CHART PACK AND METHODOLOGY GUIDE TO THE REPORT ON THE 2022 CREDIT RISK BENCHMARKING EXERCISE

RESULTS ON THE ANALYSIS OF THE VARIABILITY OF OWN FUNDS REQUIREMENTS BASED ON THE IRB

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
RGLA/ PSE	regional governments and local authorities/public sector exposures
RW	risk weight
RWA	risk-weighted assets
SA	standardised approach
SLSC	specialised lending slotting criteria
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

1. General description of the exercise and data collected

1.1 General description of the exercise & analysis

1.1.1 Introduction

This chart pack aggregates the results of the 2022 supervisory benchmarking (SVB) exercise for IRB models. The reference date for the underlying data is the 31 December 2021.

The main objectives of this years' report are to:

(i) provide an overview of RWA variability and the drivers thereof;

(ii) summarise the results of the supervisory assessments of IRB models, which were conducted between July and September 2022 based on the 2022 benchmarking data submission and

(iii) provide evidence to policymakers of the impact of recent policy changes.

The data collection is based on technical standards[1] (ITS) specifically designed for the annual SVB exercises. These ITS specify the data that institutions have to submit for different breakdowns of their IRB portfolio. These breakdowns are specified by, for instance, country, type of collateral, loan-to-value ratio and sector and are provided via the ITS as well. This structure allows to understand the impact of these factors on the different key risk drivers such as PD, LGD and RW estimates.

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 LDPs and the outturn analysis for HDPs.
- The third section contains the qualitative analysis that has been performed on the institutions' IRB models, i.e. the results from the CA assessments (a survey that the CAs have to fill for each bank for a feedback on their assessments of the bank based on the benchmarking data and any other additional information in their possess).

Compared to previous benchmarking exercises new data fields have been introduced in the data collection 2022 to be able to analyse the influence of conservatism in the IRB parameter estimates. However, as the data submission was voluntary in 2022 only limited information coupled with data quality issues was available and as such the results are not deemed representative for this year. The according charts are however included in section 2.5.4.

[1] https://www.eba.europa.eu/regulation-and-policy/supervisory-benchmarking-exercises

Although data on CCF and maturity is also collected and provided to the supervisors together with the relevant benchmarks for the individual assessment of institutions' IRB approaches, these parameters are not in scope of the horizontal analysis presented in this focus report.

1.1.2 Challenges encountered when analysing the variability of IRB model outcomes

The main challenges of this year's benchmarking exercise are related to the differentiation between outlier observations, which are driven by the following:

- the recent policy changes related to the IRB framework: EBA as part of the 'IRB repair work' required banks to update their IRB models, by the end of 2021. Further, EBA has specified new standards around the definition of default (CRR Article 178) in order to achieve greater alignment across the EU banking system (to be implemented by the end of 2020). As already investigated in the 2021 benchmarking exercise, institutions implemented the new requirements implied by the IRB roadmap with a different pace. Further, where an institution changed its DoD in the current reporting this may lead to potentially significant changes in (a) the amount of defaulted exposure and (b) the default rate reported for the relevant reporting period. These two aspects have led to significant deviation of the ratios DR1Y/PD and DR5Y/PD for several institutions.
- the recent macro-economic developments (including those implied by the COVID pandemic or the Brexit): As far Brexit banks are concerned, supervisory authorities in the EU host countries granted temporary tolerance for their IRB models, in order to allow them to prepare the validation and approval by the respective host authorities. However, in this year's benchmarking exercise we identified 4 institutions, where such temporary tolerance of IRB approaches was granted with however varying deadlines and conditions. As a result, there was a divergent reporting submission as well.
- data quality issues: the data analysis of template 105 highlighted potential issues in the data in terms of non-negligible percentage of missing values, data fields not homogeneously filled, data fields reported with different unit of measurements.

Although these cases were also present in the previous year, in the current one the EBA paid particular attention to analysing single observations for made for individual banks and portfolios. These single observations came from three different sources: the outlier identification, the data quality analysis and the delta-analysis on key characteristics compared to last year.

1.1.3 Analysis performed for high default portfolios (HDP) and low default portfolios (LDP)

The data were used to perform three main types of analysis in this report:

- **Top-down and distribution analysis of institutions' actual portfolios (both LDPs and HDPs):** these mainly use the information collected via templates C 102 and C 103. This method disentangles the impact of some key determinants of 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 (LDPs):** 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 caution.

- **Outturns (backtesting) approaches (HDPs):** 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 five years for default and loss rates) and the corresponding IRB parameters (PD, LGD and RWA), as well as PD backtesting results (RWA-/+).[2] These comparisons allow an analysis to be conducted of possible misalignments between estimated and observed parameters.

Based on the data collected, an analysis is performed in order to identify the relevant outlier institutions that deserve further investigation by the CAs and the EBA. In a first step outlier observations on the core metrics (such as average PD, LGD, RW and for HDP outturns ratios) are identified depending on the available data of the individual institutions. For both HDPs and LDPs, only portfolios that have been reported by at least 10 institutions, with at least 5 obligors, with an EAD greater than EUR 10,000 have been used to assess potential outlier observations. An observation on a core metric is identified as outlier if it is below the 10th percentile (of the distribution relevant for a considered portfolio and metric), respective above the 90th centile for the outturns ratios of DR1Y/PD, DR5Y/PD, LR1Y/LGD and LR5Y/LGD. In a second step, a qualitative assessment is made, taking into account as well the results of the data quality analysis and other information available (i.e. on recent

[2] 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.

model changes), in order to determine the final list of institutions and portfolios that deserve an in-depth investigation by the CAs.

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. Two further kinds of assessments were made in 2022 in this regard:

- **Interviews** with institutions. In cases where the identified outlier observations could not be explained by a specific business model of an institution (e.g., lower values on core metrics due to generally higher collateralisation), by recent model changes or by issue in the data submission (i.e. data quality) institutions were asked to discuss these observations more in detail with the CAs and EBA staff. The aim of these interviews was this year to understand the drivers behind the outlier observations.

- **CAs' assessments of individual institutions in their jurisdictions** have been shared with the EBA. CAs are requested to fill a qualitative questionnaire for each bank in scope of the exercise to share the evidence they have gathered among colleges of supervisors, as appropriate, and to take appropriate corrective actions to mitigate problems, when deemed necessary. The tools and benchmarks provided by the EBA and any additional bank- and model-specific information from regular ongoing supervisory functions should be used 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 range of institutions in a harmonised way across EU.

1.2 Dataset and assessment methodology

1.2.1 Dataset

The subset (sample) of European banks, which are considered for the analysis provided in this report, is obtained from the list of institutions[3], which have a reporting obligation following Article 78 of the CRD. These are the institutions which had approval to calculate their own-funds requirements for their credit risk exposures by application of the internal ratings based (IRB) approach as of 31.12.2021 (the relevant reference date for this report). However, while the published list contains 111 institutions for which a data submission was expected in April 2022, the table below illustrates that only 101 were finally taken into account for this analysis. This is because the 8 Norwegian institutions, originally on the list, did not submit data as the relevant reporting regulation (DPM) was not adopted in time, one more institution was excluded due to unsatisfactory data and an additional institution has been removed since its IRB approval had actually been revoked.

However, given the individual business models not each participating institution provides data for each portfolio. Therefore, the number of institutions which are taken into account for the charts referring to specific exposure classes or more granular benchmarking portfolios, varies. As such for each chart and table the number of banks actually considered in the analyses may be different (e.g. banks not submitting a template due to specificities of their portfolio, like no LDP IRB models).

The following section provides an overview of key characteristics of the overall sample of institutions that is considered in this report.

[3] This list is published on the EBA website: EBA updates list of institutions involved in the 2022 supervisory benchmarking exercise | European Banking Authority (europa.eu)

1.3 Portfolio composition and characteristics of institutions in the sample

1.3.1 Use of regulatory approaches

Table 1 describes the composition of the 2022 SVB sample across different dimensions (i.e. the use of regulatory approaches across SVB exposure classes).

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

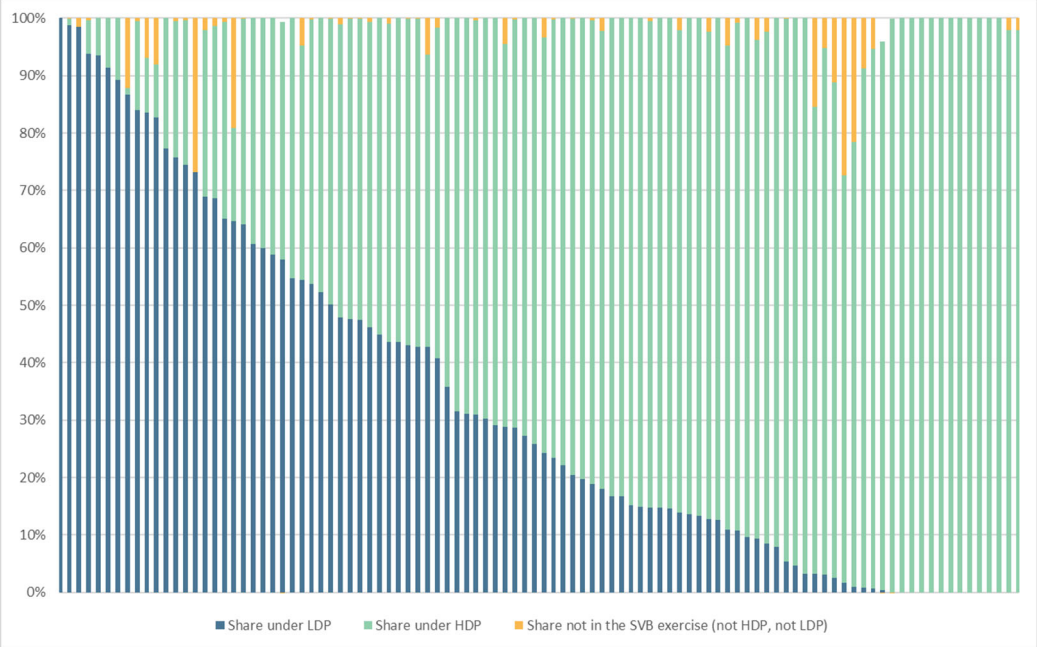
	Exposure Class	AIRB	FIRB	SLSC	Number of participating institutions
LDP	LCOR	47	51	0	80
	COSP	22	17	33	56
	CGCB	17	28	0	38
	INST	25	47	0	60
HDP	CORP	47	50	0	79
	SMEC	45	51	0	79
	SMOT	64	0	0	64
	RETO	74	0	0	74
	RSMS	57	0	0	57
	MORT	80	0	0	80
	RQRR	34	0	0	34
ALL	**ALL**	**93**	**63**	**33**	**101**

1.3.2 Portfolio composition and representativeness

This section provides an overview of aspects related to representativeness. In this context, the information illustrates the representativeness of the data as regards the IRB exposure in COREP as well as the representativeness in terms of jurisdiction where the bank is located.

The differences in terms of exposure amounts reported under the IRB approach in COREP and in the benchmarking exercise may be due to the fact that equity exposure under the IRB approach is exempted from this exercise or it may be due to data quality issues including diverging approaches in reporting the exposure under the PPU. In particular, the reporting of RGLA/PSE may partially or fully be shifted to the SA in accordance with Article 115(2) and (4) and 116 (4) CRR, if these exposures are assimilated to sovereign ones. Otherwise, if there are differences in risk between RGLA/PSE exposures and exposures to the respective central governments, the RGLA/PSE may remain under the IRB approach and should be reported consistently between COREP and benchmarking.

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



The following statistics provide information on the business models and nature of the IRB approach of the institutions in the sample. Given that RWA amount may deviate significantly in case of very different business models, the following table illustrates the share of exposure that institutions reported under the IRB approach for this exercise for LDPs and HDPs. In this regard, Figure 2 illustrates that roughly half of the total EAD and RWA can be attributed to LDP, although Table 2 and Figure 1 illustrate that this does not reflect the general share of LDP and HDP IRB exposure for individual institutions.

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

	Share of exposure		
	LDP	HDP	Other
Min	0%	0%	-4%
25th percentile	0%	13%	0%
50th percentile	17%	64%	0%
75th percentile	49%	86%	2%
Max	100%	104%	100%

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

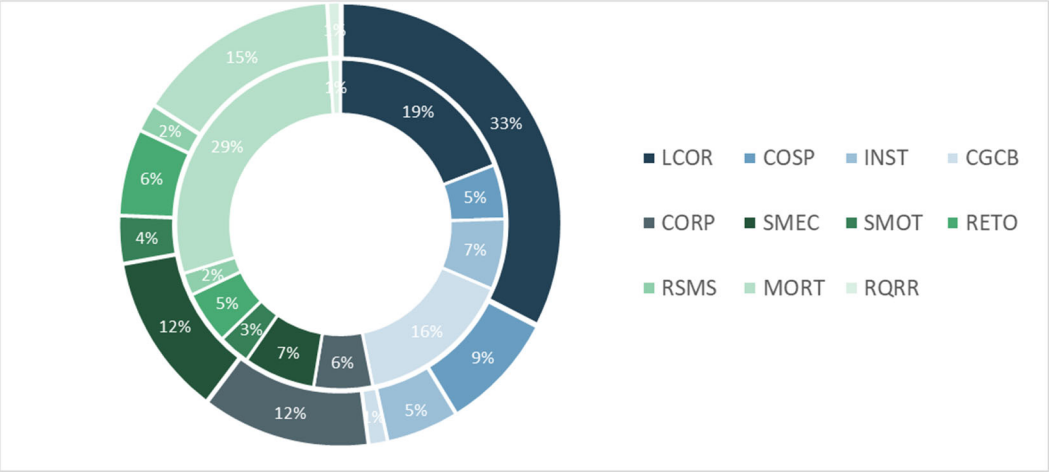


Figure 3: Portfolio composition of LDPs: proportion of large corporates, institutions and sovereigns in LDPs (sorted by proportion of specialised lending exposures in LDPs from smallest to largest)

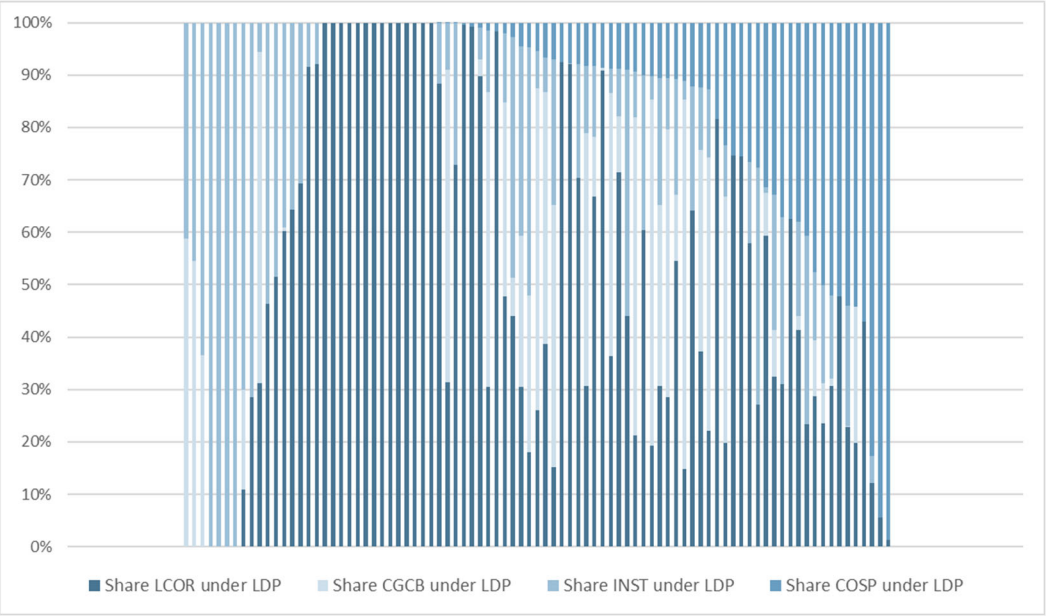
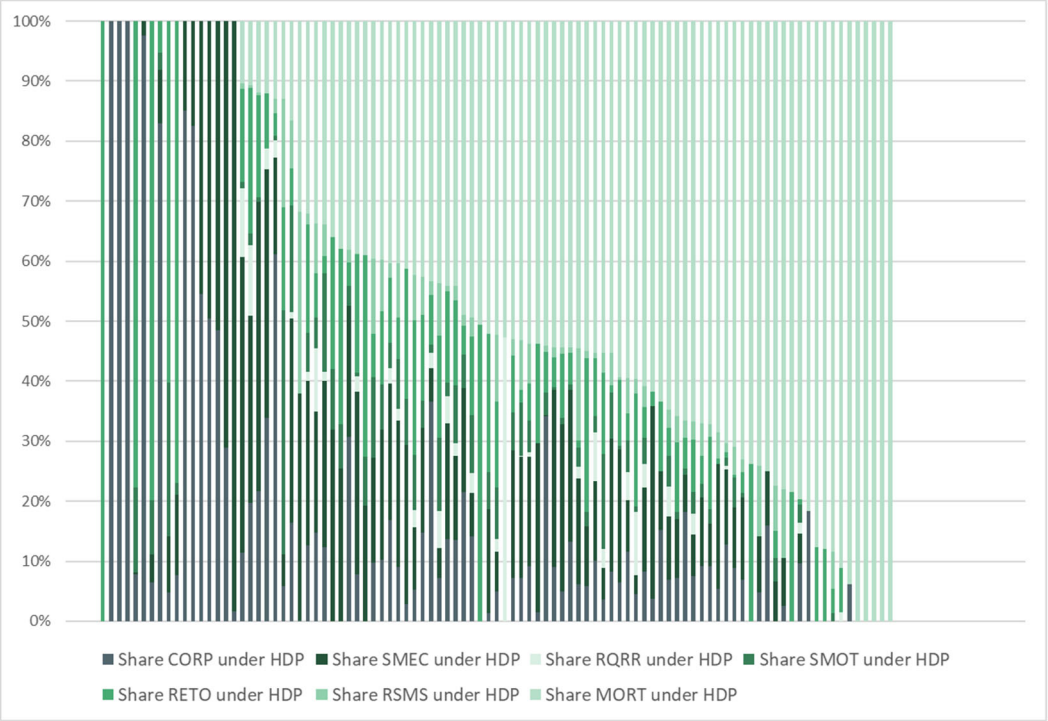


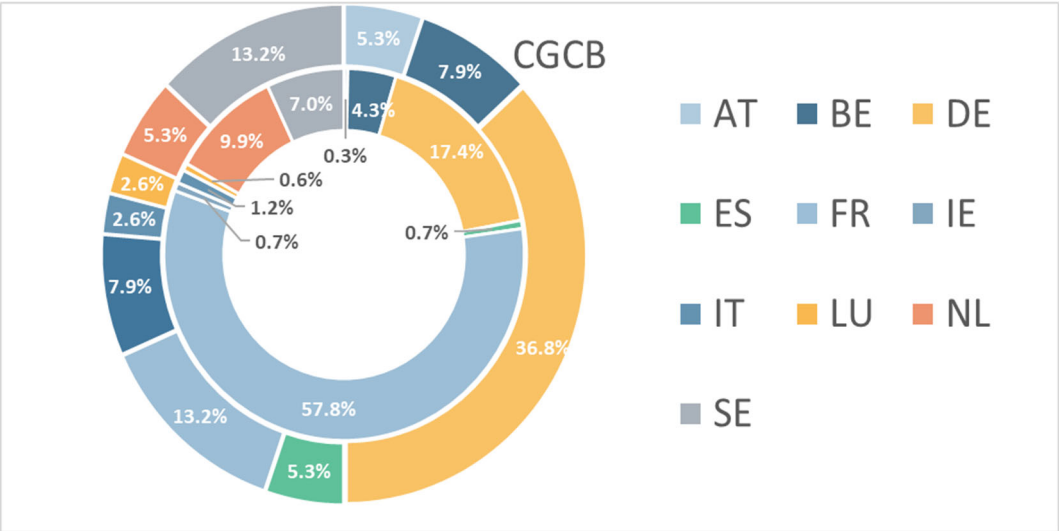
Figure 4: Portfolio composition of HDPs: proportion of residential mortgages, SME retail, SME corporate and corporate-other exposures in HDPs (sorted by proportion of mortgages in HDPs from smallest to largest)

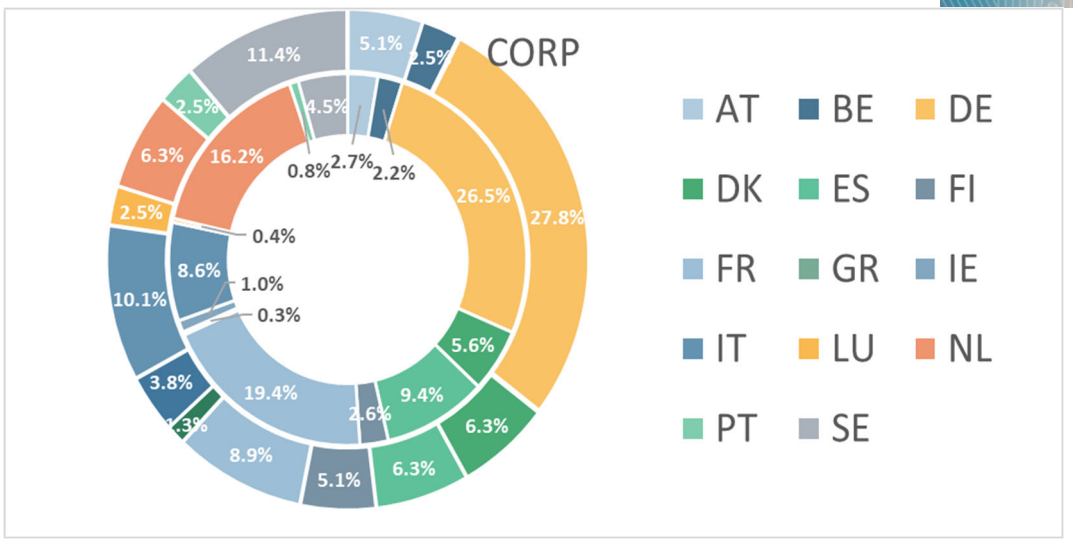


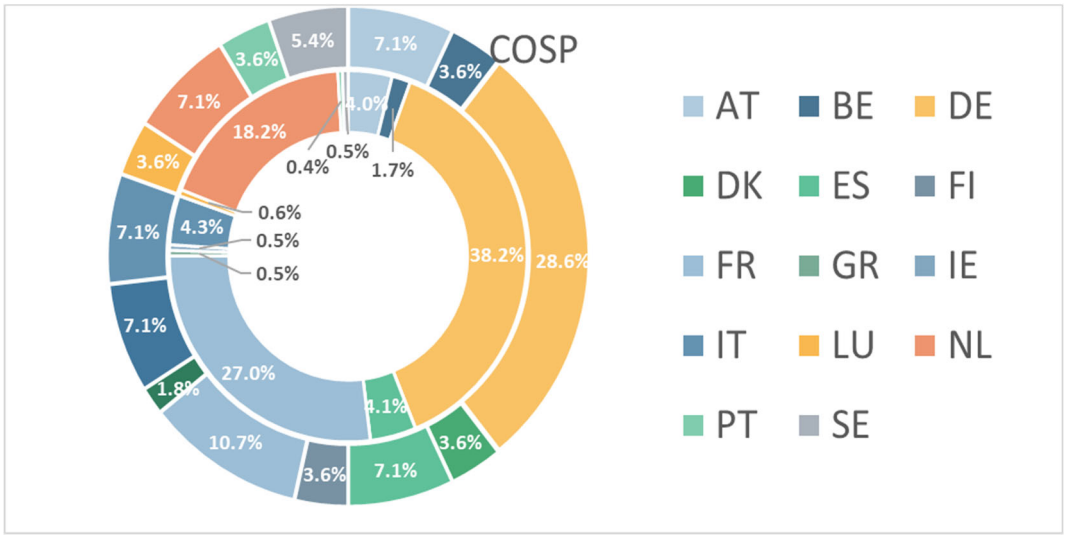
1.3.3 Coverage of countries by exposure class

The following charts show each country's exposure shares by asset class in terms of both number of banks and exposure.

Figure 5: Sample coverage by exposure class and country (outside # of banks, inside EAD)




CORP
5.1%
2.5%
11.4%
4.5%
2.5%
6.3%
16.2%
0.8%
2.7%
2.2%
26.5%
27.8%
2.5%
0.4%
8.6%
1.0%
10.1%
0.3%
5.6%
3.8%
19.4%
9.4%
2.6%
6.3%
8.9%
5.1%
6.3%
AT
BE
DE
DK
ES
FI
FR
GR
IE
IT
LU
NL
PT
SE


COSP
7.1%
3.6%
5.4%
3.6%
4.0%
7.1%
18.2%
0.4%
0.5%
1.7%
3.6%
0.6%
7.1%
4.3%
0.5%
38.2%
28.6%
0.5%
7.1%
27.0%
1.8%
4.1%
10.7%
3.6%
7.1%
3.6%
AT
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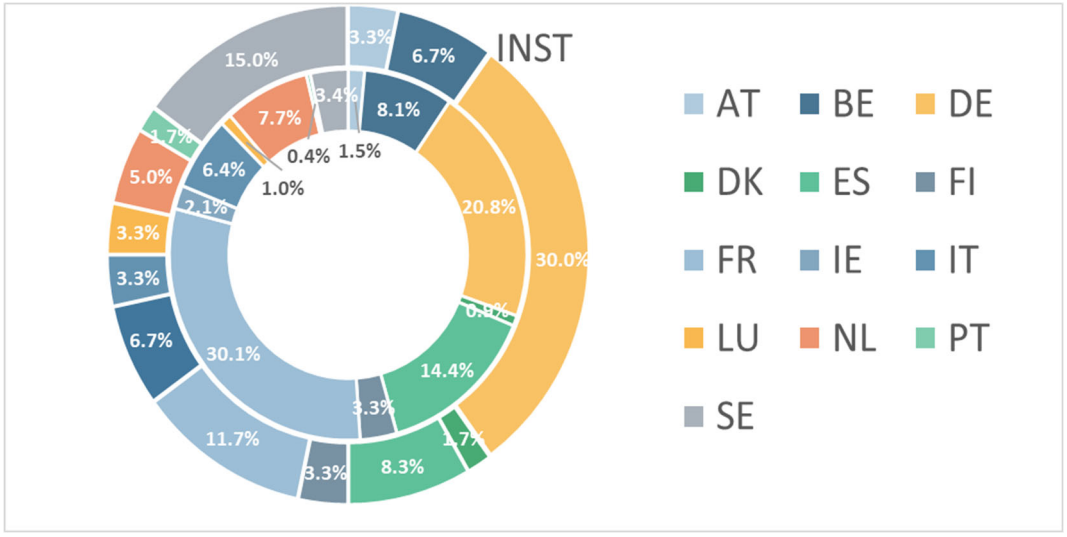
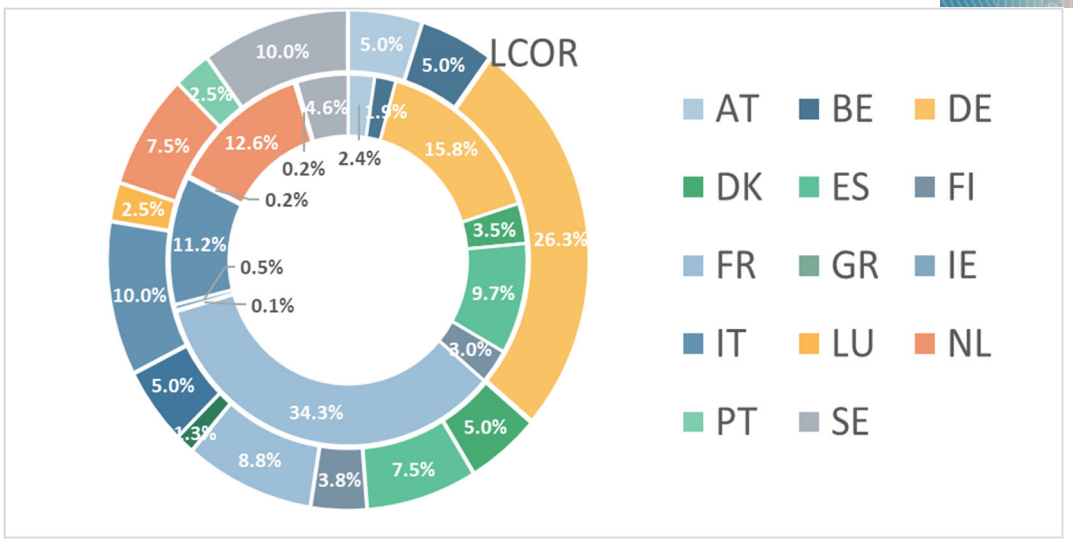
SE


INST
3.3%
6.7%
15.0%
3.4%
8.1%
7.7%
1.5%
0.4%
1.7%
5.0%
6.4%
1.0%
20.8%
30.0%
2.1%
3.3%
3.3%
14.4%
6.7%
30.1%
3.3%
11.7%
8.3%
3.3%
AT
BE
DE
DK
ES
FI
FR
IE
IT
LU
NL
PT
SE


LCOR
5.0%
5.0%
15.8%
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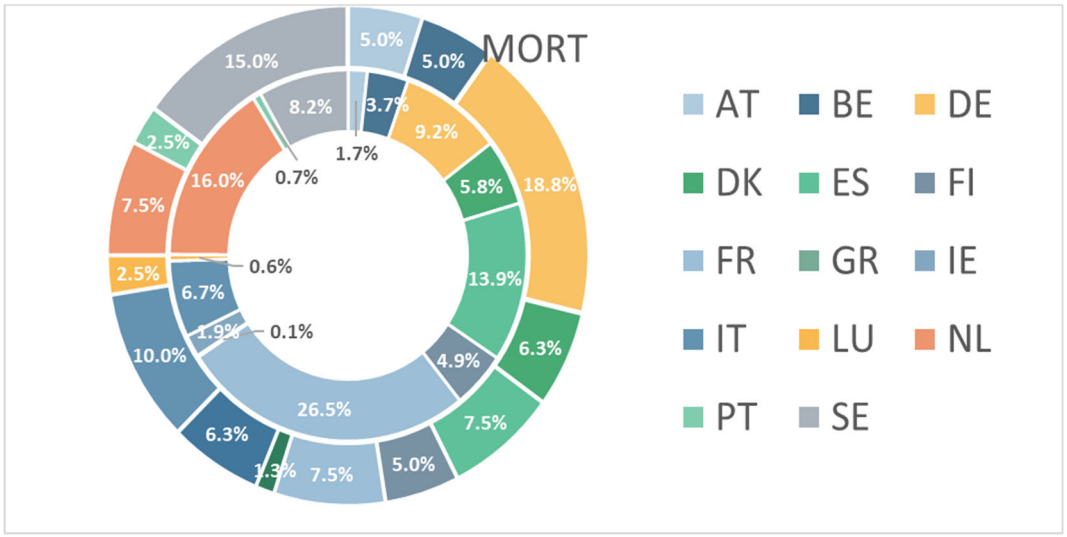
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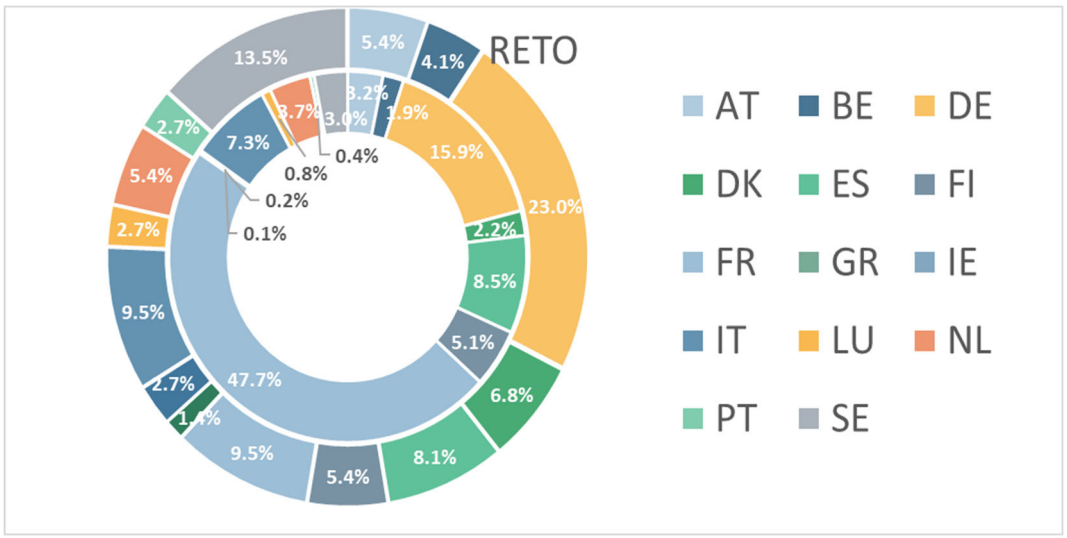
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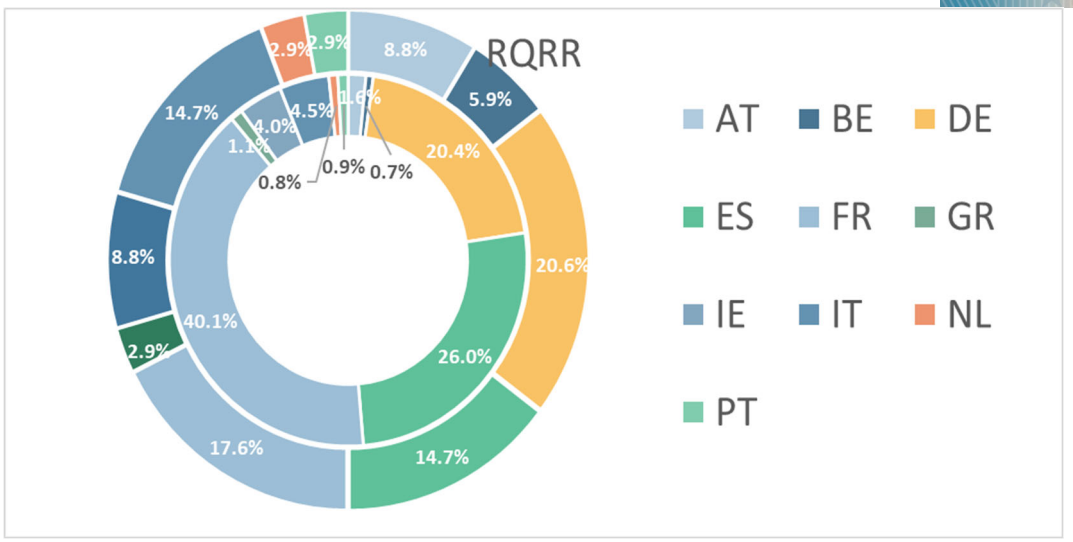
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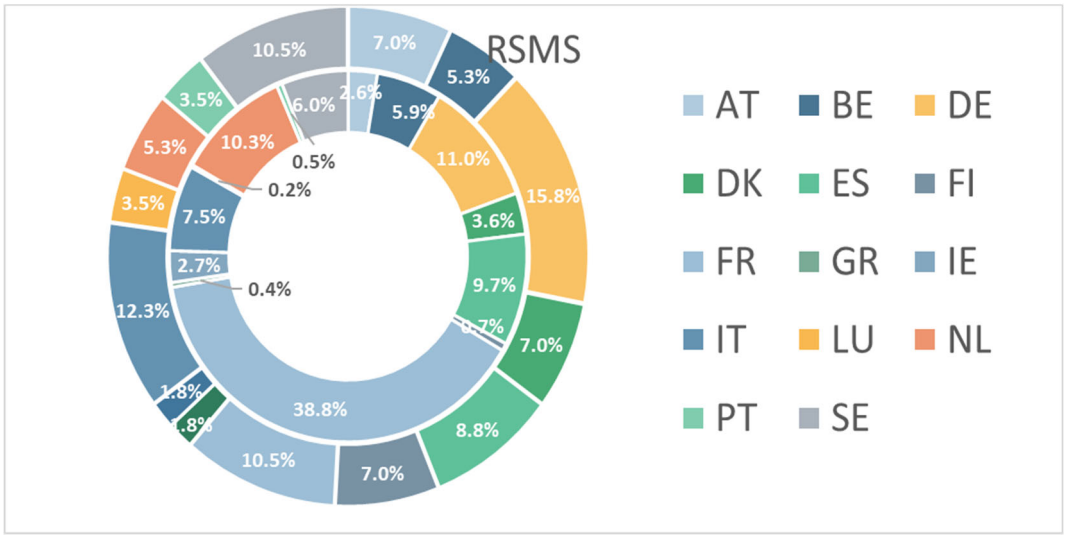
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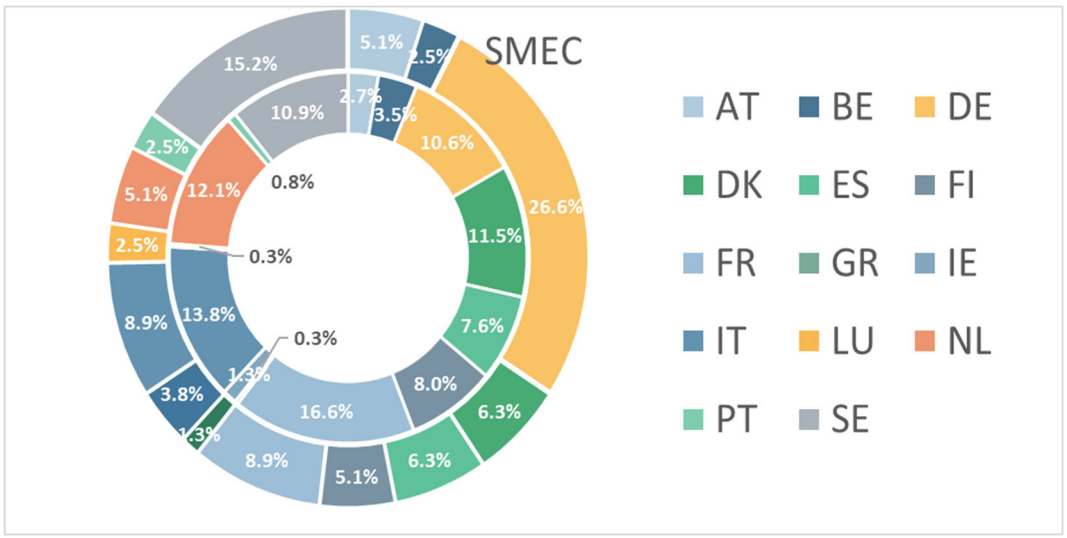
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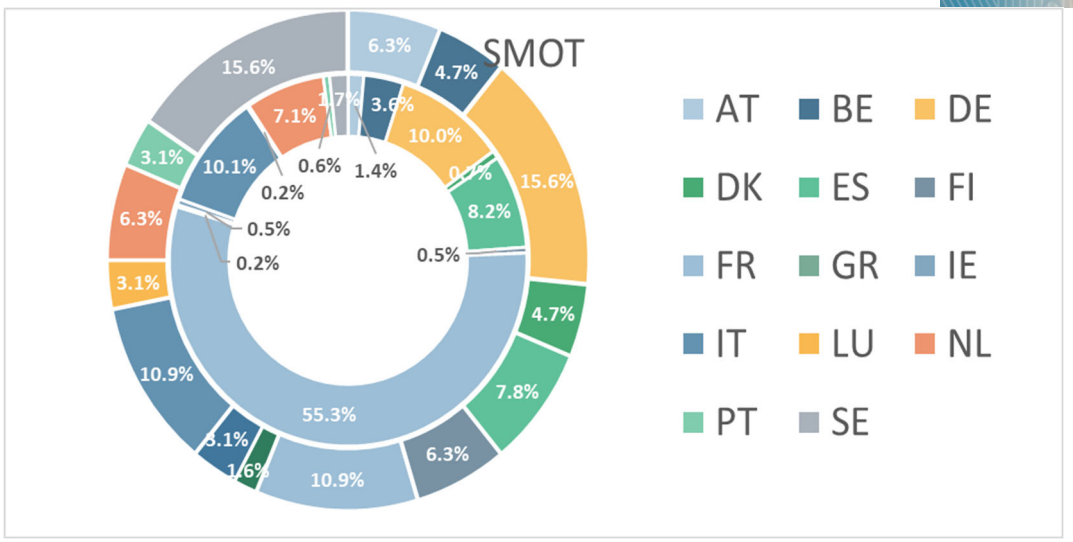
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1.3.4 Use of moratoria as of 31.12.2020 and as of 31.12.2021 in the sample

The following charts illustrate the use of moratoria as reported to the EBA for the institutions participating in the benchmarking exercise as of December 2020 and December 2021 respectively.

Figure 6:: Information on loans under moratoria by country – December 2020

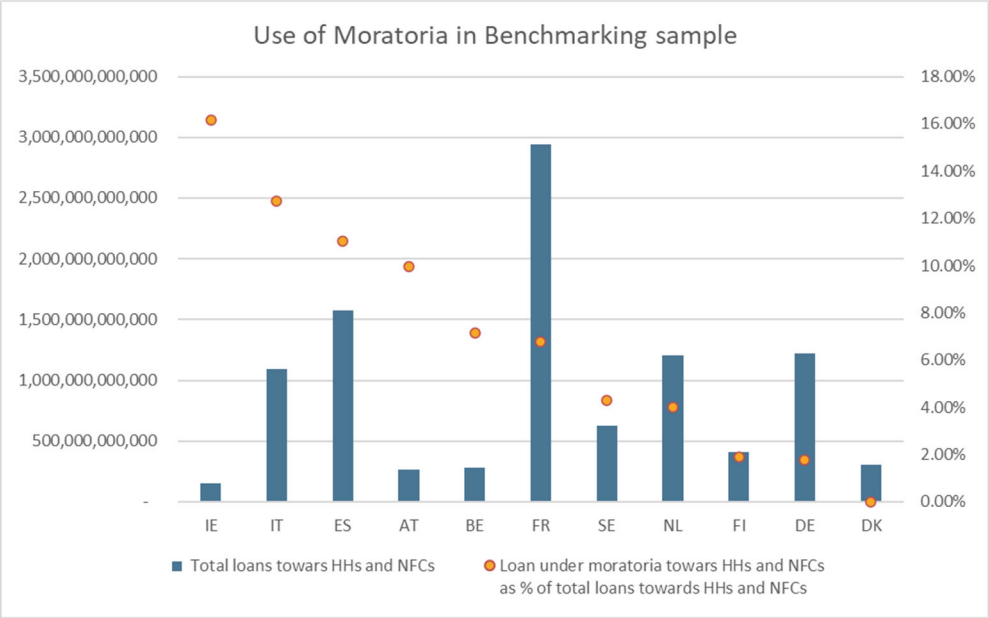
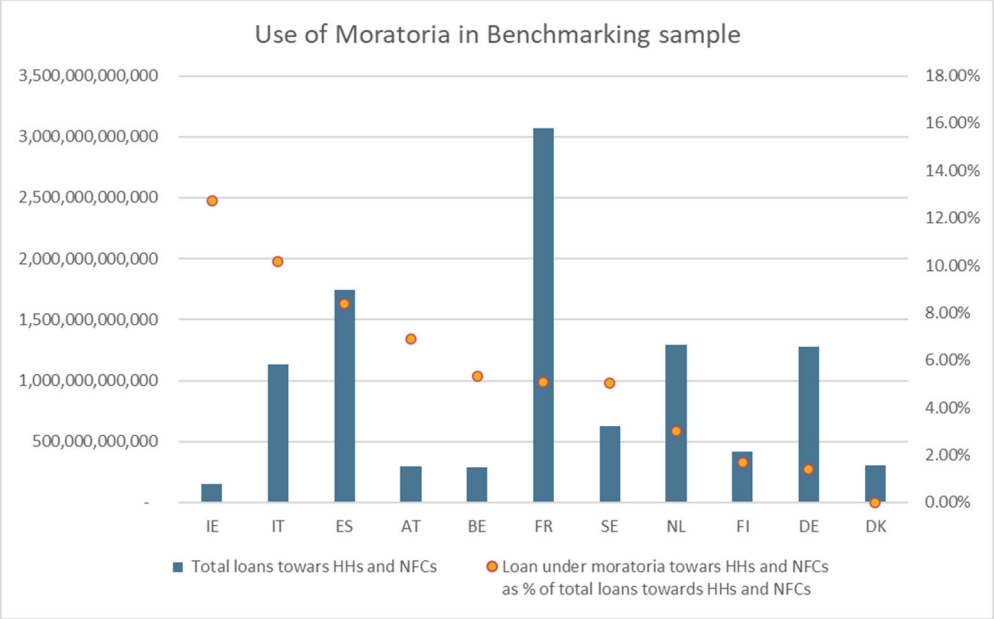


Figure 7: Information on loans under moratoria by country – December 2021



From the above graphs, it is possible to note the two following trends, in line with the economic expectations:

- the total loans are around 1bln more than last year (around +10%);
- the percentage of loans under moratoria is lowering from a non-weighted average of 6.9% to an average of 5.2%.

