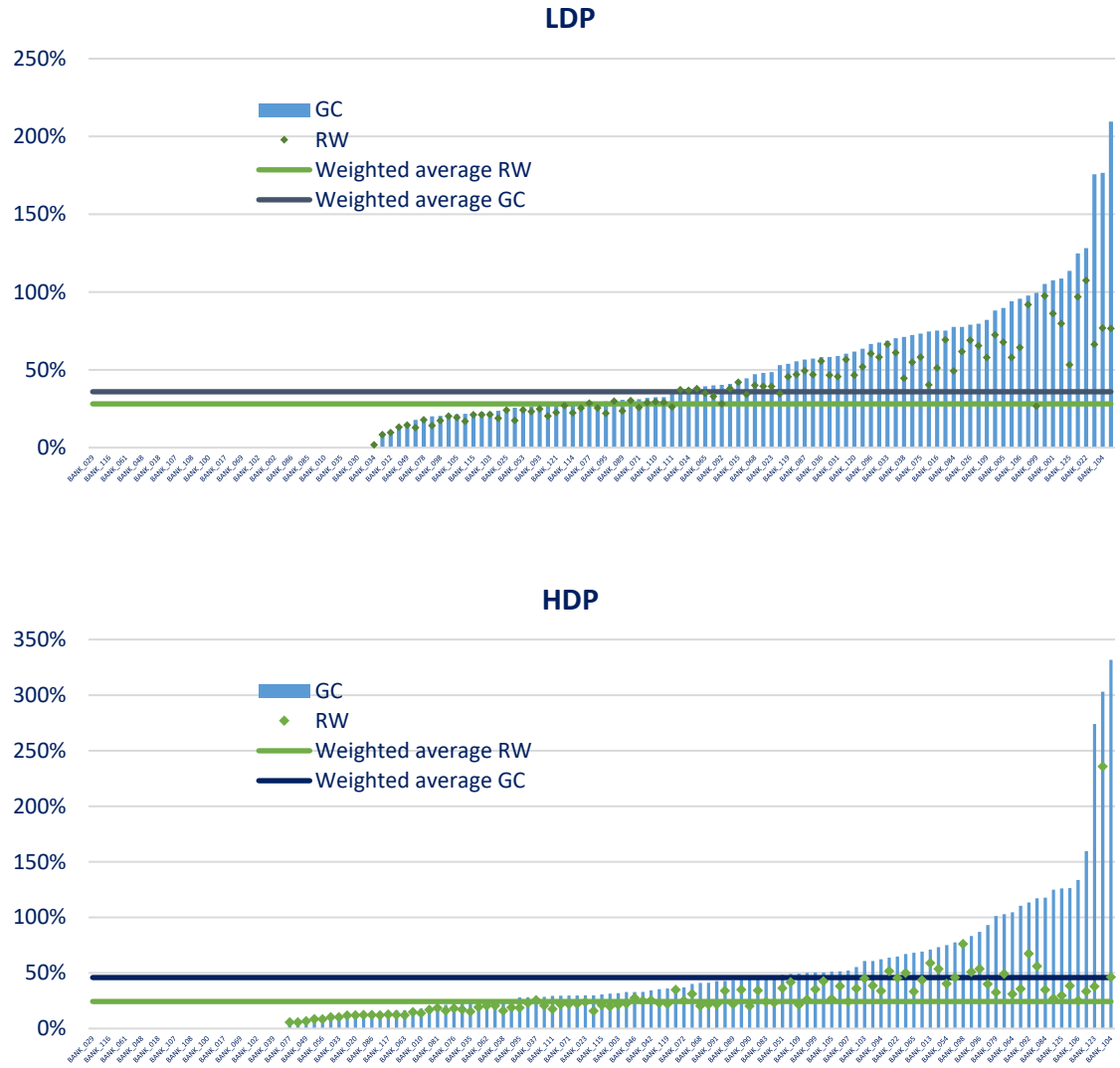
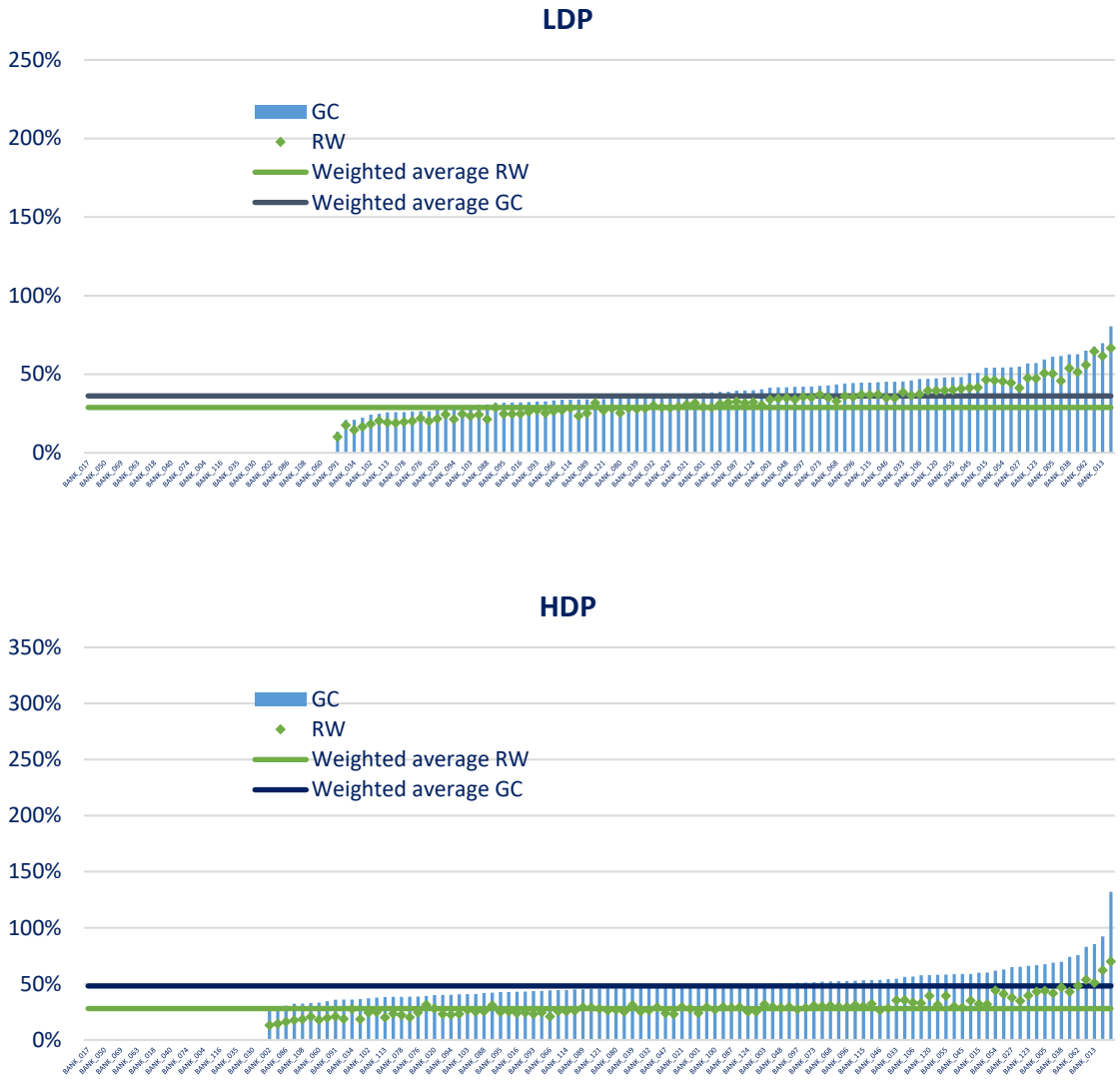
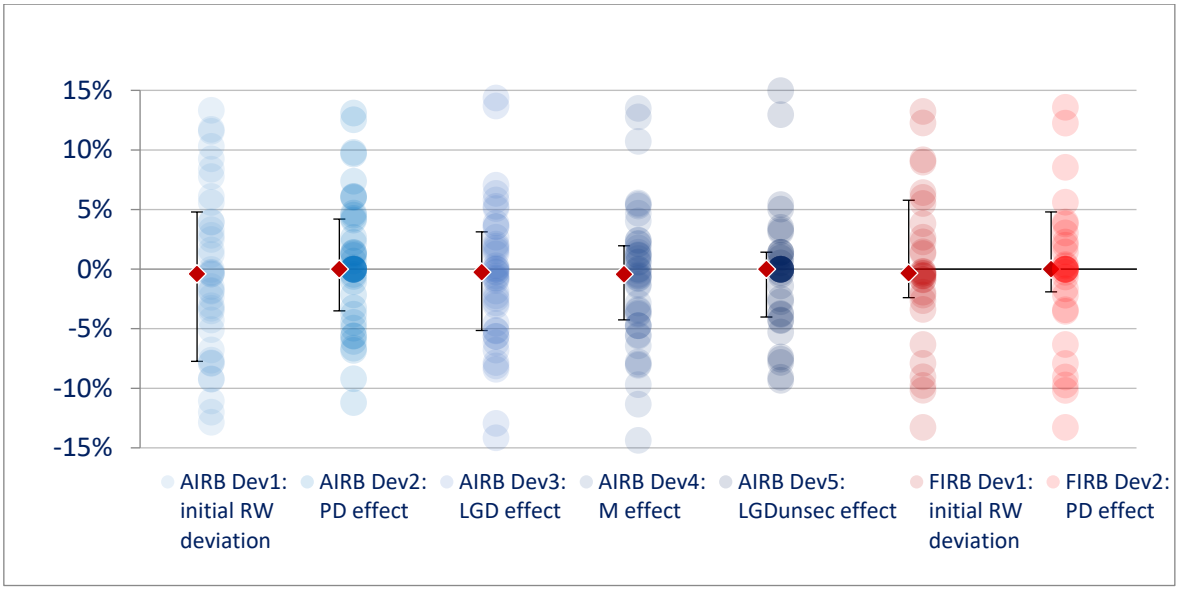


Figure 50: Adjusted GC and RW, for defaulted and non-defaulted exposures, per institution, LDP and HDP



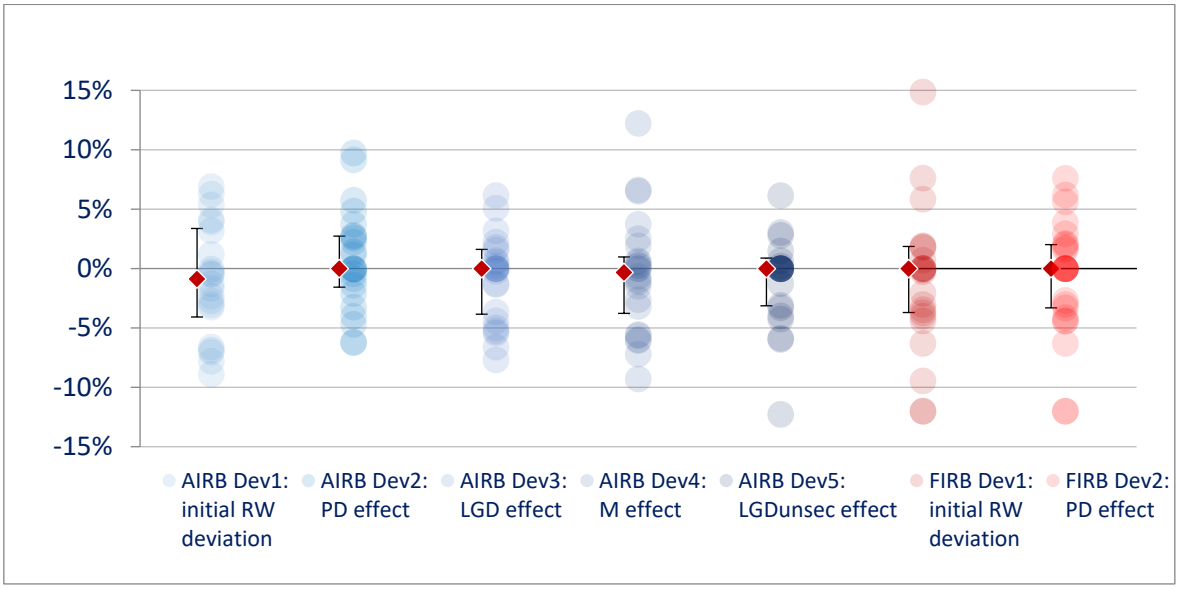
Appendix 8: Complementary graphs on the common obligors' analysis

Figure 51: RW deviations for LCOR counterparties (AIRB and FIRB)



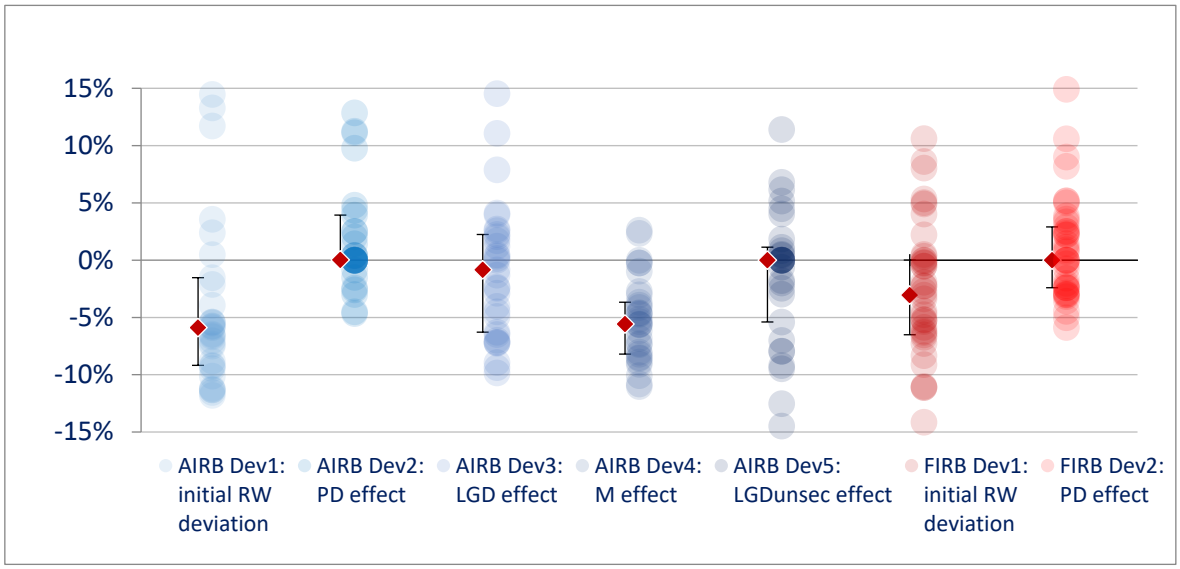
Note: In order to improve the readability of the chart, the values outside the -15% to +15% range have been eliminated in this chart. Therefore, seven values are not visible in the first column, and two, four, none, six, four and five in the others.

Figure 52: RW deviations for CGCB counterparties (AIRB and FIRB)



Note: In order to improve the readability of the chart, the values outside the -15% to +15% range have been eliminated in this chart. Therefore, two values are not visible in the first column, and none, one, none, two, two and none in the others.