1.3.5 Use of COVID-19 PGS as of 31.12.2020 and as of 31.12.2021 in the sample

The following charts illustrate the use of PGS for the institutions participating in the benchmarking exercise as of December 2020 and December 2021 respectively.

Figure 8: The use of COVID-19 PGS in the Benchmarking sample – December 2020

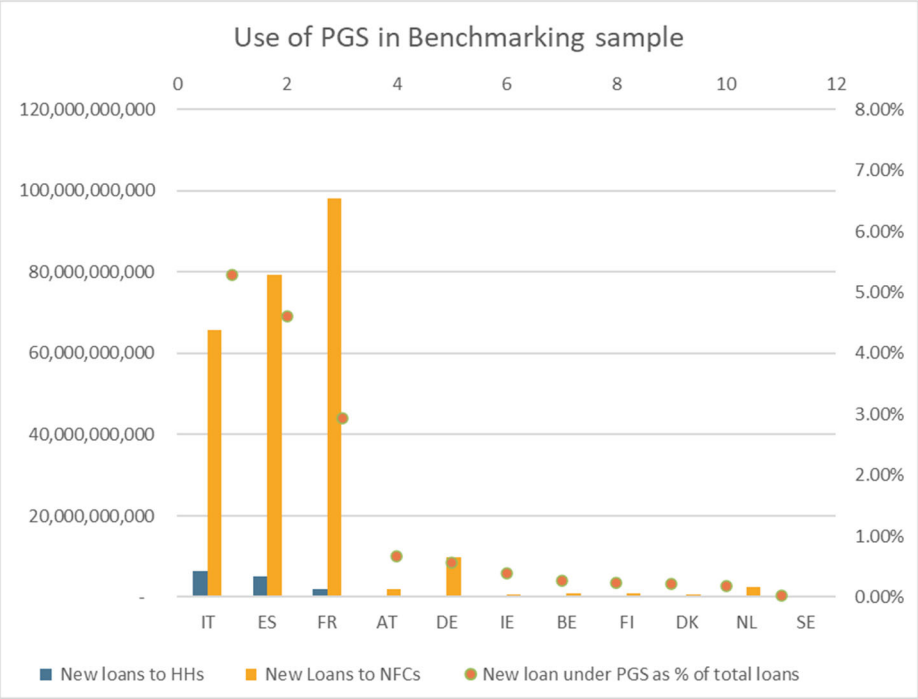
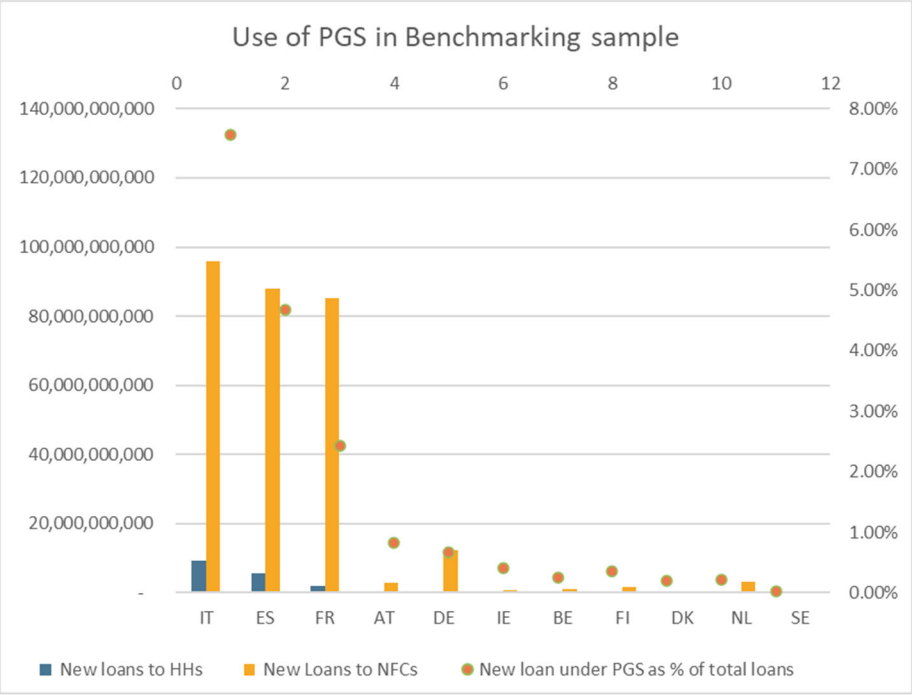


Figure 9: The use of COVID-19 PGS in the Benchmarking sample – December 2021



For the sake of completeness, it should be noted that the above analysis was done for the banks participating in the SVB benchmarking exercise, but without controlling for the share of IRB exposure that is subject to the guarantees (i.e. the corresponding loans and PGS could be applied to a SA portfolio of an IRB bank considered).

2. Quantitative analysis

2.1 Descriptive statistics of the key risk parameters

2.1.1 IRB Key risk metrics (all)

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

		LCOR		COSP			INST		CGCB		CORP		SMEC		SMOT	RETO	RSMS	MORT	QRRE
		AIRB	FIRB	AIRB	FIRB	SLSC	AIRB	FIRB	AIRB	FIRB	AIRB	FIRB	AIRB	FIRB	AIRB	AIRB	AIRB	AIRB	AIRB
Number of institutions		47	51	21	17	32	25	47	17	28	47	50	45	51	64	74	57	80	34
GC (%)	Q1	36%	43%	28%	44%	78%	18%	22%	1%	1%	40%	52%	34%	50%	32%	26%	15%	10%	12%
	Median	48%	61%	38%	58%	88%	22%	24%	6%	6%	59%	76%	47%	71%	44%	35%	26%	14%	28%
	Q3	64%	76%	42%	74%	99%	25%	31%	12%	11%	77%	98%	64%	84%	57%	53%	38%	19%	42%
	Q3-Q1	**28%**	**33%**	**14%**	**30%**	**22%**	**7%**	**9%**	**11%**	**10%**	**38%**	**46%**	**30%**	**35%**	**25%**	**27%**	**22%**	**9%**	**30%**
RW (%)	Q1	35%	41%	27%	41%	71%	18%	21%	1%	1%	36%	48%	30%	45%	23%	21%	13%	9%	8%
	Median	45%	59%	36%	54%	79%	21%	24%	6%	6%	55%	71%	40%	60%	31%	28%	21%	12%	19%
	Q3	60%	71%	40%	70%	86%	23%	30%	12%	11%	70%	88%	51%	71%	42%	42%	28%	16%	28%
	Q3-Q1	**25%**	**30%**	**13%**	**29%**	**15%**	**5%**	**9%**	**11%**	**10%**	**34%**	**39%**	**21%**	**26%**	**19%**	**21%**	**16%**	**8%**	**19%**
PD (%)	Q1	0.44%	0.31%	0.73%	0.43%	0.00%	0.14%	0.07%	0.03%	0.00%	0.95%	0.59%	1.40%	0.89%	1.67%	1.00%	1.18%	0.45%	0.59%
	Median	0.71%	0.56%	1.42%	0.61%	0.00%	0.19%	0.12%	0.05%	0.01%	1.52%	1.12%	2.15%	1.83%	2.61%	1.48%	1.95%	0.73%	1.38%
	Q3	1.13%	0.95%	2.09%	0.94%	0.45%	0.34%	0.23%	0.07%	0.04%	2.52%	1.74%	2.67%	2.80%	3.32%	2.19%	3.12%	1.12%	2.24%
	Q3-Q1	**0.69%**	**0.64%**	**1.36%**	**0.51%**	**0.45%**	**0.20%**	**0.16%**	**0.04%**	**0.04%**	**1.57%**	**1.15%**	**1.27%**	**1.91%**	**1.65%**	**1.19%**	**1.94%**	**0.67%**	**1.65%**
LGD (%)	Q1	27%	43%	14%	40%	0%	25%	27%	9%	45%	22%	39%	20%	38%	28%	29%	14%	11%	43%
	Median	34%	45%	19%	43%	0%	30%	37%	22%	45%	28%	43%	24%	41%	39%	39%	17%	17%	56%
	Q3	40%	45%	24%	44%	27%	41%	45%	39%	45%	36%	44%	34%	43%	50%	47%	21%	22%	68%
	Q3-Q1	**12%**	**2%**	**10%**	**4%**	**27%**	**15%**	**18%**	**30%**	**0%**	**14%**	**5%**	**14%**	**5%**	**22%**	**18%**	**7%**	**11%**	**25%**

2.1.2 IRB Key risk metrics and temporal evolution (non-defaulted only)

Figure 10-Figure 17 give insights into the evolution of risk parameters for each exposure class and regulatory approach for a limited subsample of institution, that reported in each exercise. The charts focus on the non-defaulted portfolios only. For the following analyses, the time series takes into account the last 3 reference dates and the sample is defined by identifying those banks that submitted data for multiple exercises for all 3 years of analysis. The final sample is composed of 86 institutions.

Methodology and assumptions

A diminishing average PD for a given exposure class is not necessarily reflected in a diminishing average RW, even though the average maturity and 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 PDs (PD = 1), but relatively low RWs), a different set of explanations should be given for the non-defaulted portfolios:

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

In addition, some portfolios are not defined with the same scope:

- In the 2019 exercise specialised lending exposures were only separately reported in the large corporate exposure class, while they were included in the corporates and corporates SME portfolios in previous exercise.
- On retail exposures, the 2020 exercise introduced 3 new exposure classes. In particular, the exposure class ‘mortgages’ is now split into two exposure classes, depending on whether the obligor is an SME or not.

It is worth noting that generally 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 10: Change in EAD by regulatory approach (million EUR), non-defaulted exposures

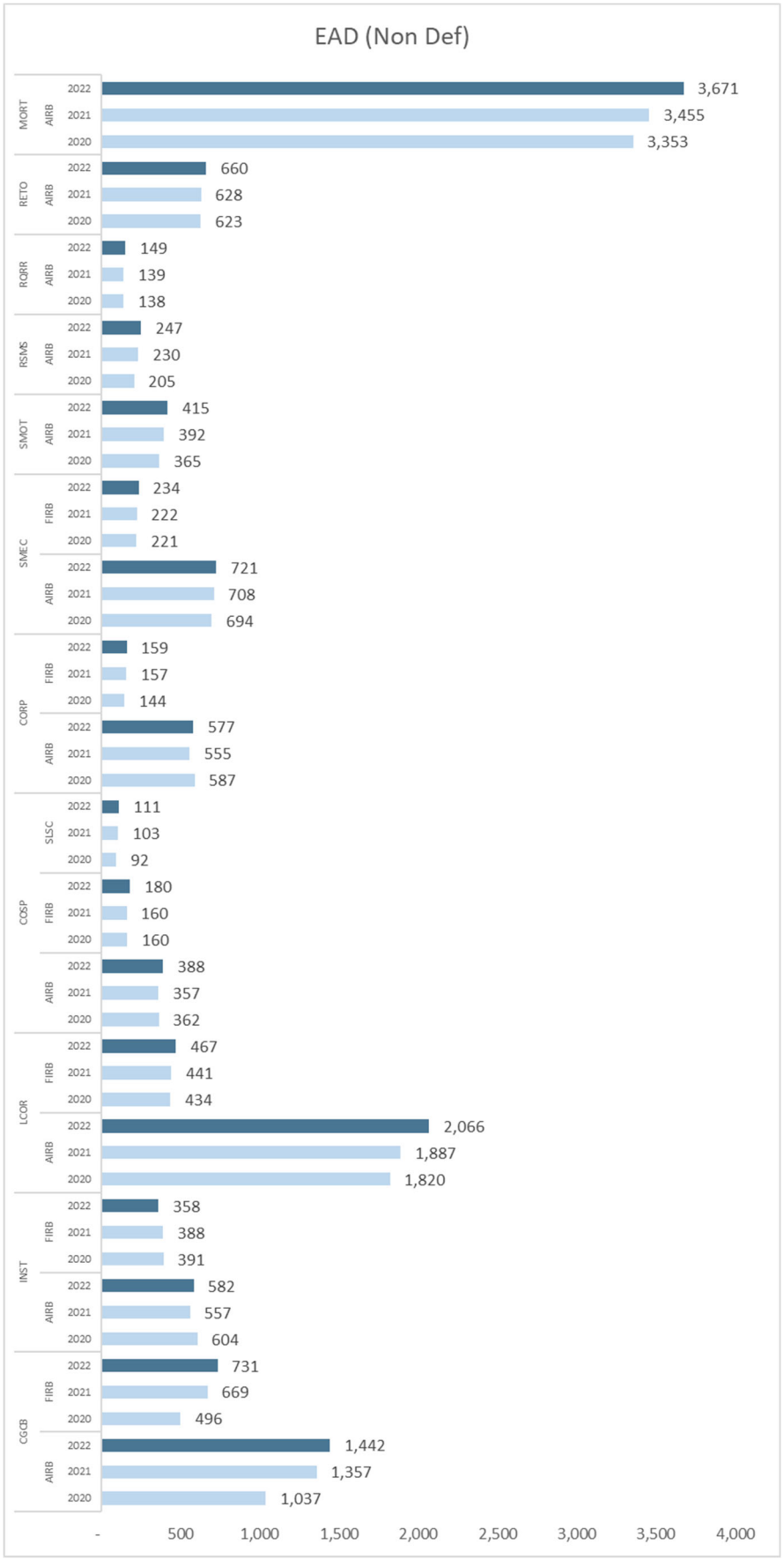


Figure 11: Change in EAD-weighted RW by regulatory approach, non-defaulted exposures - HDP

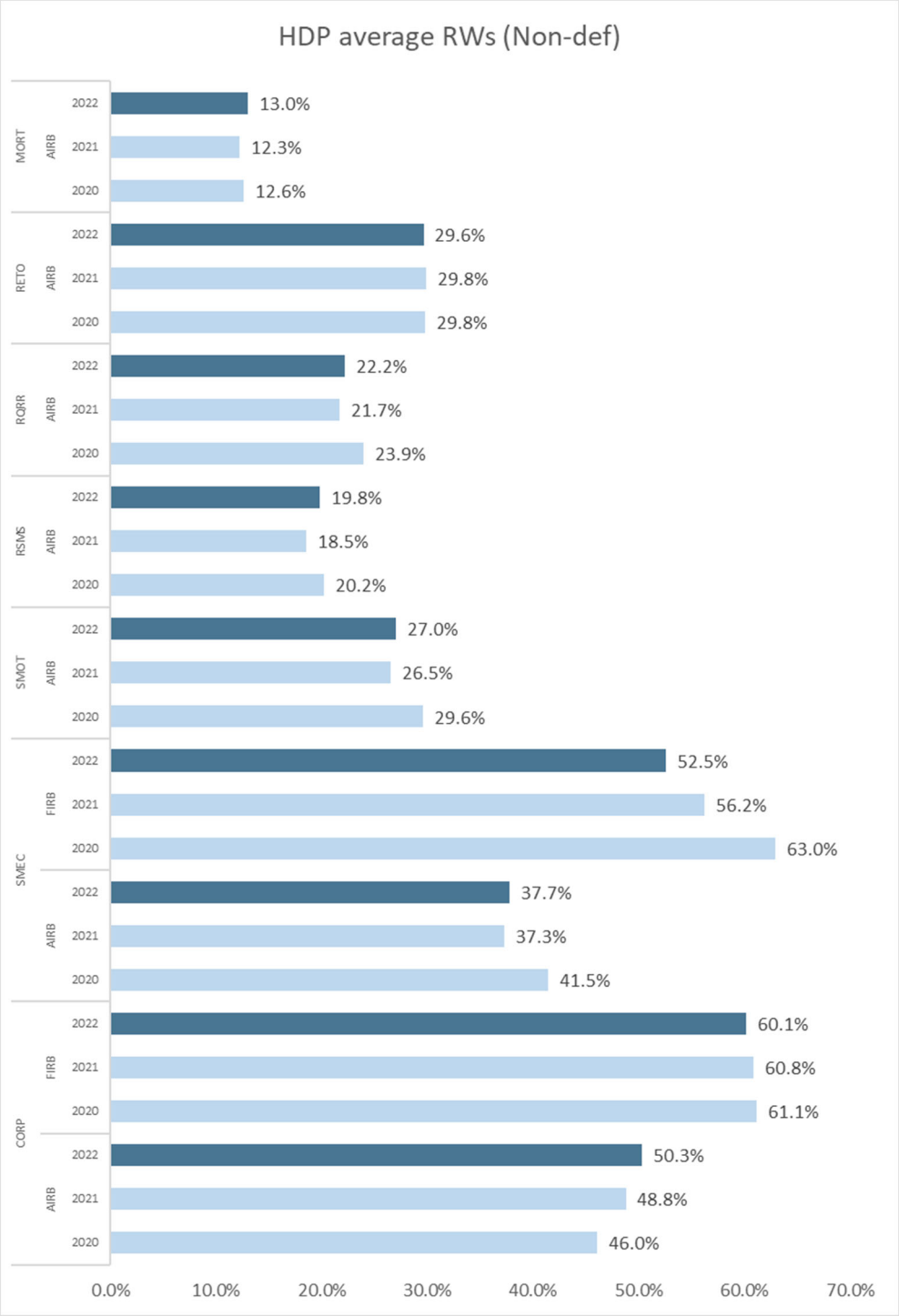


Figure 12: Change in EAD-weighted RW by regulatory approach, non-defaulted exposures - LDP

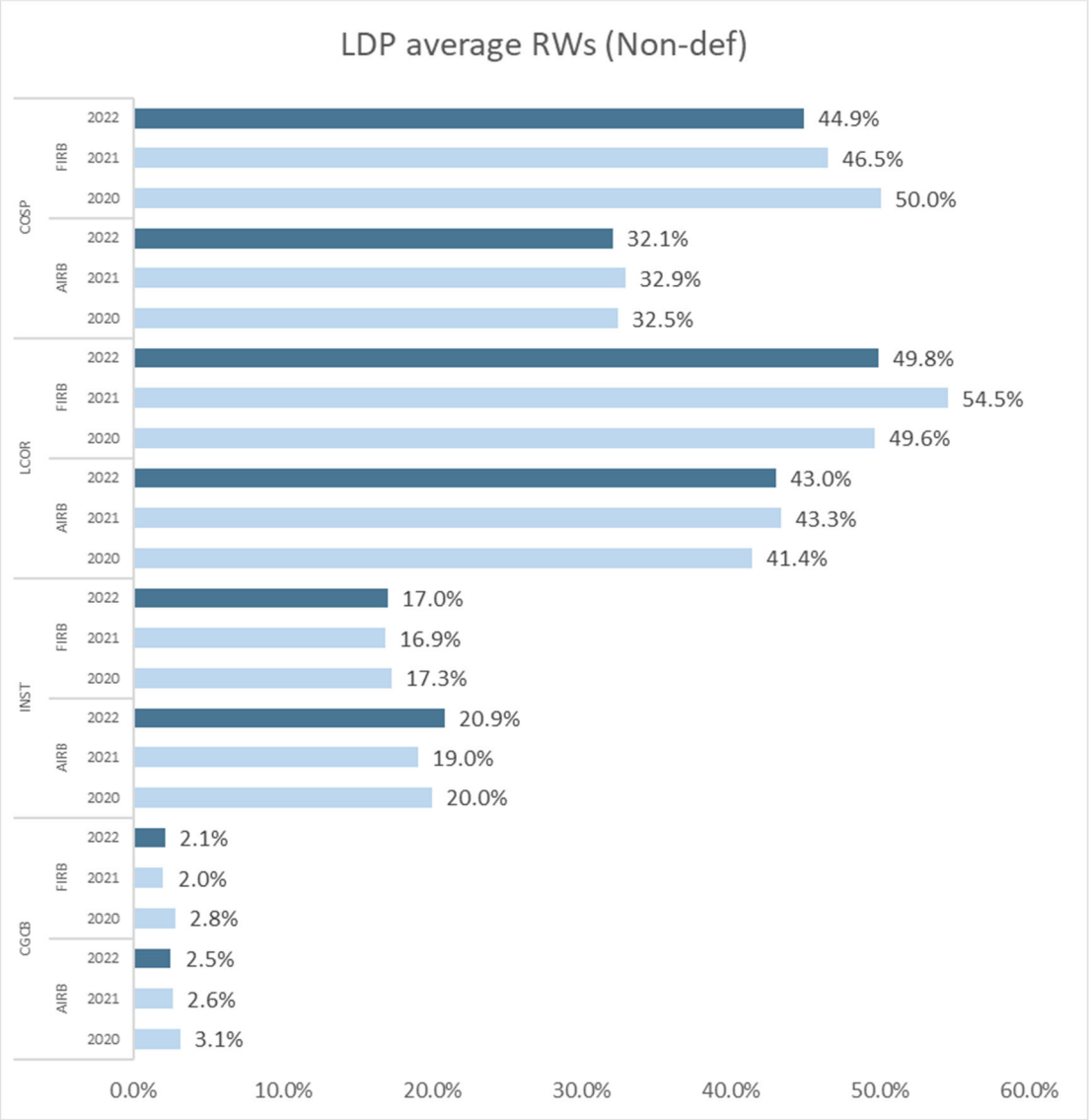


Figure 13: Change in EAD-weighted PD by regulatory approach, non-defaulted exposures - HDP

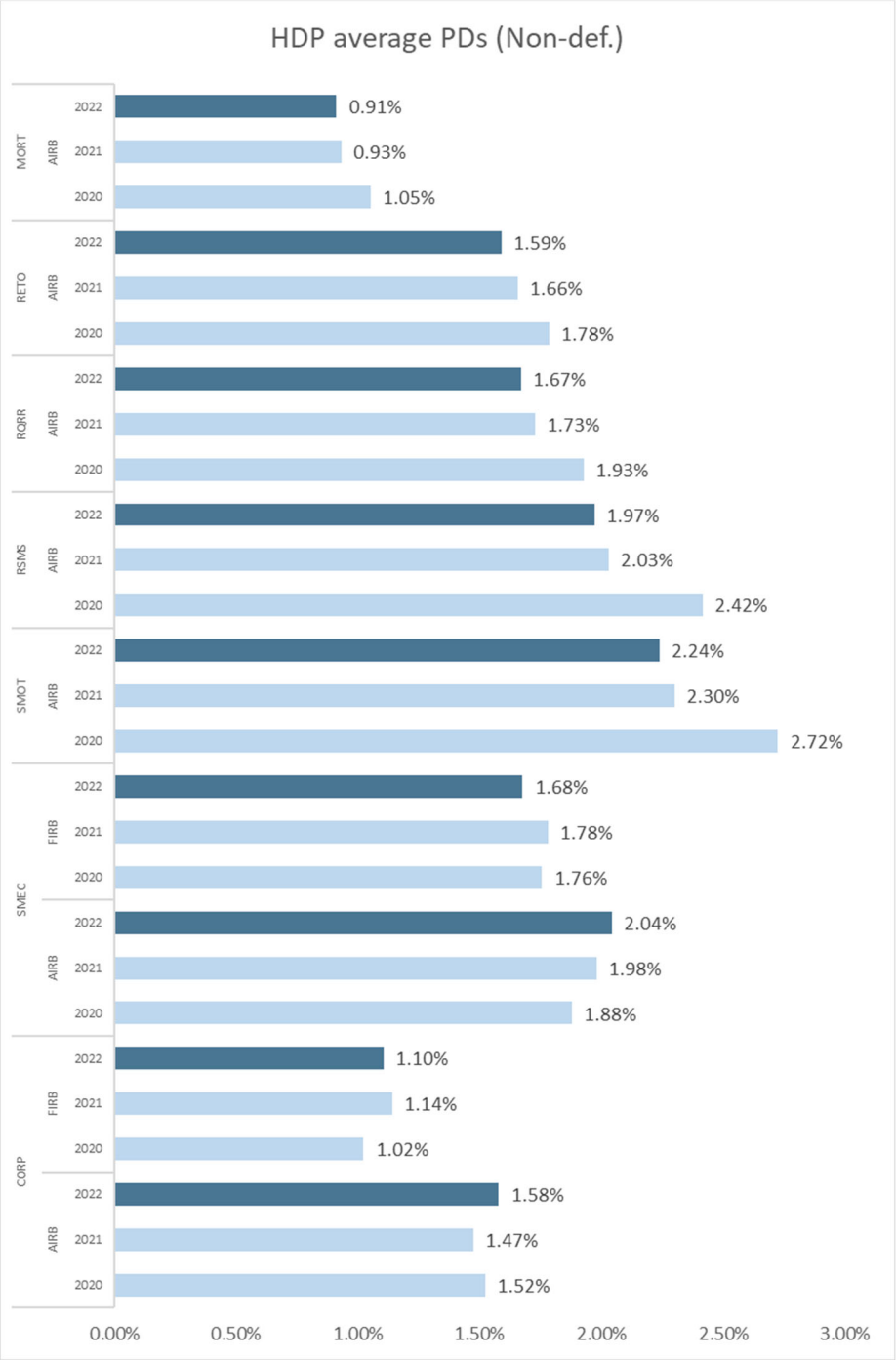


Figure 14: Change in EAD-weighted PD by regulatory approach, non-defaulted exposures - LDP

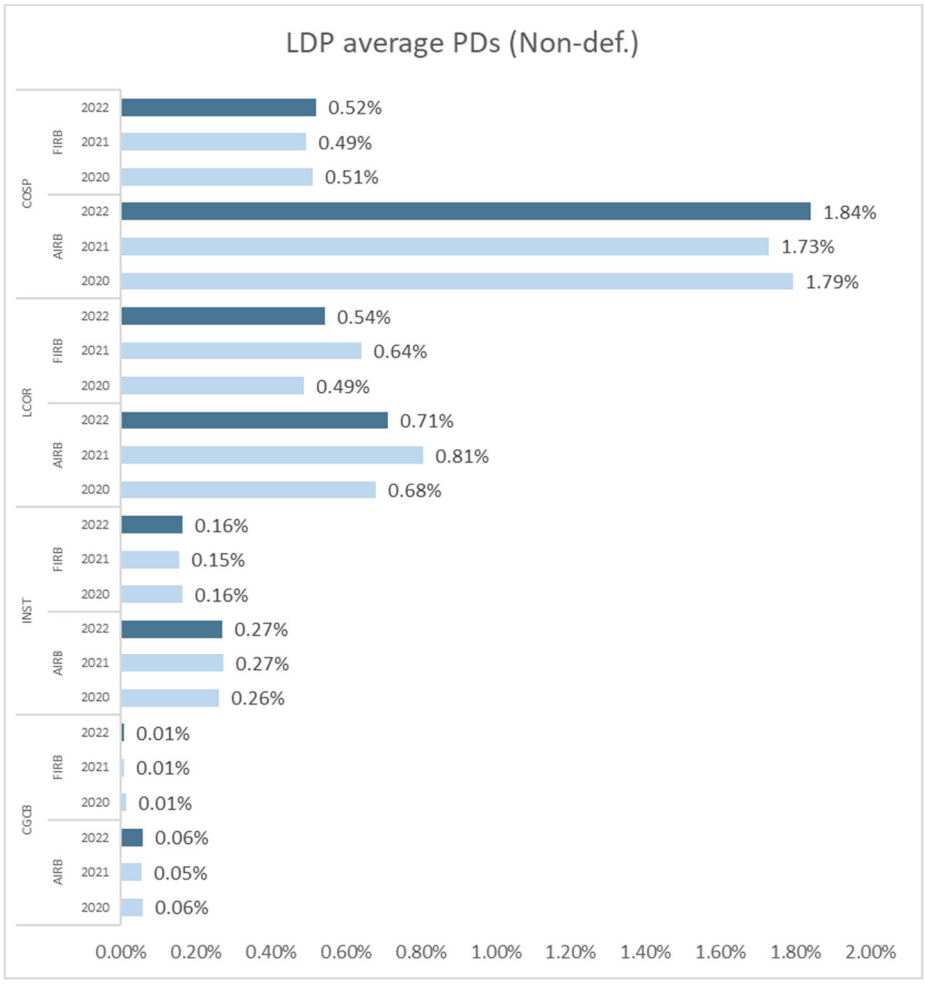


Figure 15: Change in EAD-weighted LGD by regulatory approach, non-defaulted exposures - HDP

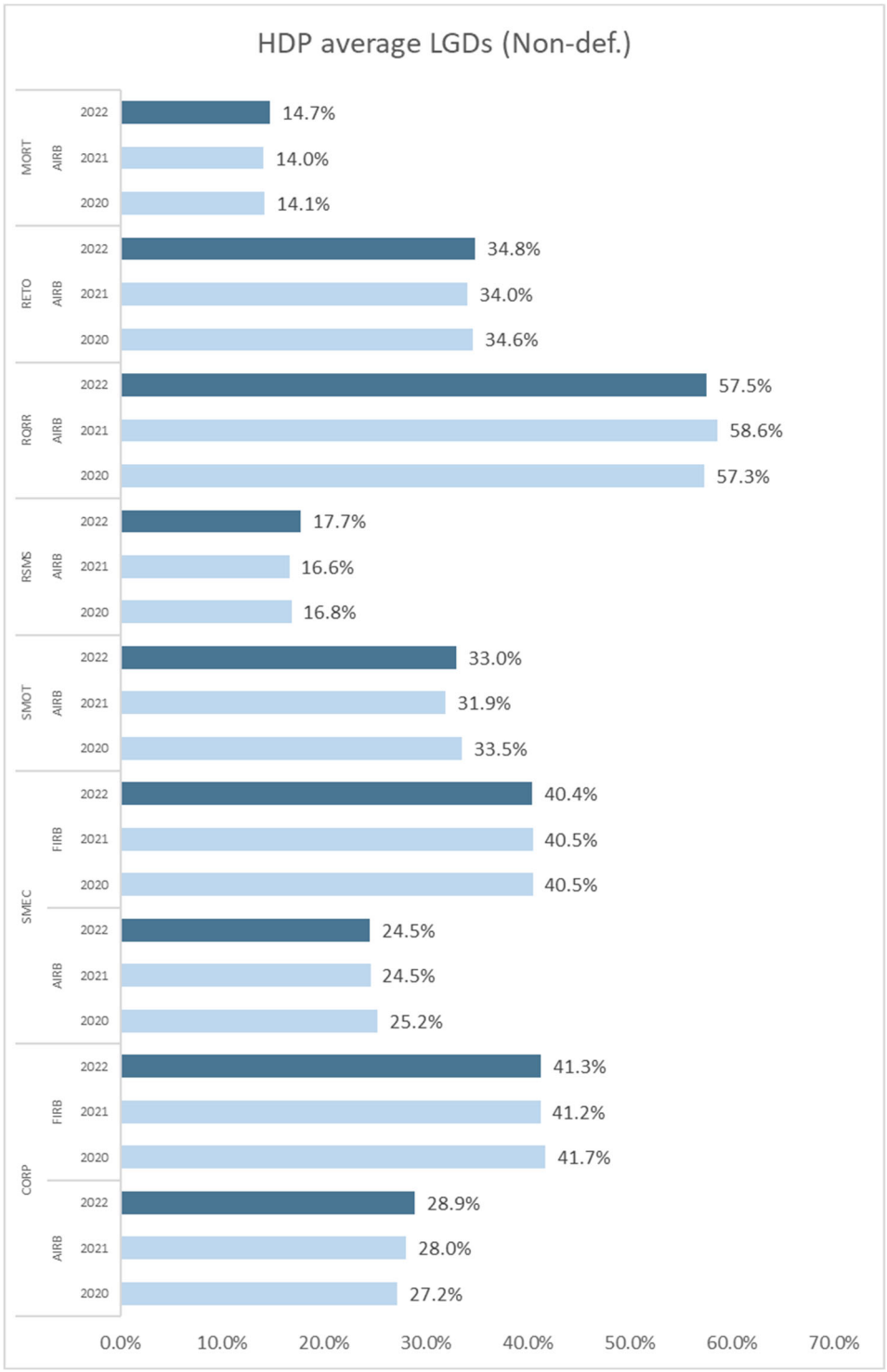
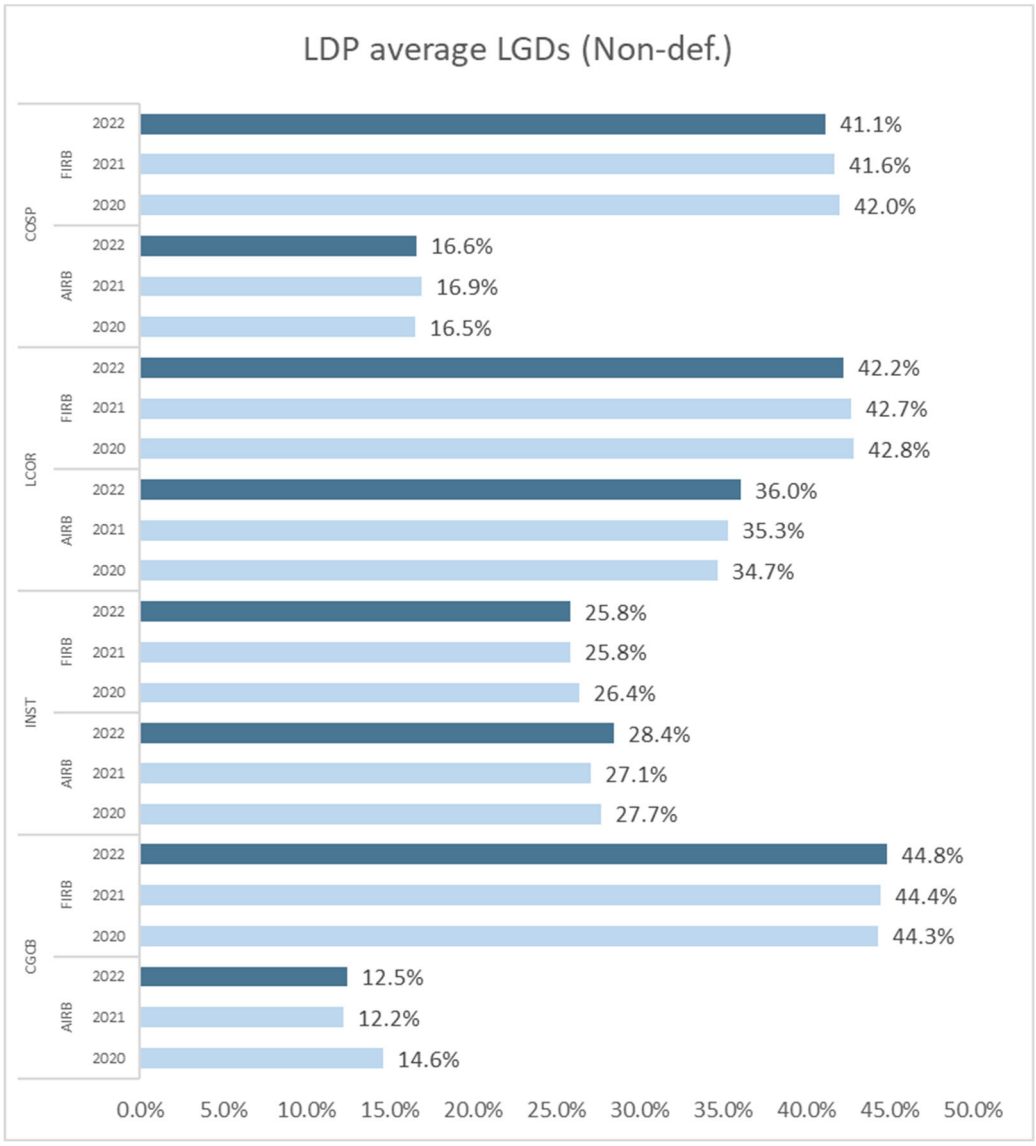


Figure 16: Change in EAD-weighted LGD by regulatory approach, non-defaulted exposures - LDP



2.1.3 IRB Key risk metrics and temporal evolution (RW and LGD; defaulted only)

Figure 17-Figure 21 give insights into the evolution of risk parameters (except for the PD, which is clearly equal to 1 for defaulted exposures) for each exposure class and regulatory approach for defaulted portfolios only. This focus allows a better understanding of the trend of risk estimates. For the following analyses, the time series takes into account the last 3 reference dates and the sample is defined by identifying those banks that submitted data for all 3 years of analysis. The final sample is composed of 86 institutions. It is important to outline that in the following charts, although the RWA for FIRB exposures is reported for the sake of completeness, it is equal to 0 according to articles 153 (1) of the CRR (in residual cases where this metric is different from 0, it is due to data quality issues).

Figure 17: Change in EAD by regulatory approach (million EUR), defaulted exposures

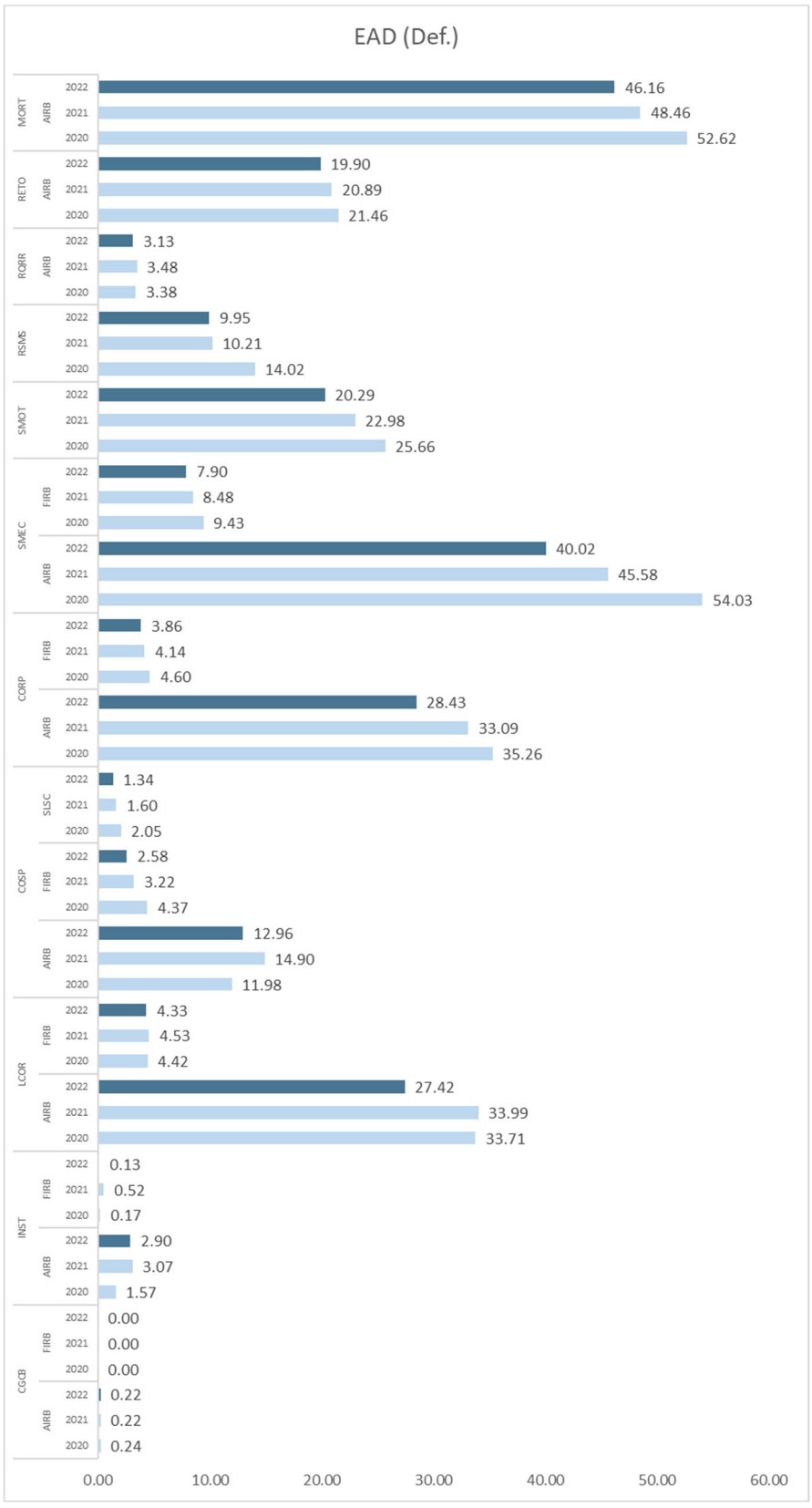


Figure 18: Change in EAD-weighted RW by regulatory approach, defaulted exposures, HDP

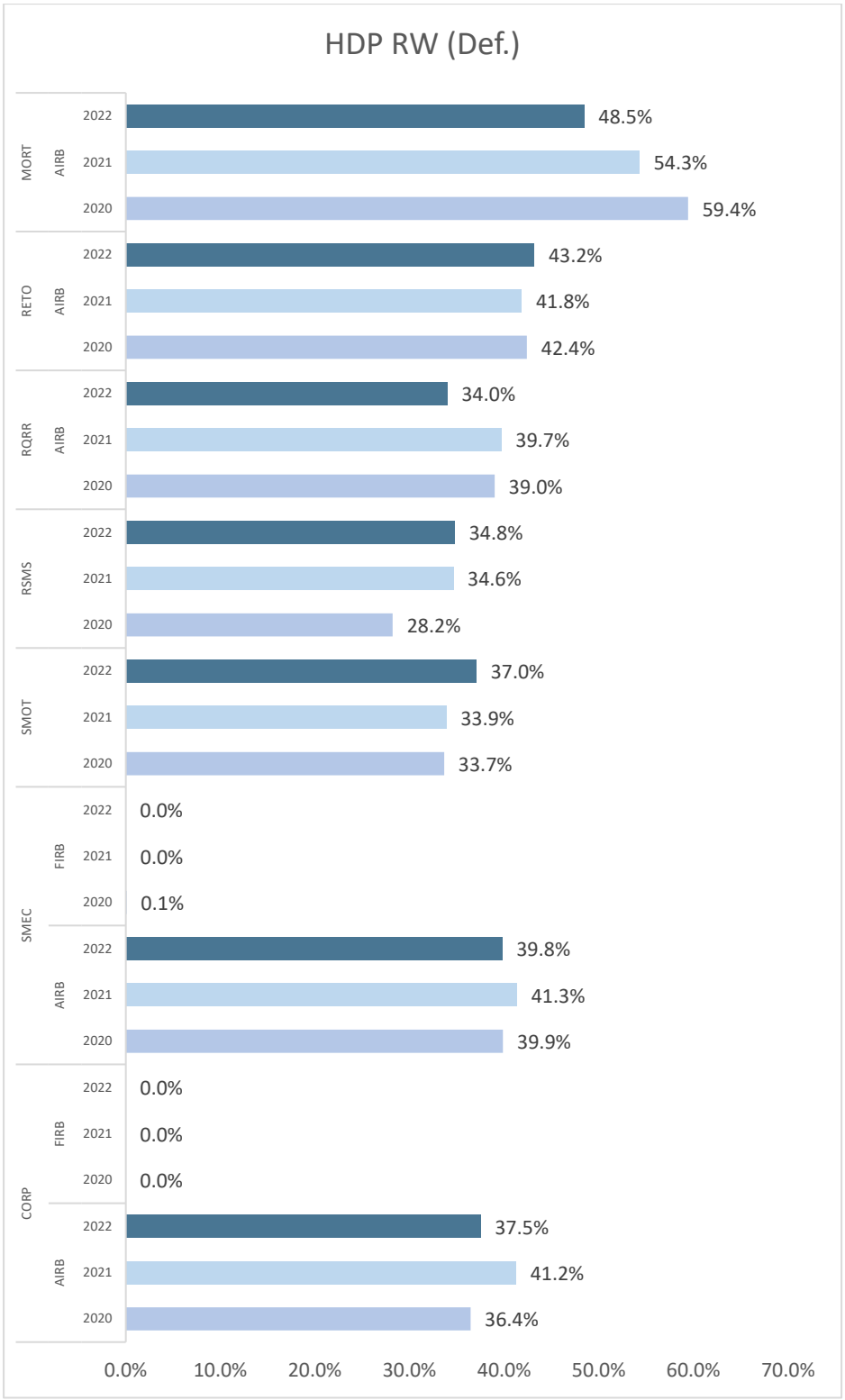


Figure 19: Change in EAD-weighted RWA by regulatory approach, defaulted exposures, LDP

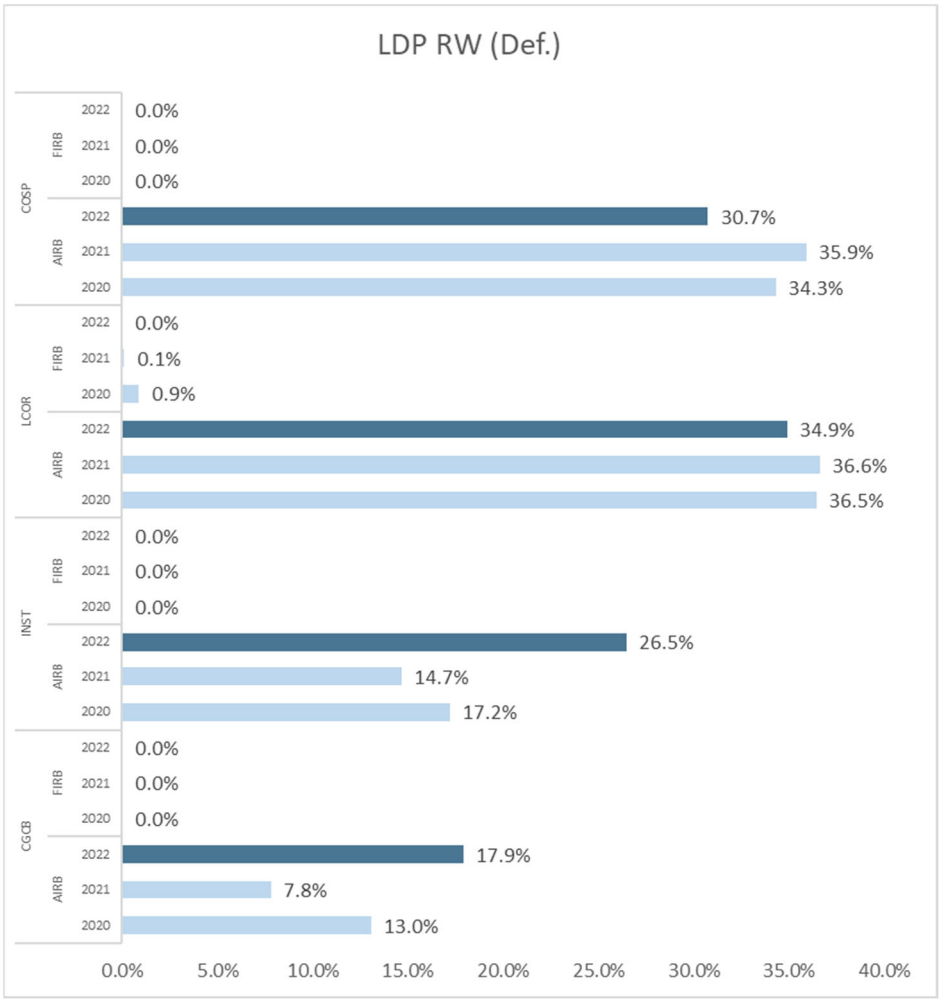


Figure 20: Change in EAD-weighted LGD by regulatory approach, defaulted exposures, HDP

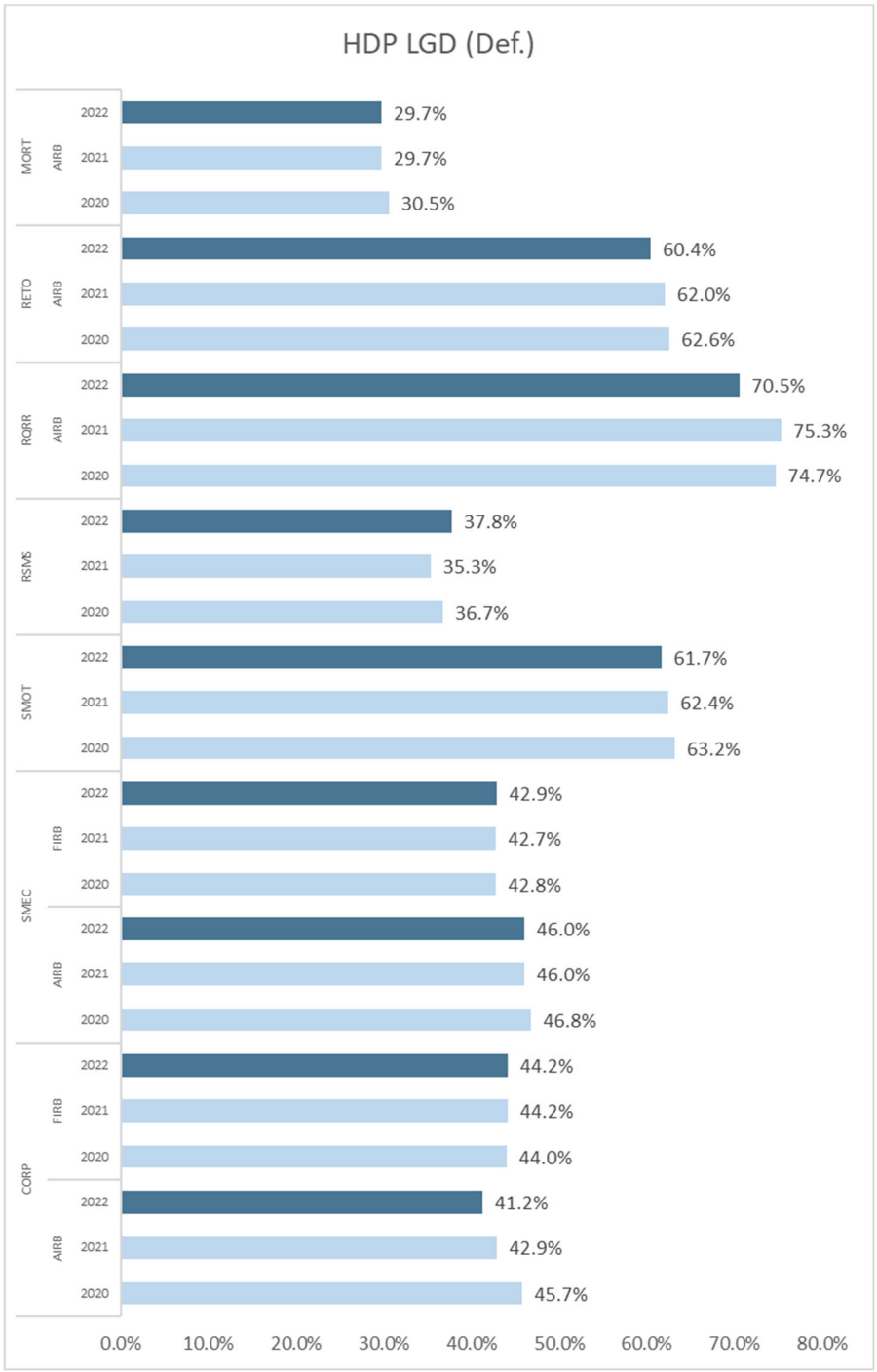
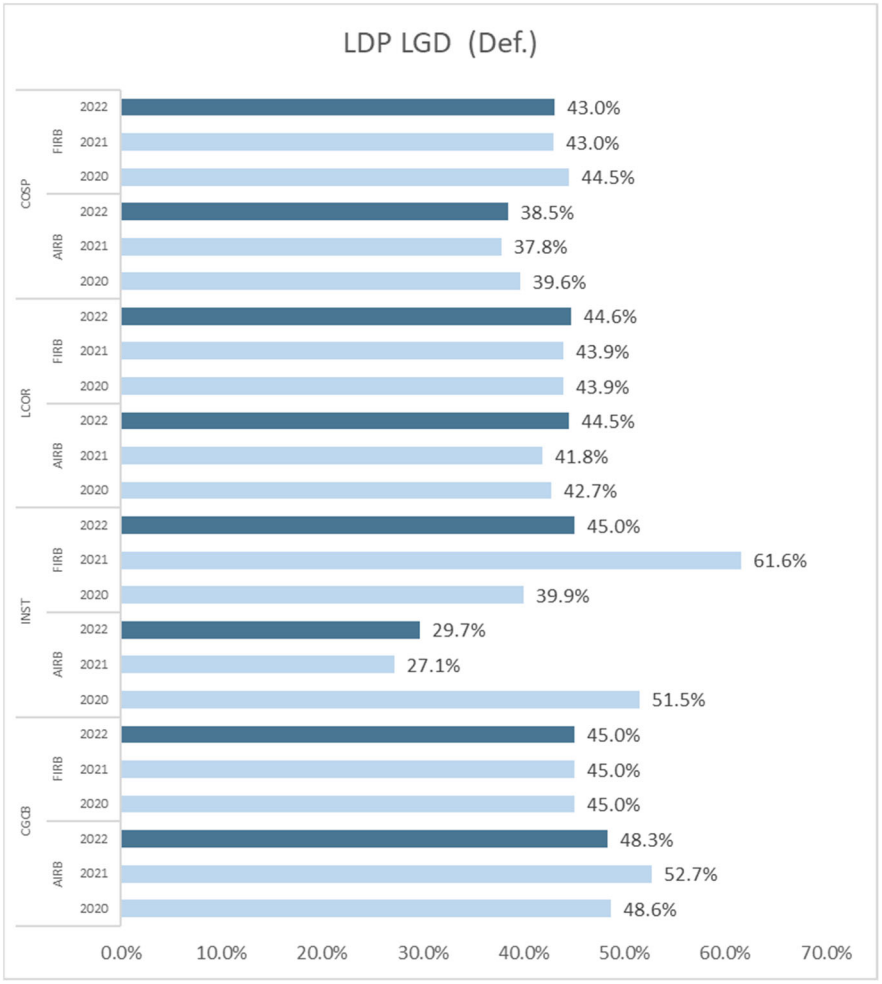


Figure 21: Change in EAD-weighted LGD by regulatory approach, defaulted exposures, LDP



2.2 Top-down analysis (LDP and HDP)

This section aims to identify and analyse other drivers (than those related to data quality and model changes) behind the observed RW variability across institutions. In this top-down approach, the variability is analysed along the GC (taking into account both EL and UL). 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 the effect of both 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: Methodologies used" 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.

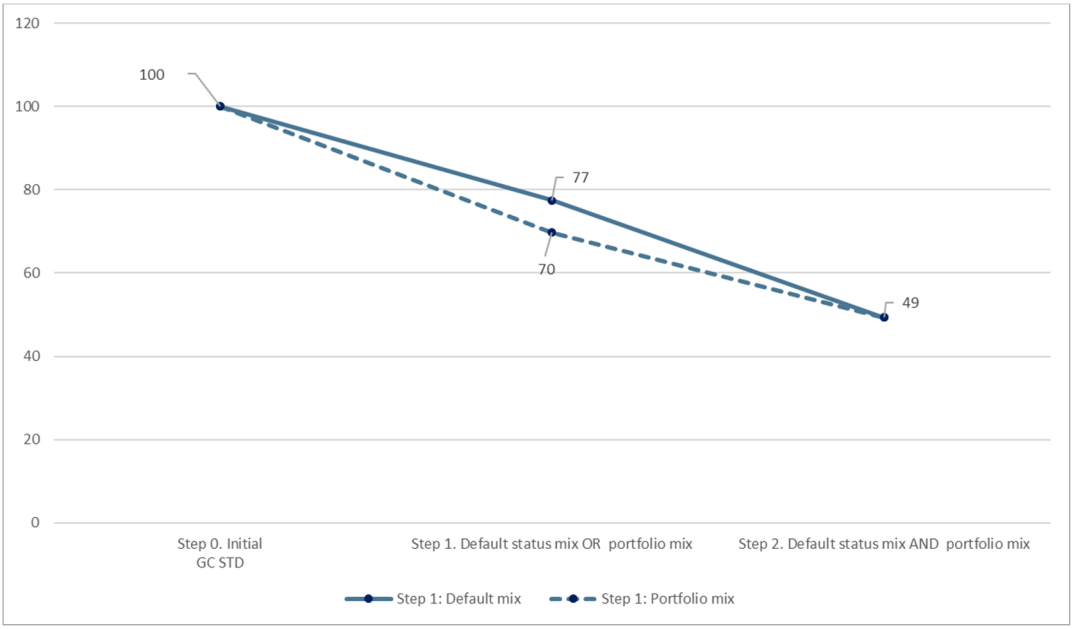
This analysis is, however, subject to a number of caveats. In particular, a change in the GC standard deviation does not directly translate into a change (either an improvement or deterioration) in the consistency of GC, since the GC standard deviation is influenced by many factors such as differences in institutions' modelling practices and risk-taking behavior, but as well by the data quality of the institutions benchmarking submission, by recent model changes and by changes in the economic environment.

The top-down approach provides an indication on the extent to which the business model contributes to differences in average GC. However, a top-down approach does not provide

indication on the remaining differences, which may stem from the definition of the metrics and portfolios, but as well from data quality or from differences in individual practices, model changes, interpretations of regulatory requirements, business strategies, etc. The sample of banks has a strong impact on the result of the analysis; hence, the 2021 results differ when they are computed on the sample of institutions used for the 2020 exercise.

2.2.1 Results on the latest collected data

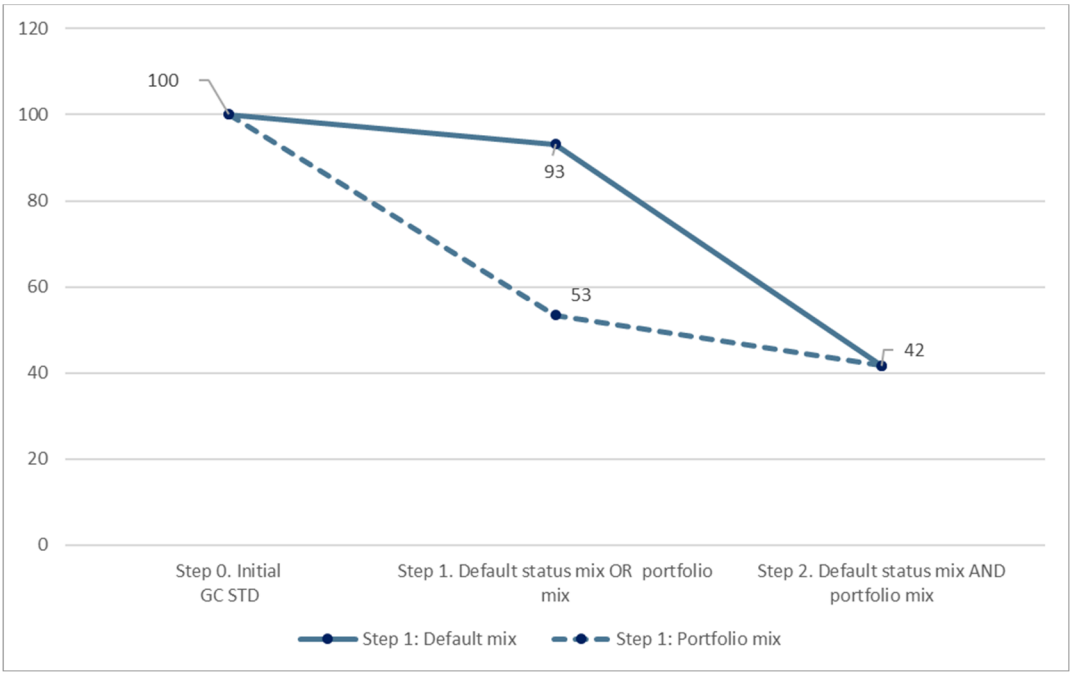
Figure 22: Decomposition of the GC standard deviation index – HDP and LDP



Sample: 83 institutions; for the missing variables the median values have been used, initial standard deviations 21% (last year 25%).

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

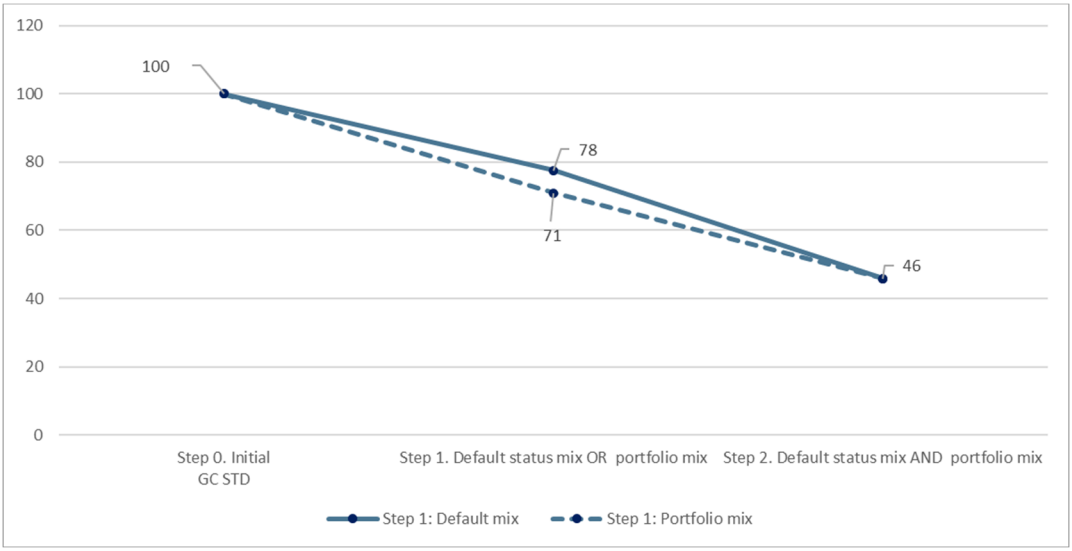
Figure 23: Decomposition of the GC standard deviation index – LDP



Sample: 87 institutions. Initial standard deviation 29% (last year 28%).

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

Figure 24: Decomposition of the GC standard deviation index – HDP

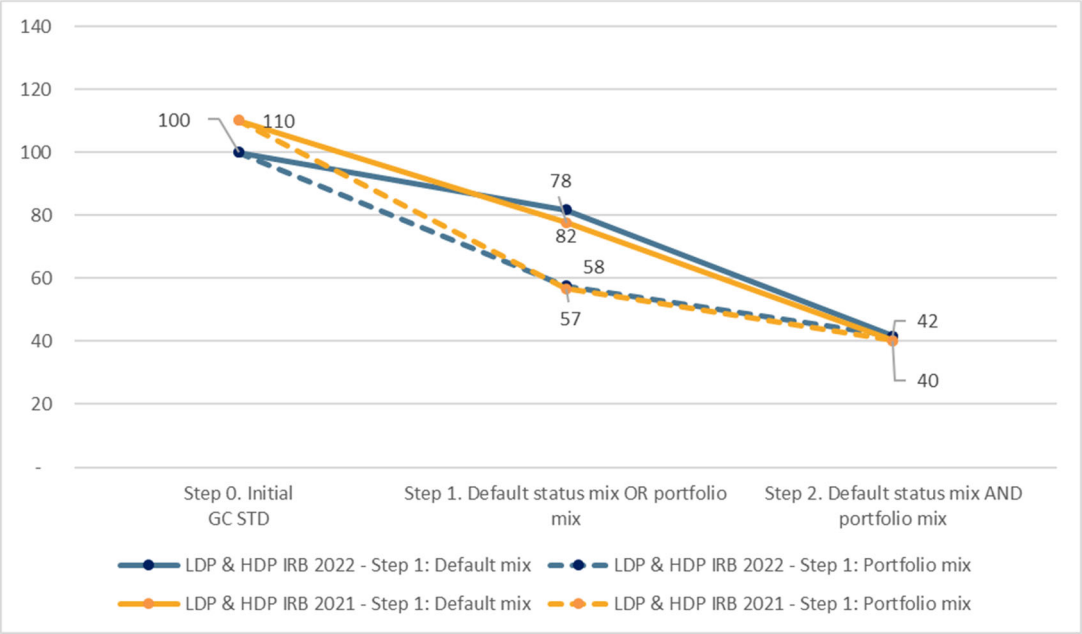


Sample: 97 institutions. Initial standard deviation 24% (last year 28%).

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

2.2.2 Results compared with previous exercise

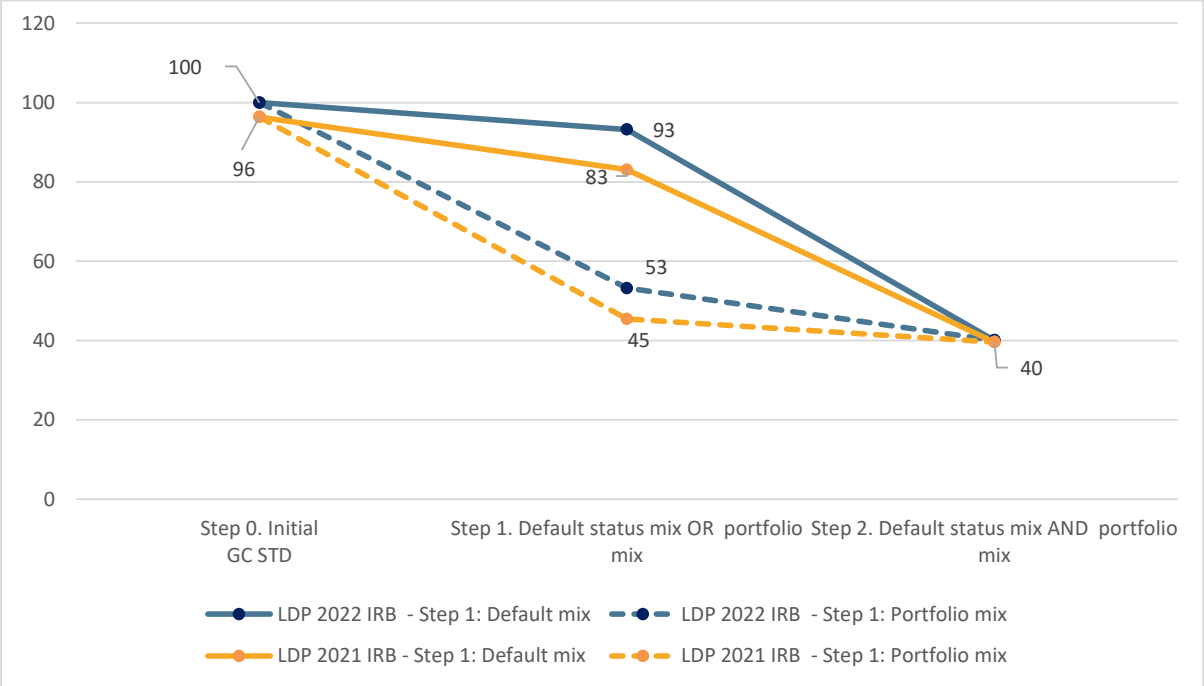
Figure 25: Comparison of the top-down analysis, HDPs and LDPs, 2021 and 2022 exercises (common sample)



Sample: 76 institutions *(only common institutions between 2021 and 2022 are kept). Initial STD 24%.*

*For comparison, the explained variability in last year's sample was 61% for both HDPs & LDPs (figure 13 of the 2021 Chart Pack). Based on the common 2021-2022 sample, the 2021 share of explained variability is equal to (100-42)=58%, but considering the different initial STD (that is equal to 110 instead of 100) the explained variability within this year common sample would be (100- 40)/110*100 = 55%.*

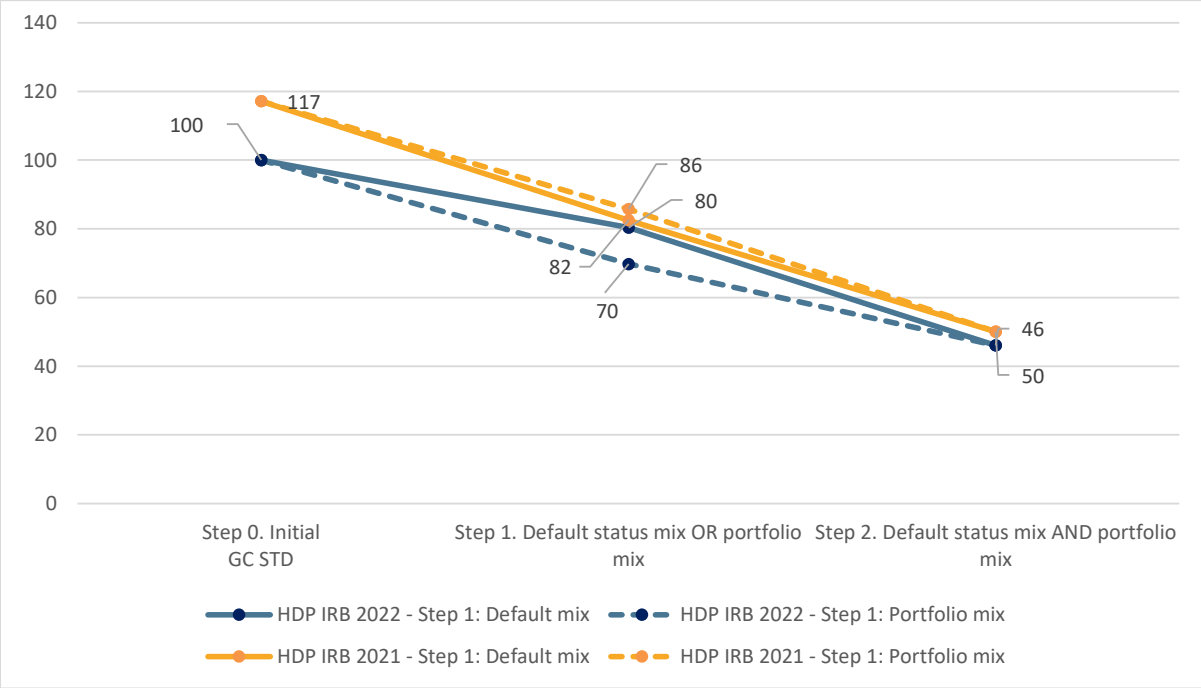
Figure 26: Comparison of the top-down analysis, LDPs, 2021 and 2022 exercises (common sample)



Sample: 76 institutions (only common institutions between 2021 and 2022 are kept). Initial standard deviation (CY) 30%.

*For comparison, the explained variability in last year's sample was 52% for LDPs (figure 14 of the 2021 Chart Pack). Based on the common 2021-2022 sample, the 2021 share of explained variability is equal to (96-40)=56%, but considering the different initial STD (that is equal to 96 instead of 100) the explained variability within this year common sample would be (100-40)/96*100 = 62.5%.*

Figure 27: Comparison of the top-down analysis, HDPs, 2021 and 2022 exercises (common sample)



Sample: 86 institutions (only common institutions between 2021 and 2022 are kept). Initial standard deviations CY 25%

*For comparison, the explained variability last year sample was 65% for HDPs (figure 15 of the 2021 Chart Pack). Based on the common 2021-2022 sample, the 2021 share of explained variability is equal to (117-46)=71%, but considering the different initial STD (that is equal to 117 instead of 100) the explained variability within this year common sample would be(100-50/117 * 100 =) 42.7%.*

2.3 Analysis of variability in IRB parameters (LDP)

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, where this group is composed of at least 5 institutions).

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 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: Methodologies used". For the reader's convenience, its main features are recalled here:

- Deviation 1 (initial RW deviation):

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

- Deviation 2 (PD effect):

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

- Deviation 3 (LGD effect):

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

- Deviation 4 (Maturity effect):

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

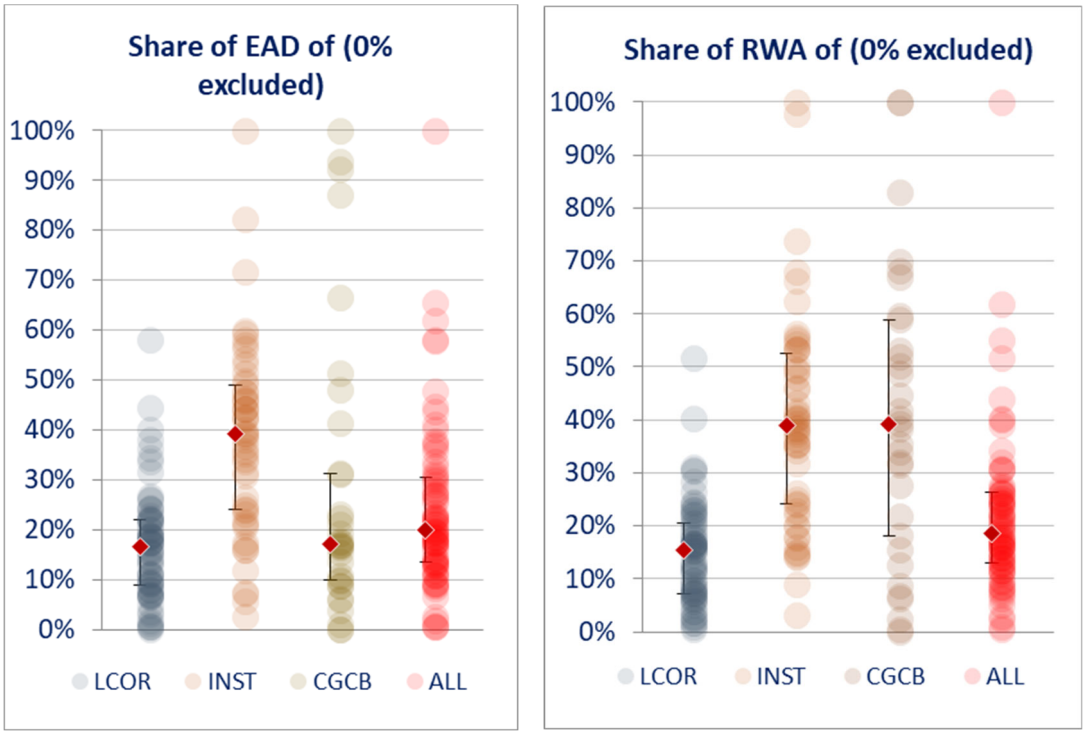
- Deviation 5 (LGD effect without CRM effect, i.e. on hypothetical unsecured LGD):

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

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 transferable to the total IRB portfolios and should be interpreted with care. Figure 28 shows that the C 101.00 sample makes up a small part of the institutions' IRB EAD. This chart shows the institutions' shares as dots. The median is displayed as a red square and the whiskers denote the range between the first and third quartiles of the observed values.

Figure 28: LDP common counterparties EAD and RWAs compared with corresponding total IRB EAD and RWAs



2.3.1 Results on the latest collected data

Table 5: Summary statistics on the RW deviations (interquartile range) by SVB exposure class and regulatory approach for the 2021 and 2022 exercise

		AIRB					FIRB	
		Dev 1 (ALL)	Dev2 (PD)	Dev3 (LGD)	Dev4 (M)	Dev5 (LGD_{unsec})	Dev 1 (ALL)	Dev2 (PD)
Large corporates	2022	**9%**	**9%**	**6%**	**6%**	**5%**	**7%**	**6%**
	2021	8%	7%	6%	6%	6%	8%	6%
Sovereigns	2022	**8%**	**2%**	**5%**	**1%**	**3%**	**4%**	**6%**
	2021	9%	2%	2%	2%	2%	3%	3%
Institutions	2022	**11%**	**4%**	**4%**	**5%**	**6%**	**5%**	**5%**
	2021	8%	3%	5%	4%	8%	5%	4%

NB: this table presents a gross comparison of the metrics between 2021 and 2022, without controlling for the sample composition of institutions and counterparties reported (see next section).

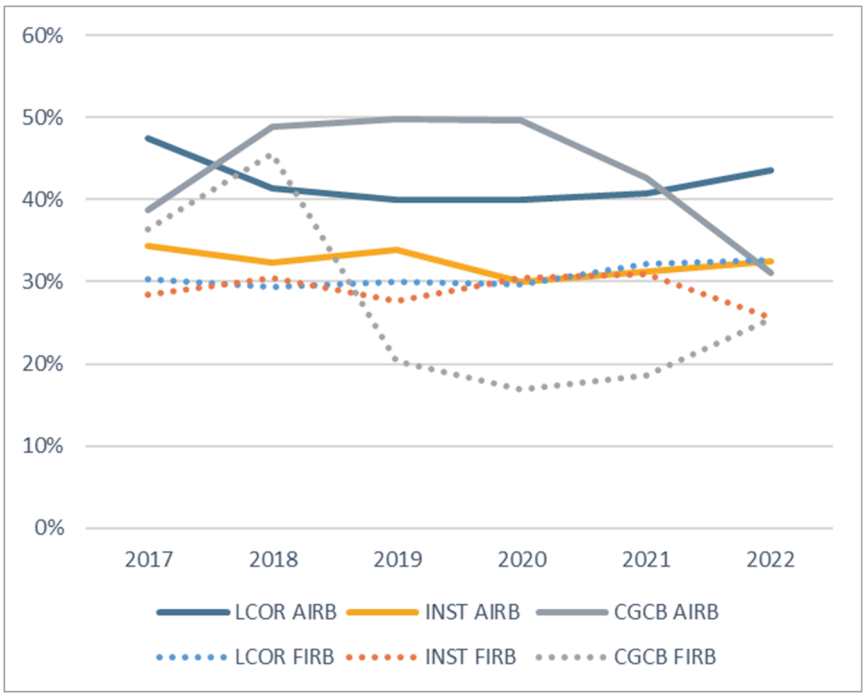
In terms of relative deviation, the following metrics are observed:

		AIRB					FIRB	
		Dev 1 (ALL)	**Dev2 (PD)**	**Dev3 (LGD)**	**Dev4 (M)**	**Dev5 (LGD_{unsec})**	**Dev 1 (ALL)**	**Dev2 (PD)**
Large corporates	Q1	-7%	-5%	-3%	-6%	-3%	-3%	-2%
	Q3	2%	5%	3%	0%	2%	4%	4%
	median	-2.1%	0.6%	0.1%	-2.0%	0.0%	-0.4%	0.0%
	Q3 -Q1	**9%**	**9%**	**6%**	**6%**	**5%**	**7%**	**6%**
Sovereigns	Q1	-1%	0%	-1%	0%	0%	-4%	-2%
	Q3	6%	2%	4%	1%	3%	0%	4%
	median	1.1%	0.0%	0.6%	0.6%	0.0%	-0.6%	0.0%
	Q3 -Q1	**8%**	**2%**	**5%**	**1%**	**3%**	**4%**	**6%**
Institutions	Q1	-11%	-1%	-3%	-9%	-4%	-5%	-3%
	Q3	1%	3%	1%	-4%	2%	0%	2%
	median	-4.6%	0.4%	0.0%	-7.6%	0.0%	-2.4%	0.0%
	Q3 -Q1	**11%**	**4%**	**4%**	**5%**	**6%**	**5%**	**5%**

2.3.1 Results compared with previous exercise

In this section, the interquartile range of risk estimates (RW, PD and LGD) for one counterparty is used as a measure of the variability. Figure 29 shows the evolution of the variability for the worst counterparties, i.e. where the interquartile range of risk estimates is the highest.[4]

Figure 29: Evolution of RW



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

Figure 30: Evolution of PD

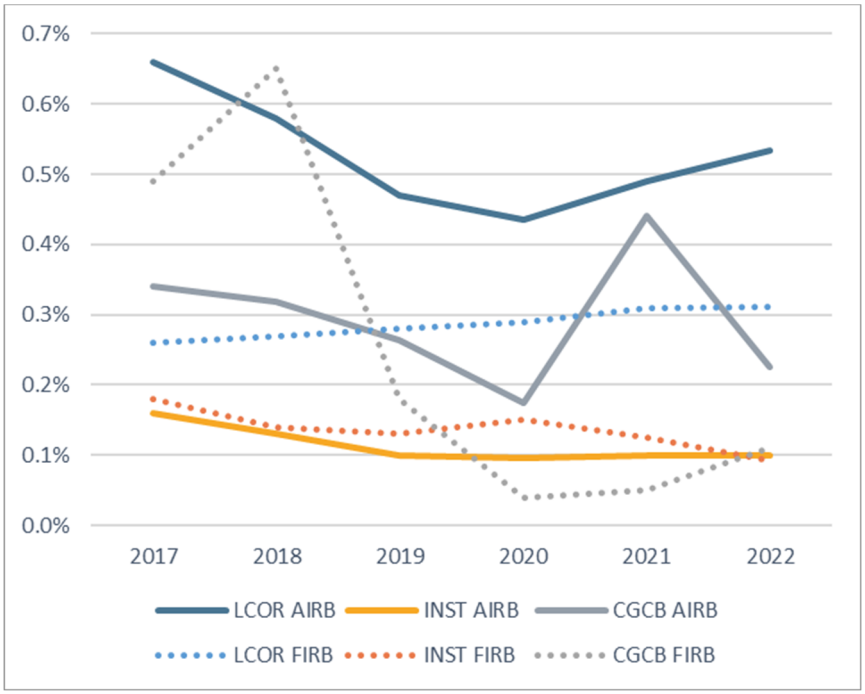
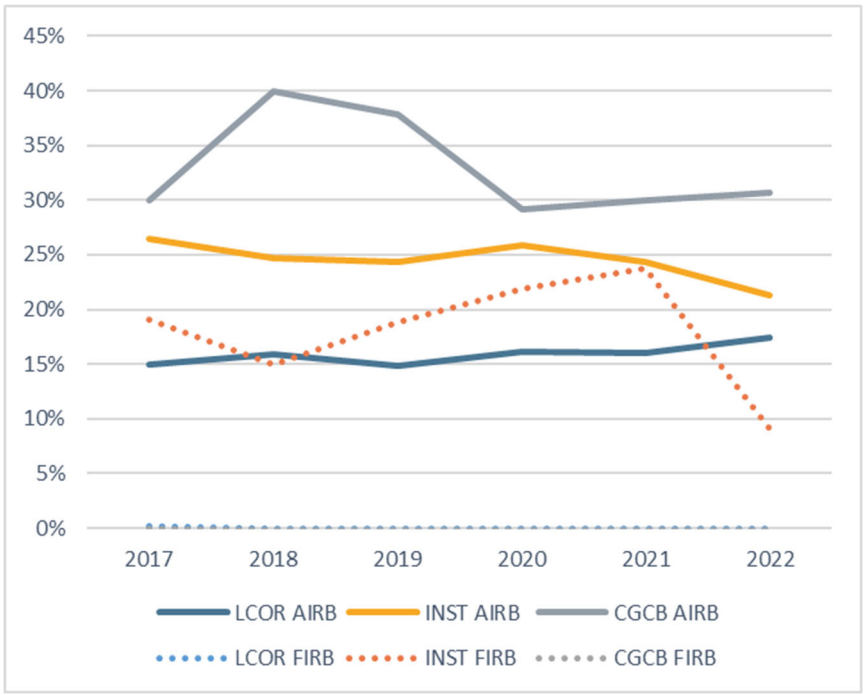


Figure 31: Evolution of LGD



2.3.2 Variability in risk differentiation

As the name indicates, 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,5 and second as the variability of the ranking of the counterparties (i.e. variability of the risk parameters relative to each other).6 This distinction between the variability deriving from risk differentiation and from risk quantification is very relevant to policymakers, as it triggers different corrective measures.7 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:

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

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].

$$\tau_{bank\,1-bank\,2} = \frac{6-0}{\frac{4\cdot 3}{2}} = 1; \quad \tau_{bank\,1-bank\,3} = \frac{2-4}{\frac{4\cdot 3}{2}} = -0.3; \quad \tau_{bank\,2-bank\,3} = \frac{2-4}{\frac{4\cdot 3}{2}} = -0.3$$

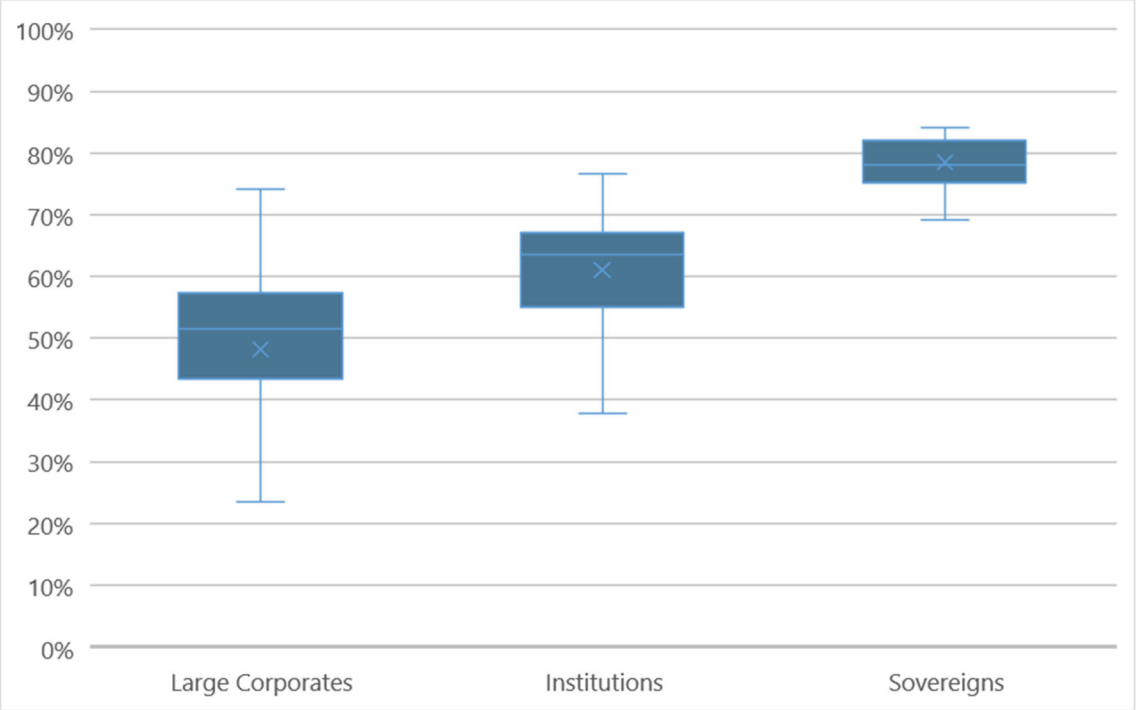
Each institution therefore has one Kendall tau with each of the other institutions with enough obligors in common (10 in the SVB exercise). These Kendall's Taus are then aggregated in a single metric at the institution level by taking the median.