Figure 53: RW deviations for INST counterparties (AIRB and FIRB)



Note: In order to improve the readability of the chart, the values outside the -15% to +15% range have been eliminated in this chart. Therefore, two values are not visible in the first column, and two, one, one, two, two and none in the others.

Appendix 9: Complementary graphs on the outturn analysis

The country analysis presented in this section has been performed on the country of the counterparty (residence of the obligor). The distributions of the institutions' ratio between the default rates and the PD and the ratio between the loss rates and the LGD are presented by country of the counterparty, where a country has at least five domestic banks.

The same caveats apply as for the other backtesting analysis (recalled here for the reader's convenience):

- Differences between the observed risk parameters used for prudential purposes and the data collected.
    - The default rate collected is an exposure-weighted ratio, whereas the default rate used for the PD estimation should be an obligor ratio (further details are available in section 5.3.2 of the Guidelines on PD and LGD estimation[36]).
    - The loss rates collected use accounting data as input. However, the loss used for prudential purposes should be the economic loss and include considerations of collection-related costs, appropriate discounting, etc. (further details are available in section 6.3.1 of the Guidelines on PD and LGD estimation).
- Differences between the rates collected and the long-run averages. PD and LGD estimates are required by Articles 180 and 181of the CRR to be representative (PD) or at least equal (LGD) to the long-run average. However:
    - The past (5) year(s) might not be representative of the long term (further details are available in section 5.3.4 of the Guidelines on PD and LGD estimation).
    - The long-run average should be the arithmetic yearly average for the PD and a default-weighted average for the LGD. The data collected are an exposure-weighted average of the DR for DR5Y and an EAD-weighted average of the yearly LR for LR5Y (further details are available in sections 5.3.3 and 6.3.3.2 of the Guidelines on PD and LGD estimation).
    - The averages are not necessarily performed at the grade and pool levels or at the calibration segment level, resulting in a potential lack of homogeneity across time.
- Differences between the long-run averages and the risk parameters.
    - Both PD and LGD should incorporate a margin of conservatism (further details are available in section 4.4.3 of the Guidelines on PD and LGD estimation).

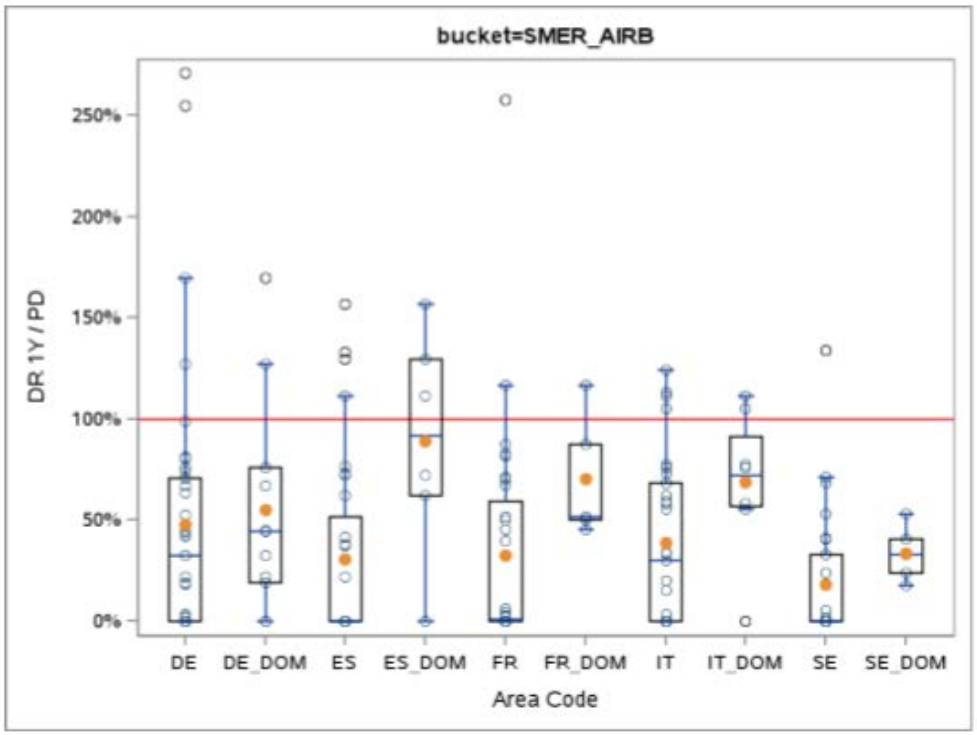
[36] https://www.eba.europa.eu/documents/10180/2033363/Guidelines+on+PD+and+LGD+estimation+%28EBA-GL-2017-16%29.pdf/6b062012-45d6-4655-af04-801d26493ed0

- LGD estimates should be appropriate for downturn conditions as per Article 181. The loss rates collected are not necessarily representative of downturn conditions.

- Potential lack of representativeness due to the computation on non-homogeneous pools.
  - For the 1-year rates, the data collected allowed only the comparison of PDs (and LGDs) at the reference date (2018) with the default rate (and loss rate) observed during the same year (2018), whereas it would be more consistent to compare this default rate (and loss rate) with the PD (and LGD) at the beginning of the observation period.
  - For the 5-year rates, the average may not be statistically well grounded, since the portfolio quality may have significantly changed over the years. This is especially true in the context of the significant improvement in the portfolios of institutions observed in some EU Member States.

SME retail

Figure 54: Comparison of the PD and the default rate (latest year and last 5 years), SME retail portfolio, non-defaulted exposures, by country of residence of the counterparties



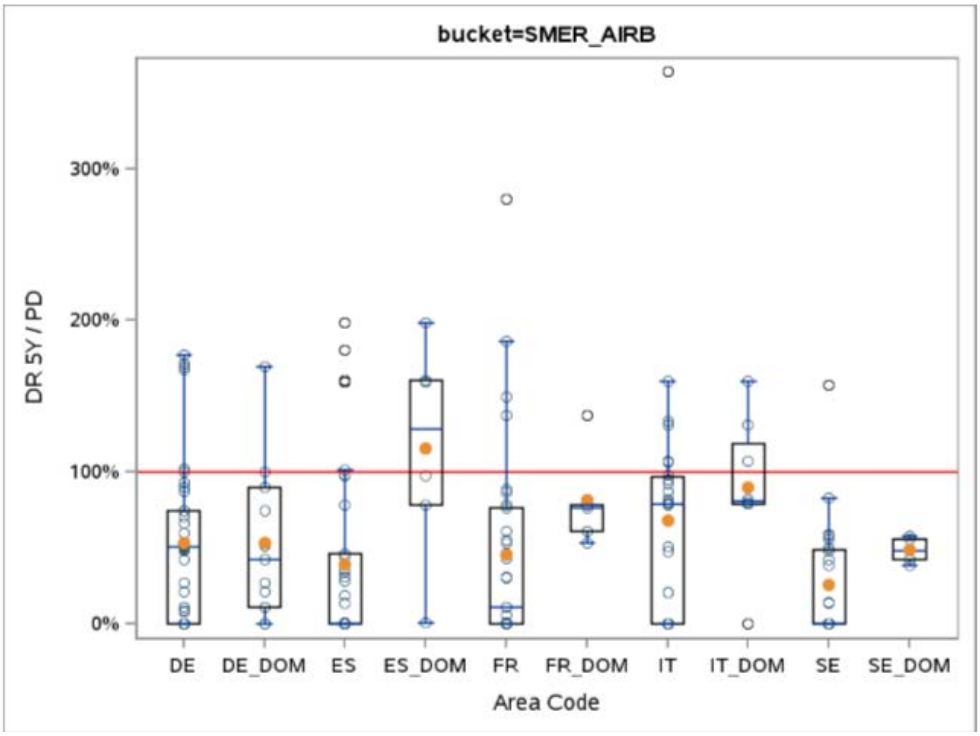
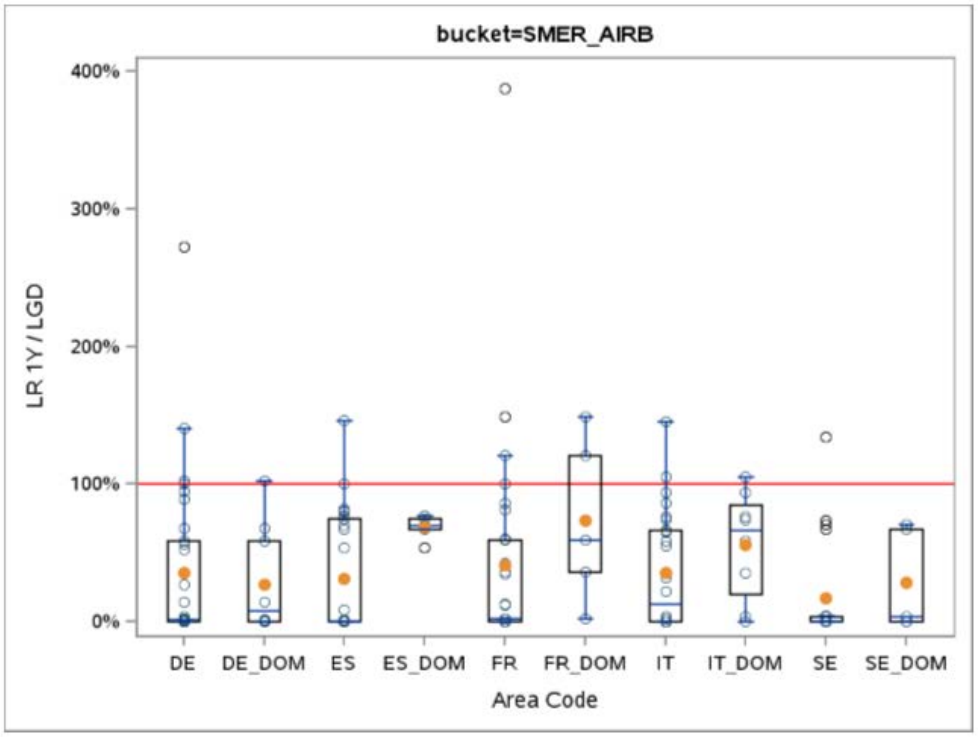
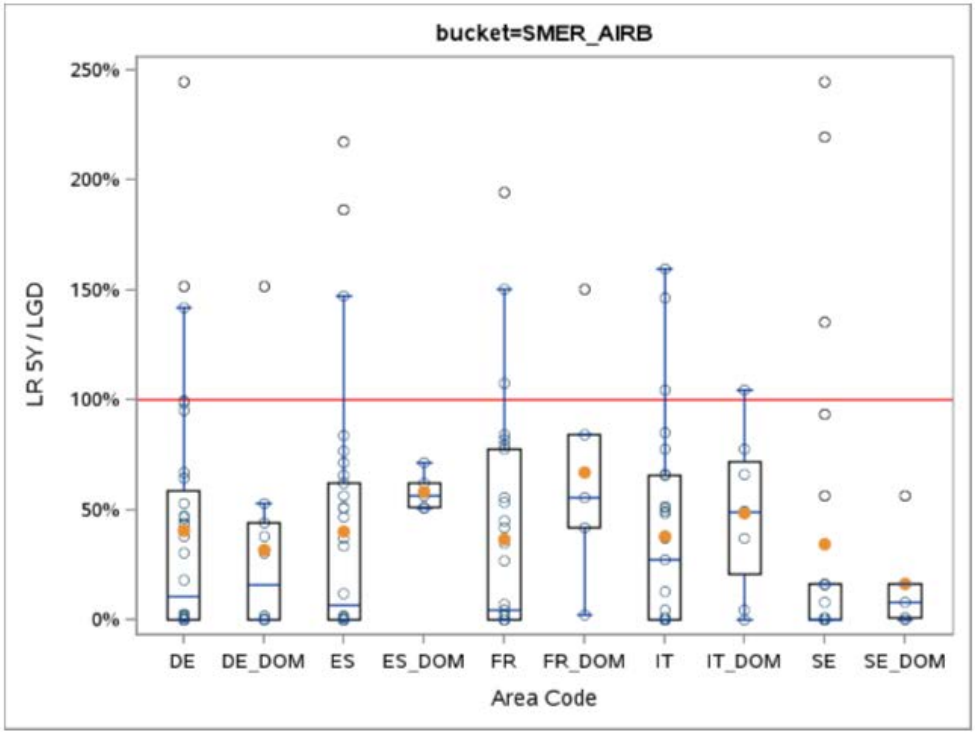


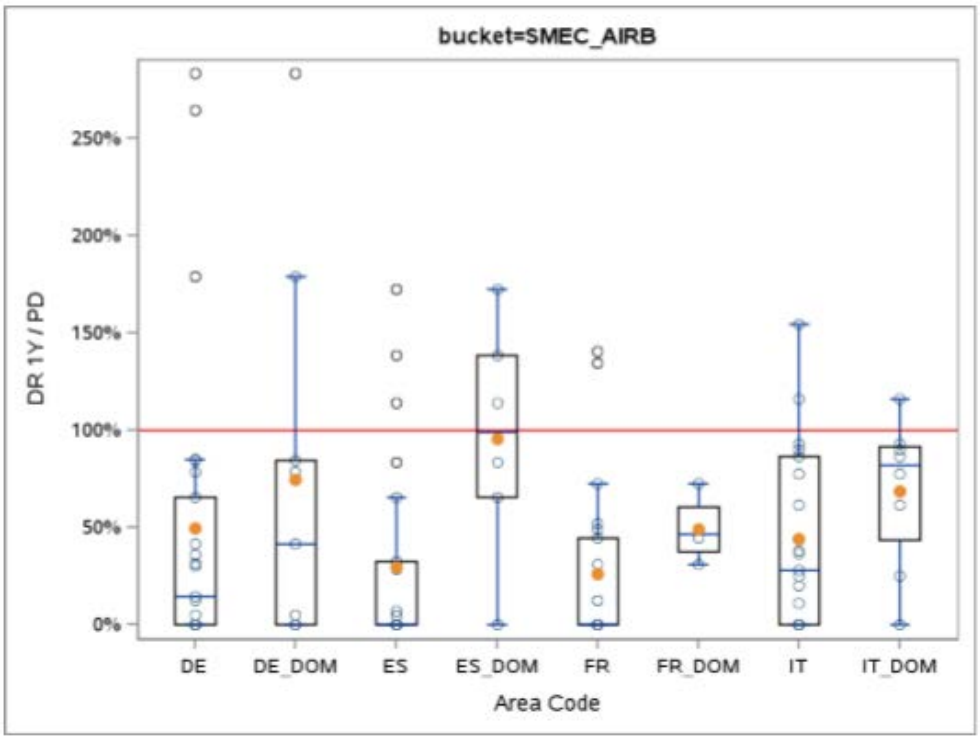
Figure 55: Comparison of the LGD and the loss rate (latest year and last 5 years), SME retail portfolio, non-defaulted exposures, by country of residence of the counterparties

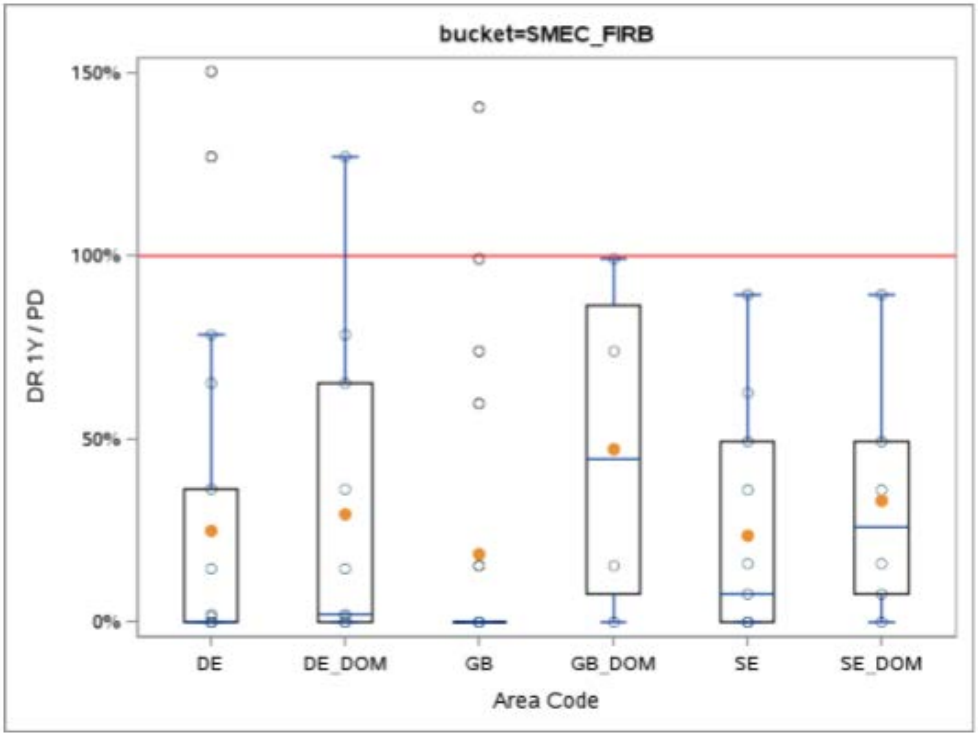


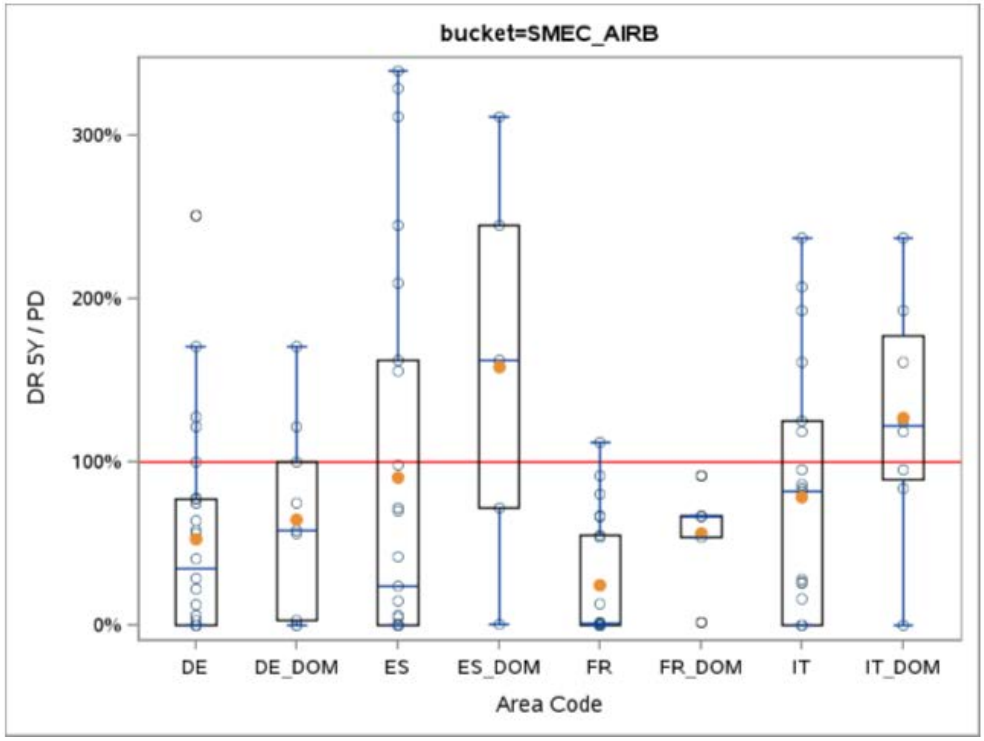


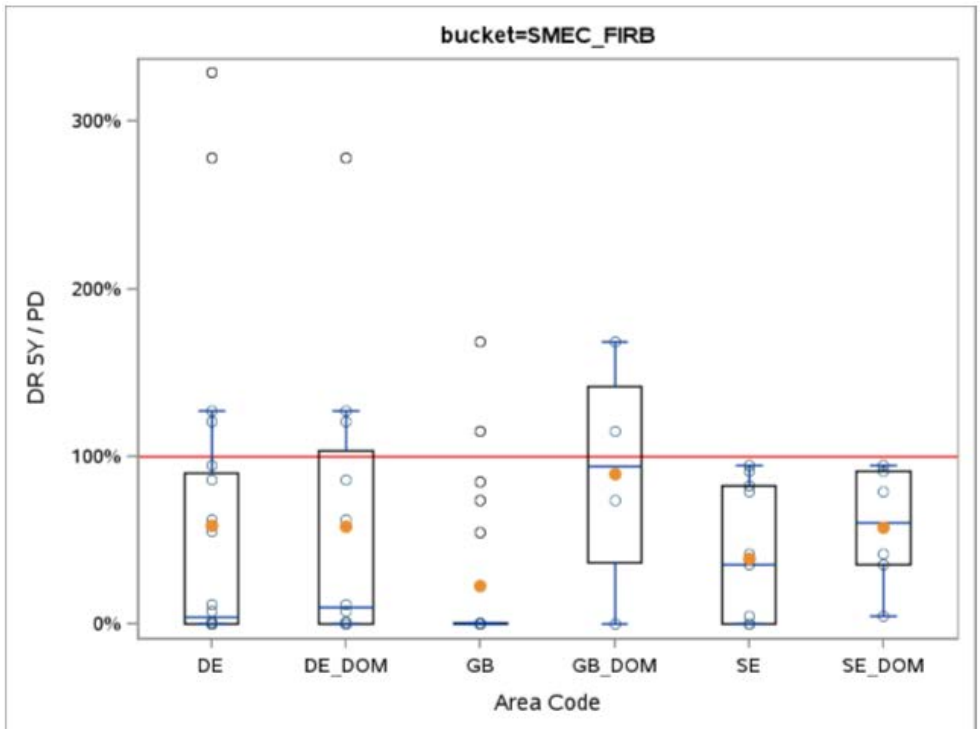
SME corporate

Figure 56: Comparison of the PD and the default rate (latest year and last 5 years), SME corporate portfolio, non-defaulted exposures, by country of residence of the counterparties






bucket=SMEC_AIRB
DR 5Y / PD
300%
200%
100%
0%
DE
DE_DOM
ES
ES_DOM
FR
FR_DOM
IT
IT_DOM
Area Code


bucket=SMEC_FIRB
DR 5Y / PD
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200%
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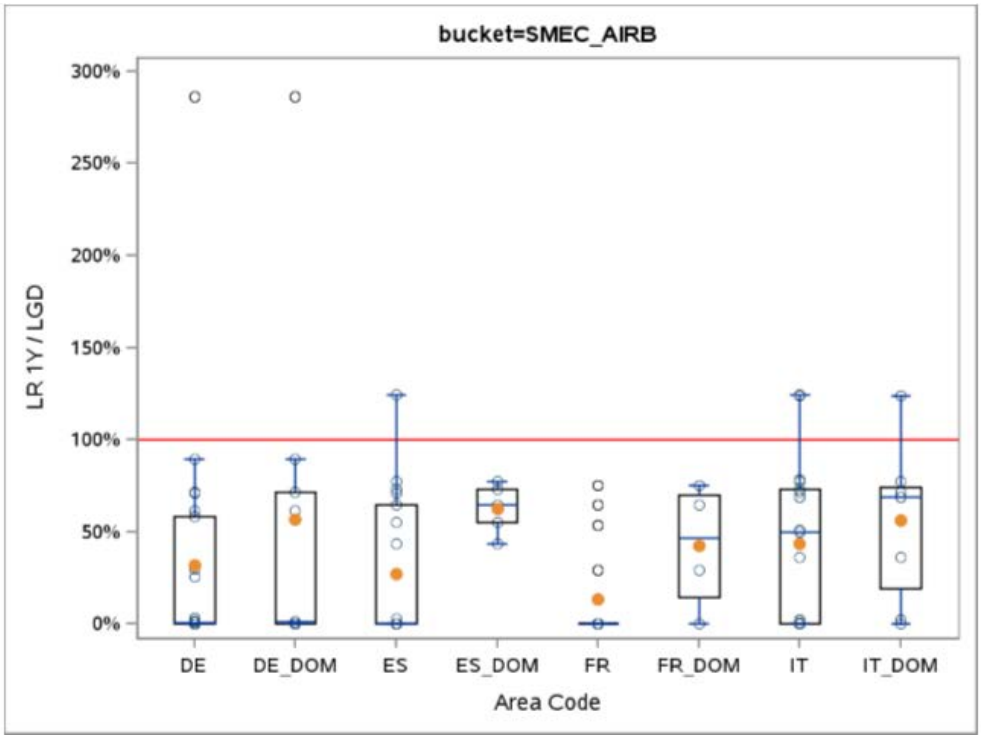
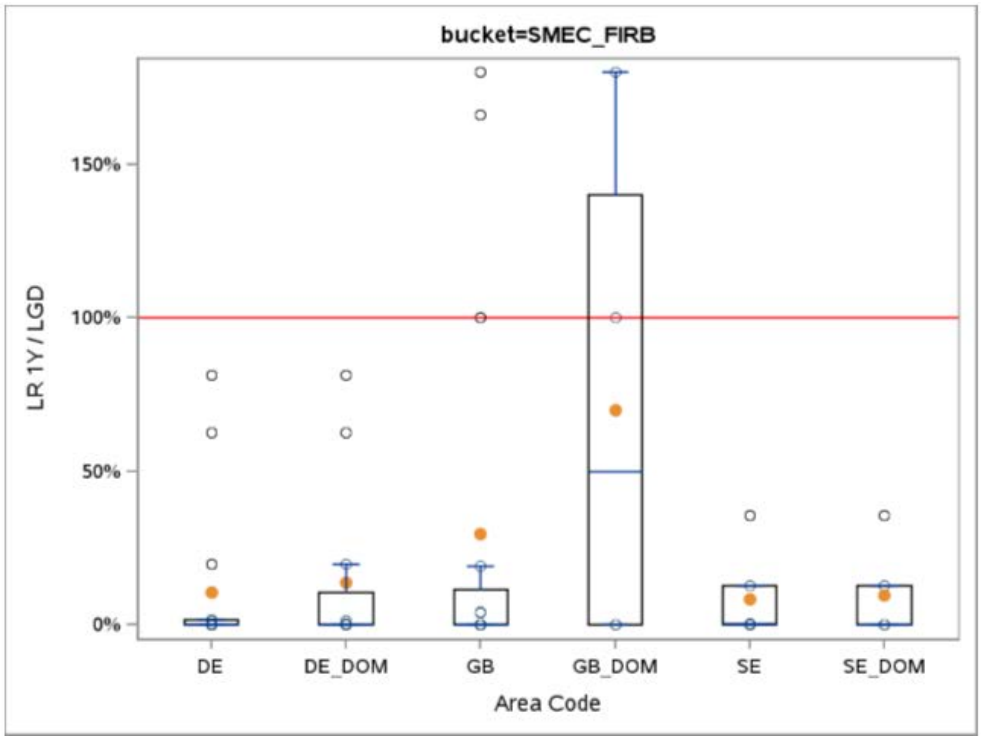
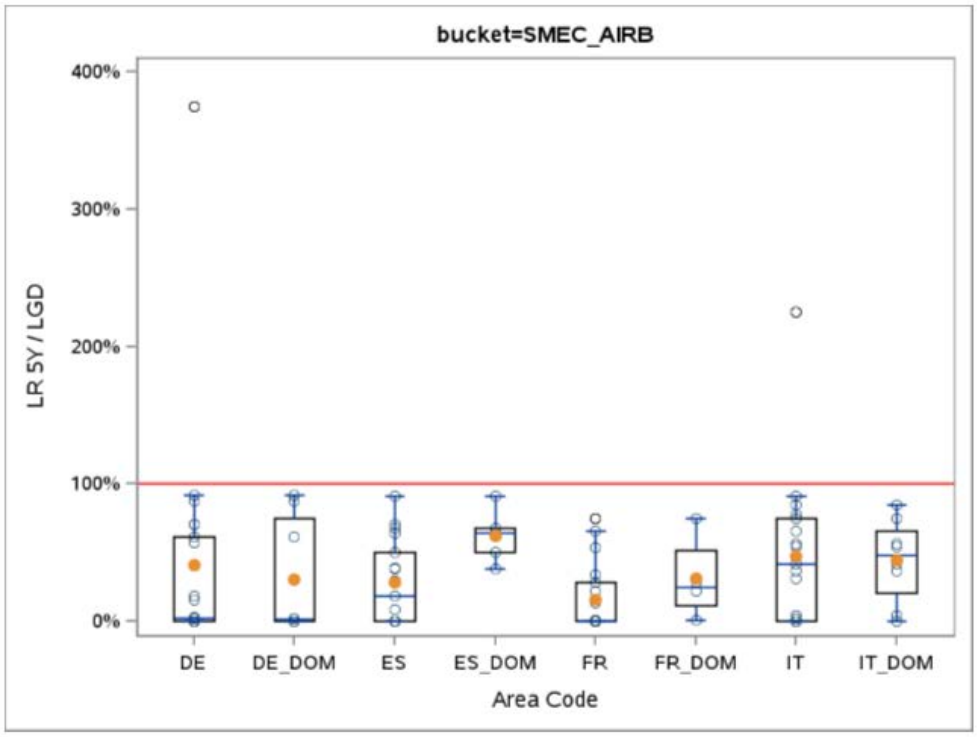
0%
DE
DE_DOM
GB
GB_DOM
SE
SE_DOM
Area Code