---

[5] For example, for counterparties *X* and *Y*, institution *A* estimates PD(*X*) and PD(*Y*) differently from institution *B*.
[6] For example, institution *A* assesses that PD(*X*) < PD(*Y*) while institution *B* assesses that PD(*X*) > PD(*Y*).
[7] 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.

Generally speaking, Figure 32 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 32: Interquartile range, median and average of Kendall tau metrics



2.4 Analysis of variability in IRB parameters (HDP)

Historical data on defaulted exposures, i.e. default rates and loss rates, are an important source of information on 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 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 in accordance with 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)[8] – PD and LGD;
- observed[9] 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 risk parameter 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:
    - For the 1-year rates, the data collected allowed only the comparison of PDs (and LGDs) at the reference date (31 December 2019) with the default rate (and loss rate) observed during the same year (1 January to 31 December 2019), 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.

[8] Parameters used for RWA calculation excluding the effect of potential measures introduced in accordance with Article 458 of Regulation (EU) No 575/2013.
[9] 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.

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

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

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

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

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

In addition, it should be noted that the relationship $\boldsymbol{RWA^-} < \boldsymbol{RWA^+}$ may not be observed in the case of small portfolios with a high default rate (i.e. higher than 30%), due to the concave shape of the RW formula.

2.4.1 Results of the latest collected data - Outturns analysis

Since the backtesting results are only relevant for 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. Generally speaking, Figure 33shows lower backtesting ratios (i.e. more conservative calibration), which is consistent with the general margin of conservatism (MoC) principle (the fewer the data an institution has, the more conservative it must be in its estimation). It should be noted that for the mortgages exposure class (MORT) there are some PDs, which are below the 1YR default rate and also very close to the 5YR default rate values. As this exposure class often provides for enough data and given the macroenomic context in 2022, the comparably low distance to observed parameters raises some concern.

Figure 33: Interquartile range of the ratio of DR 1Y to PD and the ratio of DR 5Y to PD, for non-defaulted exposures, by SVB exposure class and regulatory approach

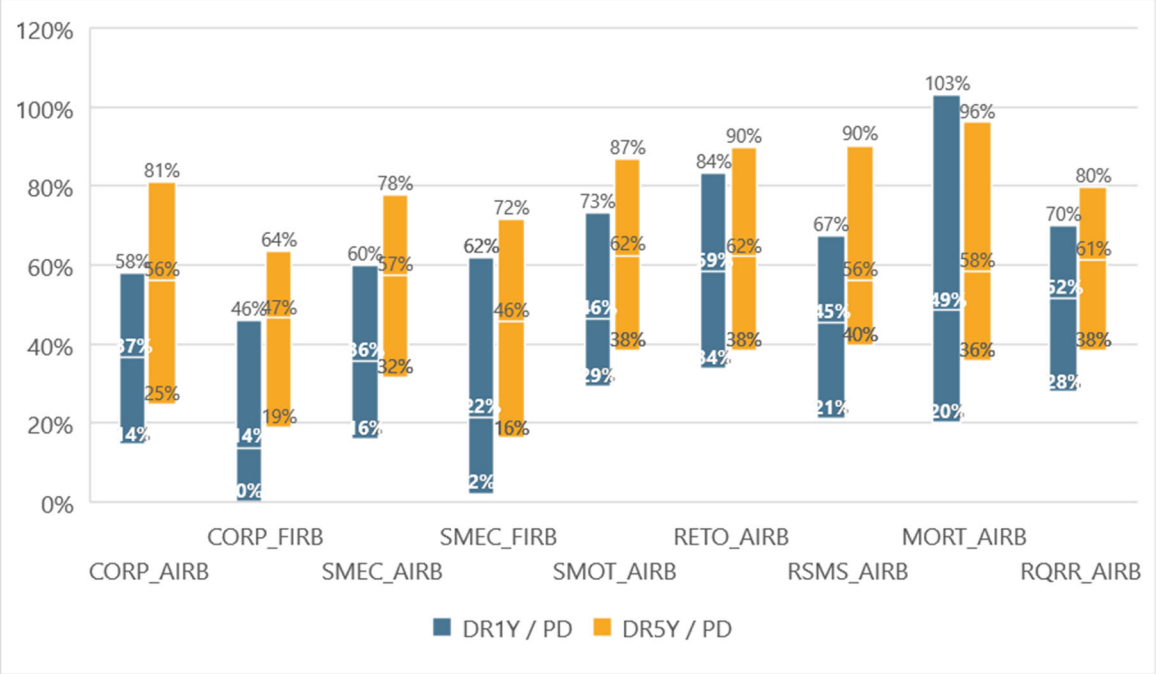
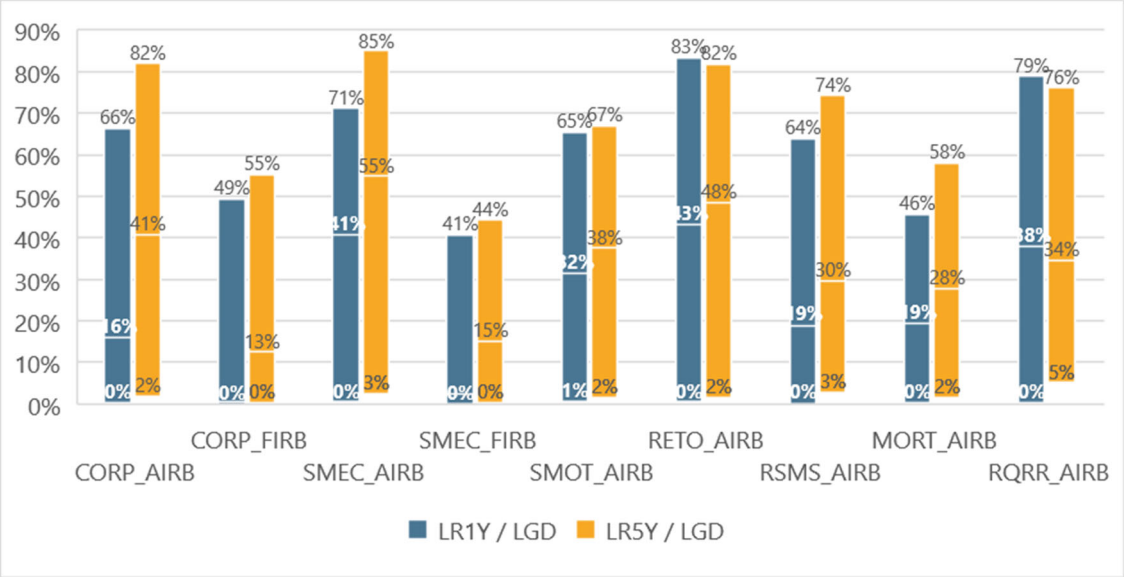


Figure 29: interquartile range of the ratio between LR 1Y and LGD and the ratio between LR 5Y and LGD, for non-defaulted exposures, by portfolio and regulatory approach

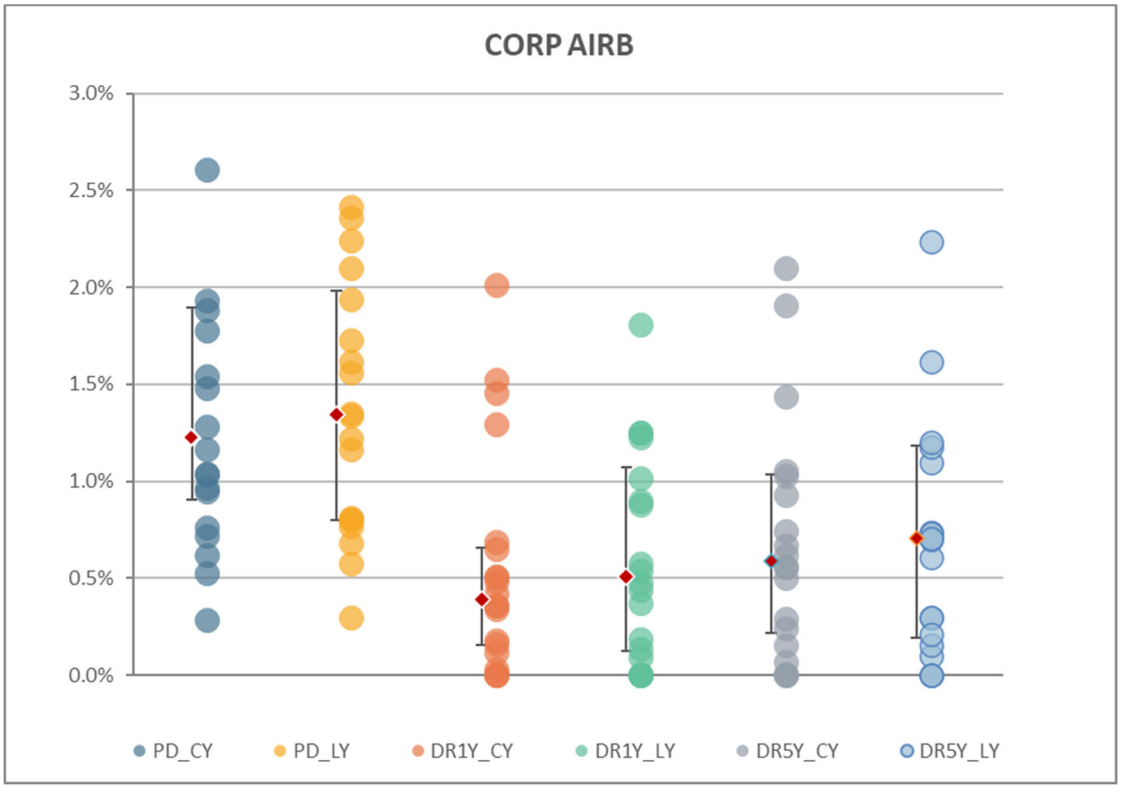


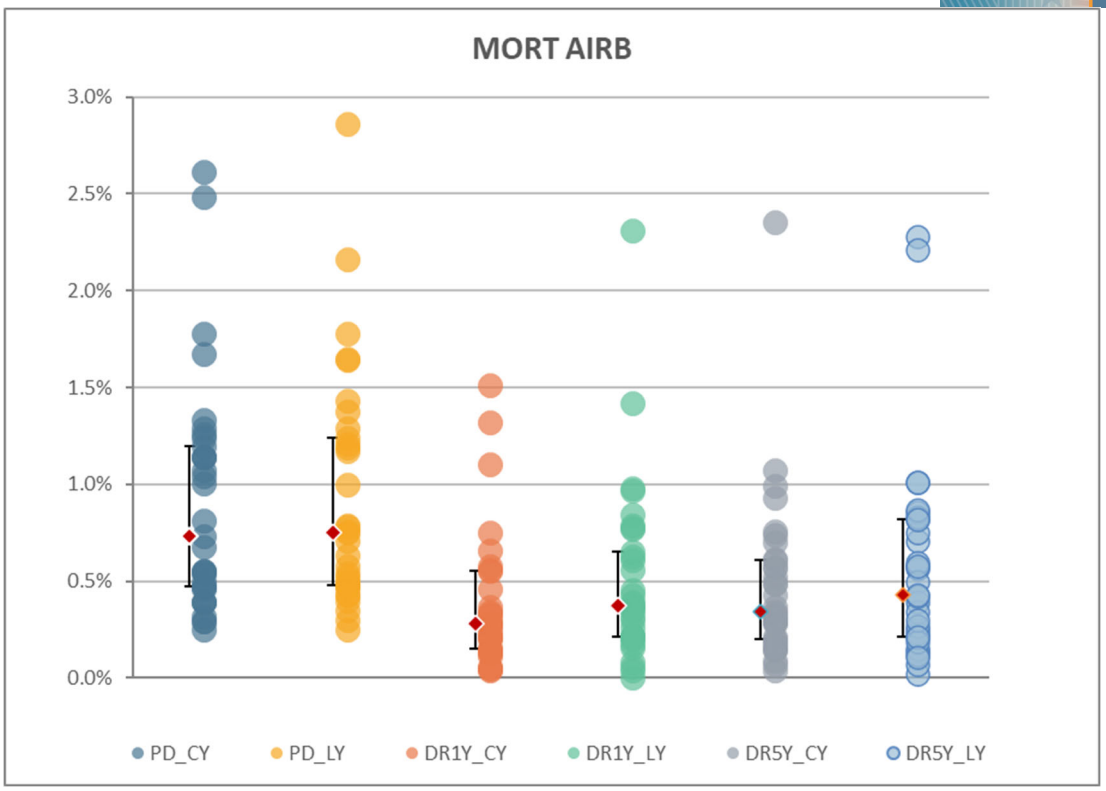
2.4.2 Results compared with previous exercise – PD & DR – By exposure class

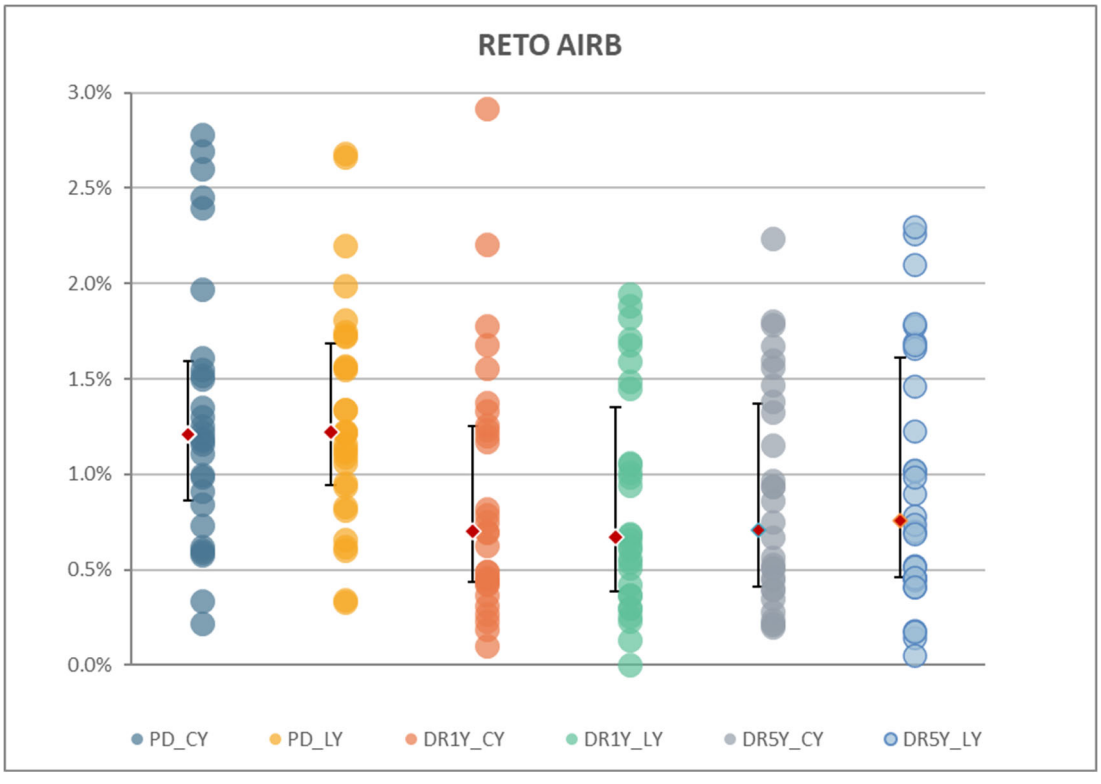
Figure 34 provides a comparison between the data collection in 2021 and in 2020 as regards the dispersion of PD estimates and one-year and five-year average default rates. This information is provided by exposure class.

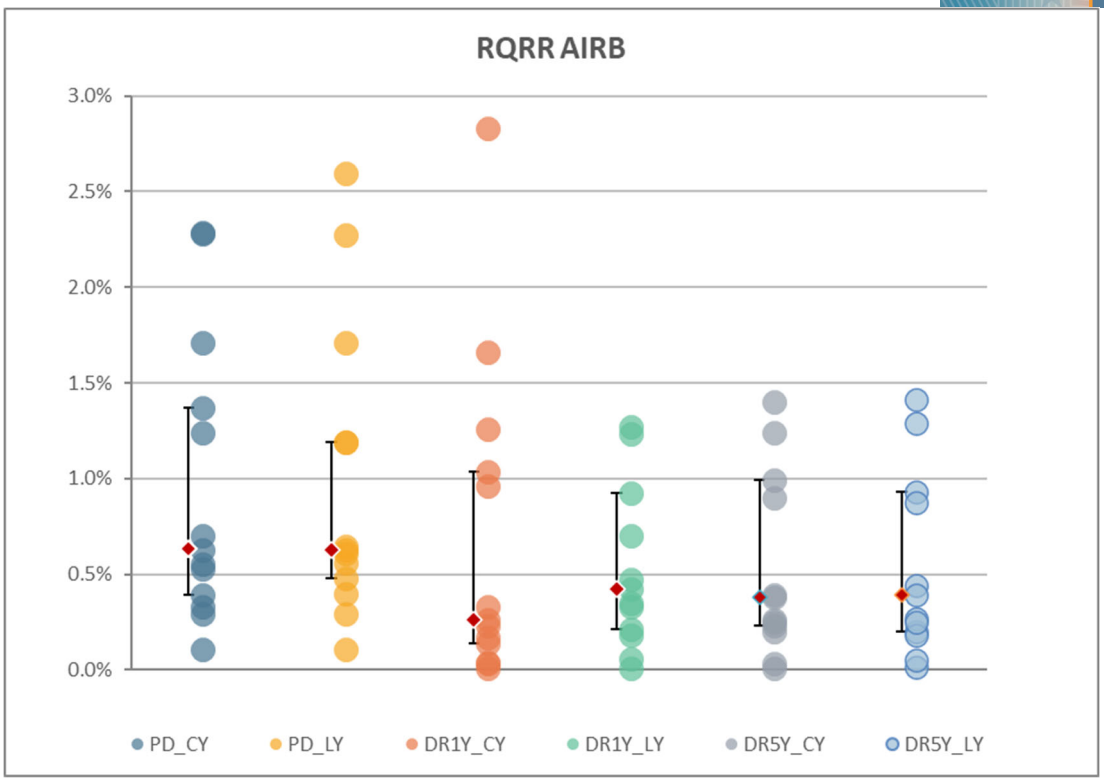
The red dot in the charts below marks the median and the black line indicates the interquartile range, which is used to assess the dispersion.

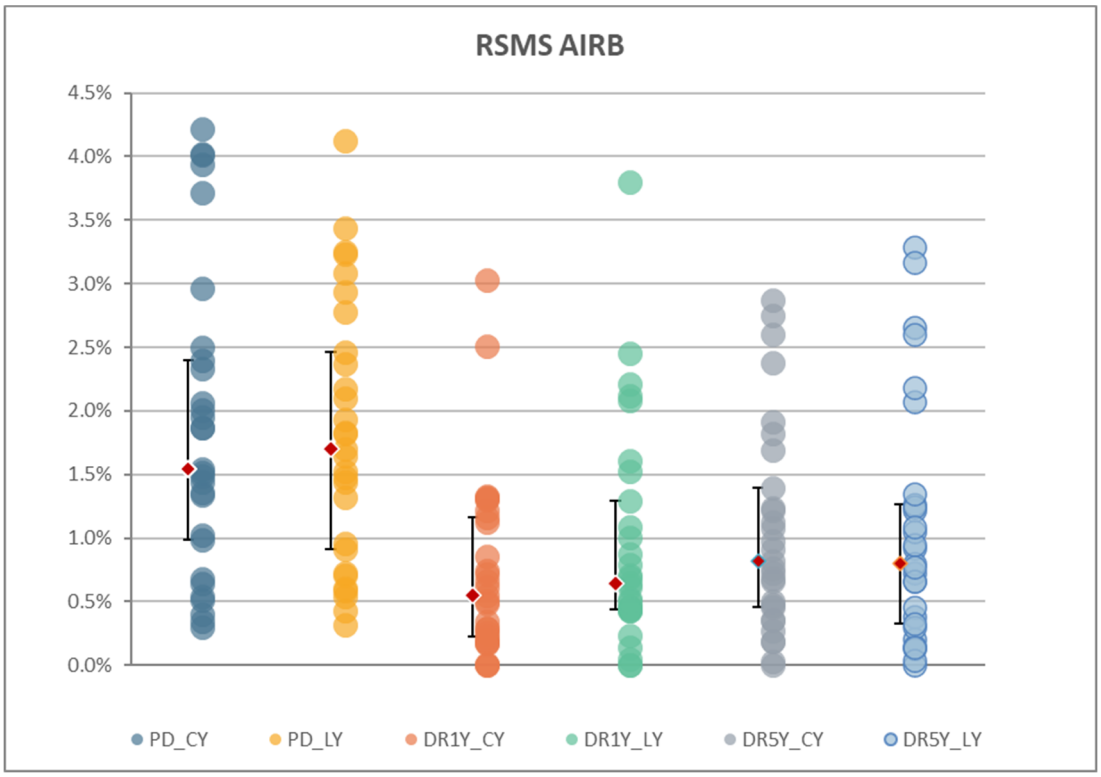
Figure 34: Comparison of the dispersion in the PD, one-year default rates (DR1Y) and five-year default rates (DR5Y) for 2021 (CY) and 2020 (LY)

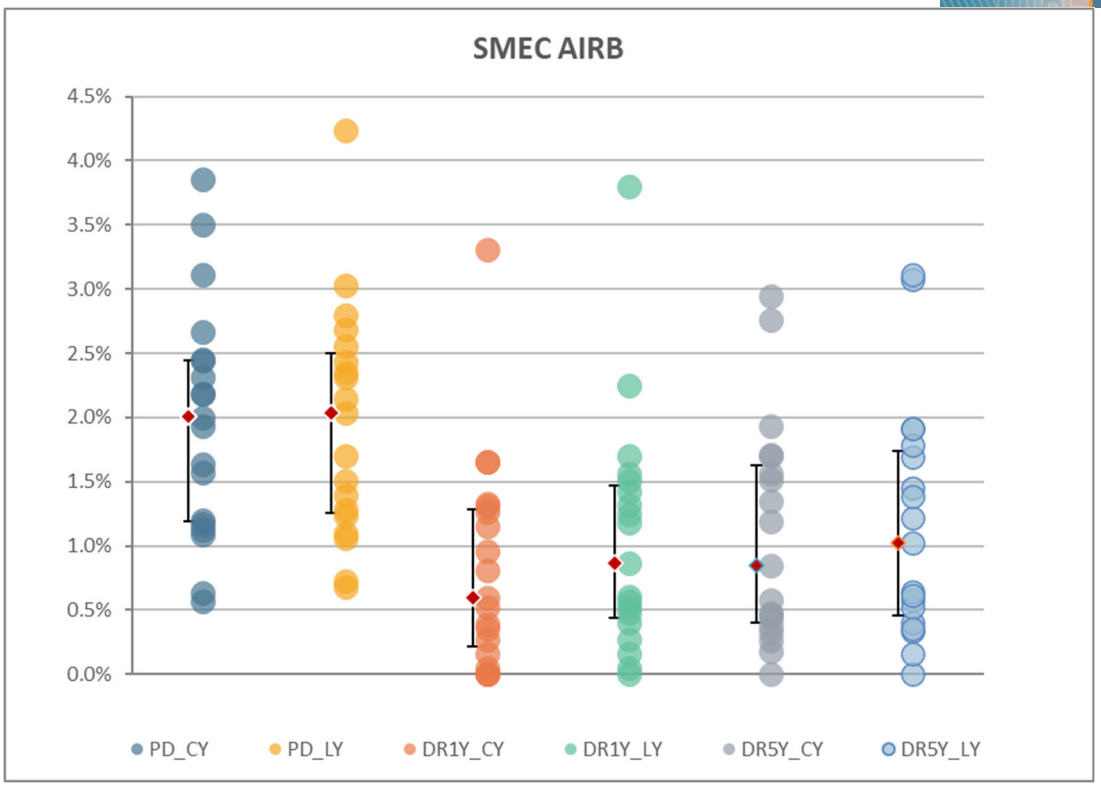


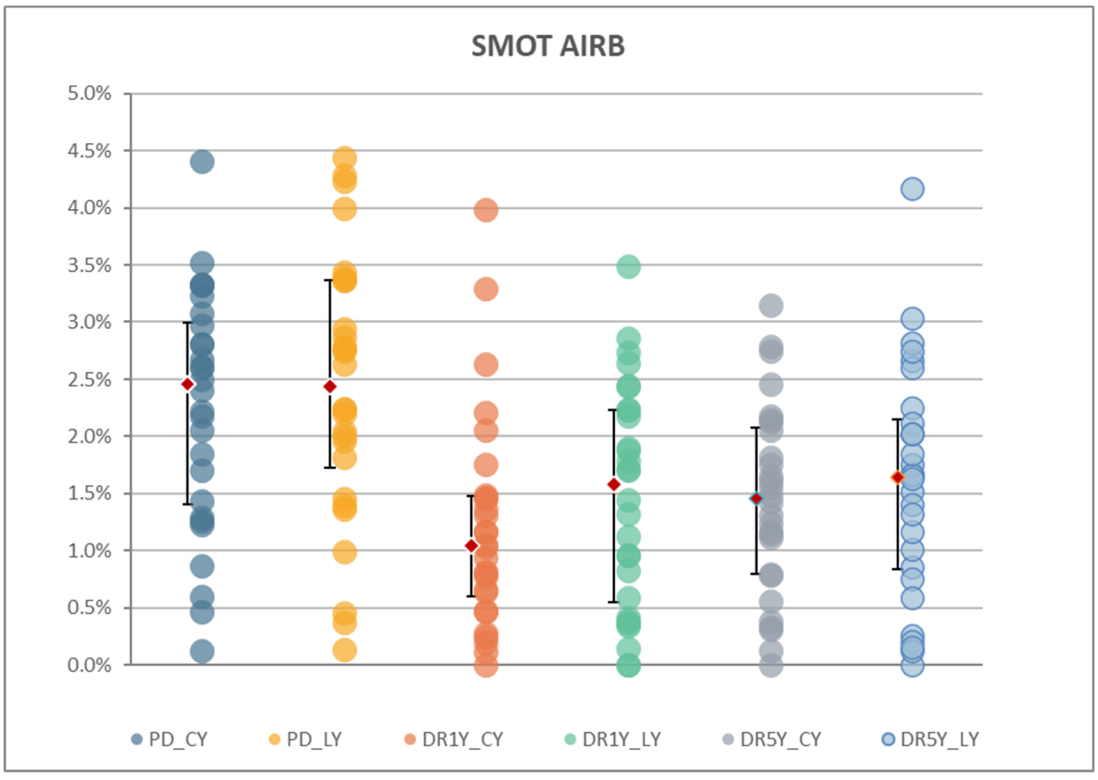

MORT AIRB
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
PD_CY
PD_LY
DR1Y_CY
DR1Y_LY
DR5Y_CY
DR5Y_LY


RETO AIRB
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
PD_CY
PD_LY
DR1Y_CY
DR1Y_LY
DR5Y_CY
DR5Y_LY


RQRR AIRB
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
PD_CY
PD_LY
DR1Y_CY
DR1Y_LY
DR5Y_CY
DR5Y_LY

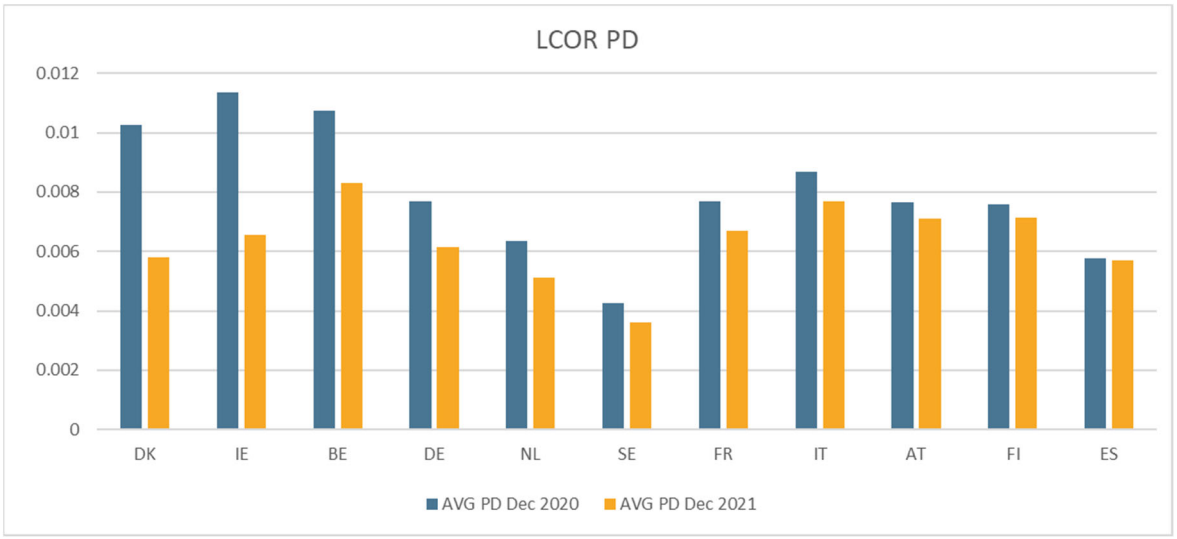

RSMS AIRB
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
PD_CY
PD_LY
DR1Y_CY
DR1Y_LY
DR5Y_CY
DR5Y_LY

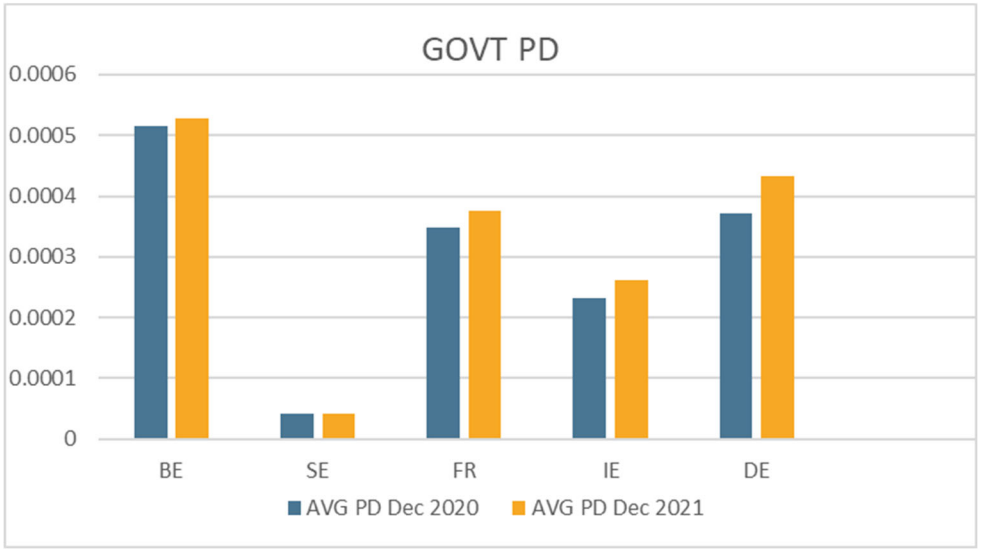

SMEC AIRB
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
PD_CY
PD_LY
DR1Y_CY
DR1Y_LY
DR5Y_CY
DR5Y_LY

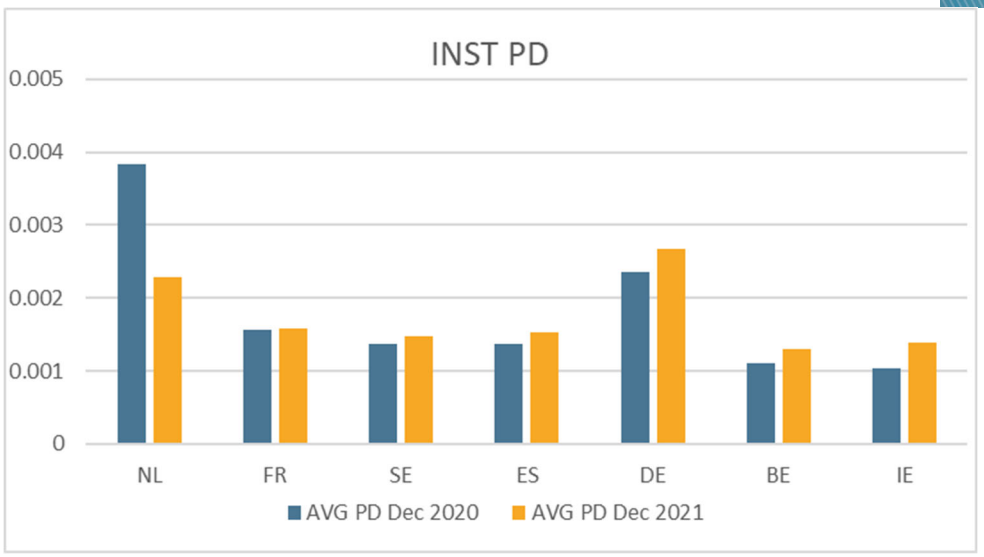

SMOT AIRB
5.0%
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
PD_CY
PD_LY
DR1Y_CY
DR1Y_LY
DR5Y_CY
DR5Y_LY

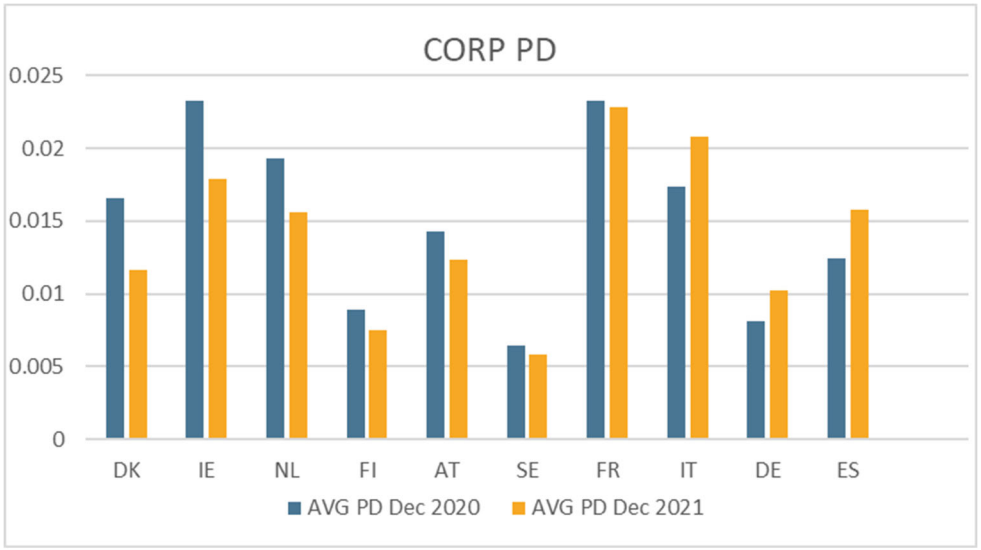
2.4.3 Results compared with previous exercise – PD & DR – By exposure class and country

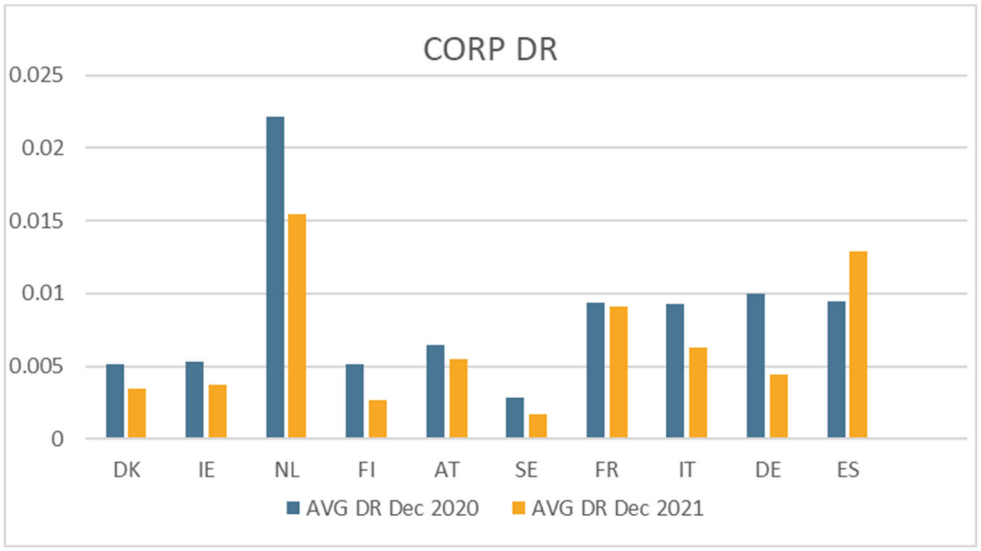
Figure 35: Average PD and DR as of 31.12.2020 and 31.12.2021

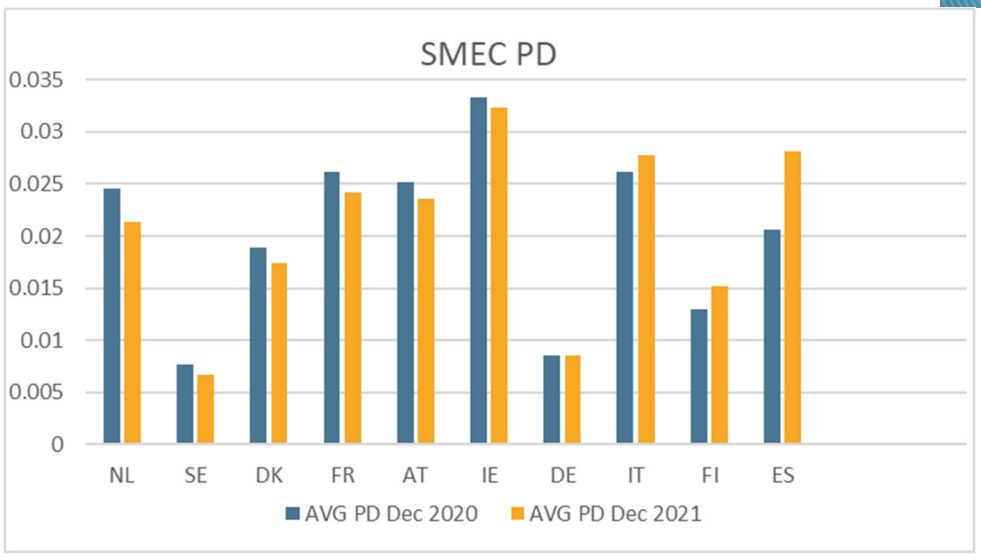


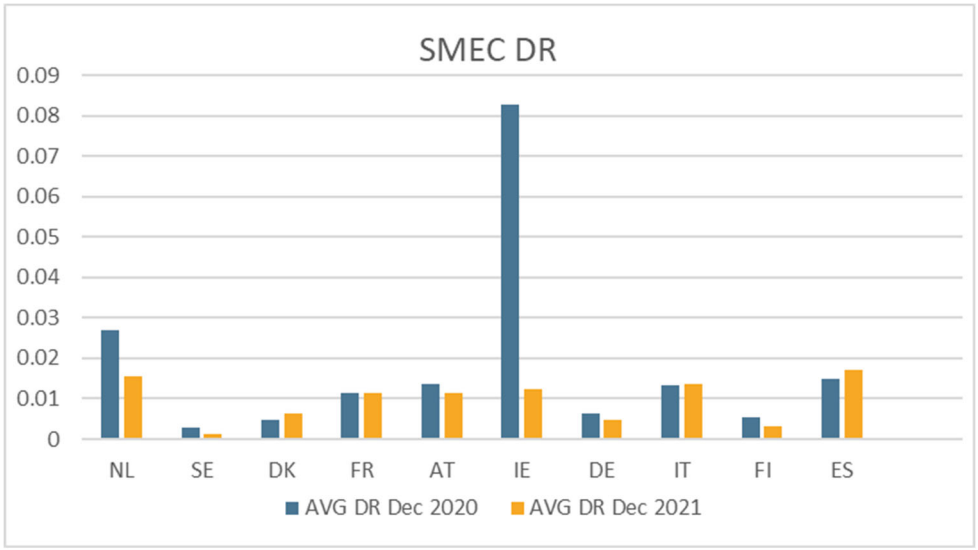


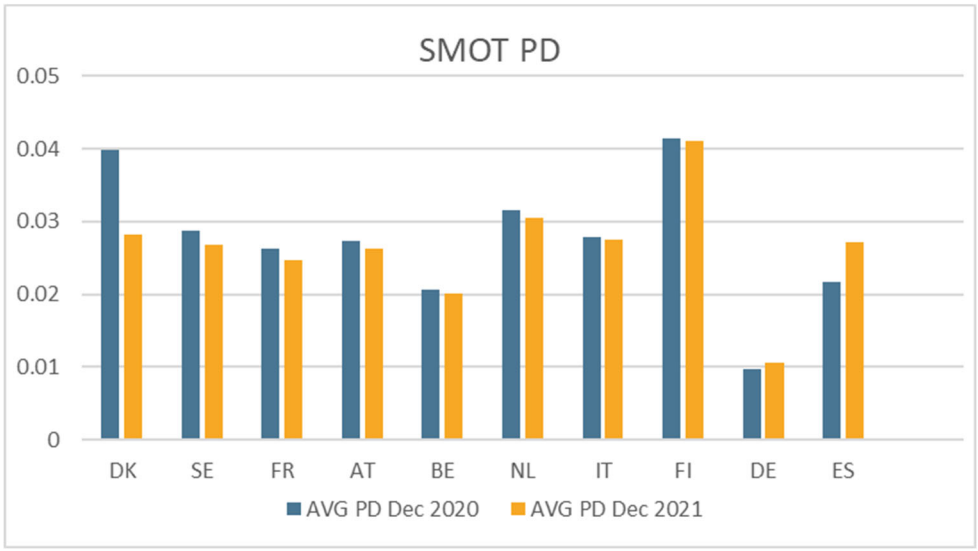

INST PD
0.005
0.004
0.003
0.002
0.001
0
NL
FR
SE
ES
DE
BE
IE
AVG PD Dec 2020
AVG PD Dec 2021

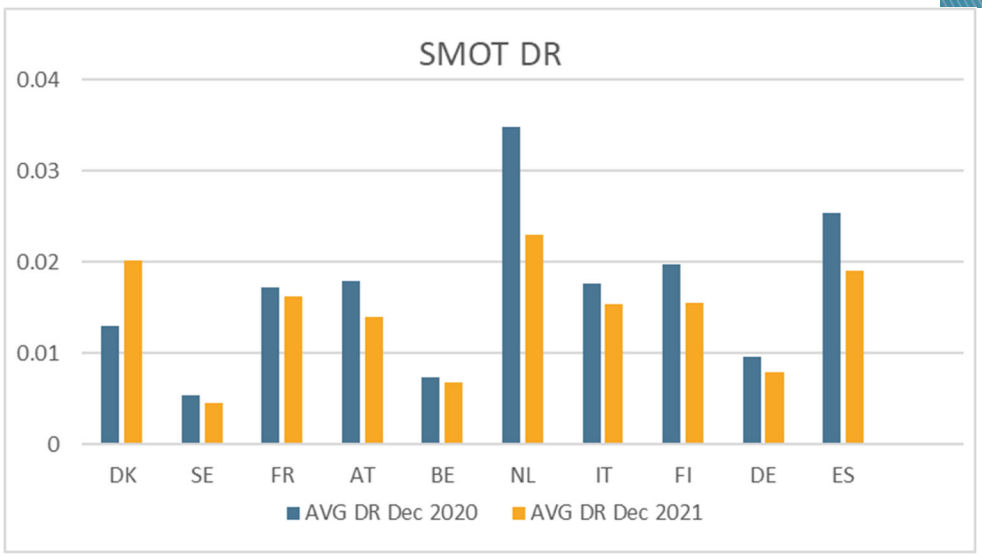

CORP PD
0.025
0.02
0.015
0.01
0.005
0
DK
IE
NL
FI
AT
SE
FR
IT
DE
ES
AVG PD Dec 2020
AVG PD Dec 2021

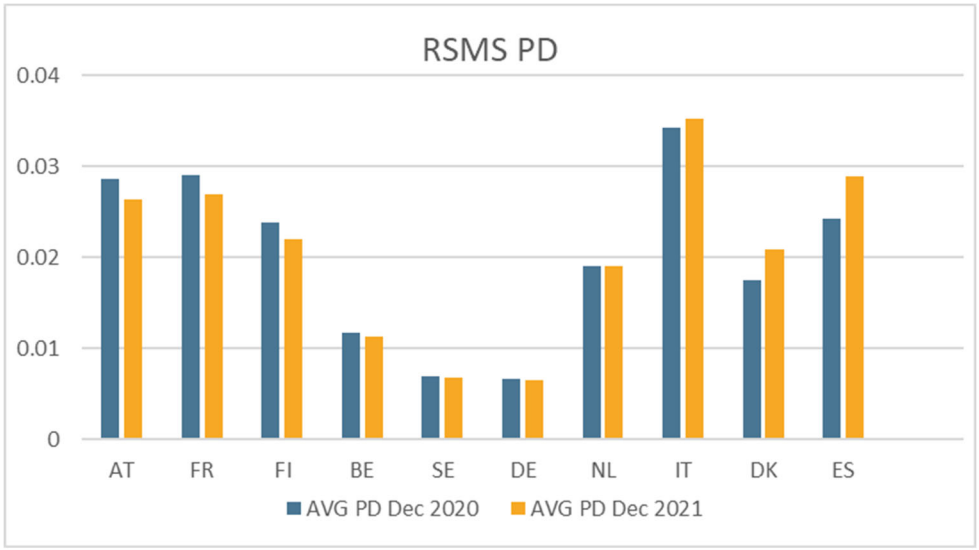

CORP DR
0.025
0.02
0.015
0.01
0.005
0
DK
IE
NL
FI
AT
SE
FR
IT
DE
ES
AVG DR Dec 2020
AVG DR Dec 2021

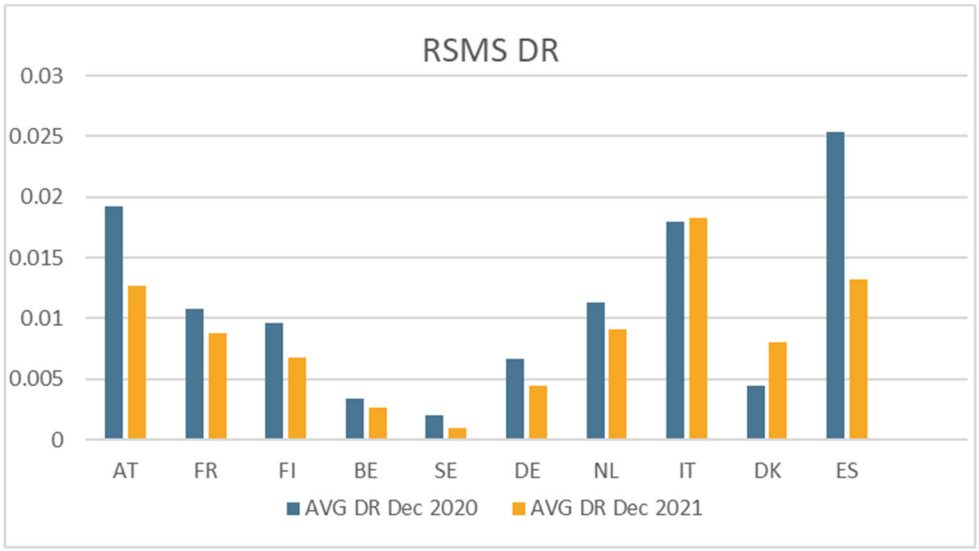

SMEC PD
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
NL SE DK FR AT IE DE IT FI ES
AVG PD Dec 2020
AVG PD Dec 2021

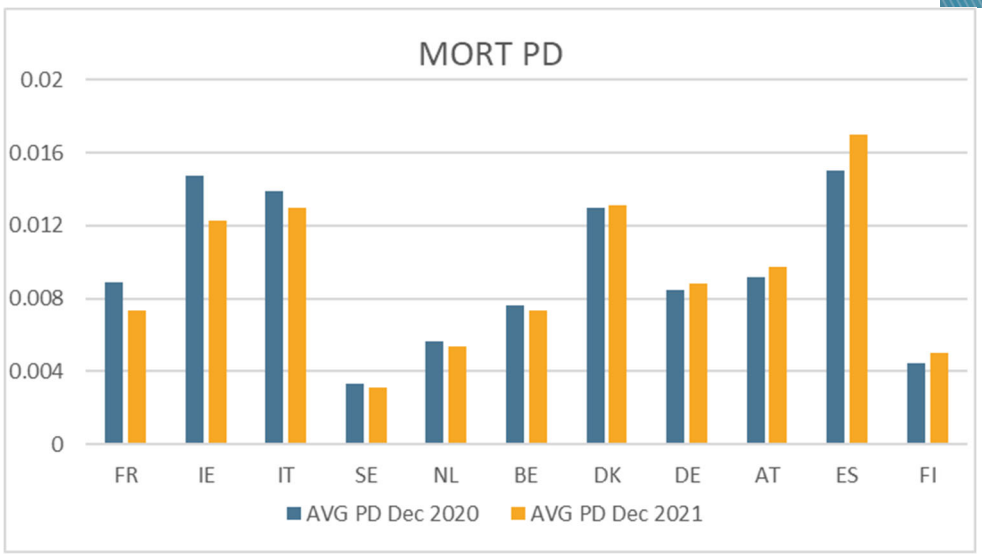

SMEC DR
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
NL SE DK FR AT IE DE IT FI ES
AVG DR Dec 2020
AVG DR Dec 2021

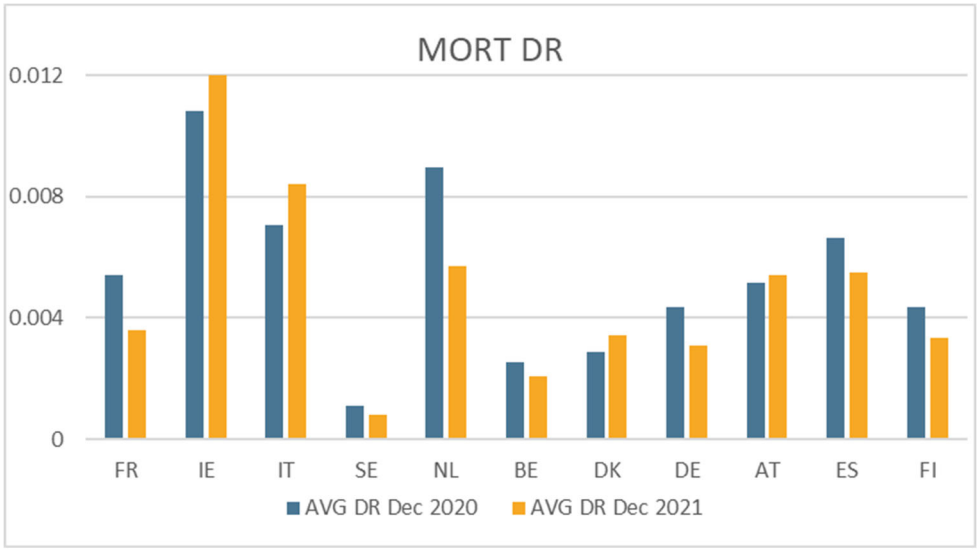

SMOT PD
0.05
0.04
0.03
0.02
0.01
0
DK SE FR AT BE NL IT FI DE ES
AVG PD Dec 2020
AVG PD Dec 2021

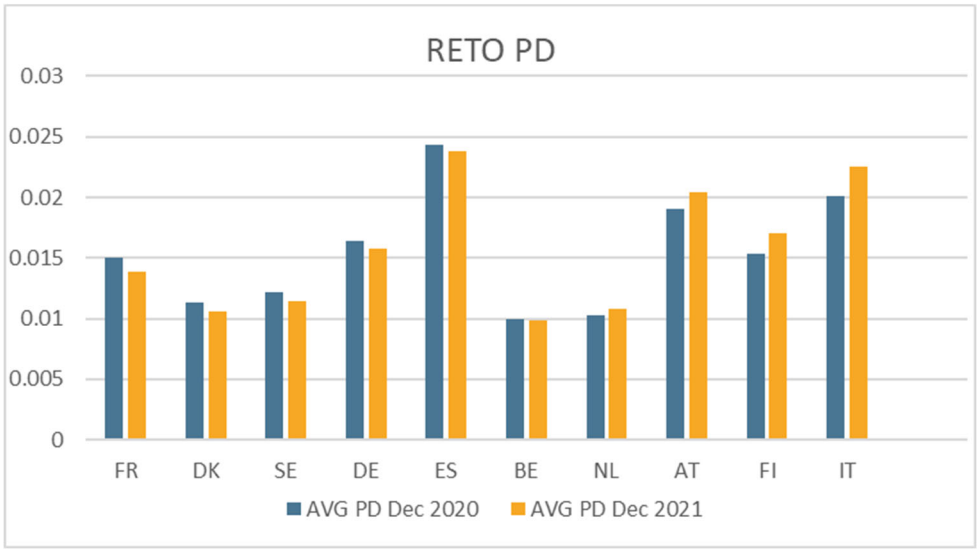

SMOT DR
0.04
0.03
0.02
0.01
0
DK
SE
FR
AT
BE
NL
IT
FI
DE
ES
AVG DR Dec 2020
AVG DR Dec 2021

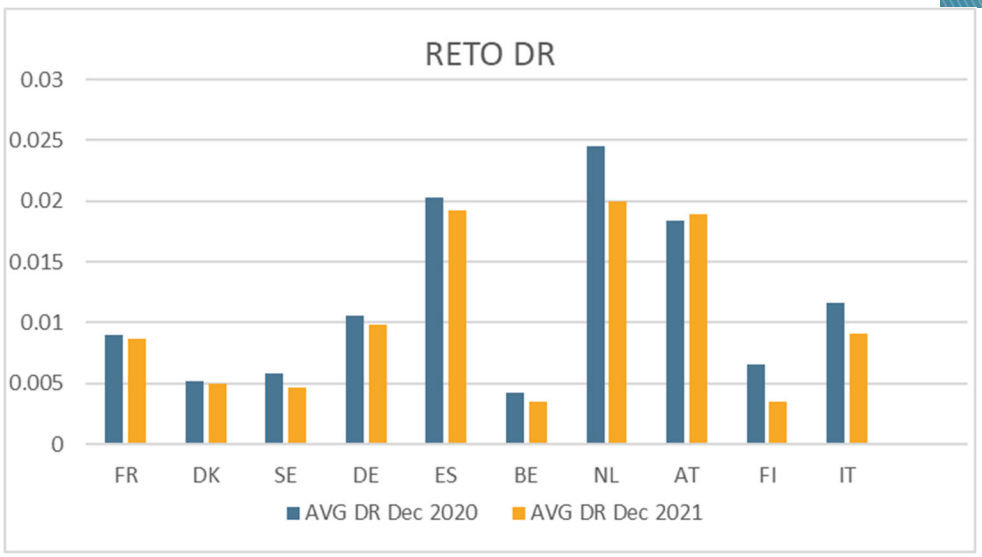

RSMS PD
0.04
0.03
0.02
0.01
0
AT
FR
FI
BE
SE
DE
NL
IT
DK
ES
AVG PD Dec 2020
AVG PD Dec 2021

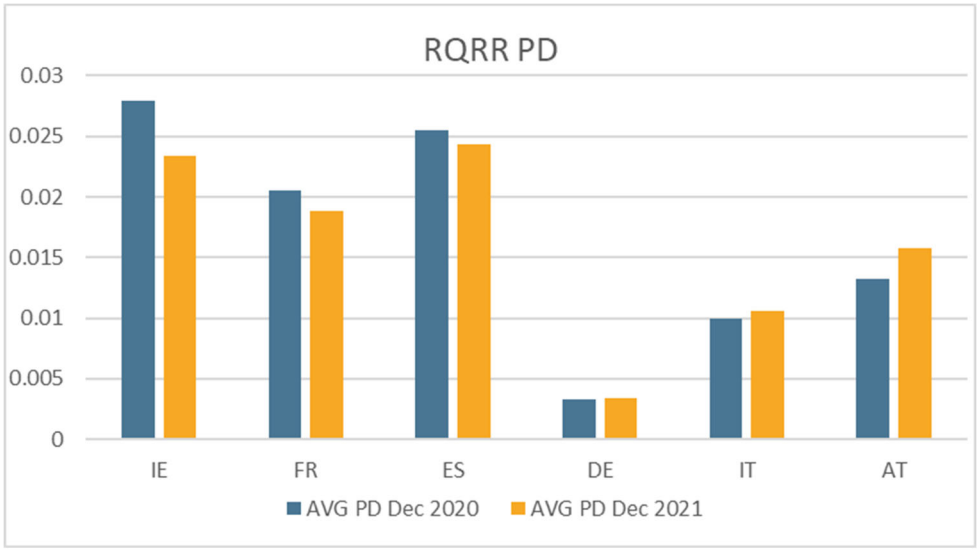

RSMS DR
0.03
0.025
0.02
0.015
0.01
0.005
0
AT
FR
FI
BE
SE
DE
NL
IT
DK
ES
AVG DR Dec 2020
AVG DR Dec 2021

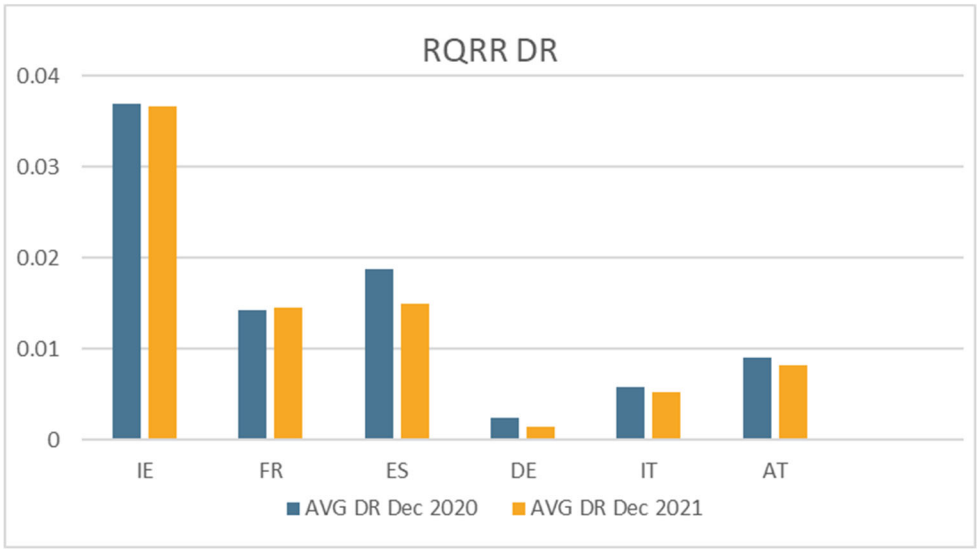

MORT PD
0.02
0.016
0.012
0.008
0.004
0
FR
IE
IT
SE
NL
BE
DK
DE
AT
ES
FI
AVG PD Dec 2020
AVG PD Dec 2021


MORT DR
0.012
0.008
0.004
0
FR
IE
IT
SE
NL
BE
DK
DE
AT
ES
FI
AVG DR Dec 2020
AVG DR Dec 2021


RETO PD
0.03
0.025
0.02
0.015
0.01
0.005
0
FR
DK
SE
DE
ES
BE
NL
AT
FI
IT
AVG PD Dec 2020
AVG PD Dec 2021

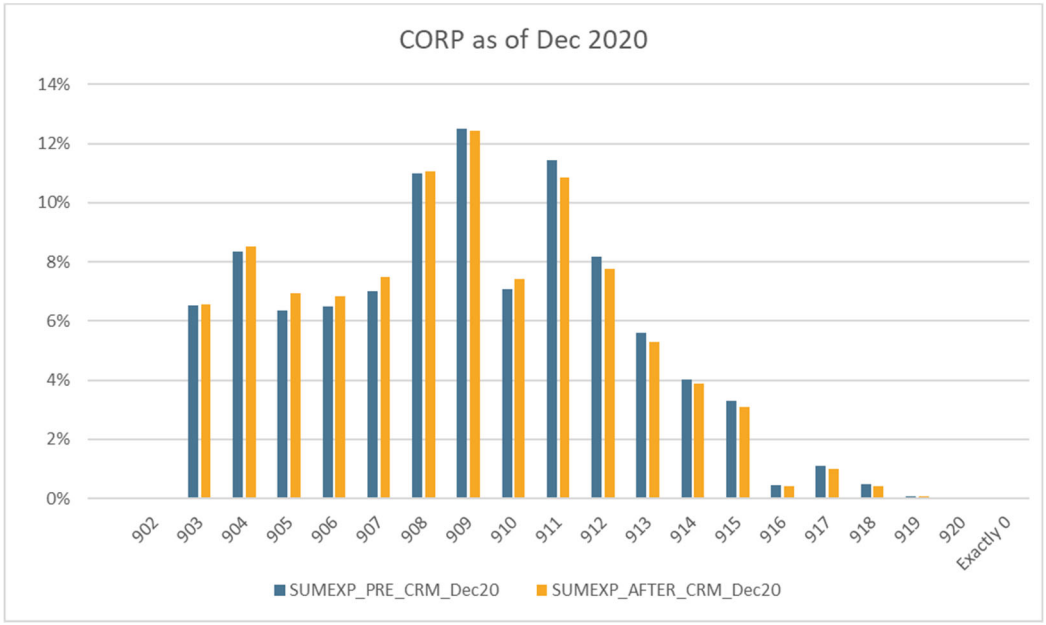

RETO DR
0.03
0.025
0.02
0.015
0.01
0.005
0
FR
DK
SE
DE
ES
BE
NL
AT
FI
IT
AVG DR Dec 2020
AVG DR Dec 2021

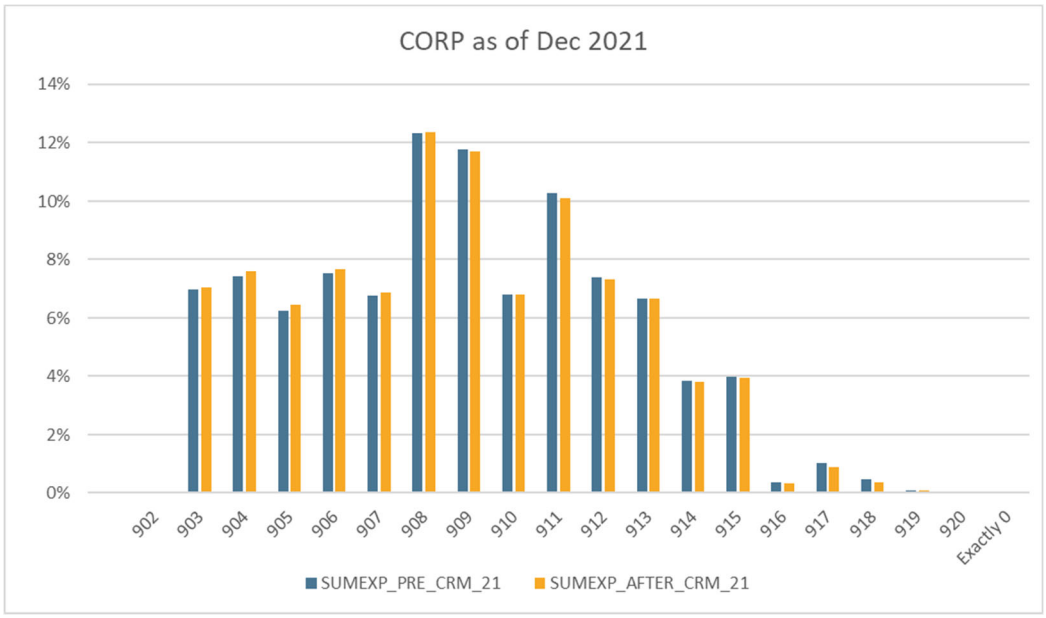

RQRR PD
0.03
0.025
0.02
0.015
0.01
0.005
0
IE
FR
ES
DE
IT
AT
AVG PD Dec 2020
AVG PD Dec 2021

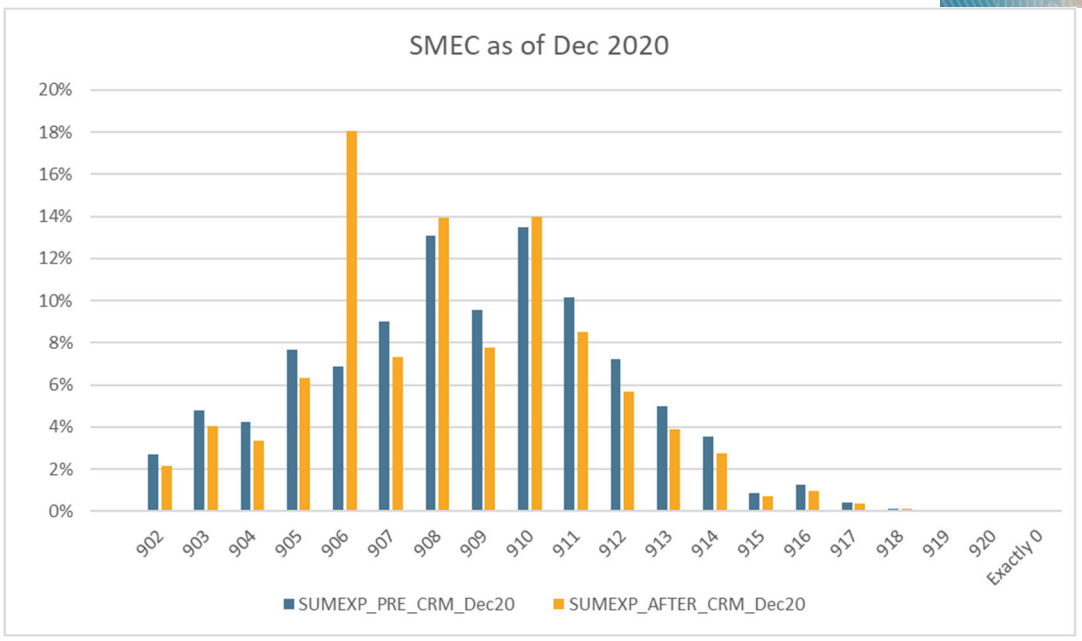

RQRR DR
0.04
0.03
0.02
0.01
0
IE
FR
ES
DE
IT
AT
AVG DR Dec 2020
AVG DR Dec 2021

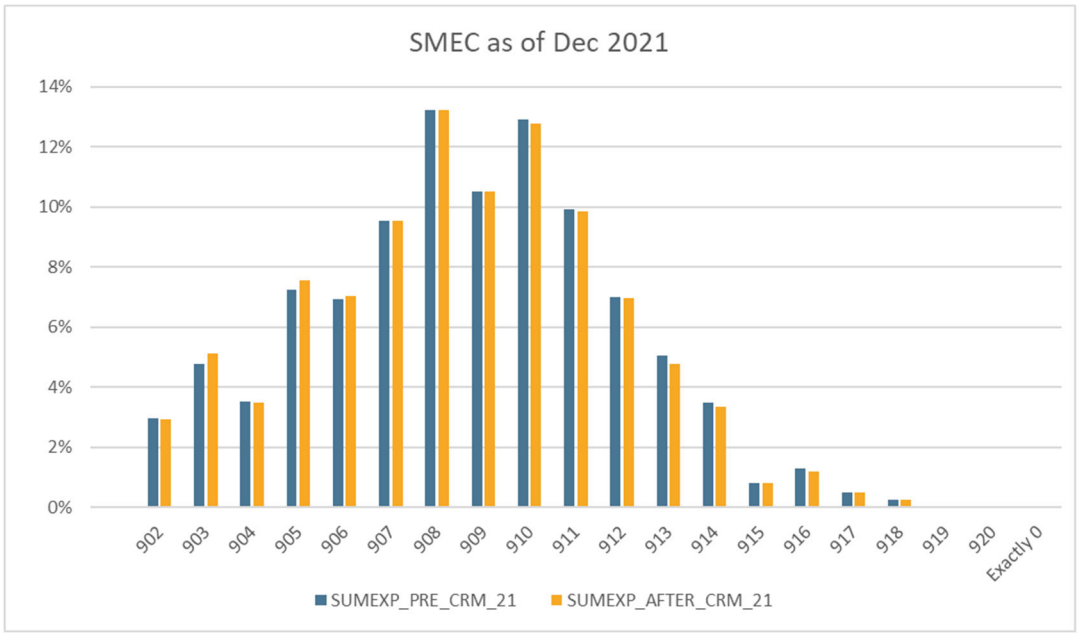
2.4.4 Results compared with previous exercise – PD & DR – By exposure class and grade in master scale

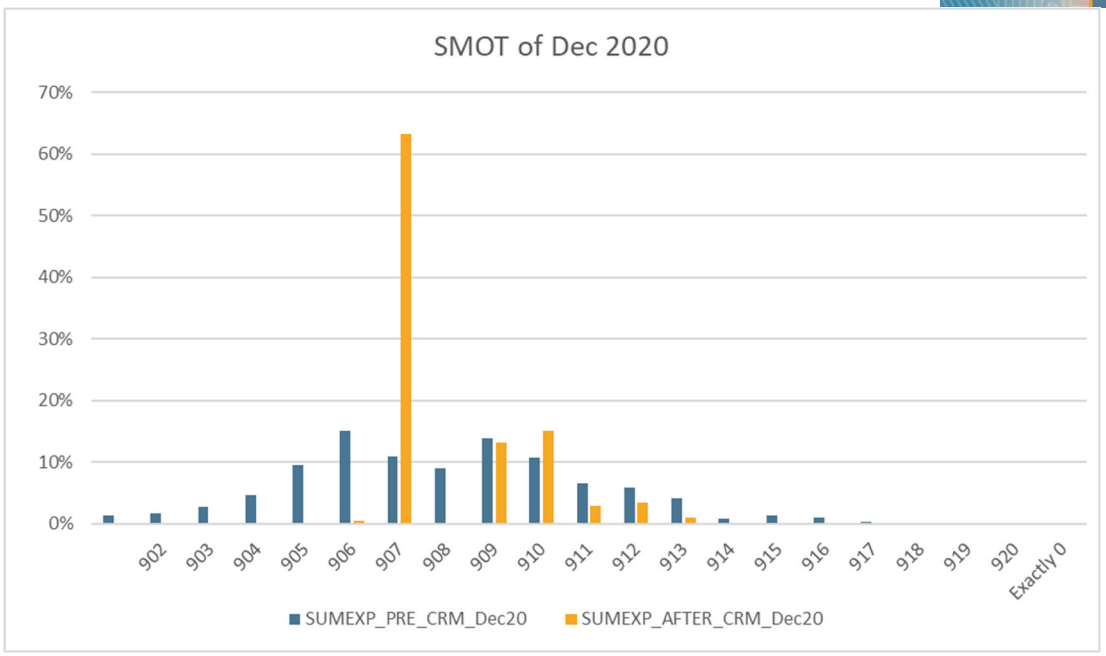
Figure 36: EAD per master rating-grade as of 31.12.2020 and 31.12.2021

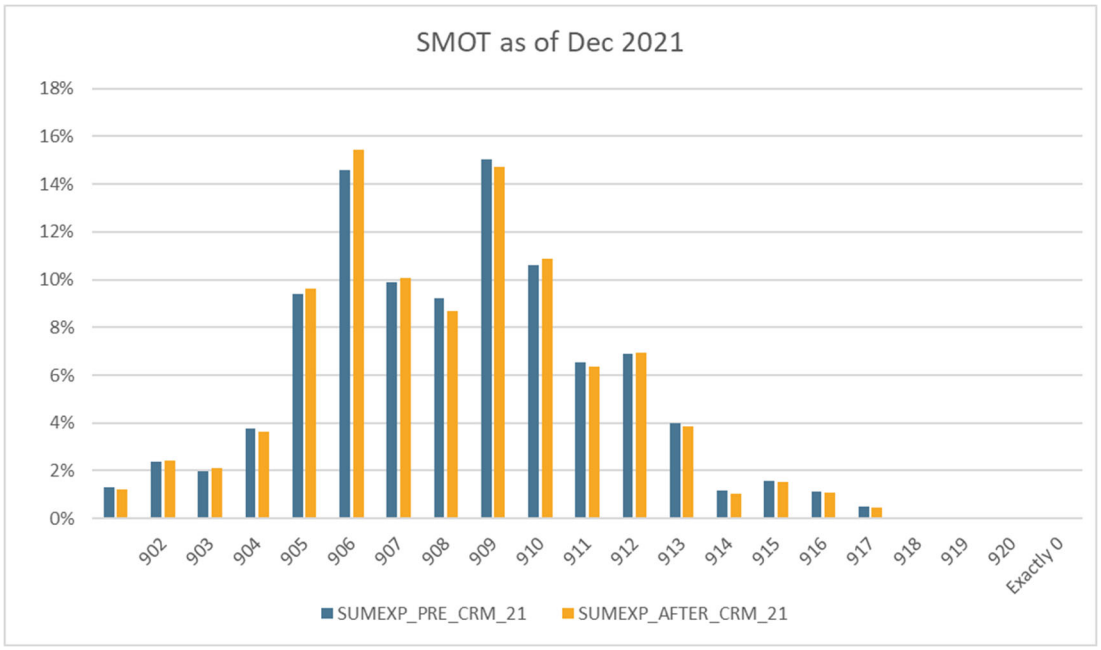


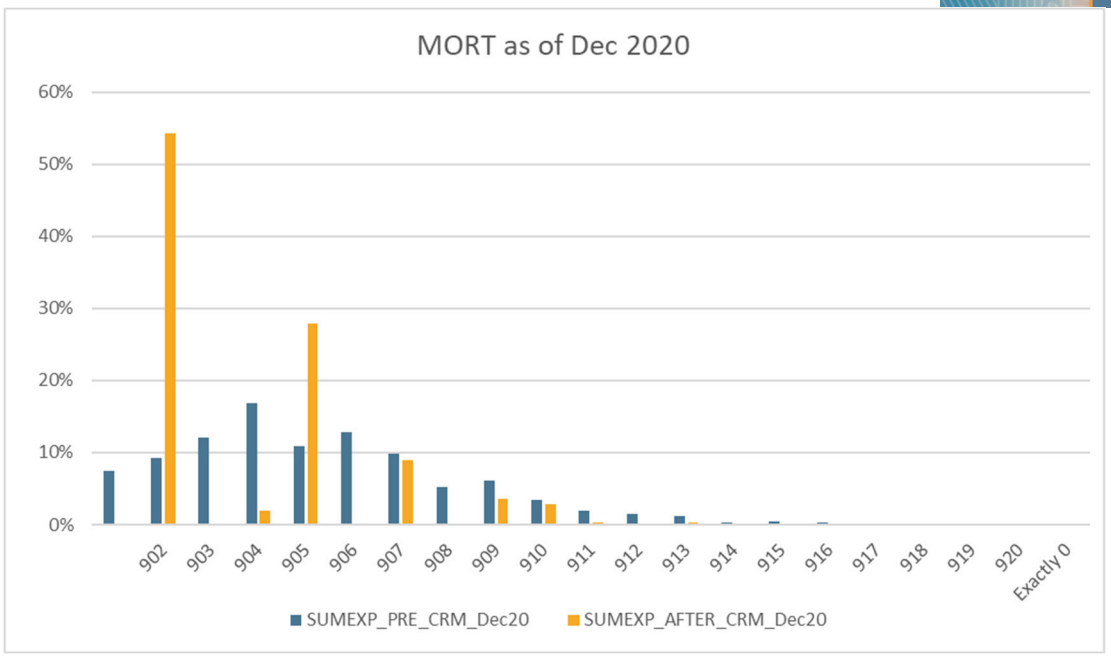


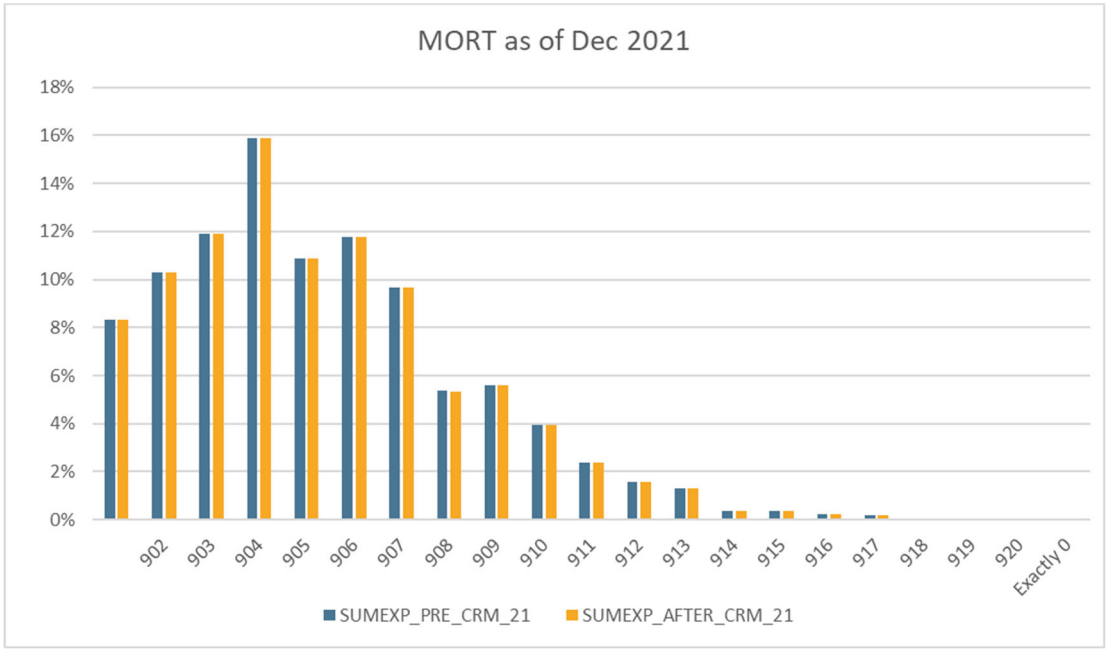

SMEC as of Dec 2020
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
Exactly 0
SUMEXP_PRE_CRM_Dec20
SUMEXP_AFTER_CRM_Dec20


SMEC as of Dec 2021
14%
12%
10%
8%
6%
4%
2%
0%
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
Exactly 0
SUMEXP_PRE_CRM_21
SUMEXP_AFTER_CRM_21


SMOT of Dec 2020
70%
60%
50%
40%
30%
20%
10%
0%
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
Exactly 0
SUMEXP_PRE_CRM_Dec20
SUMEXP_AFTER_CRM_Dec20

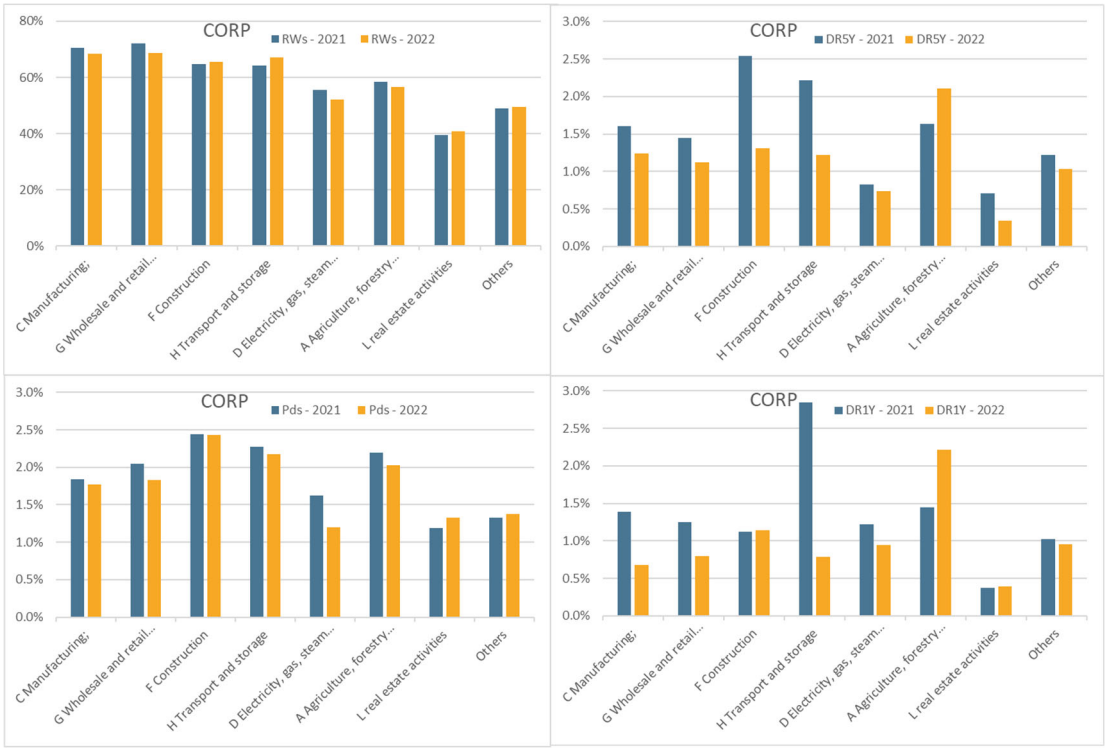

SMOT as of Dec 2021
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
Exactly 0
SUMEXP_PRE_CRM_21
SUMEXP_AFTER_CRM_21

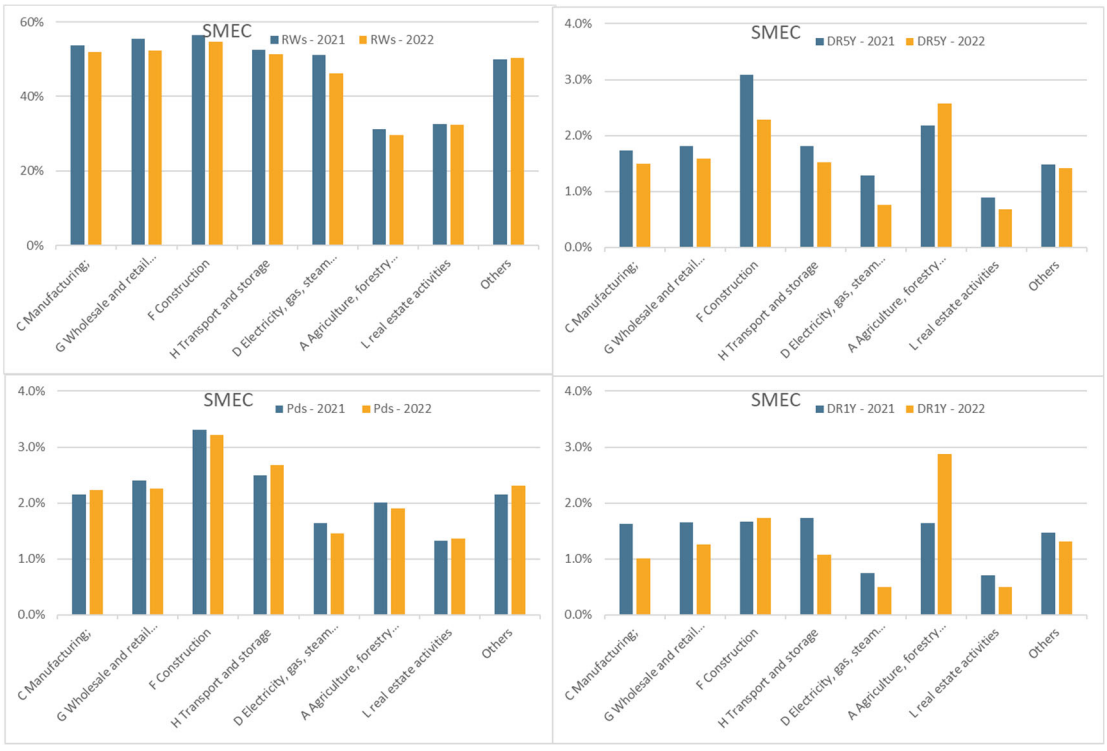

MORT as of Dec 2020
60%
50%
40%
30%
20%
10%
0%
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
Exactly 0
SUMEXP_PRE_CRM_Dec20
SUMEXP_AFTER_CRM_Dec20


MORT as of Dec 2021
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
Exactly 0
SUMEXP_PRE_CRM_21
SUMEXP_AFTER_CRM_21

2.4.5 Results compared with previous exercise – PD & DR– for CORP and SMEC by sector

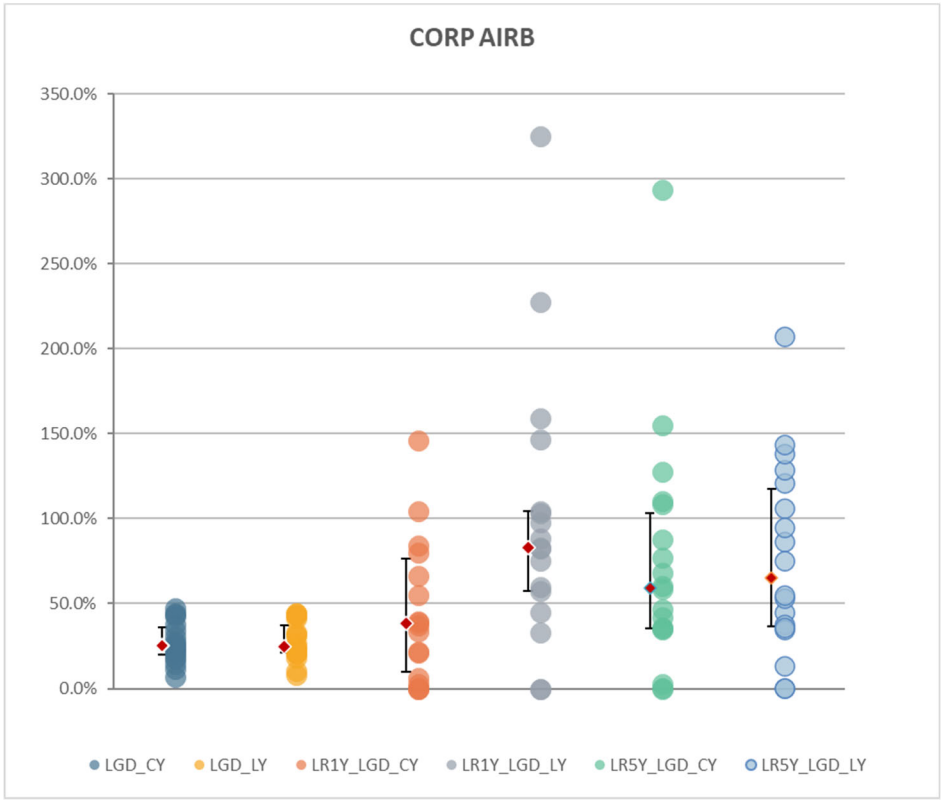
Figure 37: Key risk parameters by sector as of 31.12.2020 and 31.12.2021