Figure 57: Comparison of the LGD and the loss rate (latest year and last 5 years), SME corporate portfolio, non-defaulted exposures, by country of residence of the counterparties






bucket=SMEC_AIRB
400%
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LR 5Y / LGD
DE
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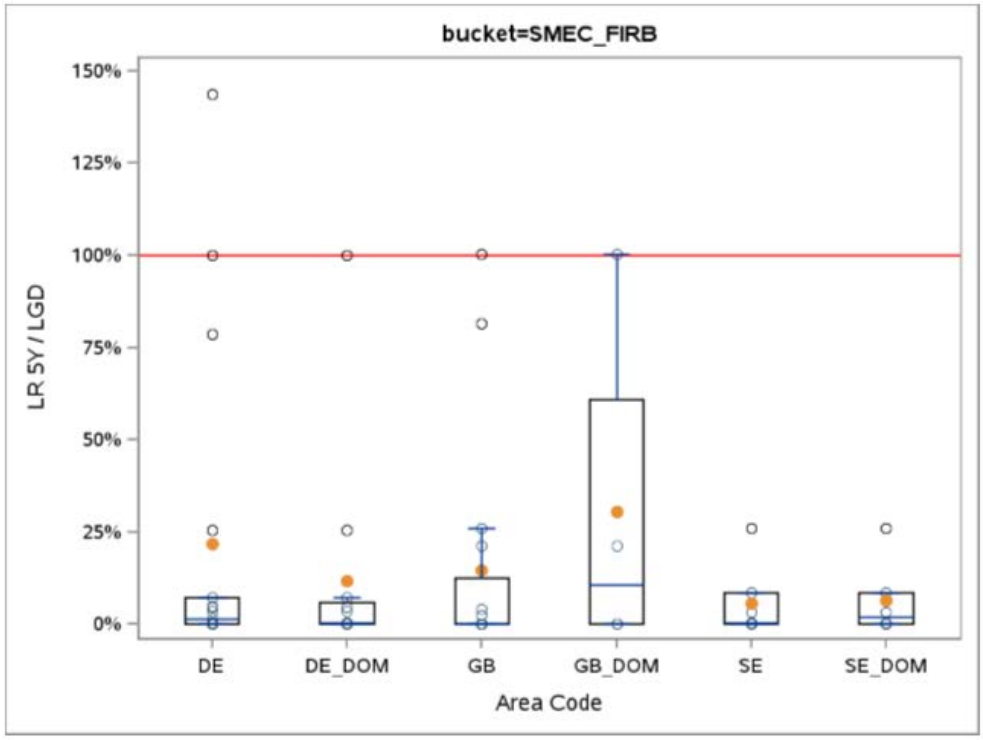
ES_DOM
FR
FR_DOM
IT
IT_DOM
Area Code


bucket=SMEC_FIRB
150%
125%
100%
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25%
0%
LR 5Y / LGD
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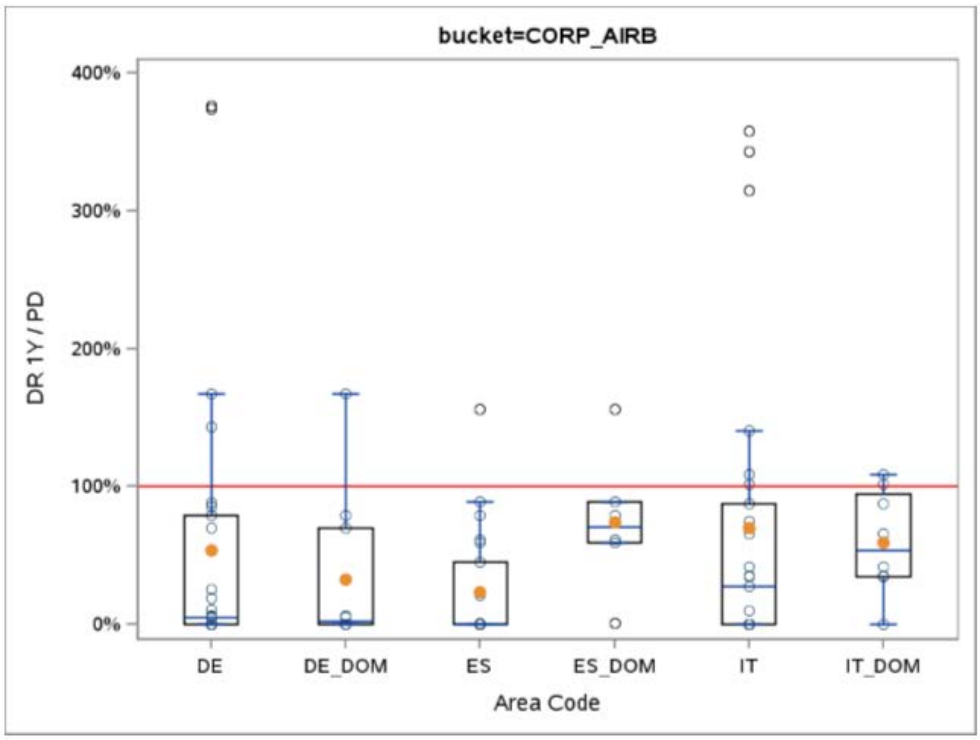
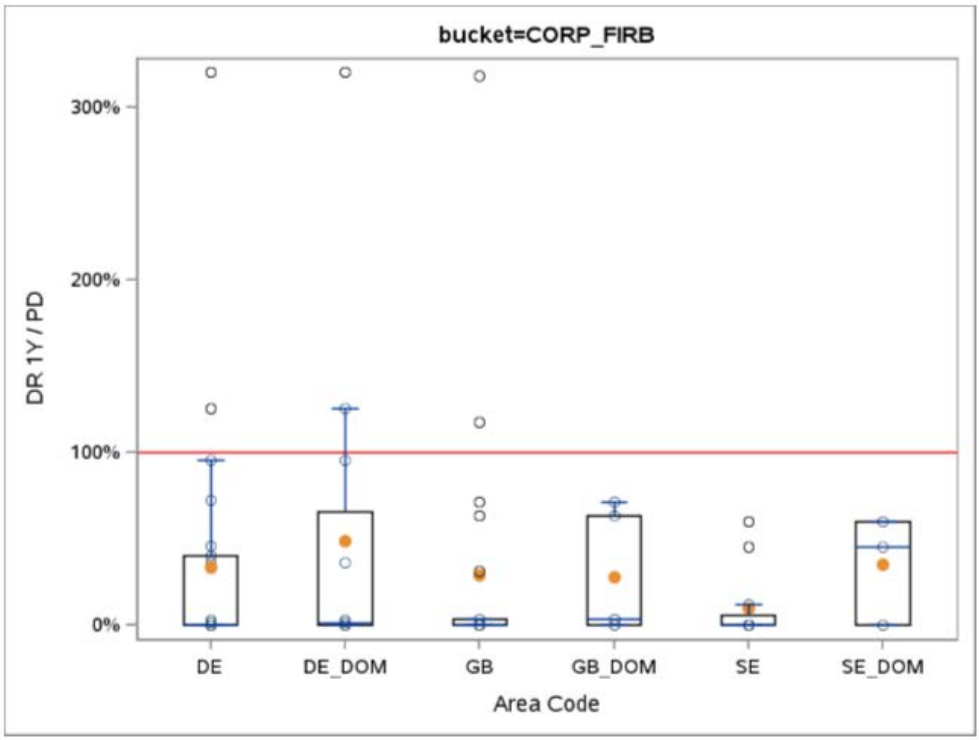
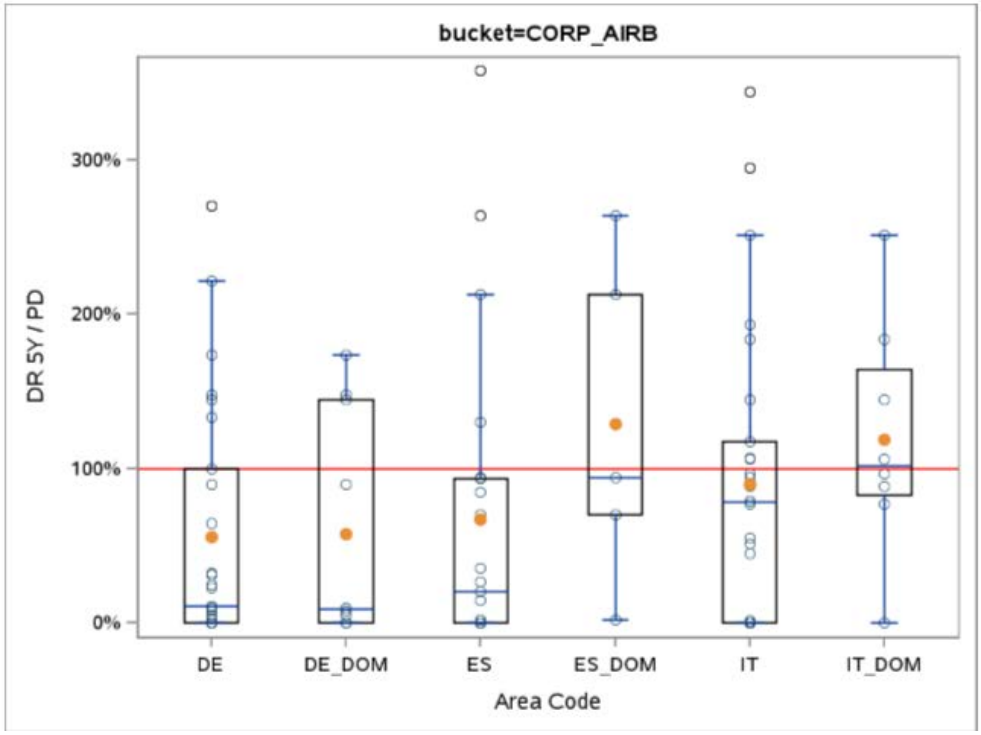
GB_DOM
SE
SE_DOM
Area Code

Corporate-other

Figure 58: Comparison of the PD and the default rate (latest year and last 5 years), for the corporate-other portfolio, non-defaulted exposures, by country of residence of the counterparties






bucket=CORP_AIRB
DR 5Y / PD
300%
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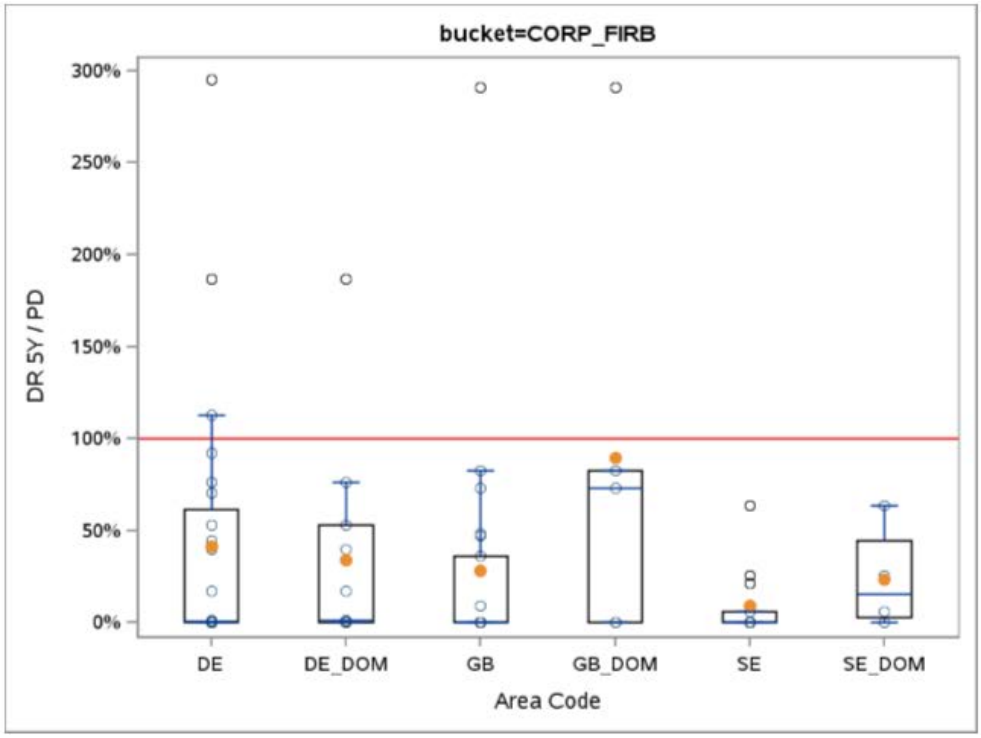
Area Code