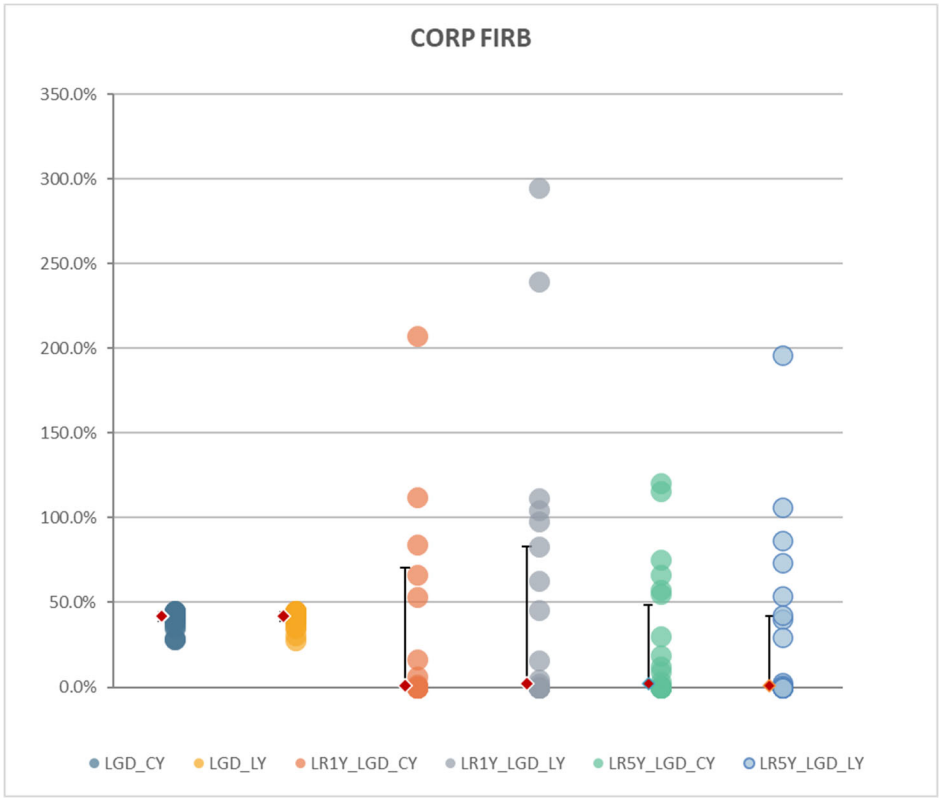


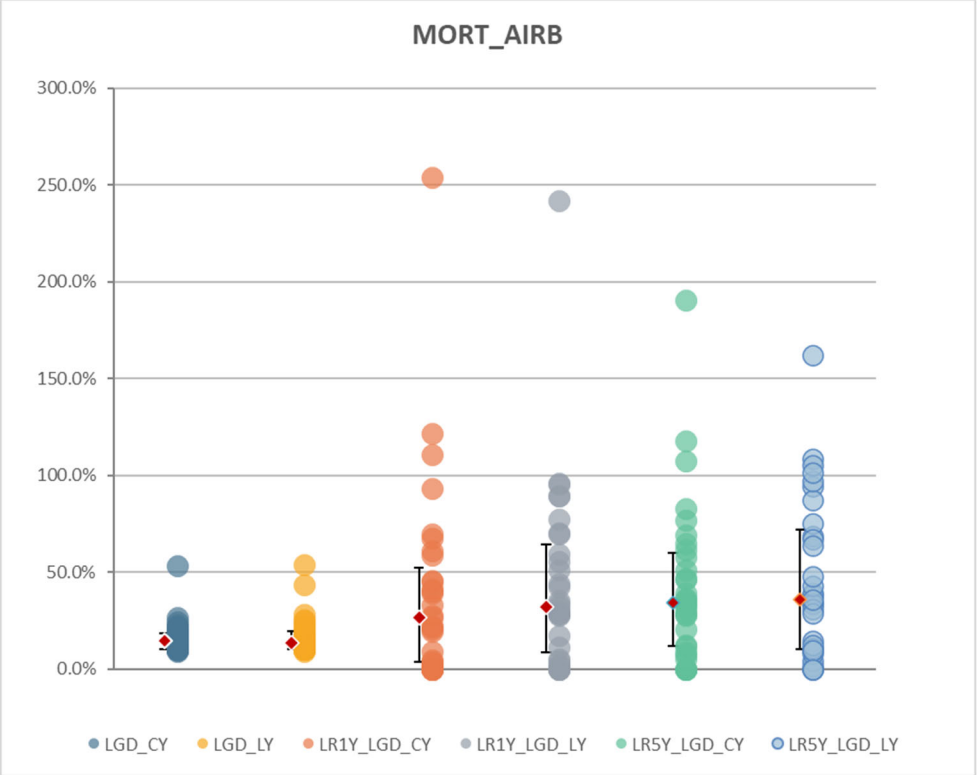


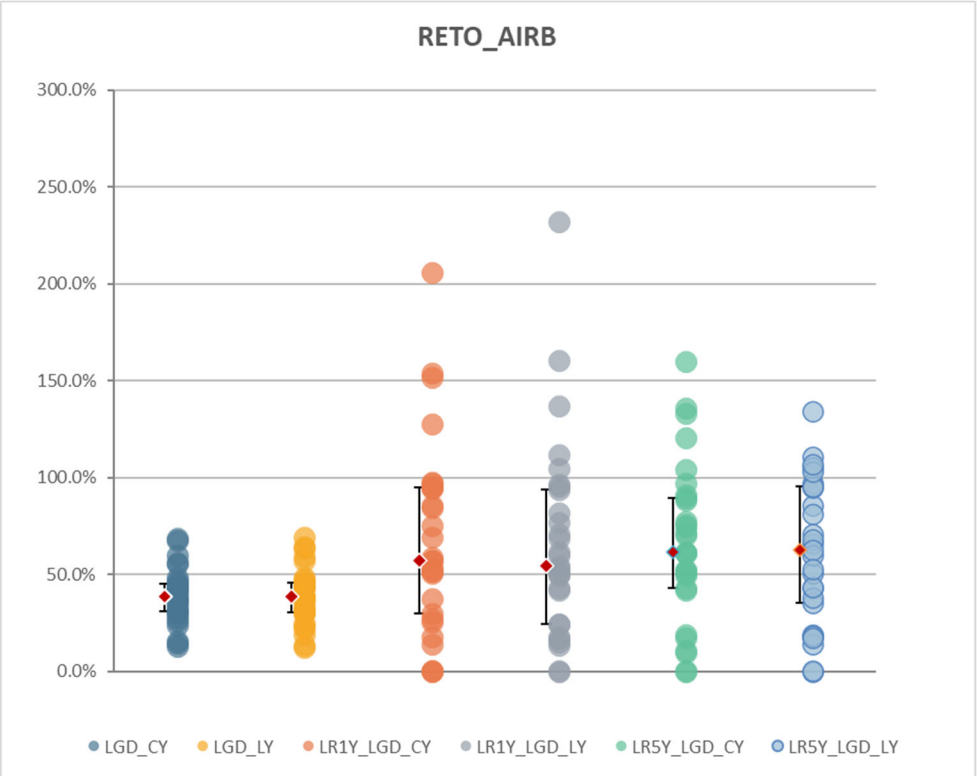
2.4.6 Results compared with previous exercise – LGD & LR – (Non-defaulted)

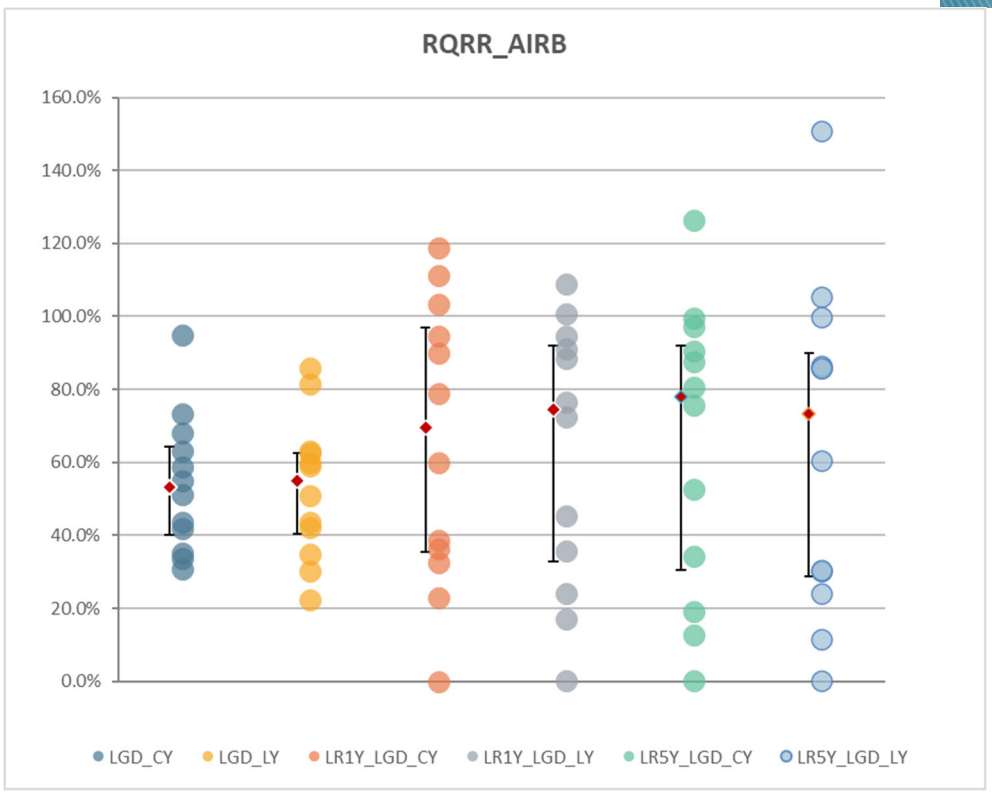
Figure 38: Comparison of the dispersion in the LGD and LR for 2021 (CY) and 2020 (LY) – Non-defaulted

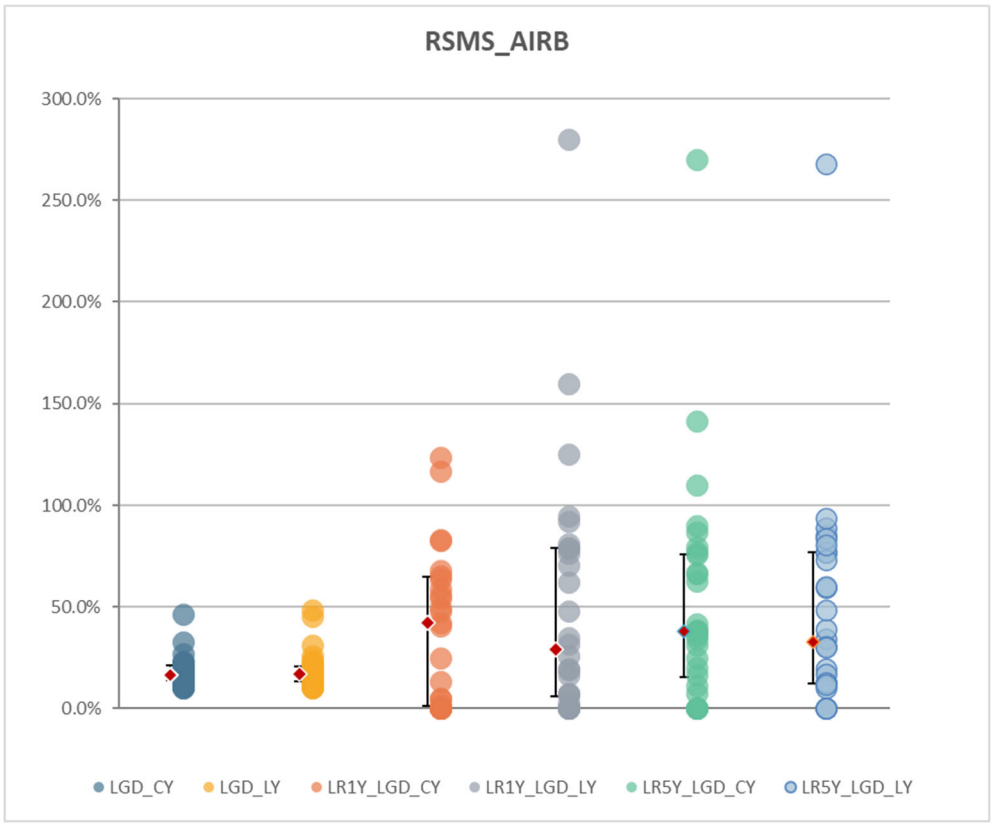


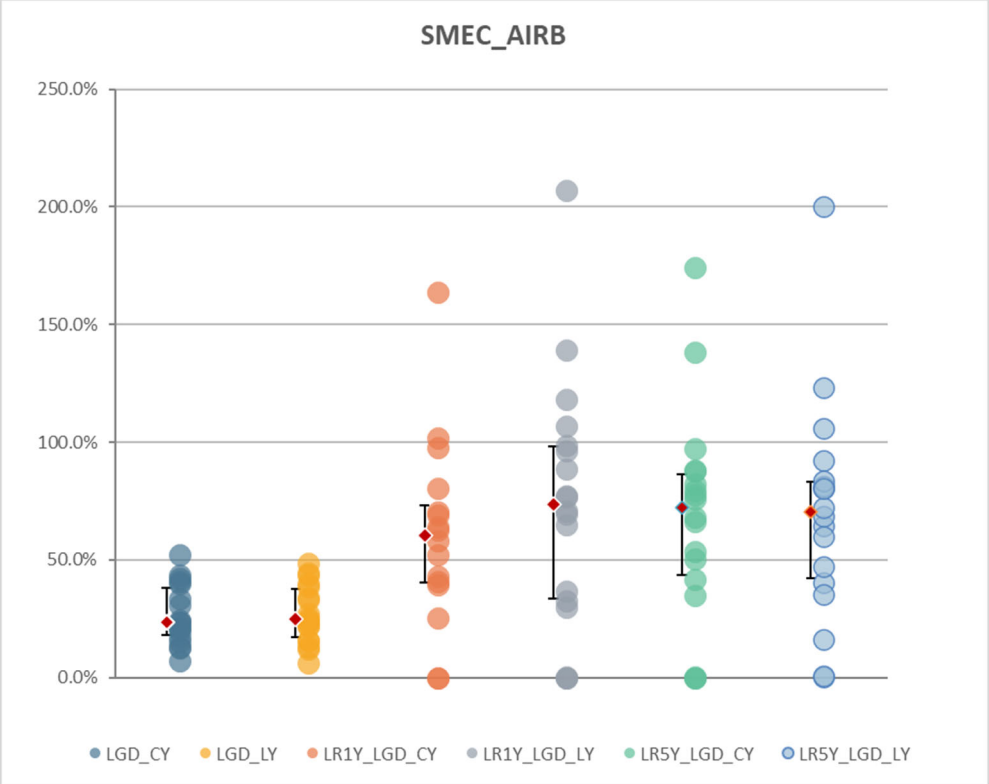


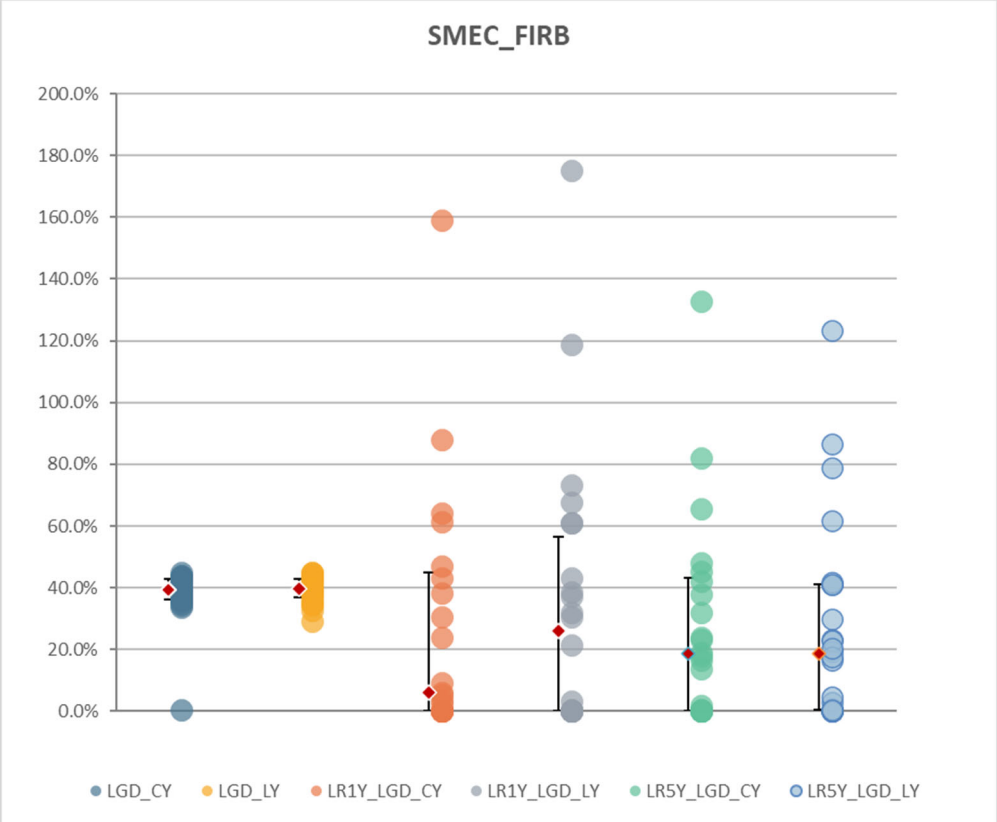

MORT_AIRB
300.0%
250.0%
200.0%
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY

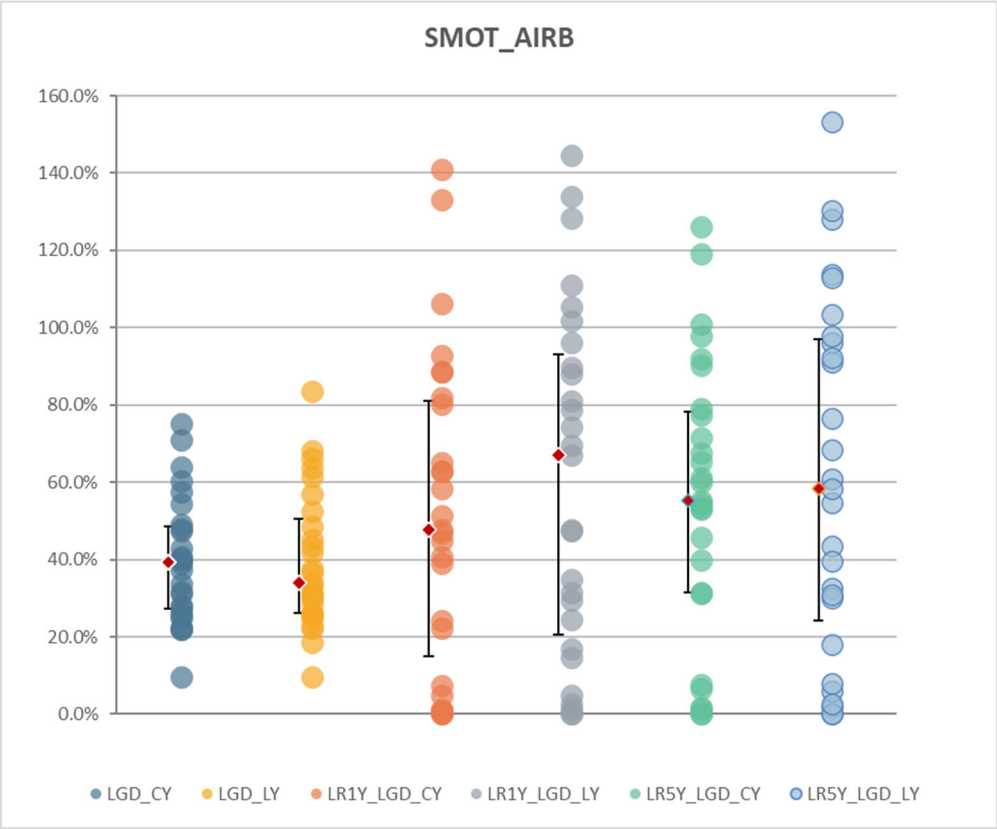

RETO_AIRB
300.0%
250.0%
200.0%
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


RQRR_AIRB
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


RSMS_AIRB
300.0%
250.0%
200.0%
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY

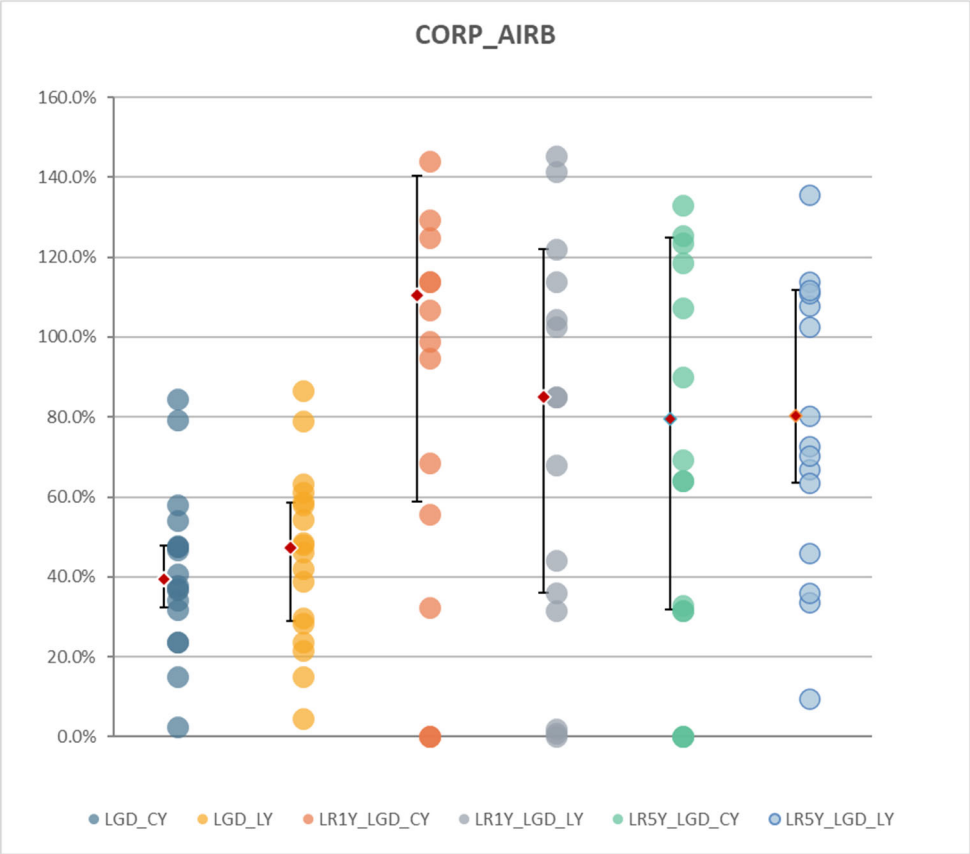

SMEC_AIRB
250.0%
200.0%
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY

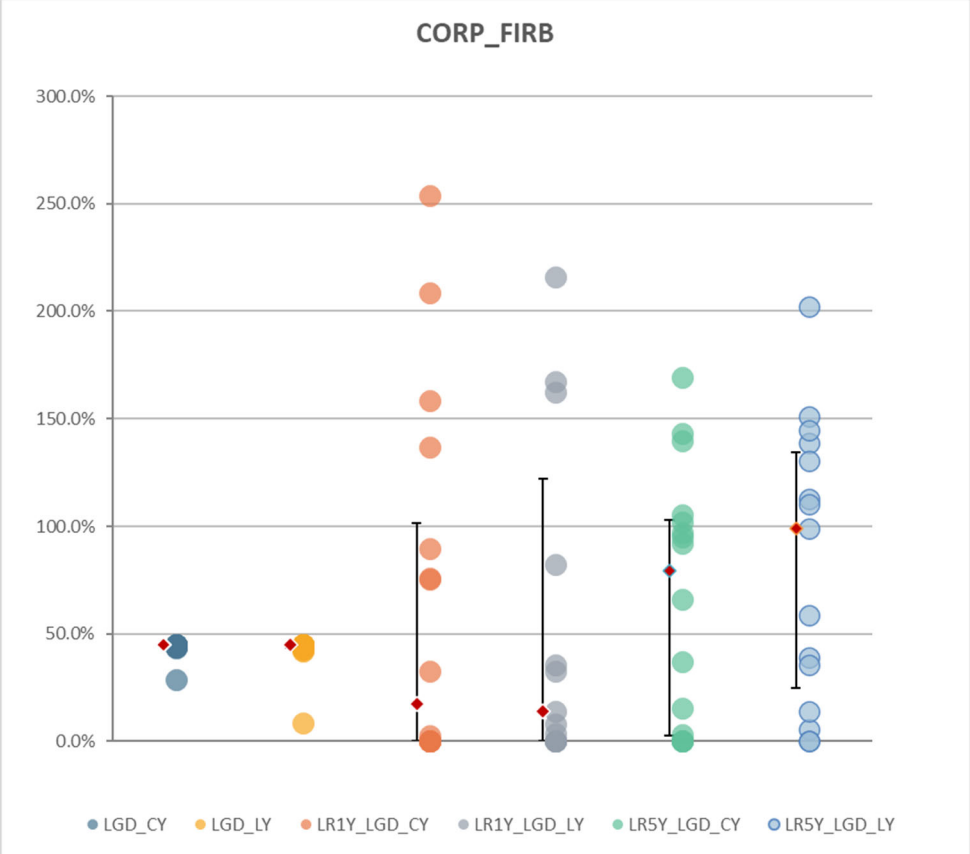

SMEC_FIRB
200.0%
180.0%
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


SMOT_AIRB
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY

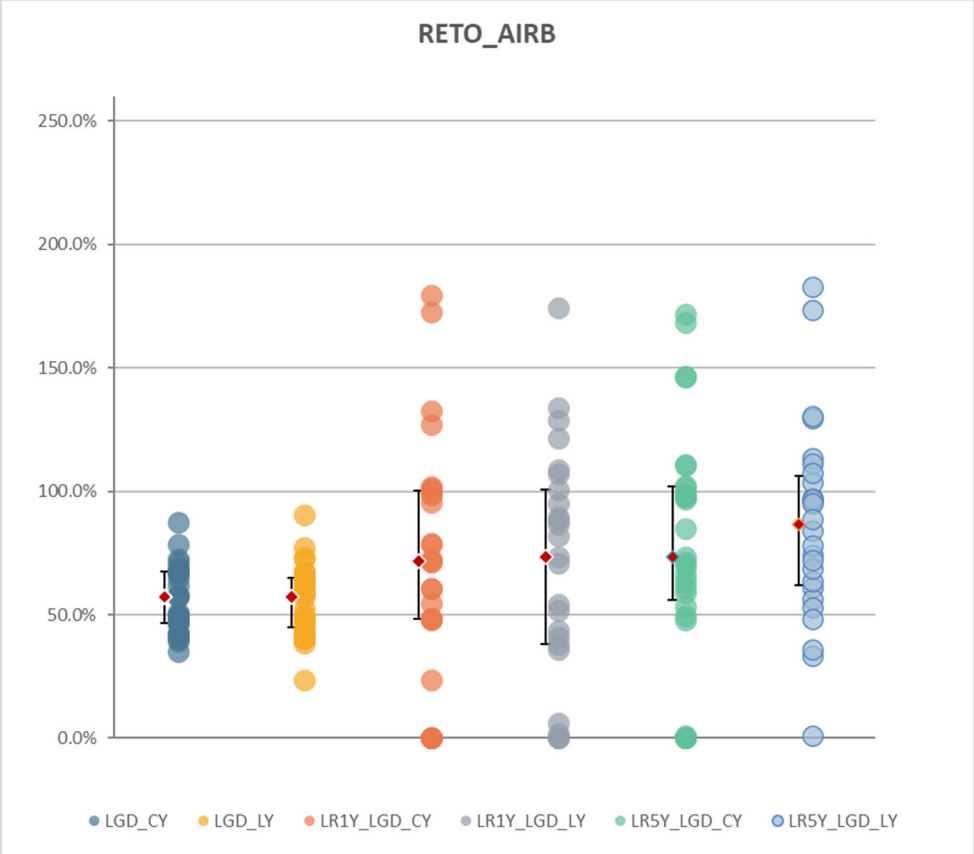
2.4.7 Results compared with previous exercise – LGD & LR – (defaulted)

Figure 39: Comparison of the dispersion in the LGD and LR for 2021 (CY) and 2020 (LY) – Defaulted

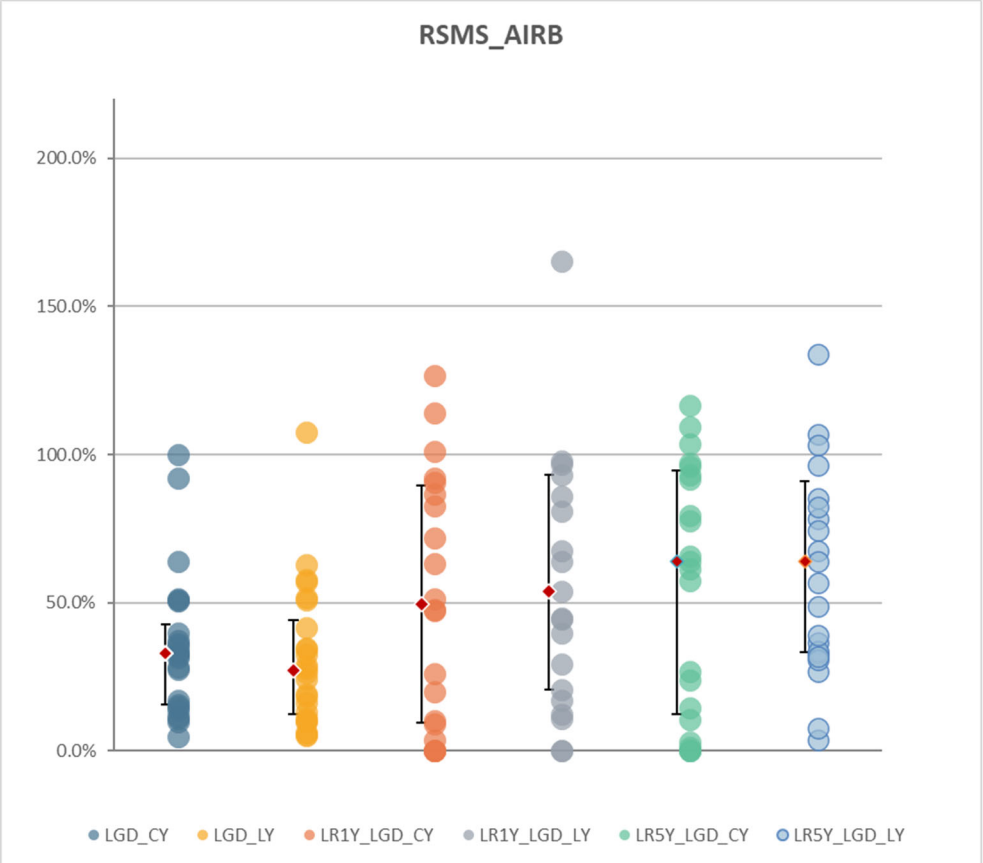


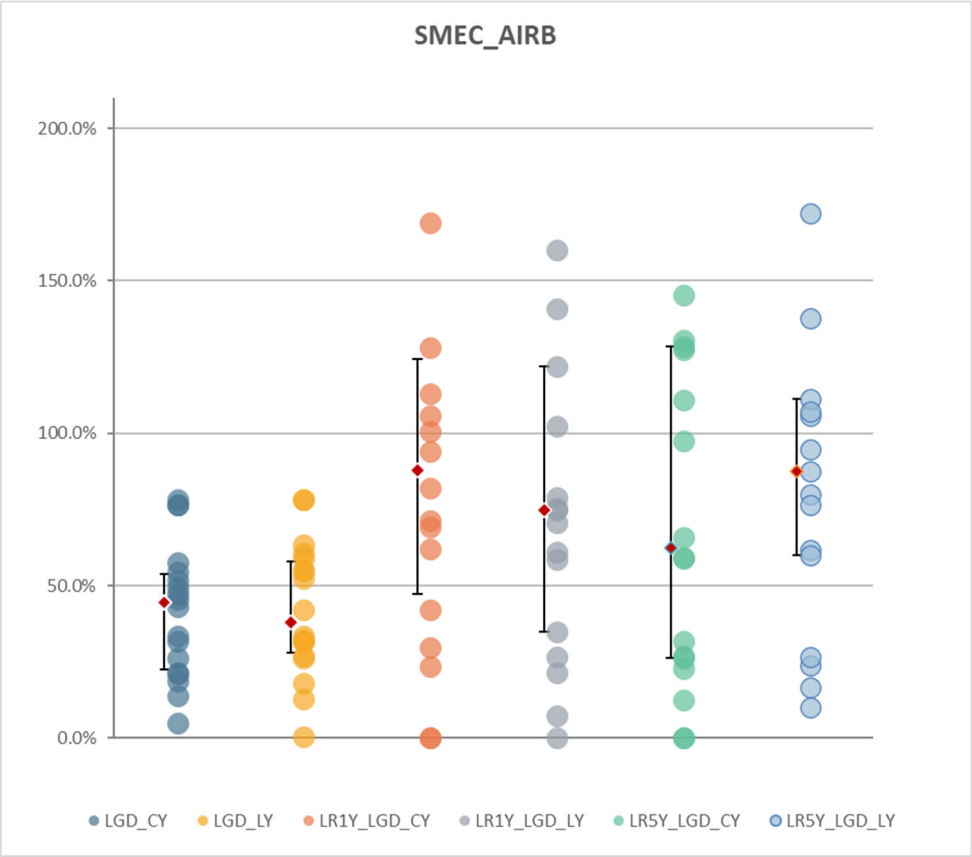


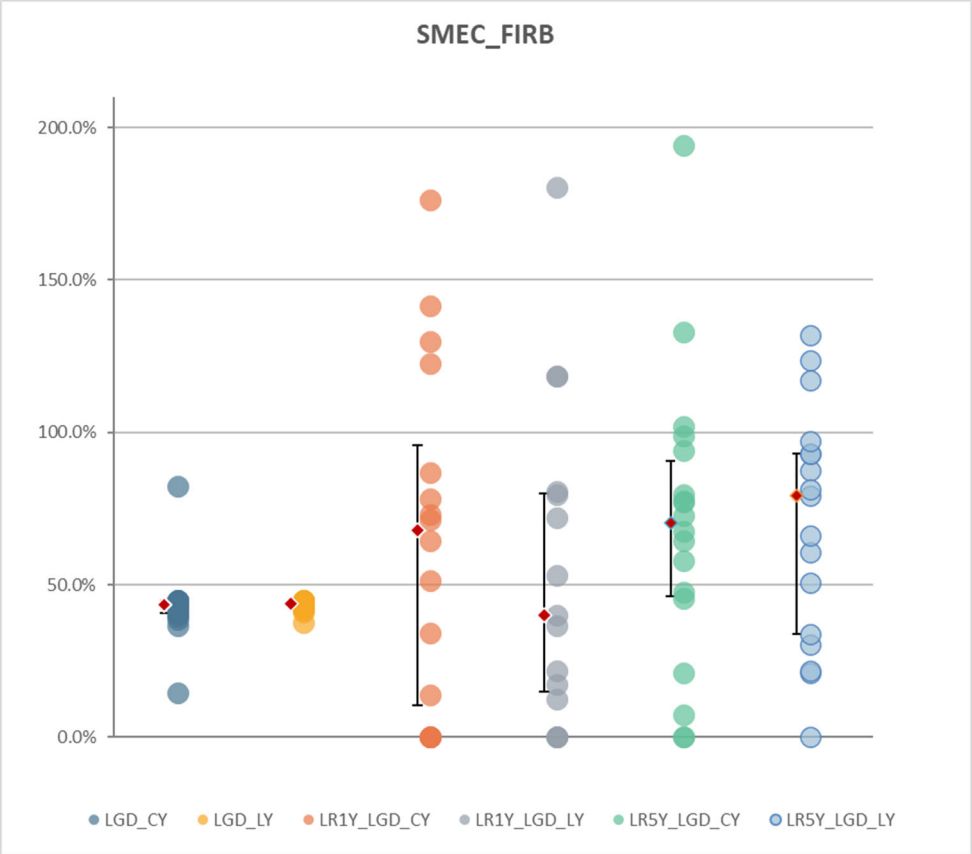

MORT_AIRB
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


RETO_AIRB
250.0%
200.0%
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


RQRR_AIRB
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


RSMS_AIRB
200.0%
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


SMEC_AIRB
200.0%
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


SMEC_FIRB
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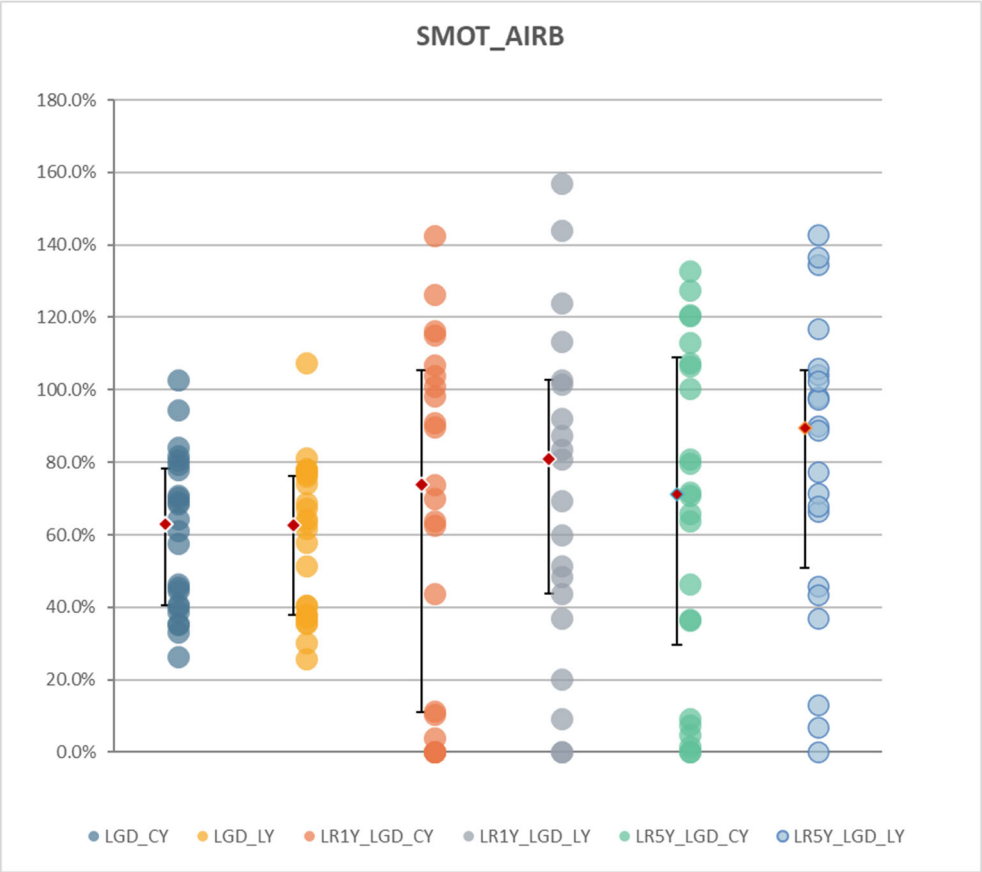
150.0%
100.0%
50.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY


SMOT_AIRB
180.0%
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
LGD_CY
LGD_LY
LR1Y_LGD_CY
LR1Y_LGD_LY
LR5Y_LGD_CY
LR5Y_LGD_LY

2.5 Specific analysis

2.5.1 COVID-19 related analysis

2.5.1.1 Use and impact of CRM by country and exposure class

Methodology and assumptions

The use of guarantees can be assessed by comparing the original exposure pre-conversion factors (column 0080 of templates C102 & C103) to the Exposure after CRM substitution effects pre-conversion factors (column 0090 of templates C102 & C103).

These fields, defined in the context of benchmarking for benchmark portfolios, are specified in template 8.1 of Annex I to Implementing Regulation (EU) No 680/2014. Following these instructions, the ORIGINAL EXPOSURE PRE-CONVERSION FACTORS shall be reported in accordance with Article 24 CRR and paragraphs 1, 2, 4, 5, 6 and 7 of Article 166 CRR and the EXPOSURE AFTER CRM SUBSTITUTION EFFECTS PRE-CONVERSION FACTORS refers to the exposure assigned in the corresponding obligor grade or pool and exposure class after taking into account outflows and inflows due to CRM techniques with substitution effects on the exposure.

In this context, outflows shall correspond to the covered part of the original exposure pre-conversion factors, that is deducted from the obligor's exposure class and, where relevant, obligor grade or pool, and subsequently assigned to the guarantor's exposure class and, where relevant, obligor grade or pool. That amount shall be considered as an inflow into the guarantor's exposure class and, where relevant, obligor grades or pools.

Inflows and outflows within the same exposure classes and, where relevant, obligor grades or pools, shall also be considered. Exposures stemming from possible in- and outflows from and to other templates shall be taken into account.

These columns shall only be used where institutions have obtained permission from their competent authority to treat these secured exposures under the permanent partial use of the Standardised approach in accordance with Article 150 CRR or to classify the exposures to exposure classes in accordance with the characteristic of the guarantor.