bucket=CORP_FIRB
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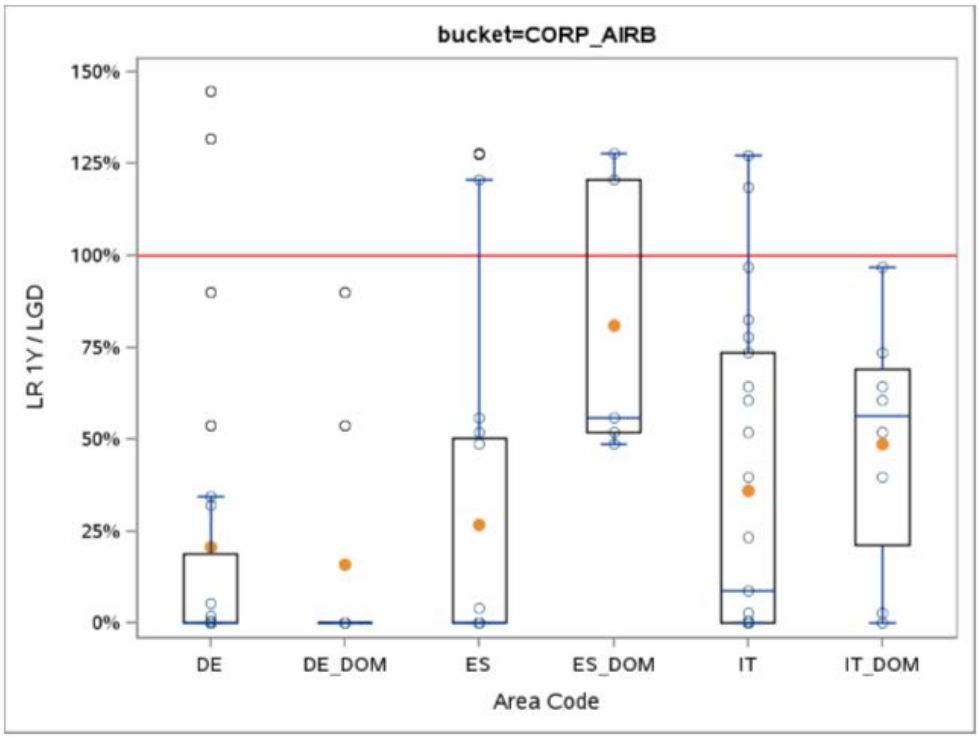
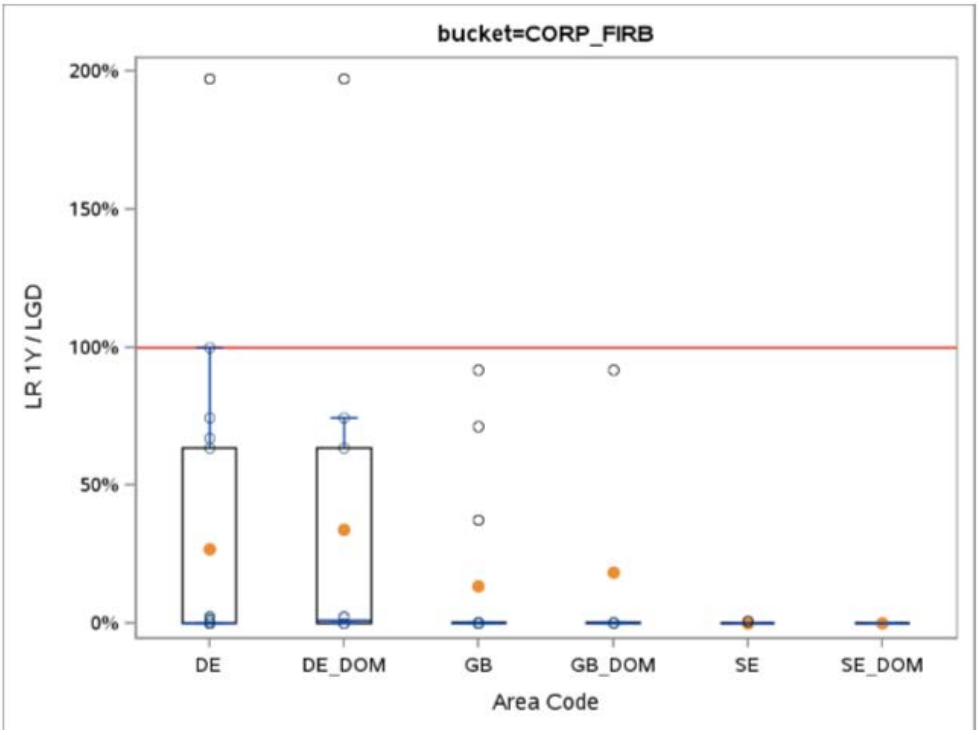
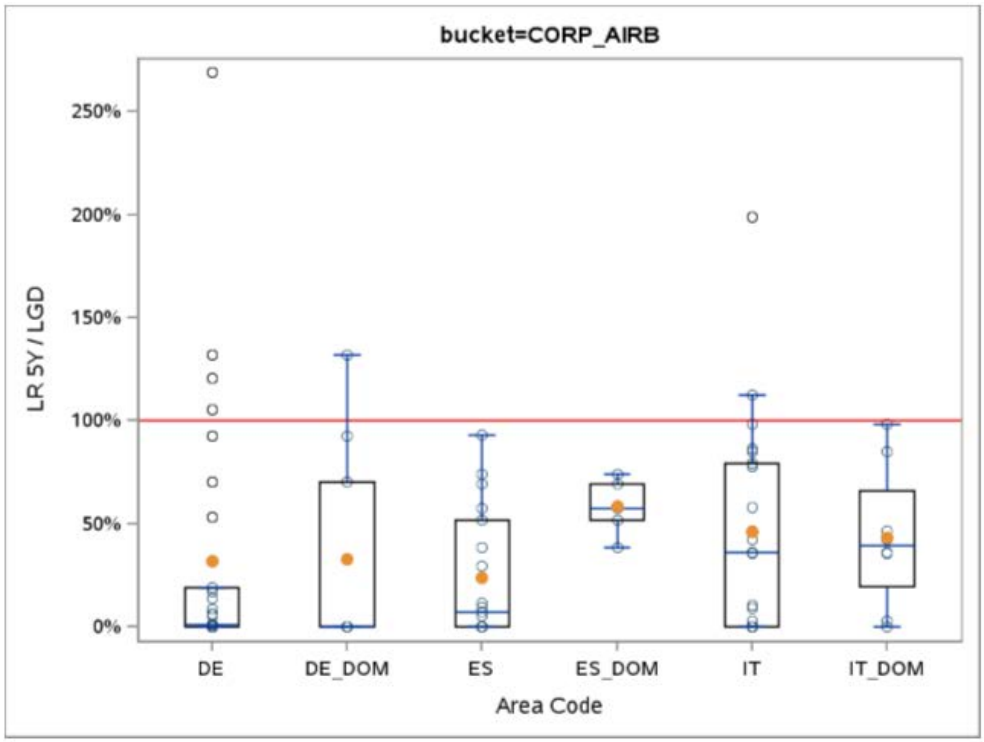
SE
SE_DOM
Area Code

Figure 59: Comparison of the LGD and the loss rate (latest year and last 5 years), corporate-other portfolio, non-defaulted exposures, by country of residence of the counterparties






bucket=CORP_AIRB
LR 5Y / LGD
250%
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DE
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ES_DOM
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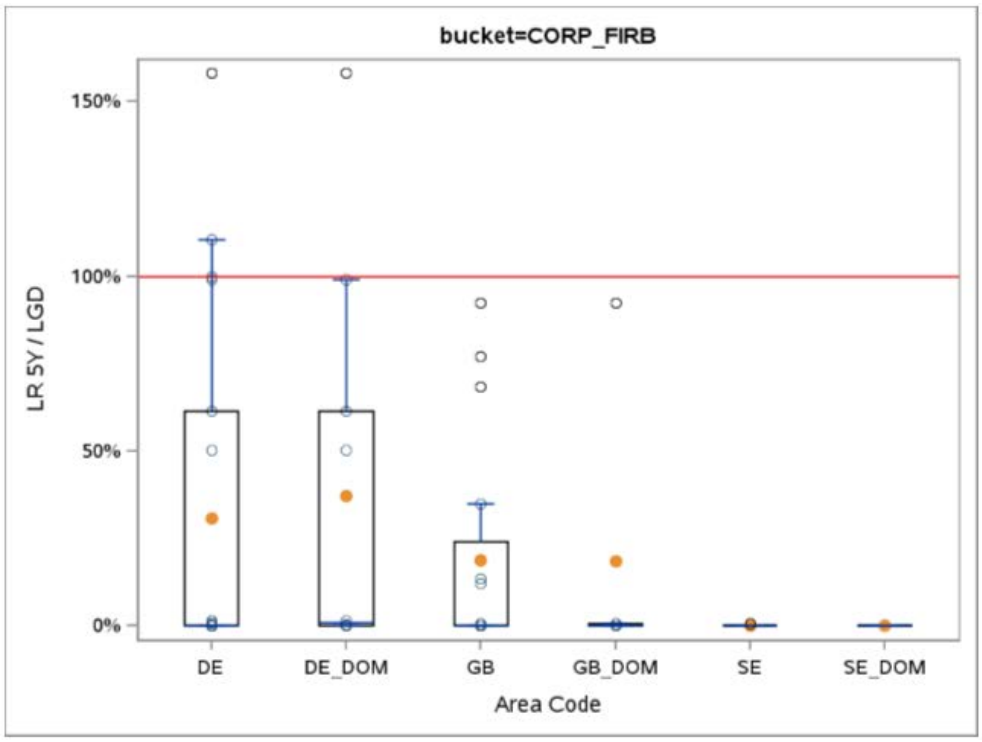
Area Code


bucket=CORP_FIRB
LR 5Y / LGD
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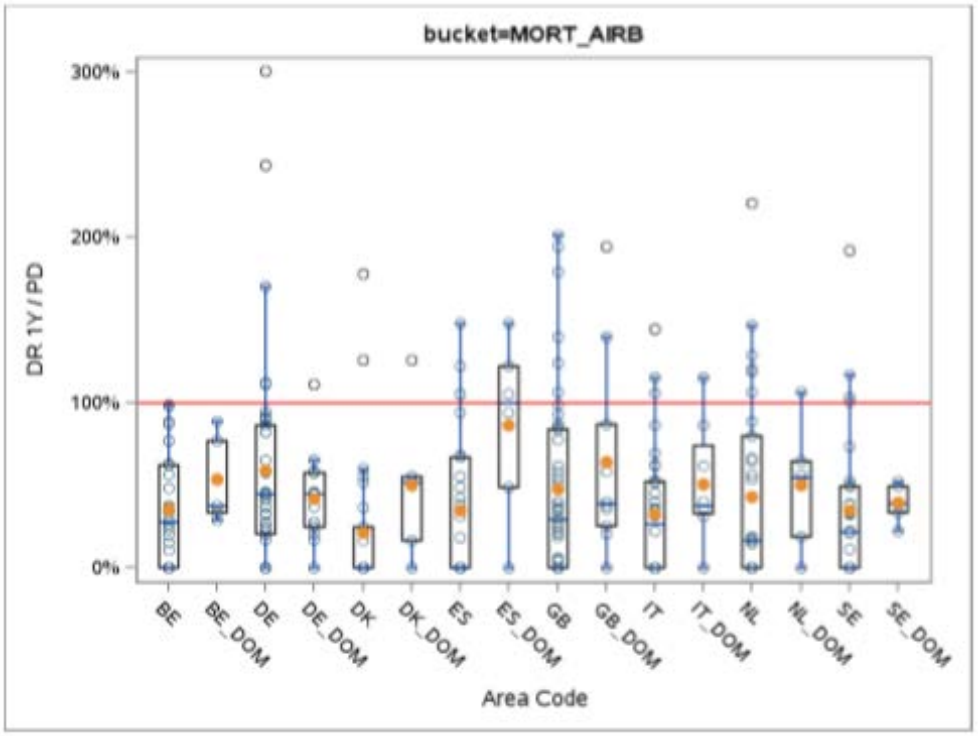
Area Code

Residential mortgages

Figure 60: Comparison of the PD and the default rate (latest year and past 5 years), for the residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties



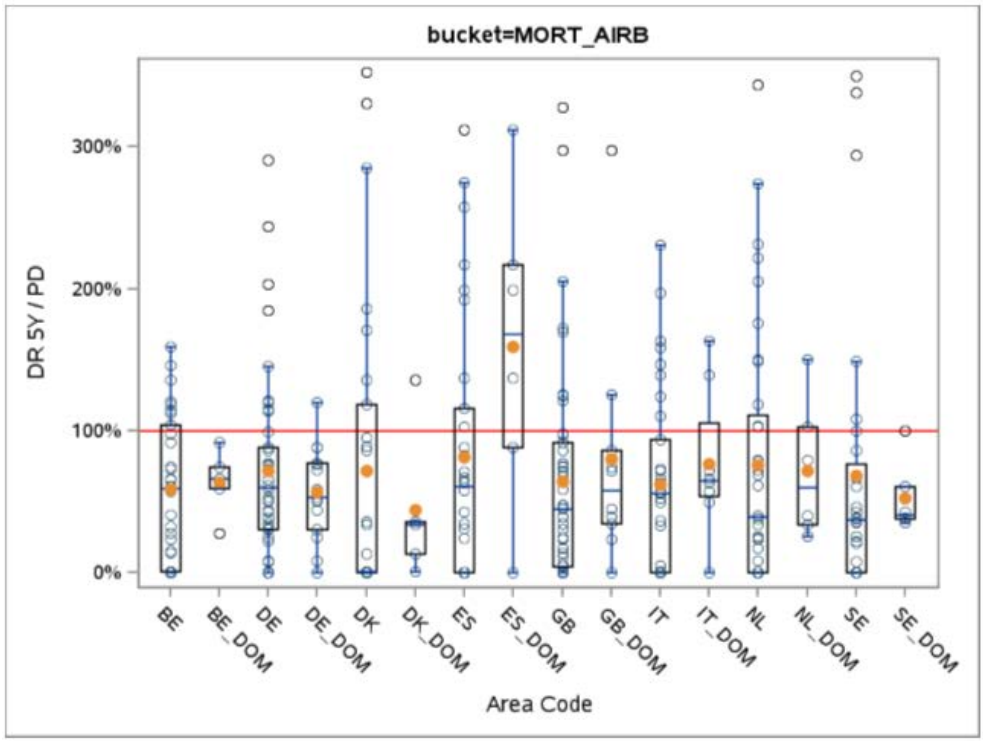
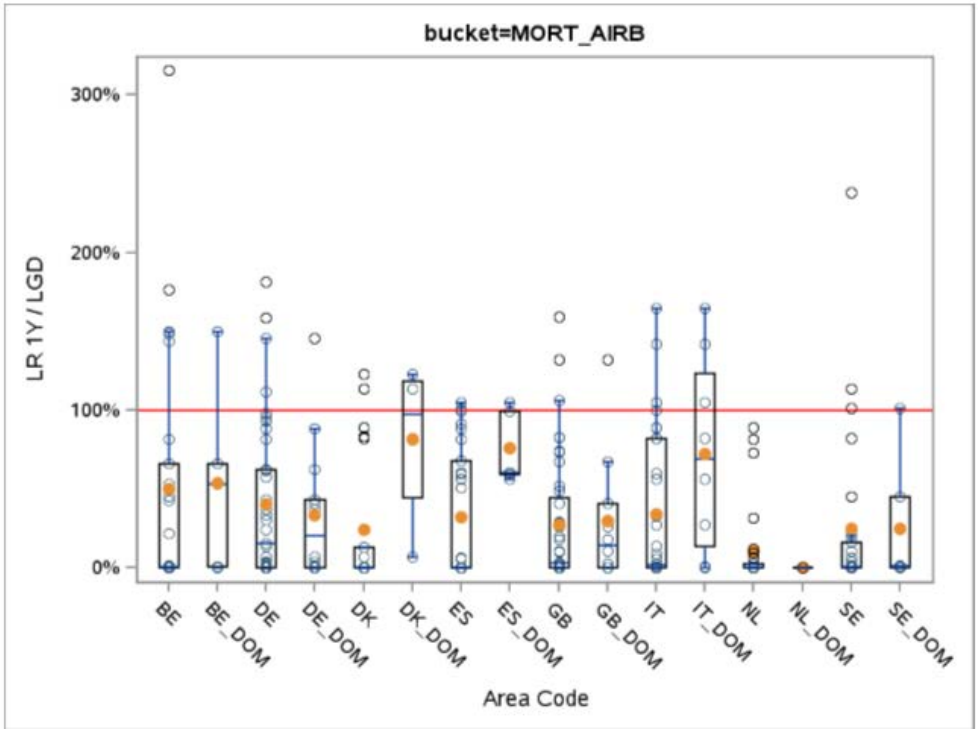
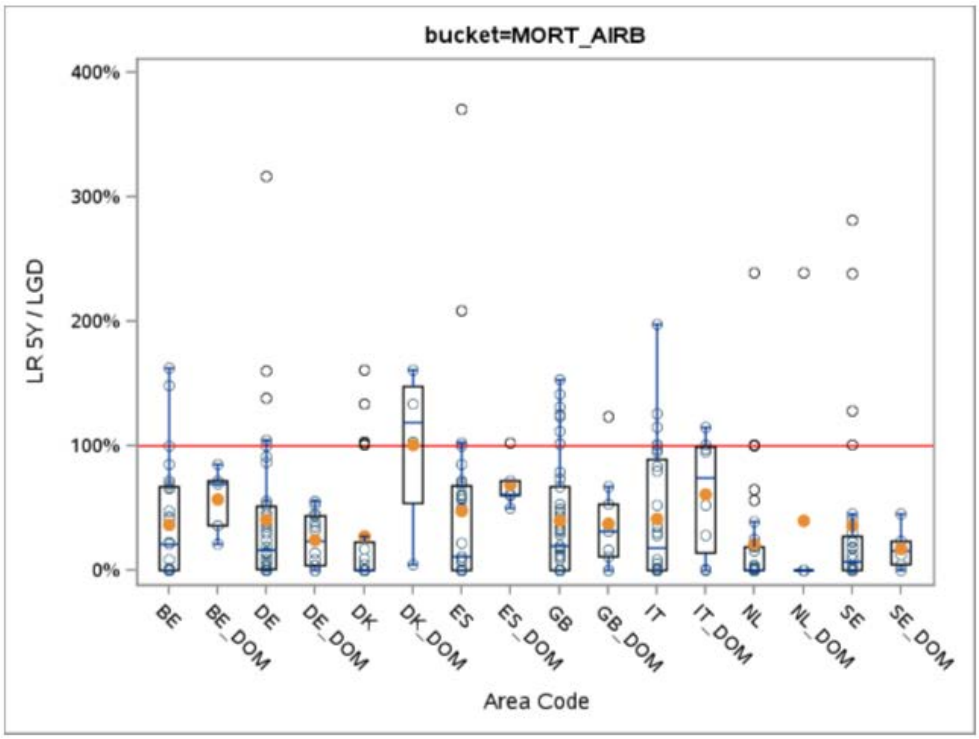


Figure 61: Comparison of the LGD and the loss rate (latest year and last 5 years), residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties





Appendix 10: Complementary graphs on the IRB versus SA variability

Whereas section 2.4 on variability between IRB and SA presents the results for the mortgages SVB exposure class, this appendix shows the results for the other three HDP SVB exposure classes (corporates, SME corporate and SME retail).

Corporates

Figure 62: RW (IRB) versus RW (SA) at the grade level, corporates portfolio - AIRB

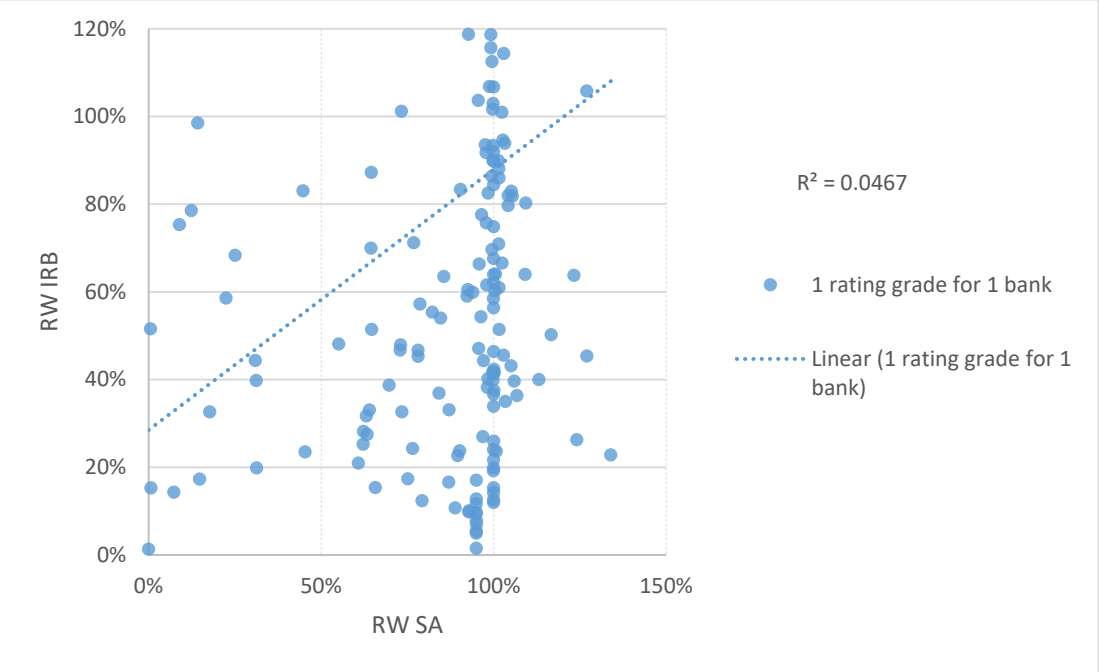


Figure 63: RW (IRB) versus RW (SA) at the grade level, corporates portfolio - FIRB

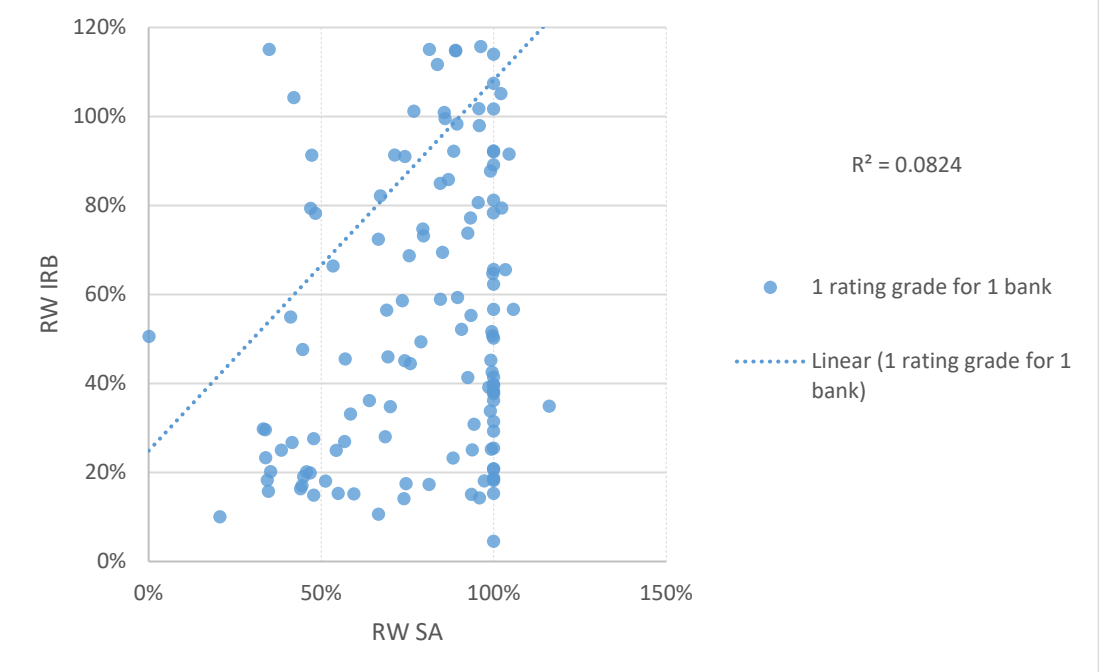


Figure 64: Distribution of RW (IRB), RW (SA) and implied RW, corporates portfolio - AIRB

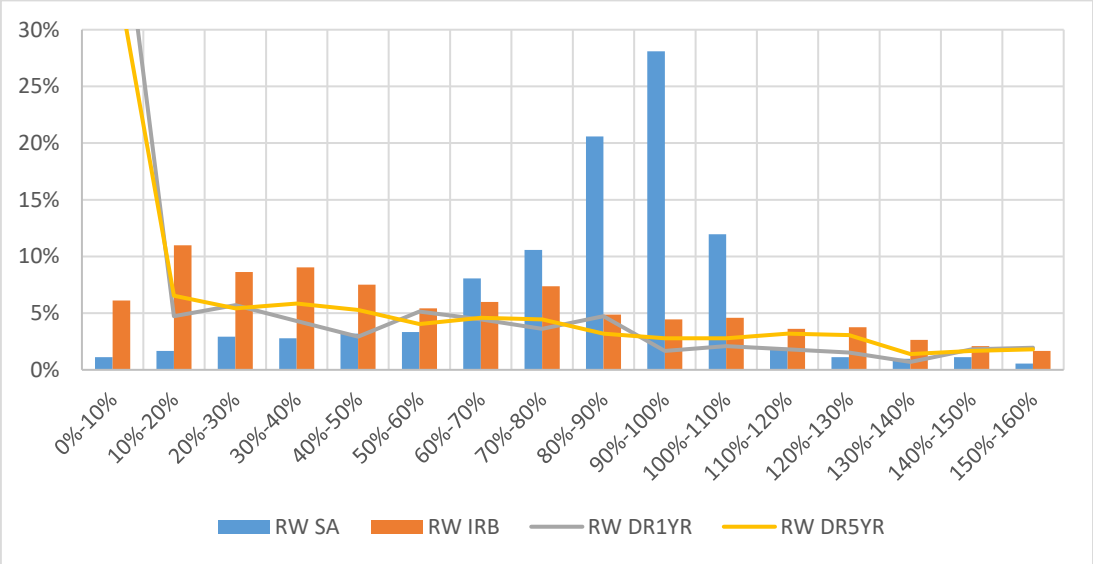
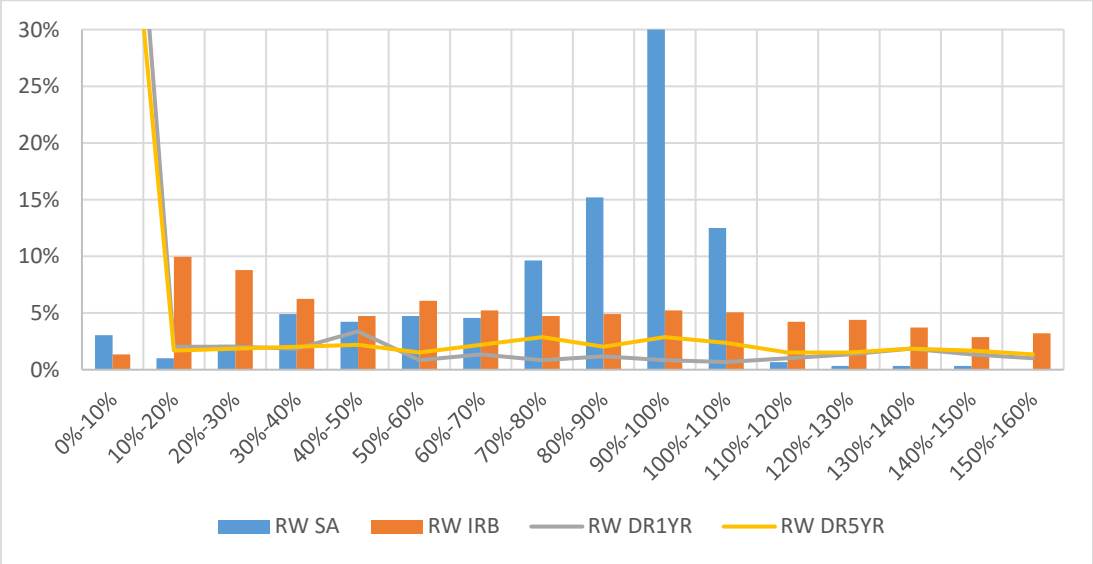


Figure 65: Distribution of RW (IRB), RW (SA) and implied RW, corporates portfolio - FIRB



Missing value due to y-axis capped at 30%: RW(SA) between 90% and 100%, 36%.

Figure 66: Distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, corporate portfolio - AIRB

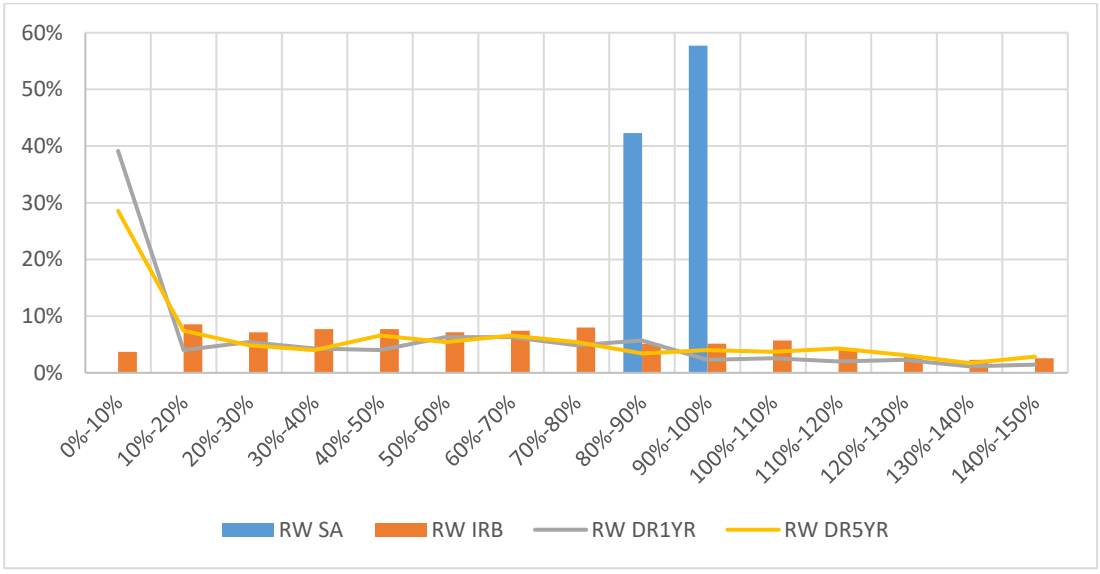
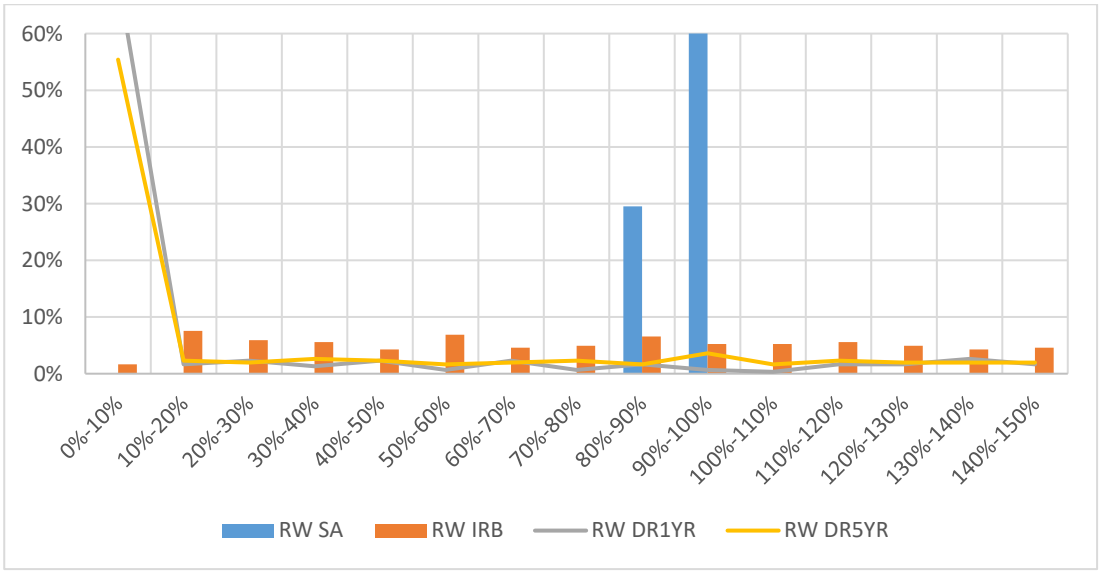


Figure 67: Distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, corporate portfolio - FIRB



Missing value due to y-axis capped at 30%: RW(SA) between 90% and 100%, 70%.