For the illustration in this section the relative outflows have been calculated as:

CRM_Impact_Dec2020 = (SUMEXP_PRE_CRM_Dec2020 - SUMEXP_AFTER_CRM_Dec2020)/ SUMEXP_PRE_CRM_Dec2020

CRM_Impact_Dec2021 = (SUMEXP_PRE_CRM_Dec2021 - SUMEXP_AFTER_CRM_Dec2021)/ SUMEXP_PRE_CRM_Dec2021

Figure 40: The use of RW substitution by exposure class

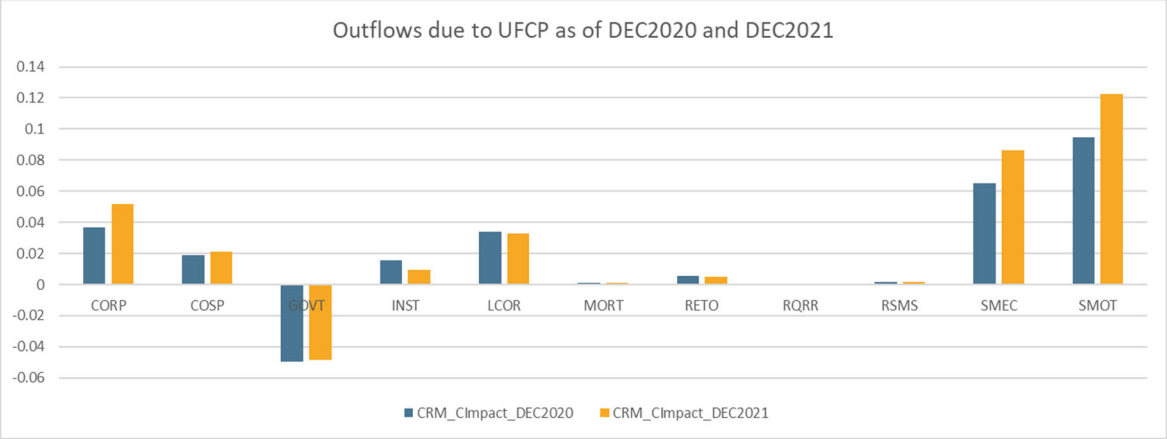
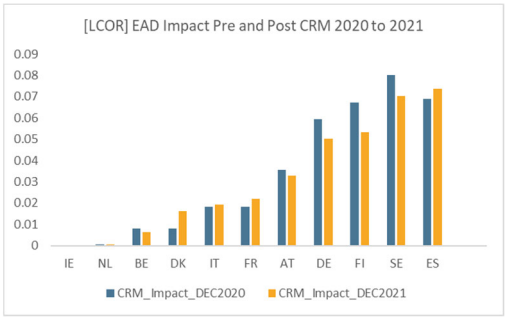
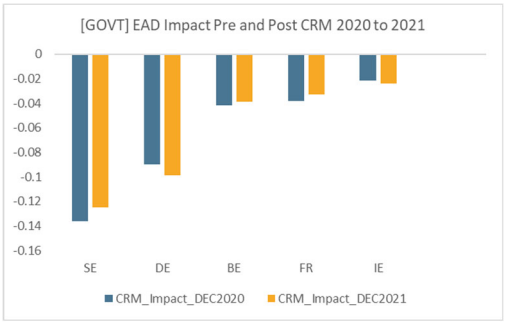
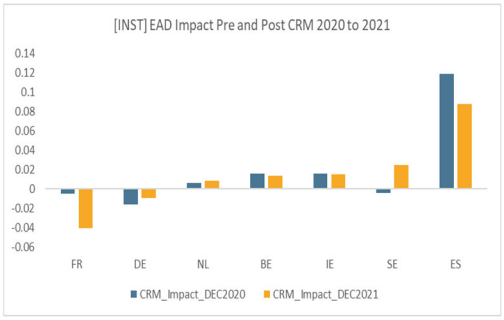
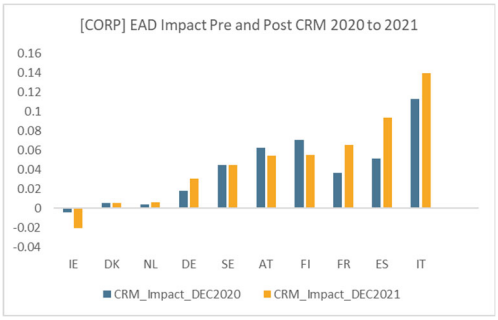


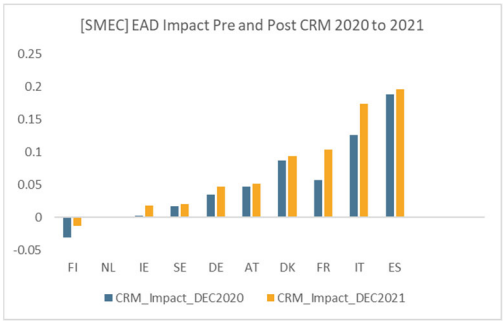
Figure 41: Outflows due to RW substitution by exposure class

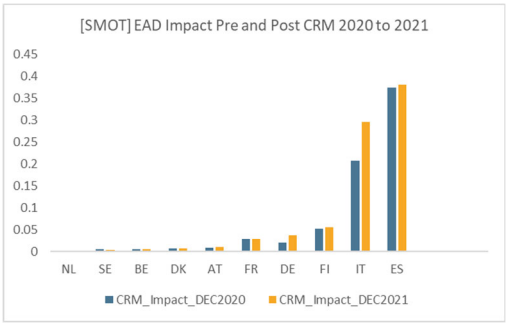


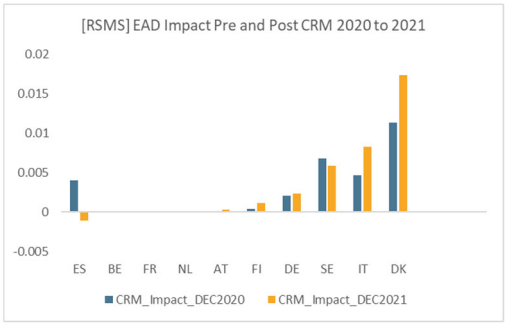












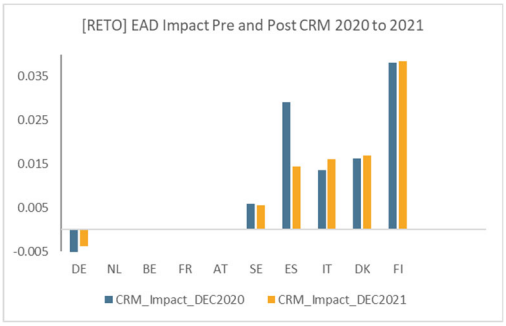
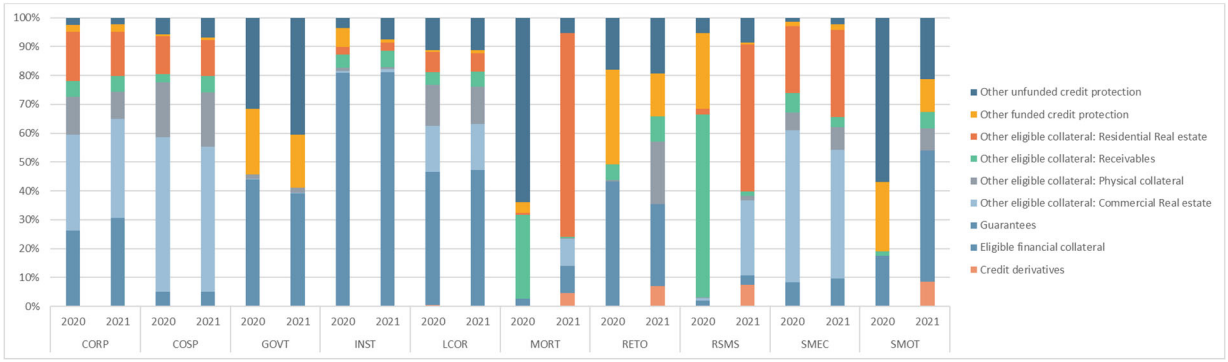
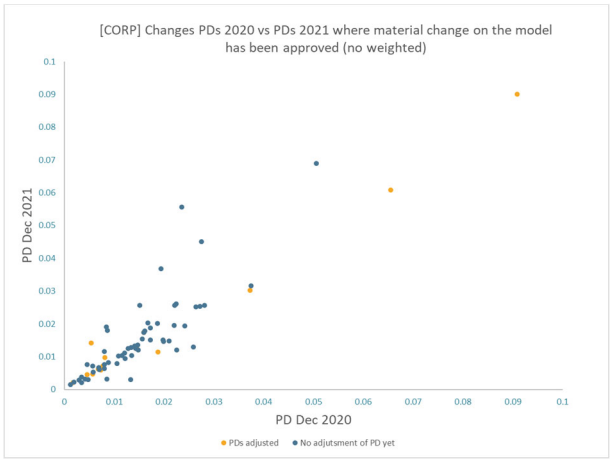


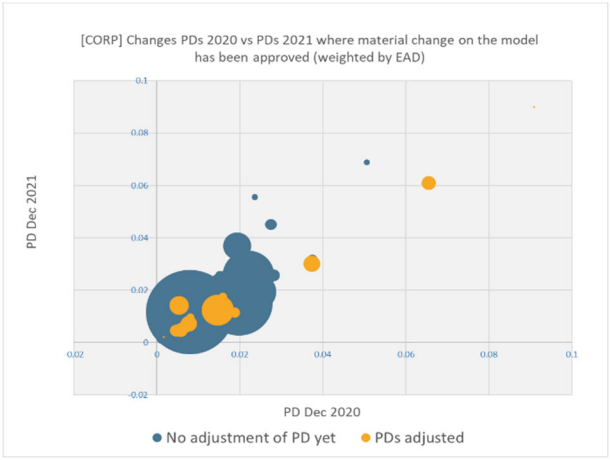
Figure 42: Breakdown of secured exposure by collateral type

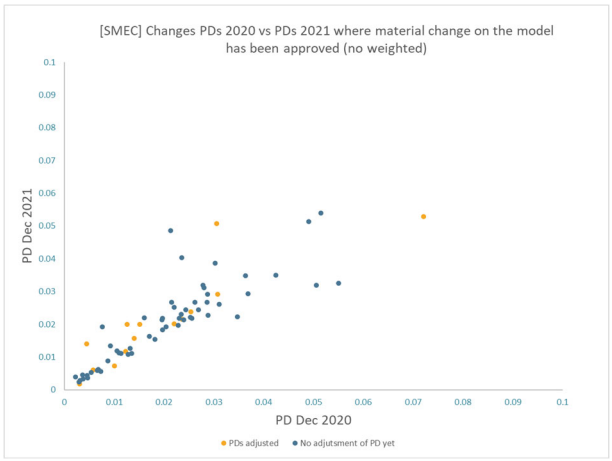


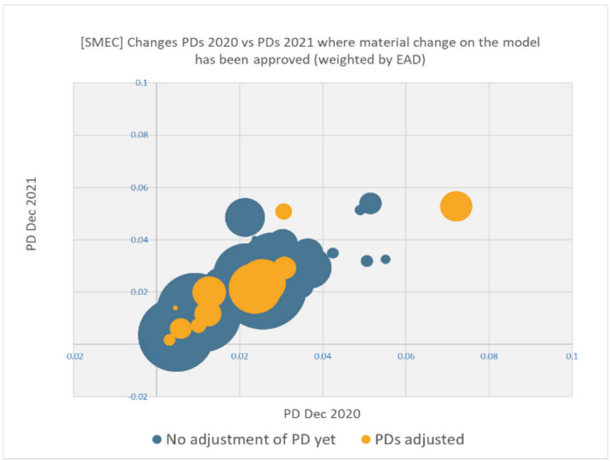
2.5.2 Impact of IRB Roadmap

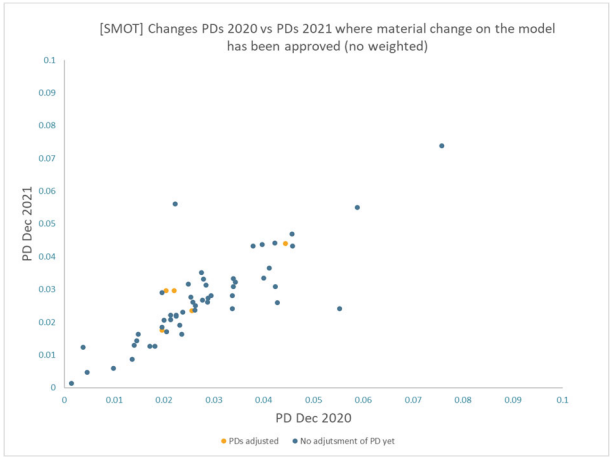
Figure 43: Chart set on average PDs observed as of December 2020 compared to the average PDs observed as of December 2021. The circles indicate the size of the relevant portfolio in terms of EAD.

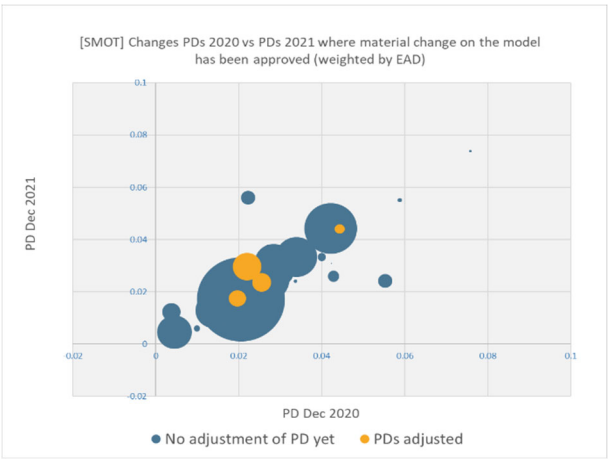


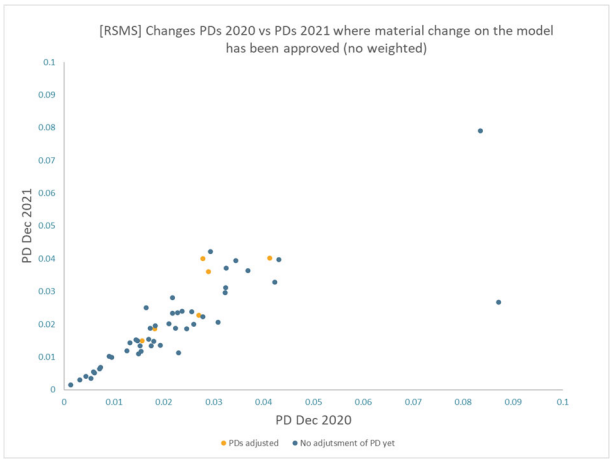


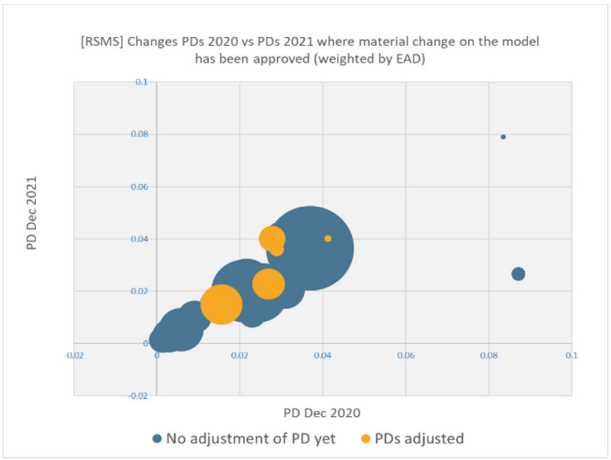


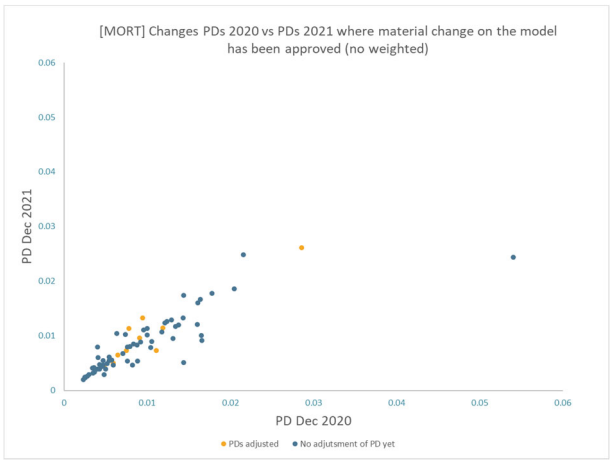


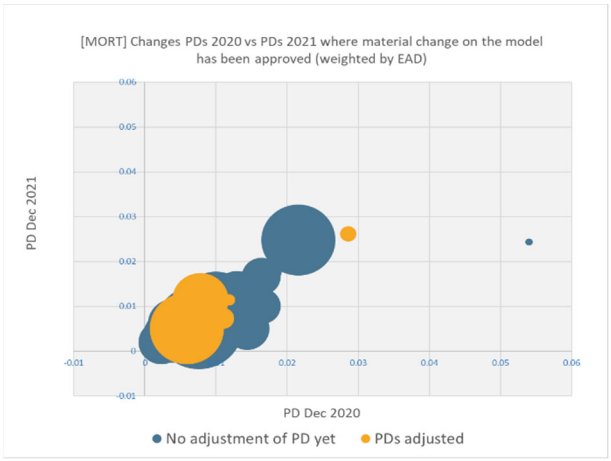


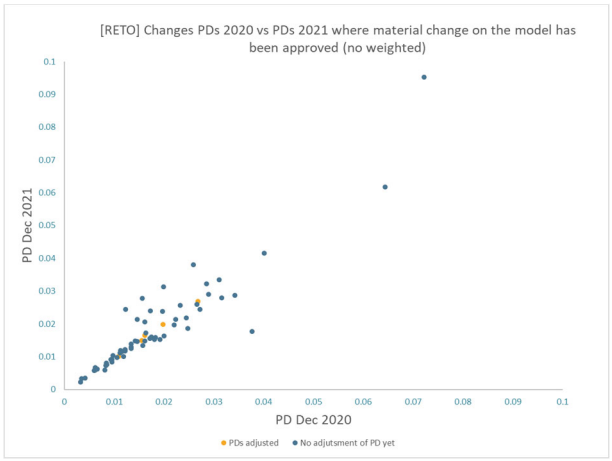


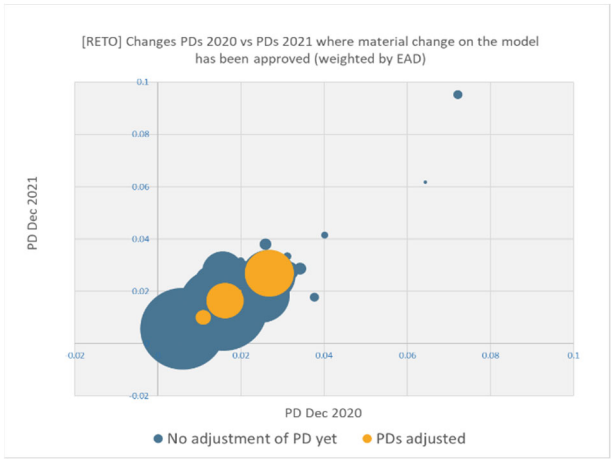

[RSMS] Changes PDs 2020 vs PDs 2021 where material change on the model has been approved (no weighted)
PD Dec 2021
PD Dec 2020
PDs adjusted
No adjutsment of PD yet


[RSMS] Changes PDs 2020 vs PDs 2021 where material change on the model has been approved (weighted by EAD)
PD Dec 2021
PD Dec 2020
No adjustment of PD yet
PDs adjusted


[MORT] Changes PDs 2020 vs PDs 2021 where material change on the model has been approved (no weighted)
PD Dec 2021
PD Dec 2020
PDs adjusted
No adjutsment of PD yet


[MORT] Changes PDs 2020 vs PDs 2021 where material change on the model has been approved (weighted by EAD)
PD Dec 2021
PD Dec 2020
No adjustment of PD yet
PDs adjusted


[RETO] Changes PDs 2020 vs PDs 2021 where material change on the model has been approved (no weighted)
PD Dec 2021
PD Dec 2020
PDs adjusted
No adjutsment of PD yet

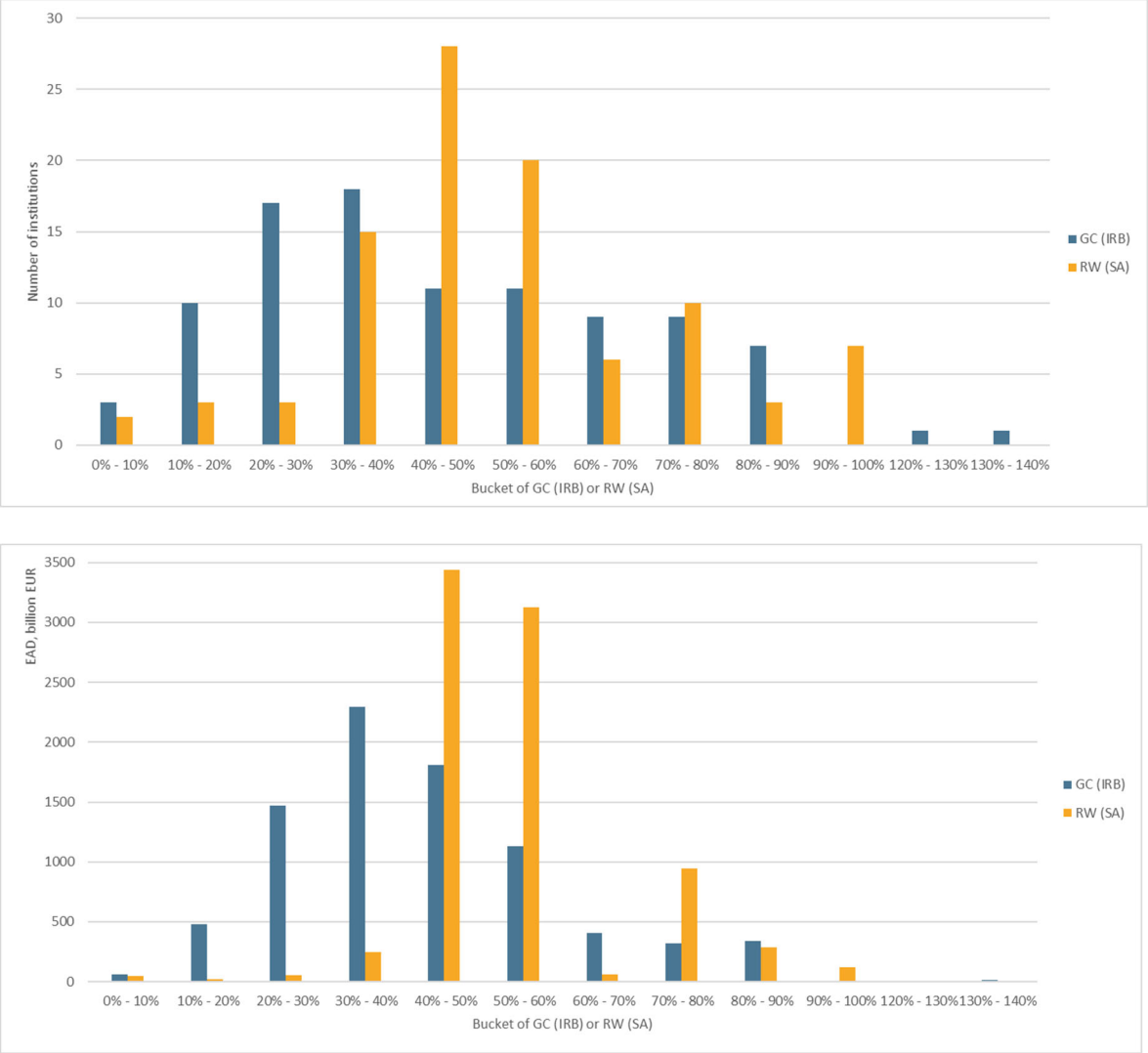

[RETO] Changes PDs 2020 vs PDs 2021 where material change on the model has been approved (weighted by EAD)
PD Dec 2021
PD Dec 2020
No adjustment of PD yet
PDs adjusted

The above set of charts displays the average PDs observed as of December 2020 (PDs 2021) compared to the average PDs observed as of December 2021 (PDs 2022) for the individual institutions' benchmarking portfolios per exposure class. In addition, it provides information on the state of the implementation of the IRB roadmap, where institutions for which the CAs claimed that a material model change has been approved are displayed in orange, while institutions for which the parameters are not yet revised (or where no impact has been observed) are displayed in light blue.

2.5.3 Finalisation of Basel III – comparison to SA

2.5.3.1 Variability analysed across exposure classes

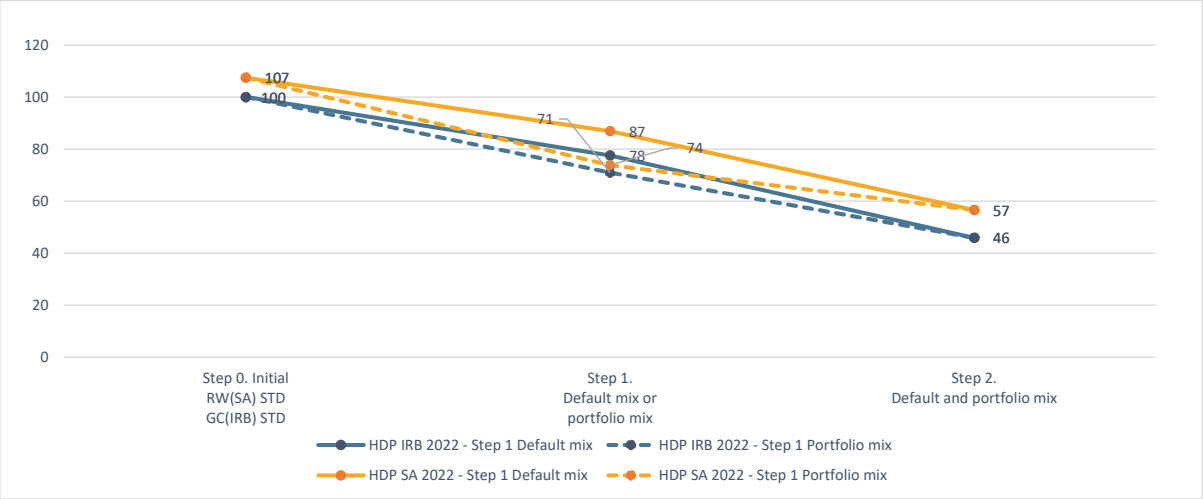
Figure 44: Distribution of GC (IRB) and RW (SA), number weighted (top) and exposure weighted (bottom)



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.

Figure 45 allows the embedded variability of each approach to be visualised at the aggregate level, but without any consideration of the riskiness of the portfolio. Leveraging 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 to the initial IRB variability (hence, the initial IRB variability is arbitrarily set at 100).

Figure 45: Top-down analysis – SA versus IRB – December 2021



2.5.3.2 Variability analysed within the exposure classes

The values of RW calculated under the SA and under the IRB can be compared at the rating grade level. Figure 46 to Figure 49 focus on mortgages, where the highest number of data points is observed, although the same conclusions can be drawn for the other exposure classes.

Figure 46: RW (IRB) versus RW (SA) at the grade level, mortgages portfolio

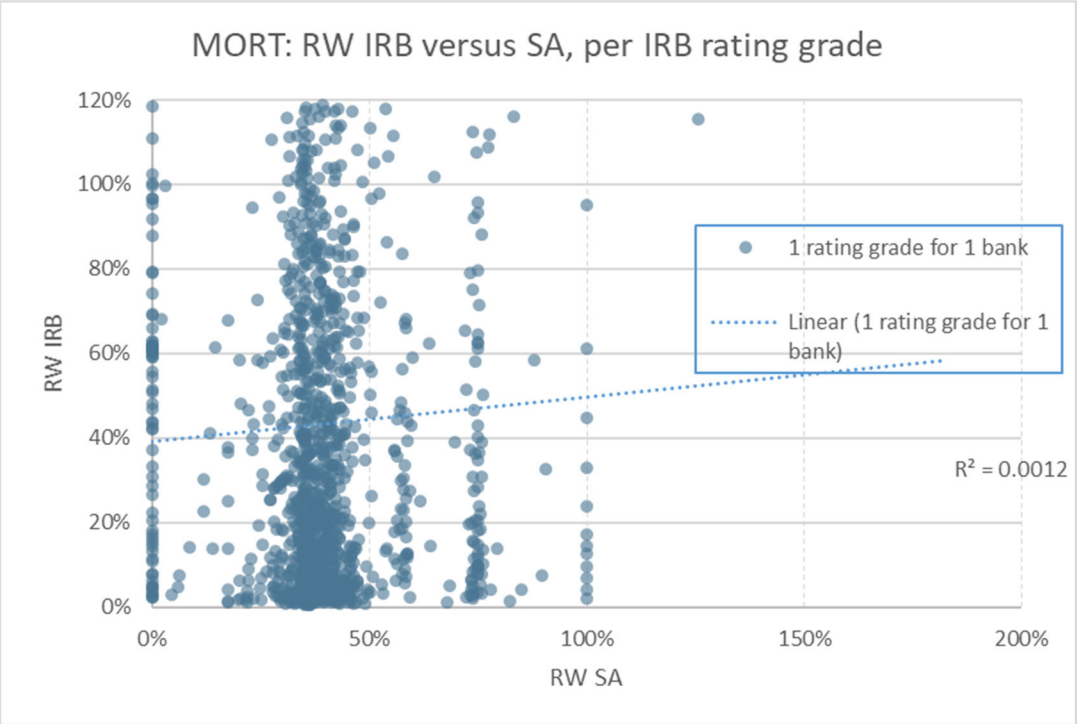
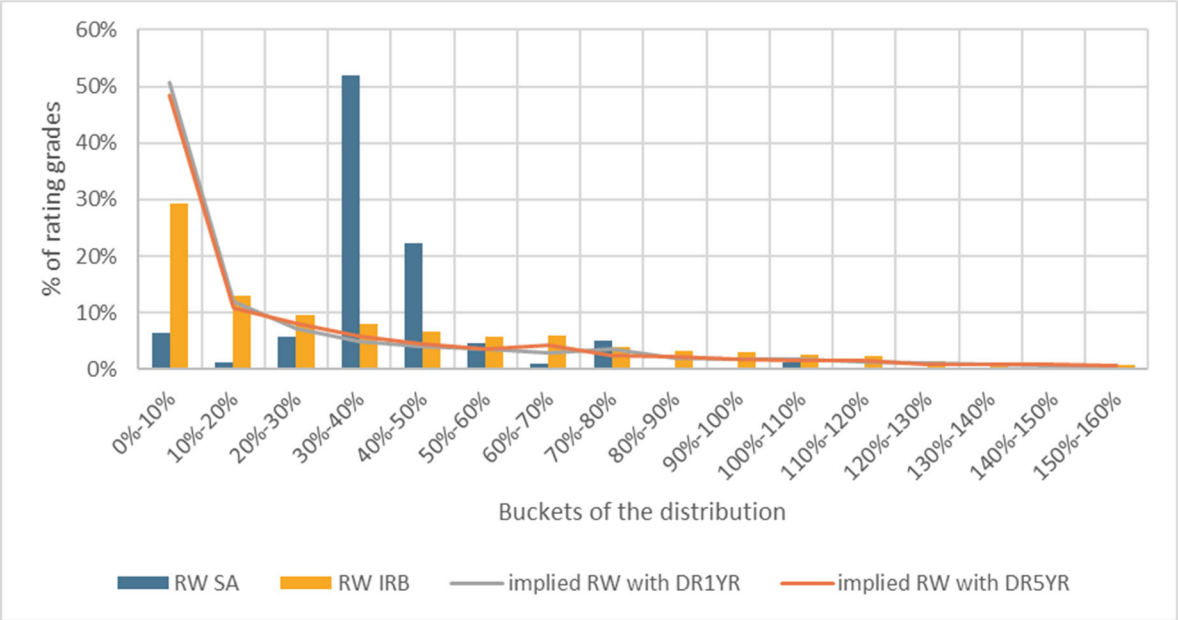


Figure 47: Distribution of RW (IRB), RW (SA) and implied RW, mortgage portfolio

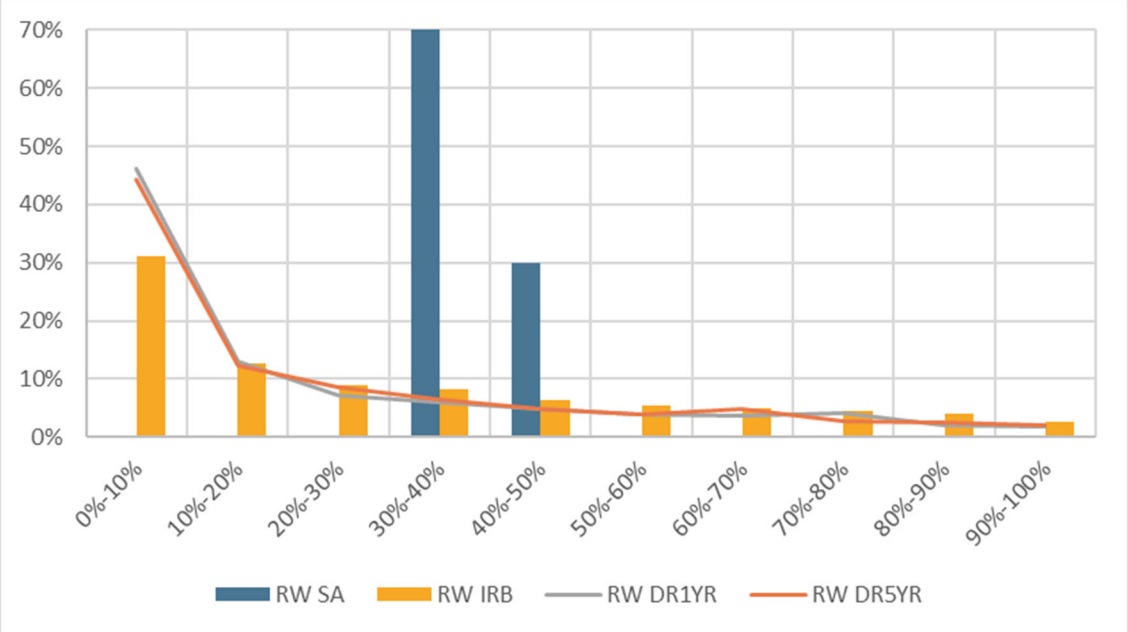


The dispersion of RW calculated under the IRB for a given SA RW band can be illustrated for selected RW bands, for instance the 30%-50% SA bucket.

Figure 48 replicates

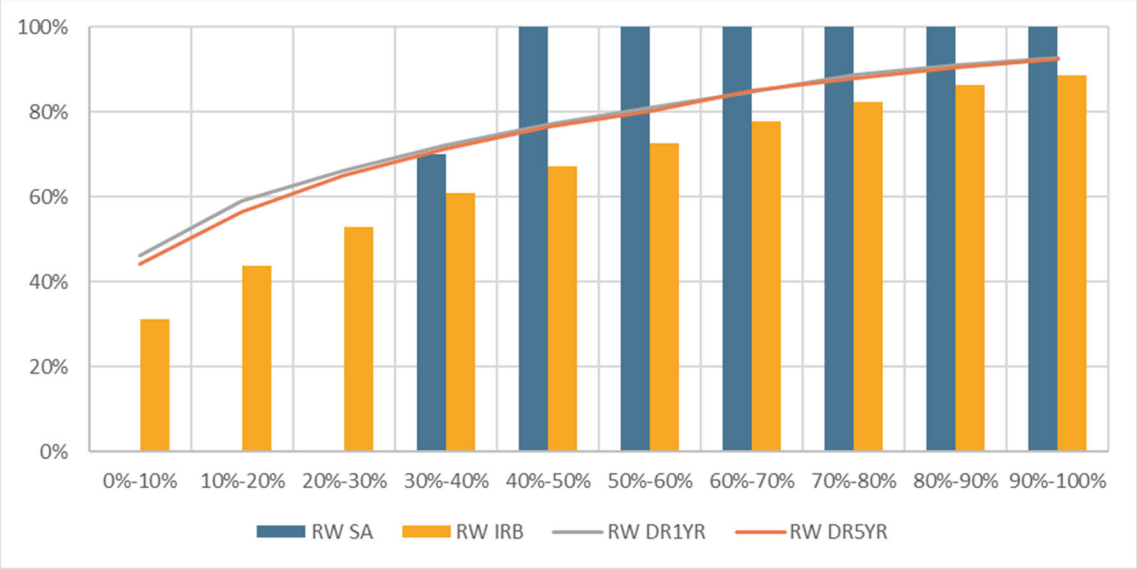
Figure 47, but only keeping the rating grades with RW (SA) between 30% and 50%.

Figure 48: Distribution of RW (IRB) for exposures with RW (SA) between 30% and 50%



This distribution analysis can be complemented by the cumulative distribution (Figure 49: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 30% and 50%).

Figure 49: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 30% and 50%



2.5.4 Variability in conservatism

A main objective of the monitoring of the IRB approaches via the benchmarking exercise is to ensure consistency in the RWAs resulting from own funds requirements calculations, which are based on internal approaches. Variability in the RWs, which different banks assign to comparable exposures, may be due to differences in the underlying business and differences in the contract characteristics. However, such variability may as well be due to differences in the level of conservatism that banks (or supervisors – if imposed) incorporate into their IRB parameters. Finally, there may as well be unjustified variability (for example where regulation is interpreted significantly different).

In the current exercise it is possible to provide for the first time summary statistics regarding supervisory add-ons, MoCs for PD and LGD and downturn component have been included. The below numbers have to be read as an initial data collection on this and should not be used for any interpretation on the conservatism embedded in the own funds requirements as of now given that the data submission on these fields was voluntary in 2022 and given that data quality is expected to be low due to the initial phase.

Range of MoC per SVB Exposure Class

Scope of the Analysis:

Level 1 portfolios (all) = TOT_ALL, Level 1 portfolios (non-defaulted) = TOT_NDE, Level 1 portfolios (defaulted) = TOT_DEF

Level 2 country split = COUNTRY

Where TOT_ALL, TOT_NDE, TOT_DEF are called macro buckets (“MB”).

Methodology:

For each bank Bi in a portfolio Pj in scope calculate

MoC_PD(Bi,Pj) = (d_0061(Bi,Pj) – d_0062(Bi,Pj))/d_0061(Bi,Pj)

MoC_LGD(Bi,Pj) = (d_0131(Bi,Pj) - d_0132(Bi,Pj))/ d_0131(Bi,Pj)

Provide Min, max, median and average of MoC_PD and MoC_LGD for each portfolio Pj in a MB in scope. I.e.: Min_MoC_PD (MB) := min (MoC_PD (Bi, Pj)) for all the Bi, Pj in the MB requested. A minimum of 3 Banks for each macro bucket will be requested.

Range of supervisory Add-on per SVB Exposure Class

Scope of the Analysis:

Level 1 portfolios (all), Level 1 portfolios (non-defaulted), Level 1 portfolios (defaulted)

Level 2 country split

Methodology:

For each bank (Bi) in a portfolio (Pj) in Scope calculate

Add_on_PD(Bi,Pj) = (d_0060 (Bi, Pj) – d_0061(Bi, Pj))/d_0060(Bi, Pj)

Add_on_LGD(Bi,Pj) = (d_0130(Bi, Pj) - d_0131(Bi, Pj))/ d_0130 (Bi, Pj)

Provide Min, max, median and average of Add_on_PD and Add_on_LGD for all the Bi, Pj in the MB requested. Details of the analysis analogous to 2022.1.

The following tables show the percentage of banks that on a voluntarily basis submitted the data and the median of PD and LGD, MoCs and downturn component. Please note that the median PDs (resp. LGDs) reported in the last column of the below table(s) indicate the median of the average PDs (LGDs) reported by institutions for each of the non-defaulted benchmarking portfolios listed in the rows of that table. Following the instruction provided in the ITS for the reporting of these metrics, the average PDs and LGDs are reported as used for the own funds, i.e. they include supervisory add-ons and MOCs. Therefore, the table below indicates the conservatism that is incorporated in the reported metrics, separately for supervisory induced add-ons and the own-estimated MoC added on average to the internal estimates.

Table 7: Ranges of supervisory add-ons to PDs by exposure class – Performing AIRB

Exposure class	% PD submission	Median supervisory Add-on to PDs	Median MoCs to PDs	Median PDs[10]
CORP	44.7%	0.0%	2.3%	1.45%
COSP	47.6%	2.0%	1.2%	1.94%
GOVT	52.9%	0.0%	0.0%	0.06%
INST	48.0%	1.9%	3.9%	0.32%
LCOR	48.9%	4.1%	6.5%	0.69%
MORT	42.5%	0.0%	15.0%	1.04%
RETO	32.4%	0.0%	5.5%	1.45%
RQRR	35.3%	1.9%	13.8%	1.1%
RSMS	38.6%	0.0%	8.2%	1.7%
SMEC	42.2%	0.0%	5.2%	2.02%
SMOT	32.8%	0.0%	7.7%	2.08%

[10] Median PDs are reported as observed in the full sample (i.e. banks used for Figure 13-Figure 14 as well)

Table 8: Ranges of supervisory add-ons to LGDs by exposure class – Performing AIRB

Exposure class	% LGD submission	Median supervisory Add-on to LGDs	Median MoCs to PGDs	Median LGDs[11]
CORP	42.6%	5.6%	9.5%	27.0%
COSP	47.6%	10.4%	22.4%	15.9%
GOVT	35.3%	59.1%	30.5%	28.2%
INST	36.0%	0.0%	9.1%	32.4%
LCOR	44.7%	4.8%	10.3%	36.5%
MORT	38.8%	4.8%	14.1%	13.8%
RETO	28.4%	0.0%	9.5%	33.4%
RQRR	29.4%	0.0%	7.0%	53.7%
RSMS	35.1%	5.8%	13.4%	17.4%
SMEC	40.0%	2.6%	5.2%	24.1%
SMOT	28.1%	1.6%	7.7%	32.4%

Table 9: Ranges of LGD downturn component by exposure class - Performing AIRB

Exposure class	% LGD submission	Median downturn component
CORP	42.6%	3.4%
COSP	47.6%	8.2%
GOVT	35.3%	3.3%
INST	36.0%	1.8%
LCOR	44.7%	3.6%
MORT	38.8%	17.3%
RETO	28.4%	8.1%
RQRR	29.4%	4.8%
RSMS	35.1%	5.1%
SMEC	40.0%	4.1%
SMOT	28.1%	5.5%

[11] Median PDs are reported as observed in the full sample (i.e. banks used for Figures 10-16 as well)

Ranges of MoC relative to PD by exposure class (NDE AIRB)

PD MOC SUP							
Macro_exposure	MIN_EU_pd_MocSup	MAX_EU_pd_MocSup	P50_EU_pd_MocSup	Mean_EU_pd_MocSup	N_EU_pd_MocSup	NMISS_EU_pd_MocSup	Mean_EU_PD
CORP	0.00%	100.00%	2.05%	17.47%	20	26	1.95%
COSP	0.00%	100.00%	1.17%	27.14%	10	11	1.65%
GOVT	0.00%	100.00%	0.00%	27.08%	9	8	0.07%
INST	0.00%	100.00%	3.87%	23.82%	12	13	0.26%
LCOR	0.00%	100.00%	5.86%	20.76%	22	24	0.86%
MORT	0.00%	100.00%	14.22%	25.20%	33	46	0.92%
RETO	0.00%	100.00%	5.47%	18.25%	23	50	1.76%
RQRR	0.00%	100.00%	12.77%	24.51%	11	22	1.47%
RSMS	0.00%	100.00%	7.98%	22.08%	21	35	2.96%
SMEC	0.00%	100.00%	5.19%	20.57%	17	26	2.56%
SMOT	0.00%	100.00%	10.80%	21.29%	20	43	2.96%

Ranges of MoC relative to LGD by exposure class (NDE AIRB)

LGD MOC SUP							
Macro_exposure	MIN_EU_lgd_MocSup	MAX_EU_lgd_MocSup	P50_EU_lgd_MocSup	Mean_EU_lgd_MocSup	N_EU_lgd_MocSup	NMISS_EU_lgd_MocSup	Mean_EU_LGD
CORP	0.00%	100.00%	9.94%	28.12%	19	27	28.83%
COSP	0.00%	100.00%	22.35%	38.21%	10	11	20.79%
GOVT	6.87%	100.00%	30.49%	51.10%	5	12	24.43%
INST	0.00%	100.00%	9.11%	29.76%	9	16	30.86%
LCOR	0.00%	100.00%	9.98%	22.47%	19	27	33.11%
MORT	0.00%	100.00%	15.27%	23.59%	27	52	17.24%
RETO	0.00%	100.00%	9.60%	18.08%	20	53	39.82%
RQRR	0.00%	100.00%	7.22%	17.45%	8	25	56.53%
RSMS	0.00%	100.00%	15.54%	29.20%	19	37	18.60%
SMEC	0.00%	100.00%	18.83%	30.39%	16	27	26.61%
SMOT	0.00%	100.00%	6.74%	18.97%	17	46	39.77%

Ranges of downturn-component relative to LGD by exposure class (NDE AIRB)

LGD DOWNTURN							
Macro_exposure	MIN_EU_lgd_dwntrn	MAX_EU_lgd_dwntrn	P50_EU_lgd_dwntrn	Mean_EU_lgd_dwntrn	N_EU_lgd_dwntrn	NMISS_EU_lgd_dwntrn	Mean_EU_LGD
CORP	0.00%	38.40%	3.02%	9.59%	19	27	28.83%
COSP	0.00%	23.95%	8.24%	8.91%	10	11	20.79%
GOVT	0.00%	18.00%	3.32%	6.91%	5	12	24.43%
INST	0.00%	29.37%	1.77%	9.94%	9	16	30.86%
LCOR	0.00%	43.15%	2.95%	9.70%	19	27	33.11%
MORT	0.00%	81.72%	18.26%	21.30%	27	52	17.24%
RETO	0.00%	33.63%	8.30%	10.66%	20	53	39.82%
RQRR	0.00%	74.06%	6.86%	14.20%	8	25	56.53%
RSMS	0.00%	81.82%	6.77%	17.66%	19	37	18.60%
SMEC	0.00%	38.74%	3.56%	11.70%	16	27	26.61%
SMOT	0.00%	32.53%	2.92%	9.36%	17	46	39.77%

Table 10: Ranges of supervisory add-ons to PD and LGD by exposure class – Defaulted AIRB

Exposure class	% PD submission	% LGD submission	Median PD	Median LGD
CORP	42.2%	40.0%	0.0%	0.4%

Exposure class	% PD submission	% LGD submission	Median PD	Median LGD
COSP	55.0%	50.0%	0.0%	0.0%
GOVT	40.0%	40.0%	50.0%	50.0%
INST	44.4%	44.4%	0.0%	0.0%
LCOR	46.3%	43.9%	0.0%	0.0%
MORT	41.0%	34.6%	0.0%	0.8%
RETO	31.5%	27.4%	0.0%	0.0%
RQRR	35.3%	26.5%	0.0%	0.0%
RSMS	40.0%	36.4%	0.0%	0.8%
SMEC	43.2%	40.9%	0.0%	0.7%
SMOT	33.9%	29.0%	0.0%	0.0%

Table 11: Ranges of MoC on PD and LGD by exposure class – Defaulted AIRB

Exposure class	% PD submission	% LGD submission	Median MoC - PD	Median MoC - LGD
CORP	42.2%	40.0%	0.0%	0.7%
COSP	55.0%	50.0%	0.0%	12.8%
GOVT	40.0%	40.0%	50.0%	54.5%
INST	44.4%	44.4%	0.0%	5.7%
LCOR	46.3%	43.9%	0.0%	5.3%
MORT	41.0%	34.6%	0.0%	2.3%
RETO	31.5%	27.4%	0.0%	1.6%
RQRR	35.3%	26.5%	0.0%	0.0%
RSMS	40.0%	36.4%	0.0%	5.6%
SMEC	43.2%	40.9%	0.0%	6.2%
SMOT	33.9%	29.0%	0.0%	3.9%

Table 12: Ranges of LGD downturn component by exposure class - Defaulted AIRB

Exposure class	% LGD submission	Median downturn component
CORP	40.0%	1.4%
COSP	50.0%	7.3%
GOVT	40.0%	0.0%
INST	44.4%	0.0%
LCOR	43.9%	2.7%
MORT	34.6%	3.0%
RETO	27.4%	1.2%
RQRR	26.5%	1.7%
RSMS	36.4%	1.7%
SMEC	40.9%	1.7%
SMOT	29.0%	1.3%

2.6 Qualitative analysis

2.6.1 Competent authority assessments

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. The CA should investigate the reasons for the divergence 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 was to be completed for each institution participating in the SVB exercise. The EBA received the responses for 101 institutions. This section summarises the key information derived from these assessments.