Figure 68: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, corporate portfolio - AIRB

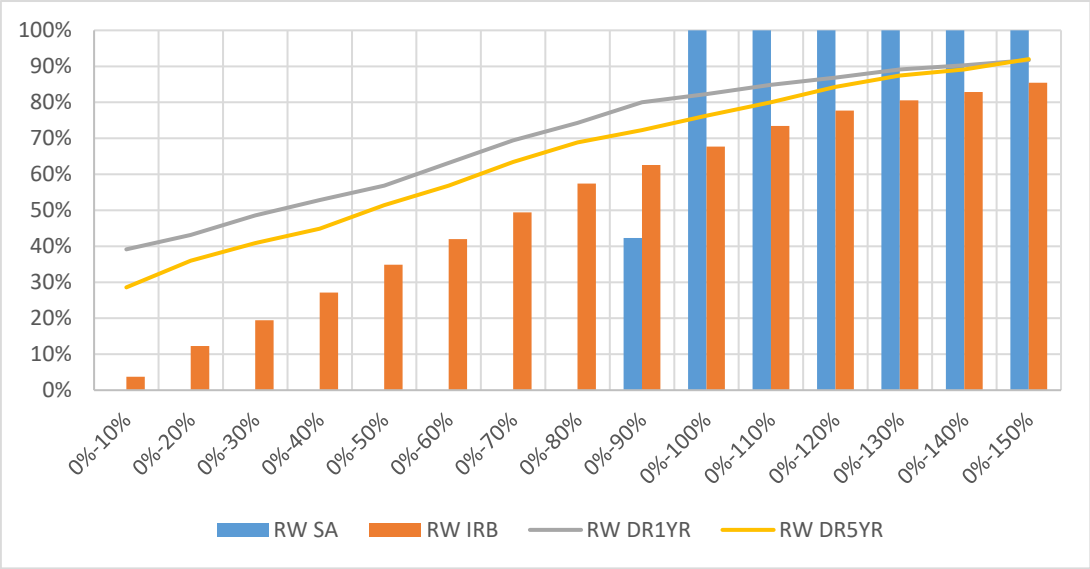
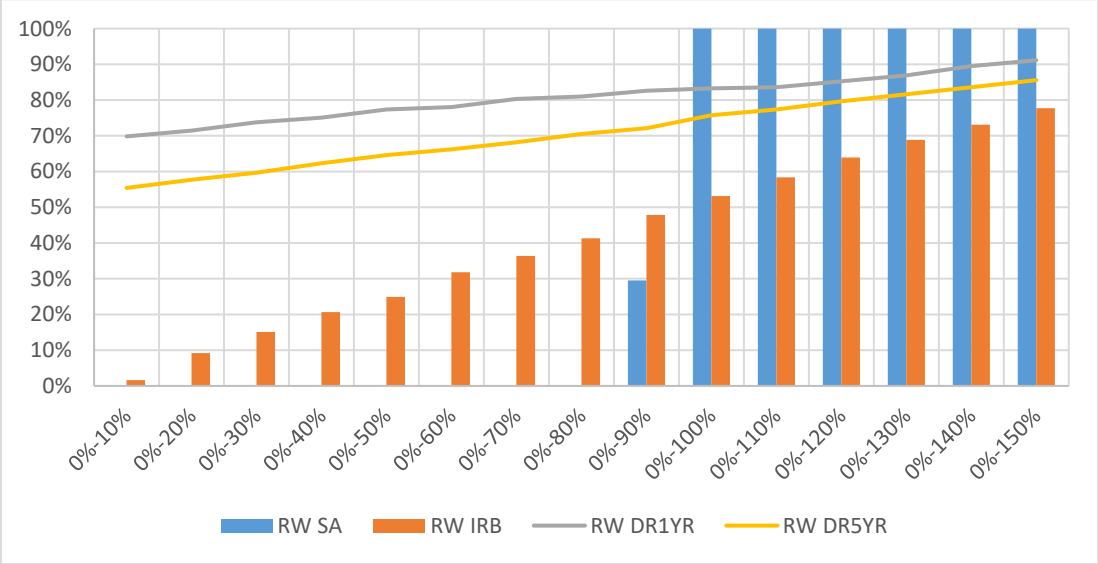


Figure 69: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, corporate portfolio - FIRB



SMEC

Figure 70: RW (IRB) versus RW (SA) at the grade level, SMEC portfolio - AIRB

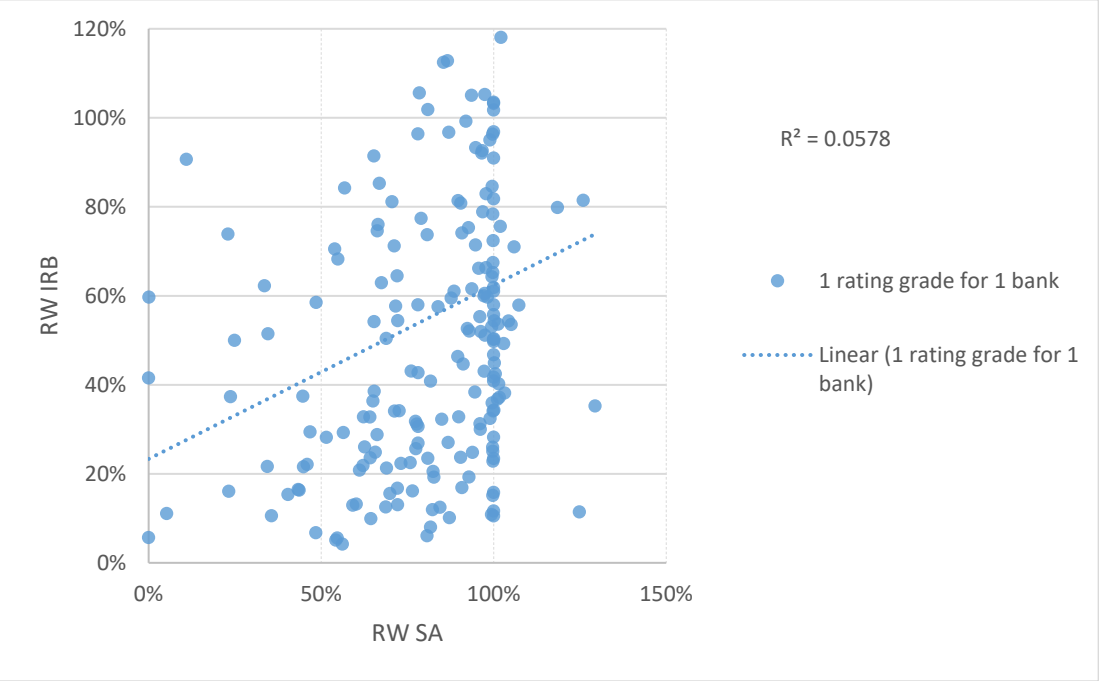


Figure 71: RW (IRB) versus RW (SA) at the grade level, SMEC portfolio - FIRB

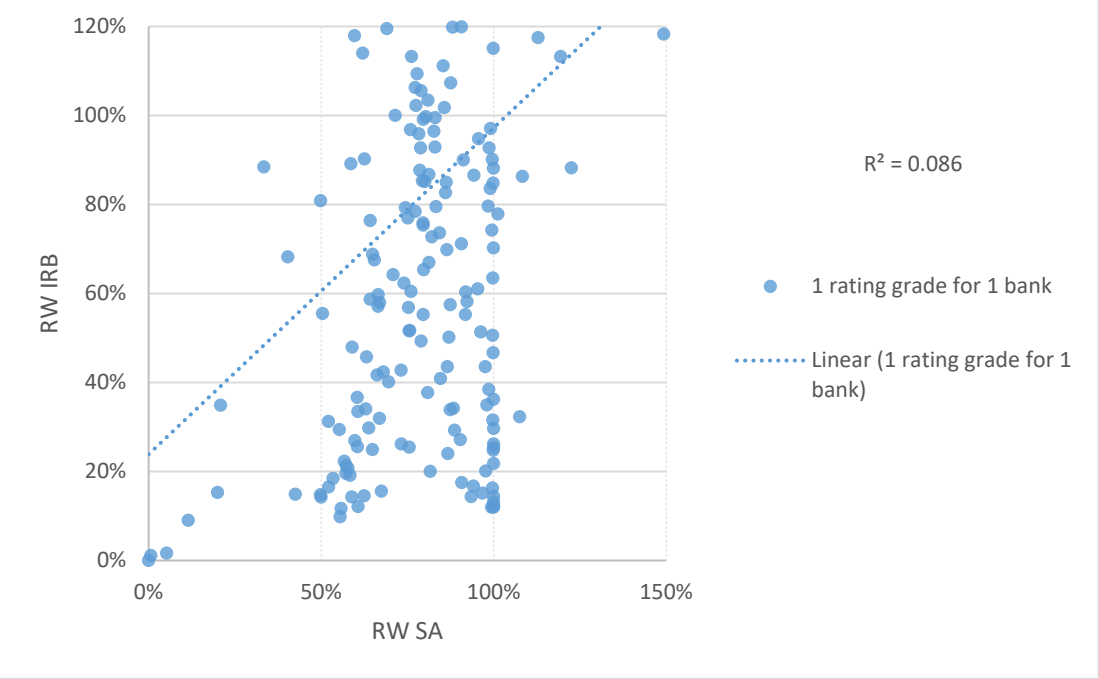


Figure 72: Distribution of RW (IRB), RW (SA) and implied RW, SMEC portfolio - AIRB

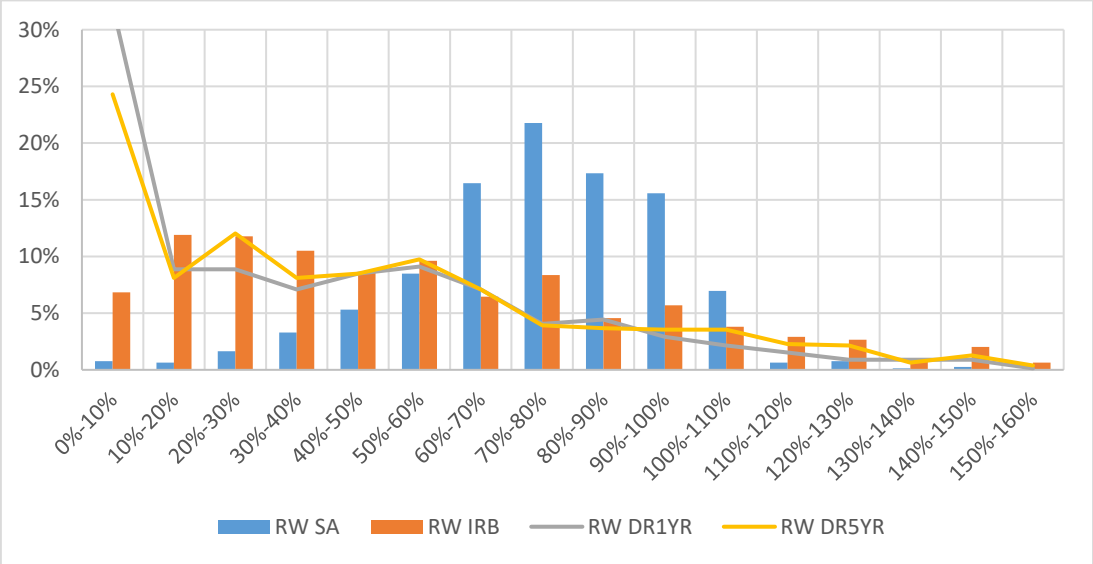


Figure 73: Distribution of RW (IRB), RW (SA) and implied RW, SMEC portfolio - FIRB

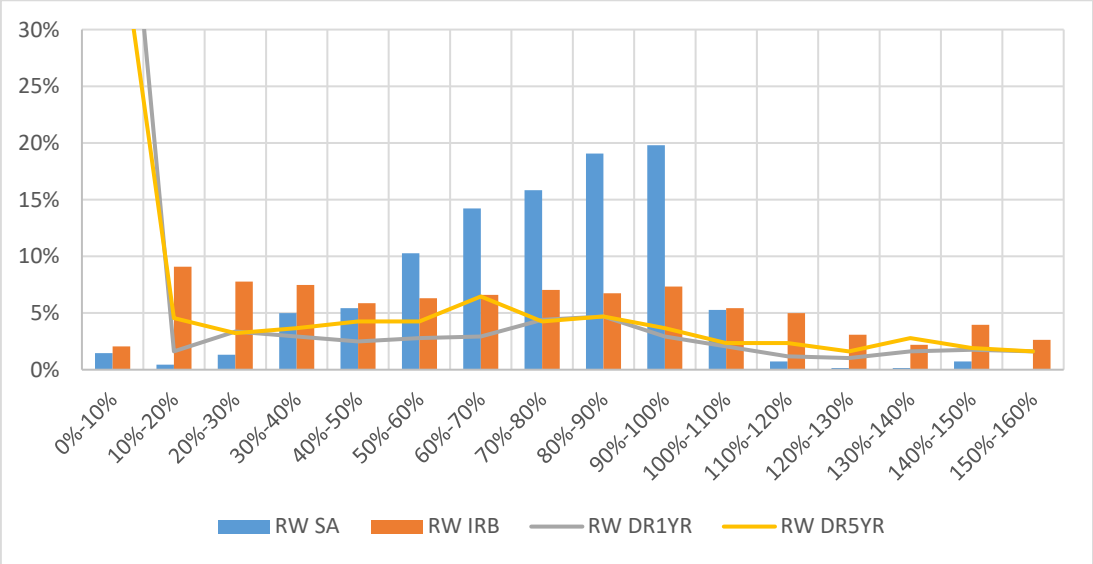


Figure 74: Distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, SMEC portfolio - AIRB

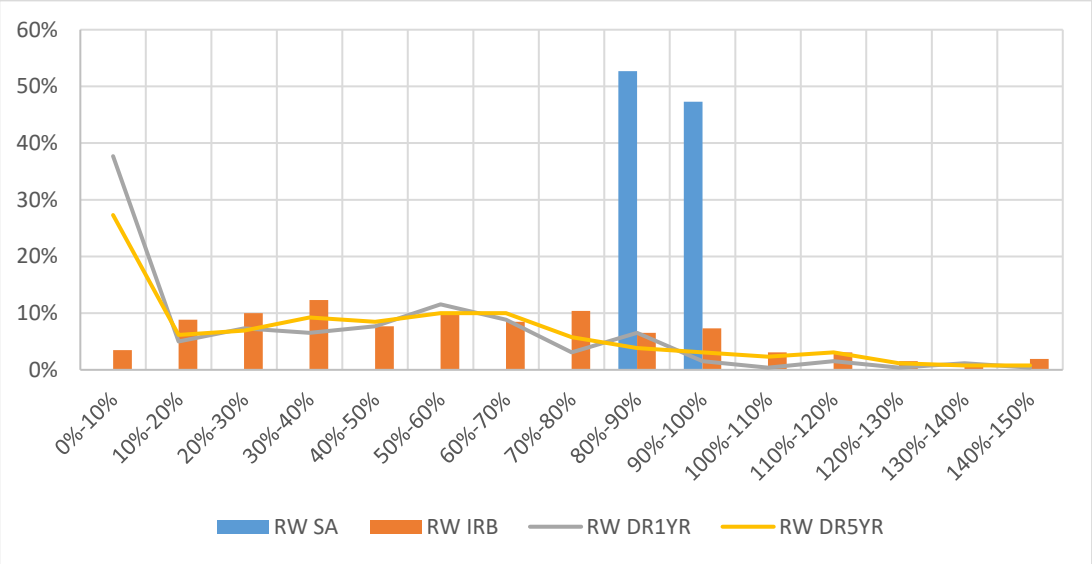


Figure 75: Distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, SMEC portfolio - FIRB

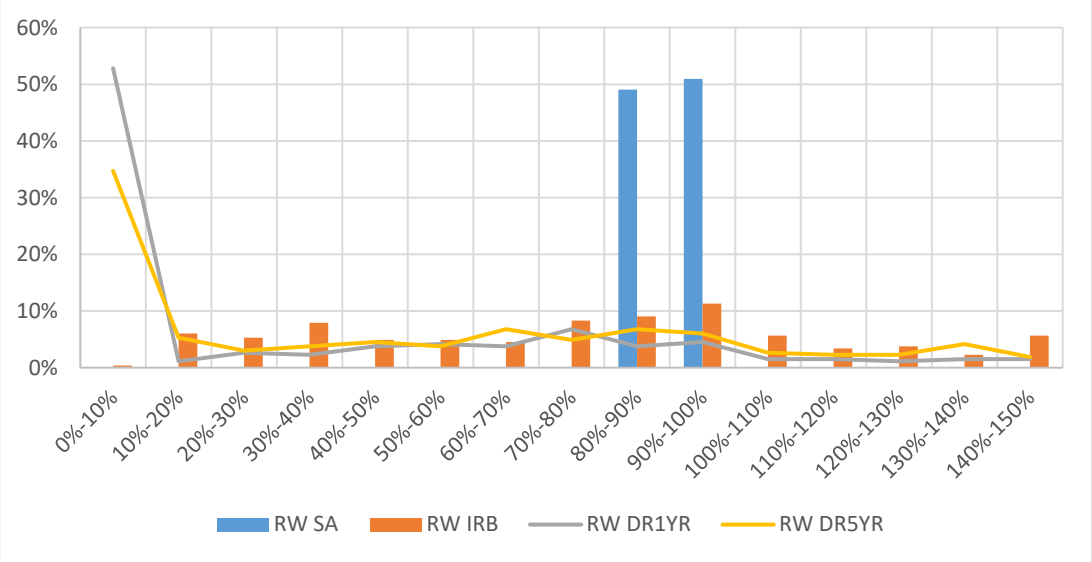


Figure 76: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, SMEC portfolio - AIRB

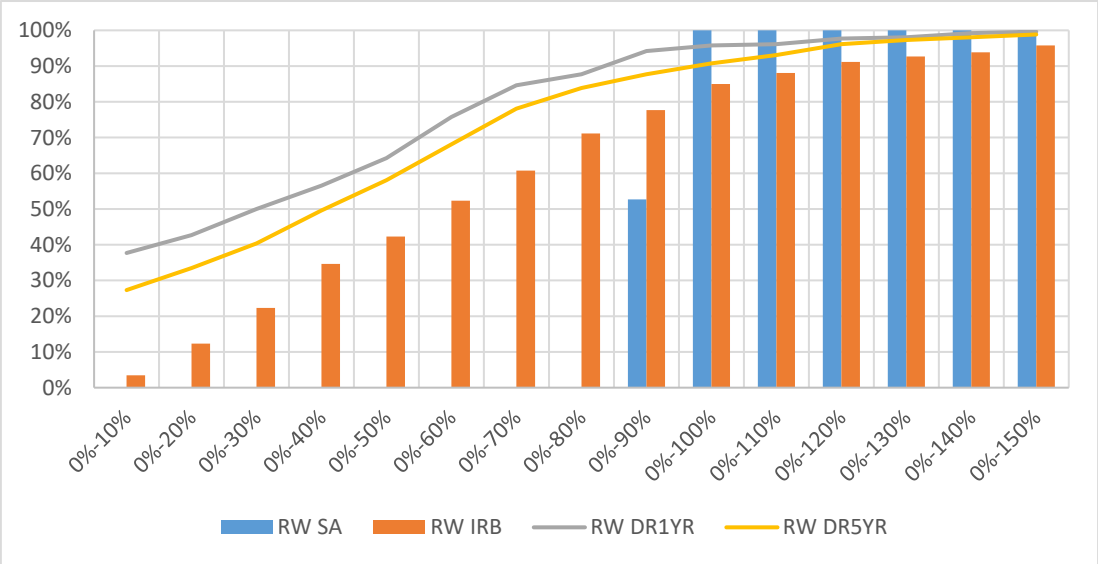
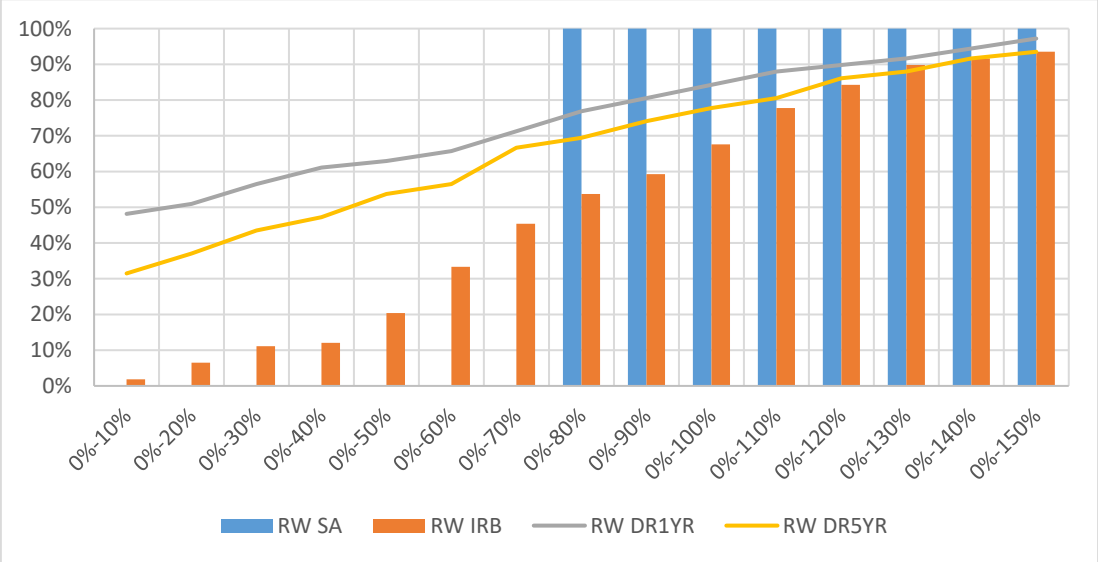


Figure 77: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 80% and 100%, SMEC portfolio - FIRB



SMER

Figure 78: RW (IRB) versus RW (SA) at the grade level, SMER portfolio

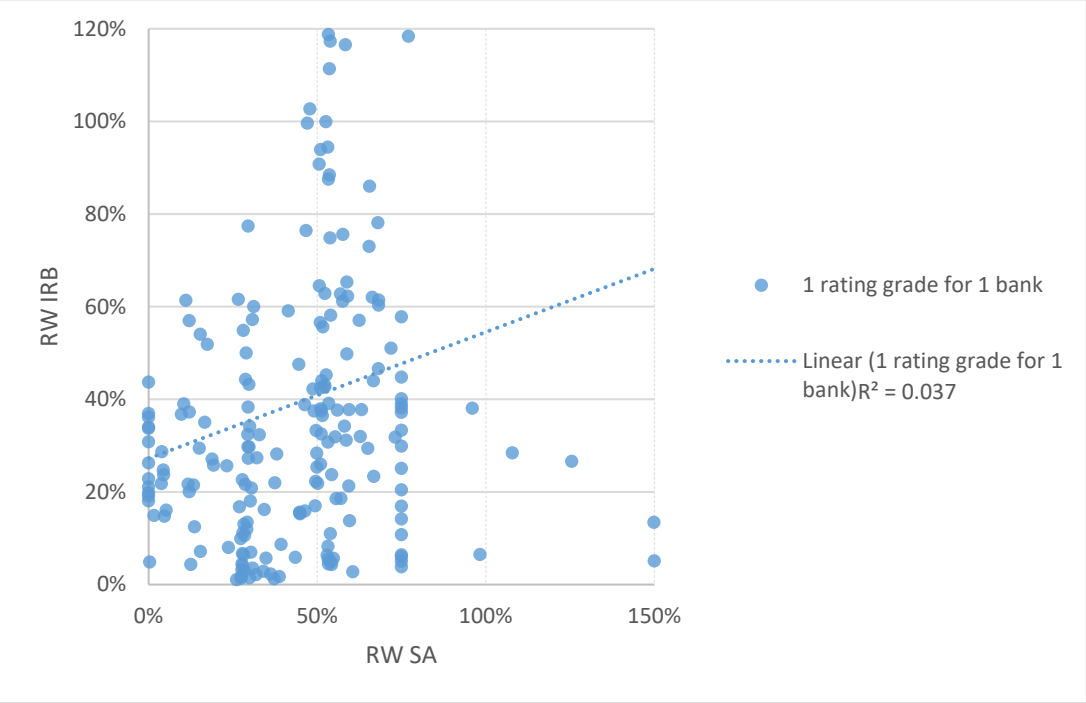


Figure 79: Distribution of RW (IRB), RW (SA) and implied RW, SMER portfolio

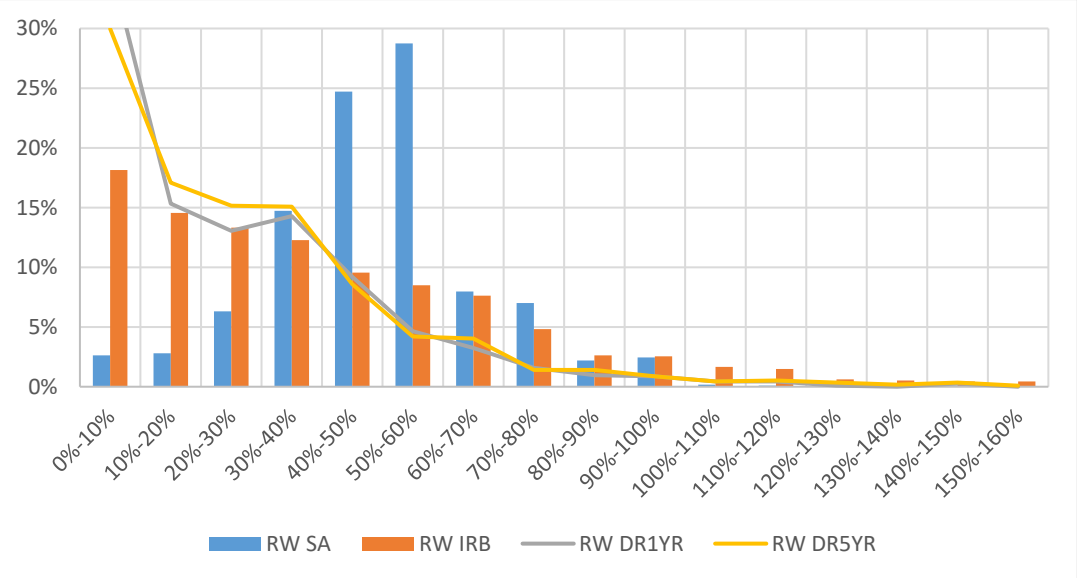


Figure 80: Distribution of RW (IRB) for exposures with RW (SA) between 40% and 60%, SMER portfolio

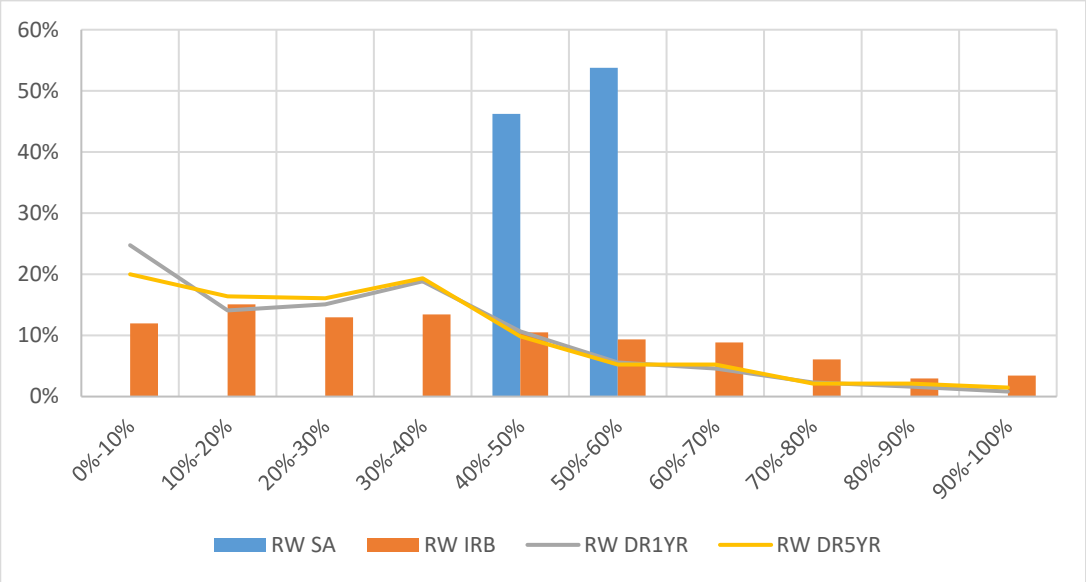
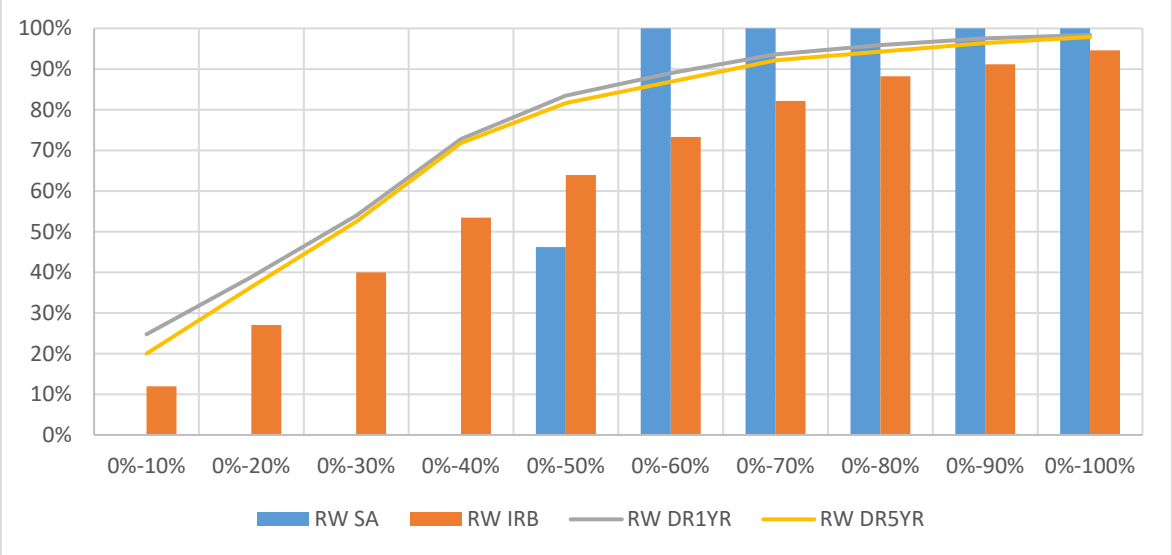


Figure 81: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 40% and 60%, SMER portfolio



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