Figure 50: CA's overall assessment of the deviations from the benchmark(s) for the SVB exposure classes

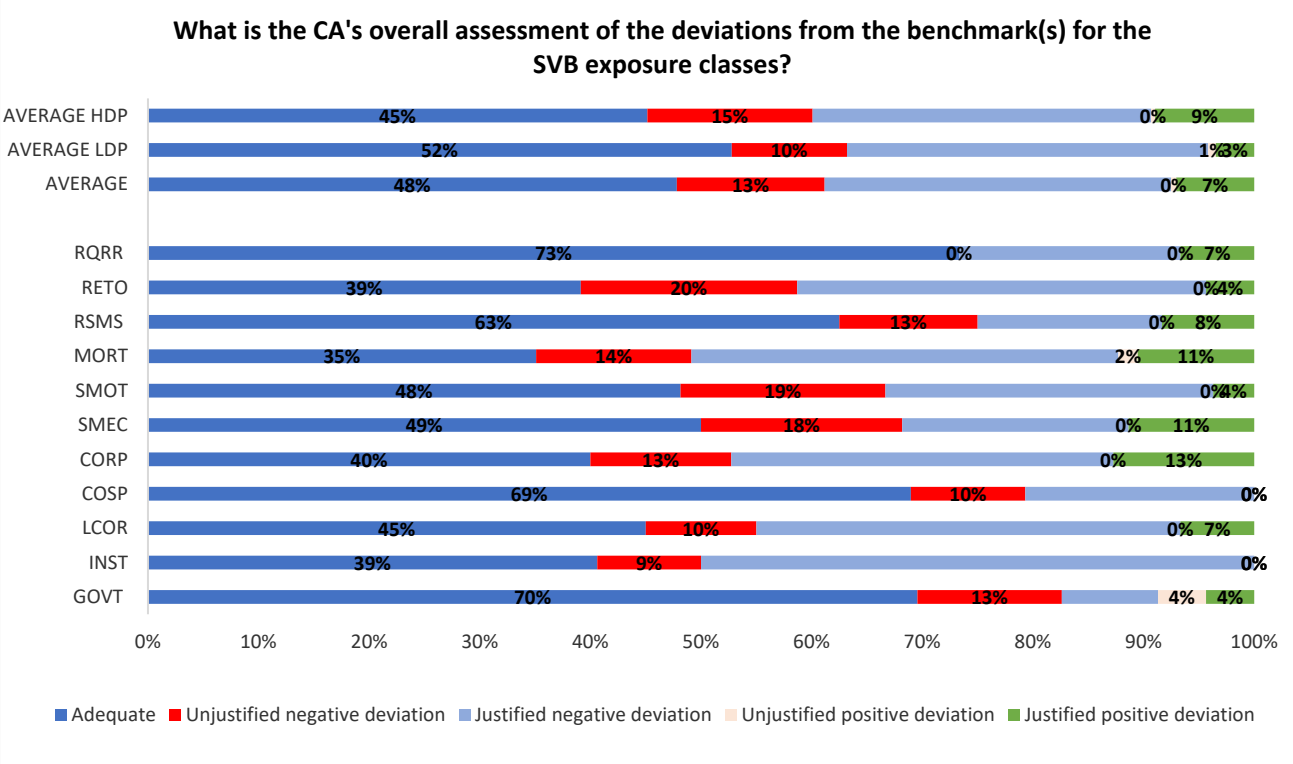
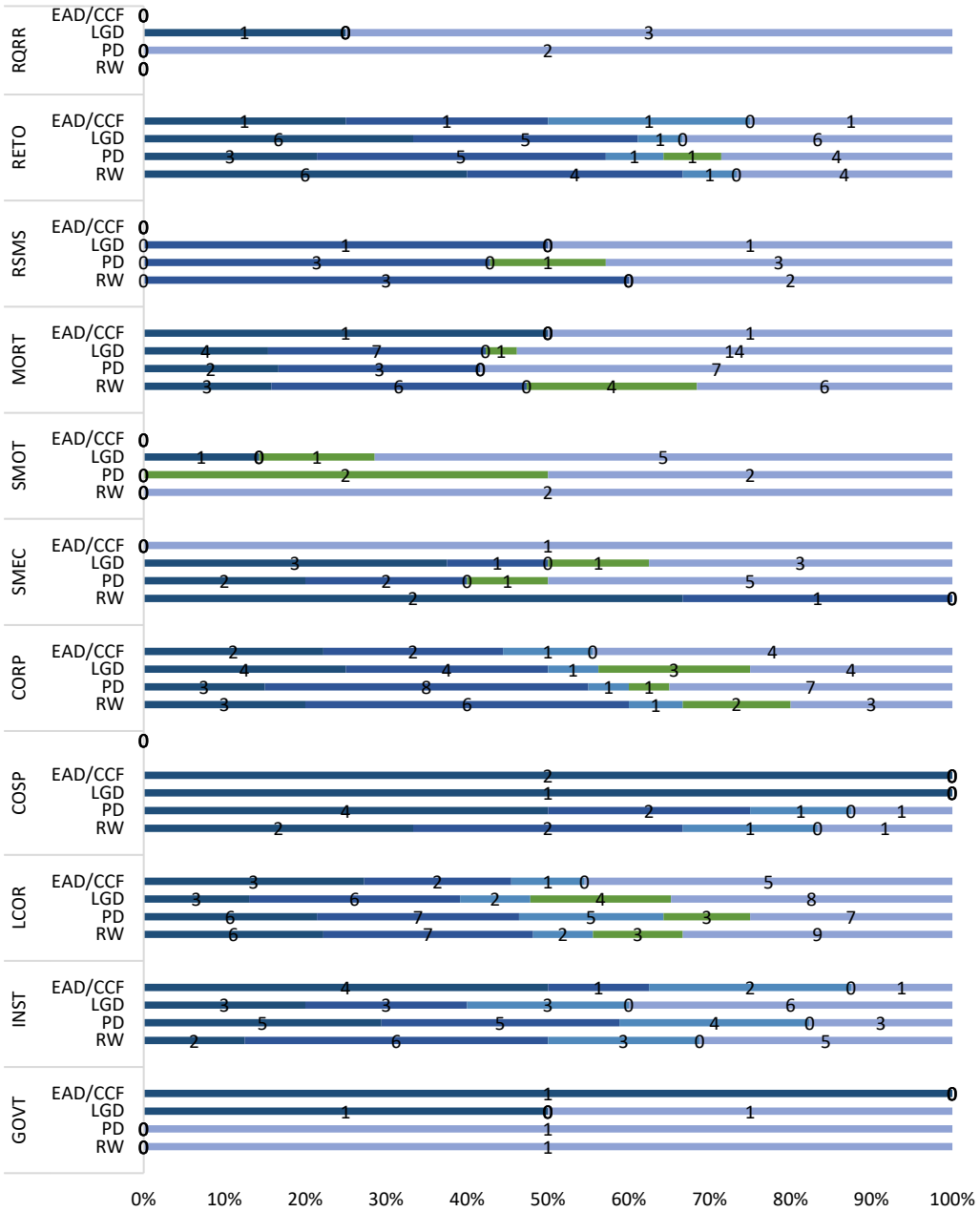


Figure 51:: Justification for negative deviations



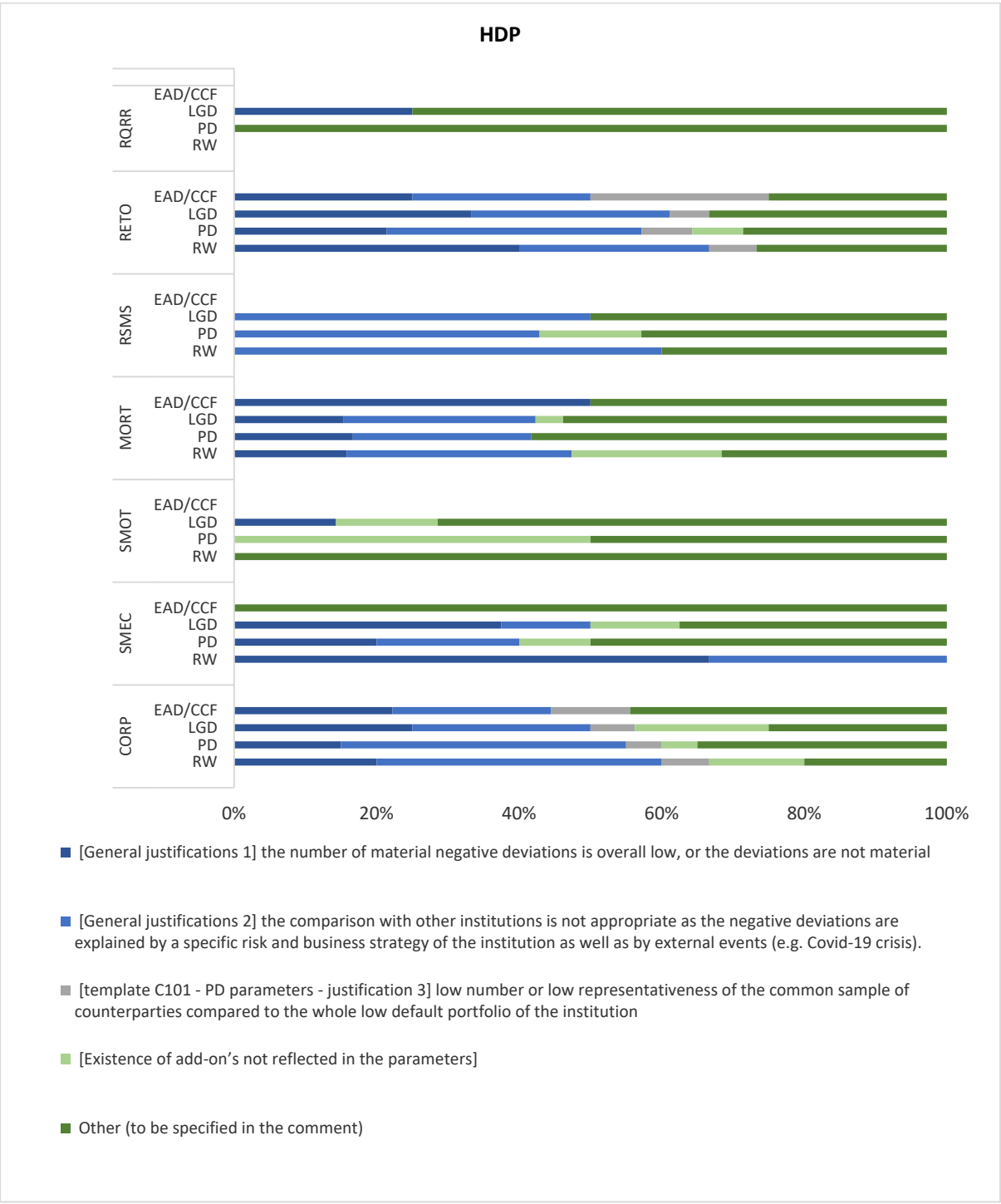
[General justifications 1] the number of material negative deviations is overall low, or the deviations are not material

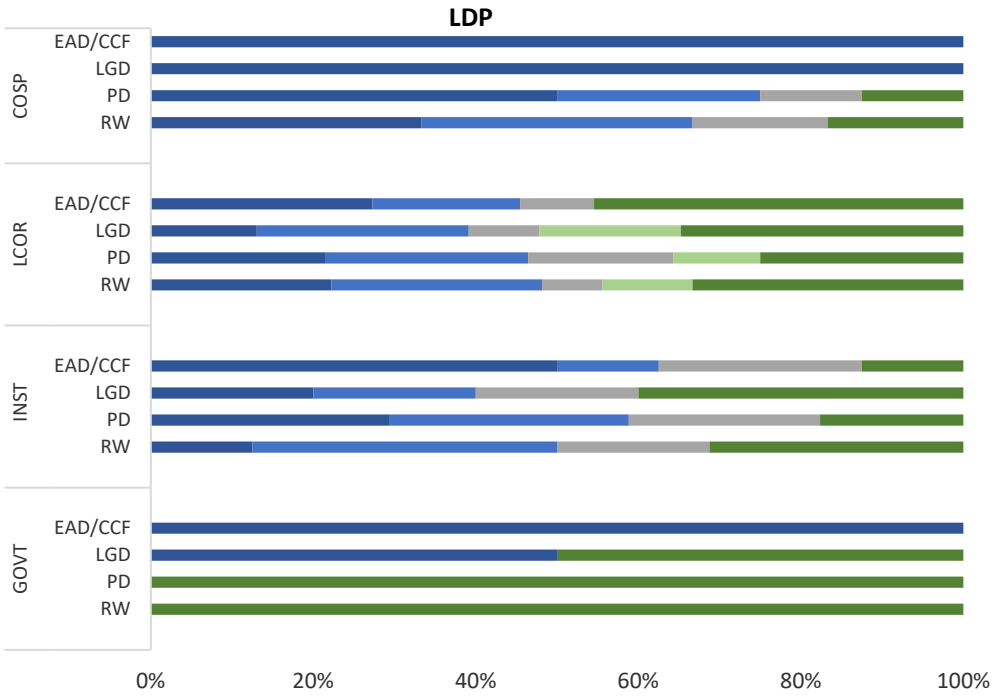
[General justifications 2] the comparison with other institutions is not appropriate as the negative deviations are explained by a specific risk and business strategy of the institution as well as by external events (e.g. Covid-19 crisis).

[template C101 - PD parameters - justification 3] low number or low representativeness of the common sample of counterparties compared to the whole low default portfolio of the institution

[Existence of add-on's not reflected in the parameters]

Other (to be specified in the comment)


HDP
RQRR
RETO
RSMS
MORT
SMOT
SMEC
CORP
EAD/CCF
LGD
PD
RW
0%
20%
40%
60%
80%
100%
[General justifications 1] the number of material negative deviations is overall low, or the deviations are not material
[General justifications 2] the comparison with other institutions is not appropriate as the negative deviations are explained by a specific risk and business strategy of the institution as well as by external events (e.g. Covid-19 crisis).
[template C101 - PD parameters - justification 3] low number or low representativeness of the common sample of counterparties compared to the whole low default portfolio of the institution
[Existence of add-on's not reflected in the parameters]
Other (to be specified in the comment)



[General justifications 1] the number of material negative deviations is overall low, or the deviations are not material

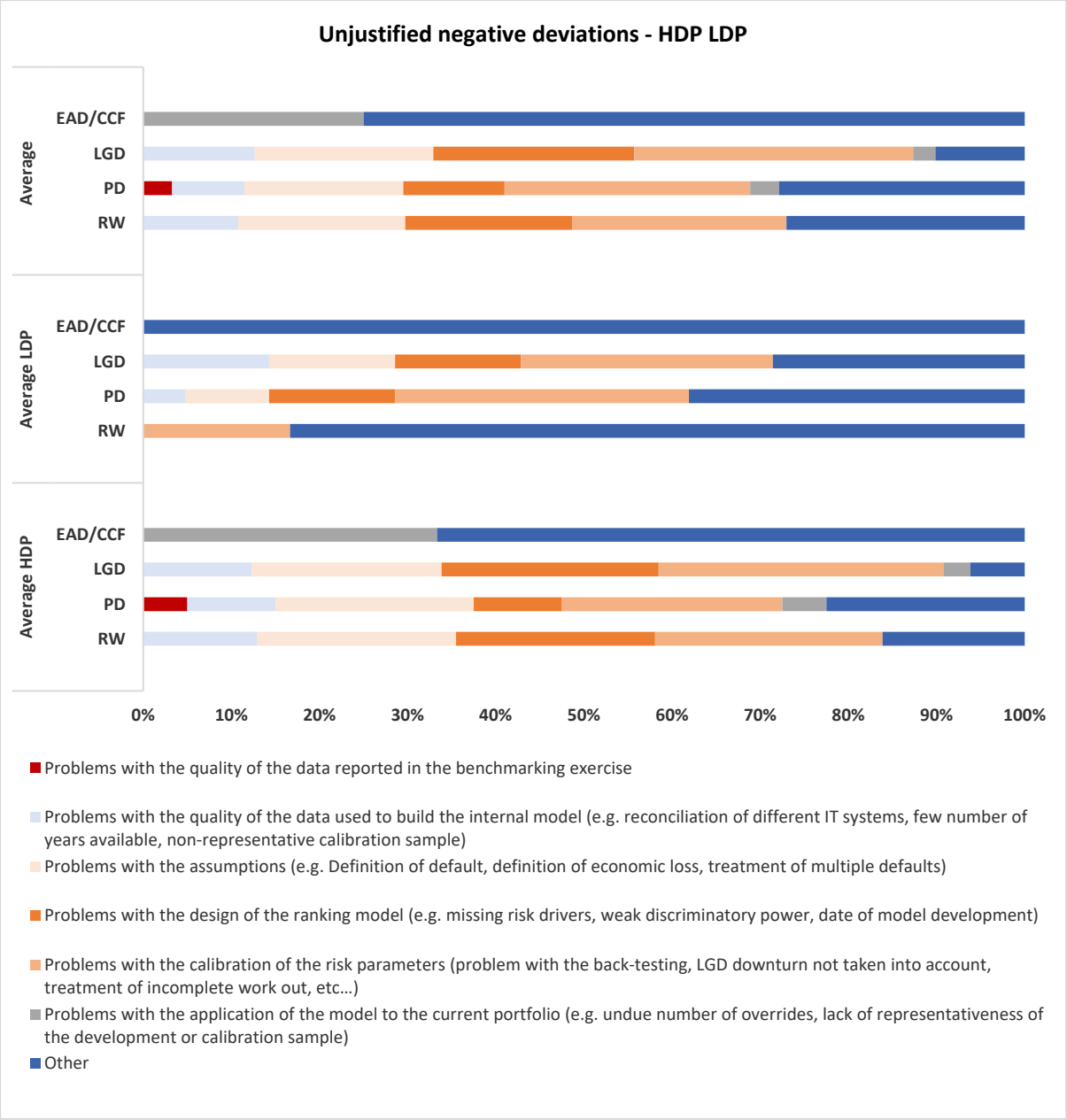
[General justifications 2] the comparison with other institutions is not appropriate as the negative deviations are explained by a specific risk and business strategy of the institution as well as by external events (e.g. Covid-19 crisis).

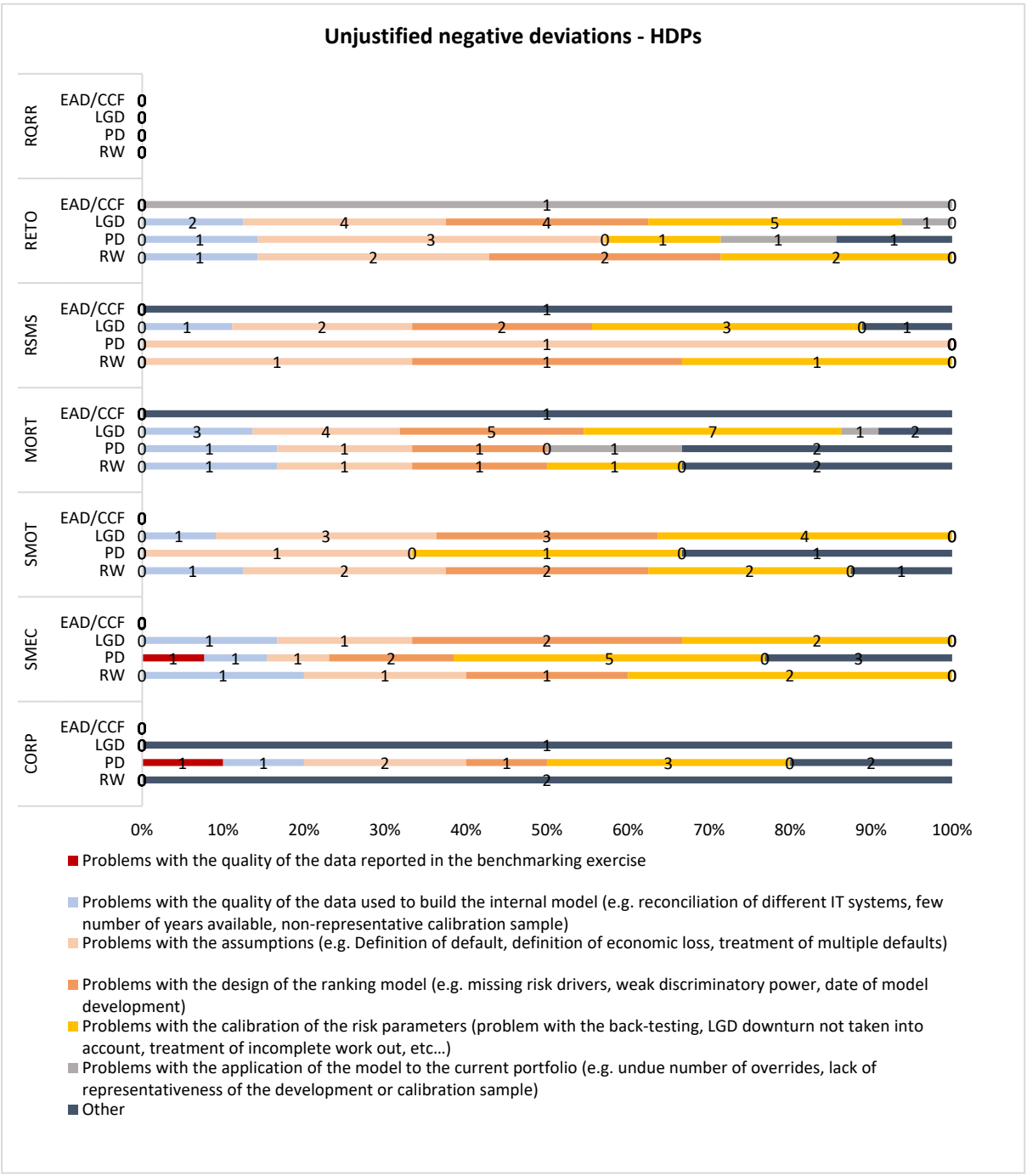
[template C101 - PD parameters - justification 3] low number or low representativeness of the common sample of counterparties compared to the whole low default portfolio of the institution

[Existence of add-on's not reflected in the parameters]

Other (to be specified in the comment)

Figure 52: Reasons identified for unjustified negative deviations




Unjustified negative deviations - HDPs
RQRR
EAD/CCF 0
LGD 0
PD 0
RW 0
RETO
EAD/CCF 0 1 0
LGD 0 2 4 4 5 1 0
PD 0 1 3 0 1 1 1
RW 0 1 2 2 2 0
RSMS
EAD/CCF 0 1
LGD 0 1 2 2 3 0 1
PD 0 1 0
RW 0 1 1 1 0
MORT
EAD/CCF 0 1
LGD 0 3 4 5 7 1 2
PD 0 1 1 1 0 1 2
RW 0 1 1 1 1 0 2
SMOT
EAD/CCF 0
LGD 0 1 3 3 4 0
PD 0 1 0 1 0 1
RW 0 1 2 2 2 0 1
SMEC
EAD/CCF 0
LGD 0 1 1 2 2 0
PD 1 1 1 2 5 0 3
RW 0 1 1 1 2 0
CORP
EAD/CCF 0
LGD 0 1
PD 1 1 2 1 3 0 2
RW 0 2
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Problems with the quality of the data reported in the benchmarking exercise
Problems with the quality of the data used to build the internal model (e.g. reconciliation of different IT systems, few number of years available, non-representative calibration sample)
Problems with the assumptions (e.g. Definition of default, definition of economic loss, treatment of multiple defaults)
Problems with the design of the ranking model (e.g. missing risk drivers, weak discriminatory power, date of model development)
Problems with the calibration of the risk parameters (problem with the back-testing, LGD downturn not taken into account, treatment of incomplete work out, etc…)
Problems with the application of the model to the current portfolio (e.g. undue number of overrides, lack of representativeness of the development or calibration sample)
Other

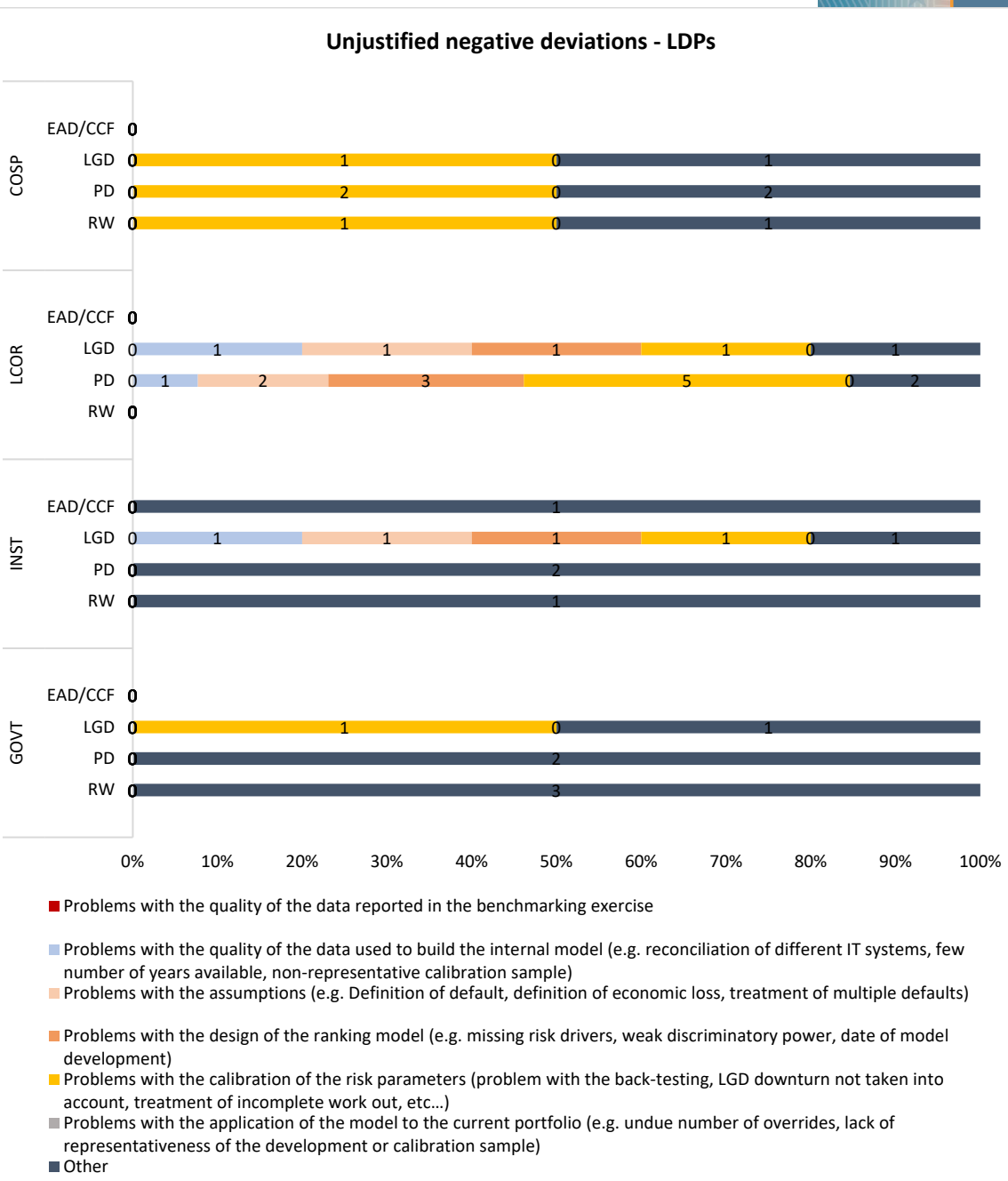

Unjustified negative deviations - LDPs
COSP
EAD/CCF 0
LGD 0 1 0 1
PD 0 2 0 2
RW 0 1 0 1
LCOR
EAD/CCF 0
LGD 0 1 1 1 1 0 1
PD 0 1 2 3 5 0 2
RW 0
INST
EAD/CCF 0 1
LGD 0 1 1 1 1 0 1
PD 0 2
RW 0 1
GOVT
EAD/CCF 0
LGD 0 1 0 1
PD 0 2
RW 0 3
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Problems with the quality of the data reported in the benchmarking exercise
Problems with the quality of the data used to build the internal model (e.g. reconciliation of different IT systems, few number of years available, non-representative calibration sample)
Problems with the assumptions (e.g. Definition of default, definition of economic loss, treatment of multiple defaults)
Problems with the design of the ranking model (e.g. missing risk drivers, weak discriminatory power, date of model development)
Problems with the calibration of the risk parameters (problem with the back-testing, LGD downturn not taken into account, treatment of incomplete work out, etc…)
Problems with the application of the model to the current portfolio (e.g. undue number of overrides, lack of representativeness of the development or calibration sample)
Other

Figure 53: Are any actions planned by the CA following the SVB results?

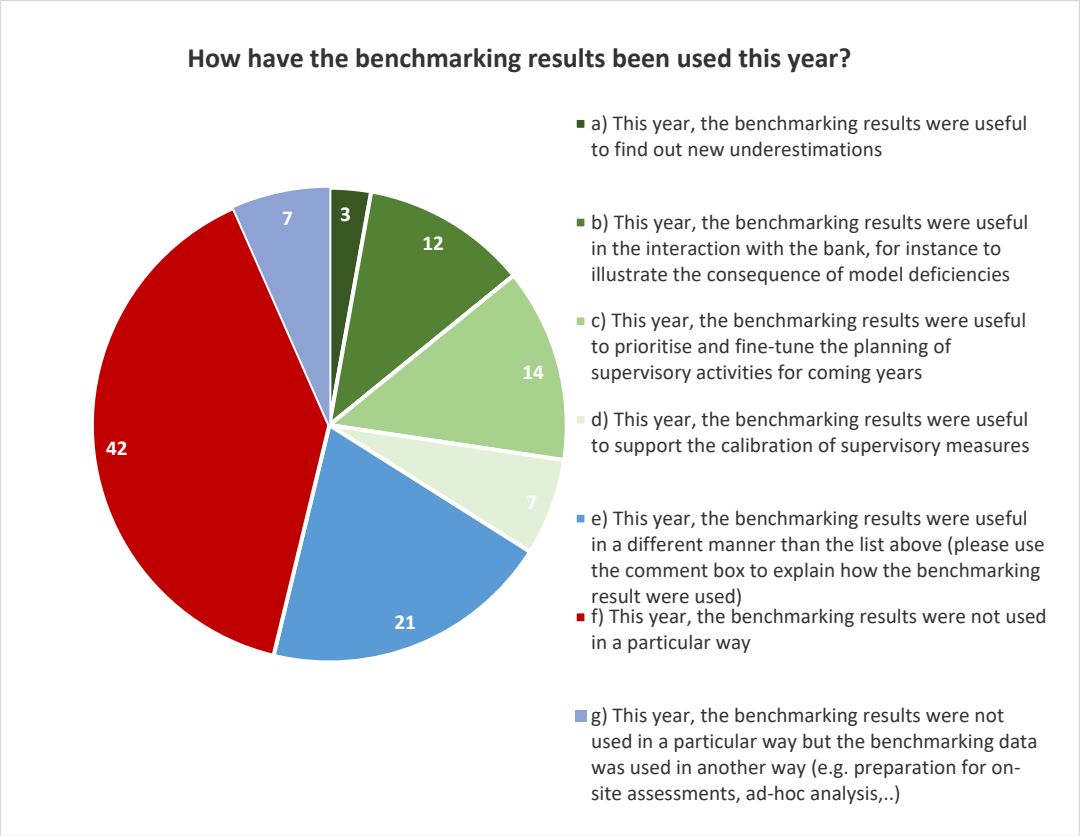


Figure 54: Will the action lead to capital add-ons under Pillar 2?

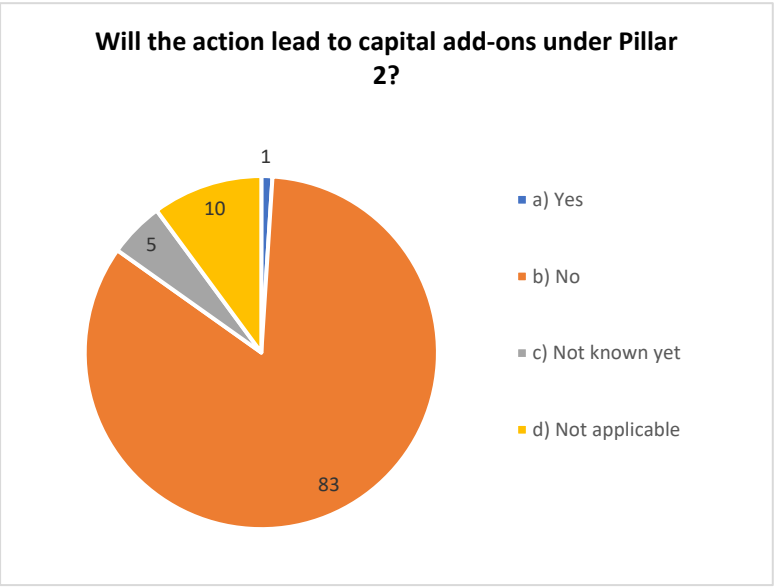
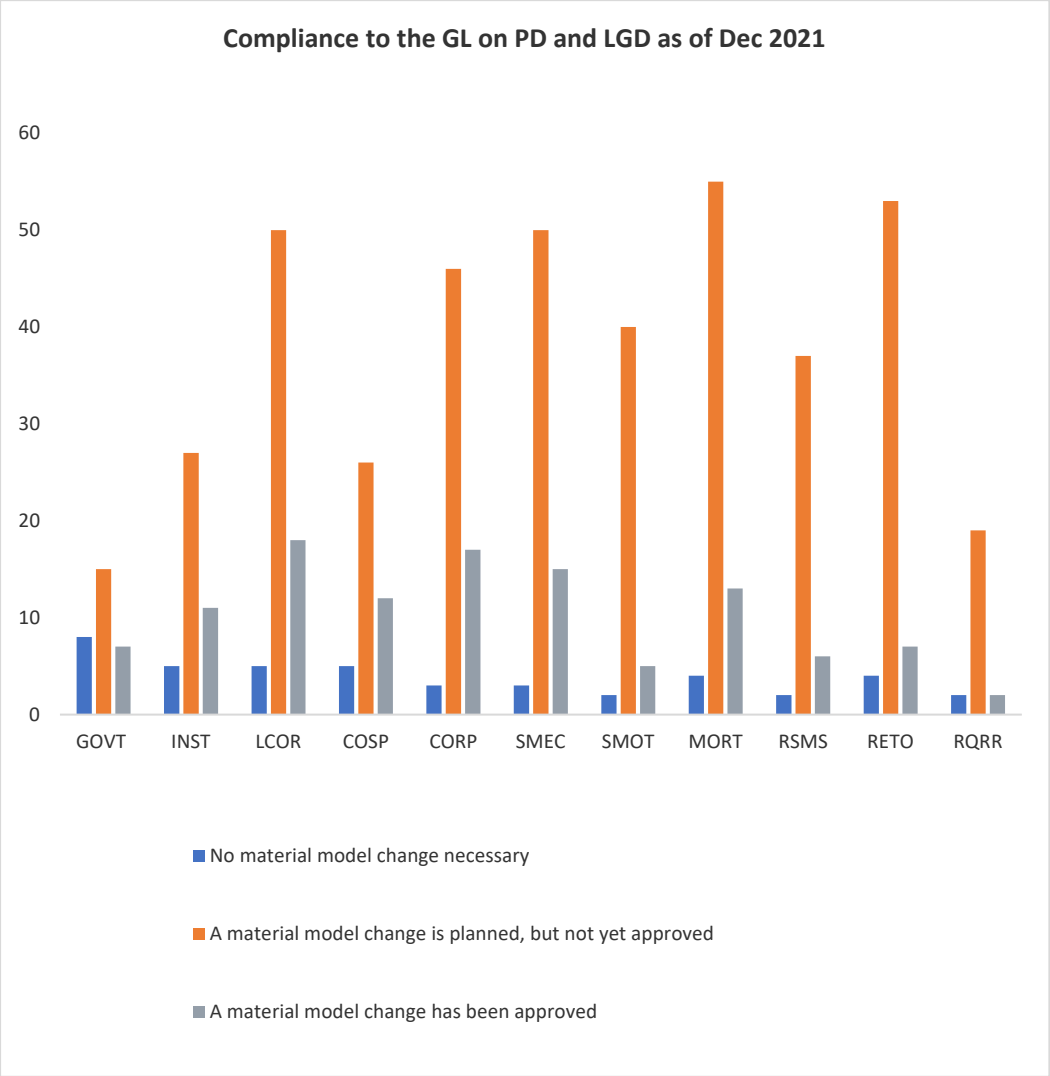


Figure 55: State of compliance with the GL on PD and LGD



2.7 Appendix

2.7.1 Appendix 1: List of participating institutions

The participant institutions in scope of the SVB exercise are the ones that on 31 December 2021 had approval for the use of the credit risk internal models[12].

Table 13: List of institutions participating in the current exercise

Institution name	Country	Submits Credit Risk?
BAWAG Group AG	AT	Yes
Erste Group Bank AG	AT	Yes
Raiffeisen Bank International AG	AT	Yes
Volkskredit Verwaltungsgenossenschaft registrierte Genossenschaft mit beschränkter Haftung	AT	Yes
AXA Bank Belgium	BE	Yes
Belfius Bank	BE	Yes
Crelan	BE	Yes
Euroclear	BE	Yes
Investeringsmaatschappij Argenta - Société d'investissements Argenta - Investierungsgesellschaft Arg	BE	Yes
KBC Groep	BE	Yes
Aareal Bank AG	DE	Yes
ALTE LEIPZIGER Bauspar AG	DE	Yes
Bayerische Landesbank	DE	Yes
BMW Bank GmbH	DE	Yes
COMMERZBANK Aktiengesellschaft	DE	Yes
Degussa Bank AG	DE	Yes
DekaBank Deutsche Girozentrale	DE	Yes
DEUTSCHE APOTHEKER- UND ÄRZTEBANK EG	DE	Yes
DEUTSCHE BANK AKTIENGESELLSCHAFT	DE	Yes
Deutsche Bausparkasse Badenia Aktiengesellschaft	DE	Yes
Deutsche Pfandbriefbank AG	DE	Yes
DZ BANK AG Deutsche Zentral-Genossenschaftsbank, Frankfurt am Main	DE	Yes
Erwerbsgesellschaft der S-Finanzgruppe mbH & Co. KG	DE	Yes
Hamburg Commercial Bank AG	DE	Yes
HSBC Germany Holdings GmbH	DE	Yes

[12] This information is published on the EBA website: https://eba.europa.eu/risk-analysis-and-data/reporting-by-authorities.

Institution name	Country	Submits Credit Risk?
IKB Deutsche Industriebank Aktiengesellschaft	DE	Yes
KfW Beteiligungsholding GmbH	DE	Yes
Landesbank Baden-Württemberg	DE	Yes
Landesbank Hessen-Thüringen Girozentrale	DE	Yes
Landesbank Saar	DE	Yes
LBS Bayerische Landesbausparkasse	DE	Yes
Münchener Hypothekenbank eG	DE	Yes
Norddeutsche Landesbank - Girozentrale -	DE	Yes
Oldenburgische Landesbank Aktiengesellschaft	DE	Yes
Süd-West-Kreditbank Finanzierung GmbH	DE	Yes
TOYOTA Kreditbank GmbH	DE	Yes
Wüstenrot Bausparkasse Aktiengesellschaft	DE	Yes
Danske Bank A/S	DK	Yes
DLR Kredit AS	DK	Yes
Jyske Bank A/S	DK	Yes
Laan og Spar Bank AS	DK	Yes
Nykredit Realkredit A/S	DK	Yes
Sydbank A/S	DK	Yes
Banco Bilbao Vizcaya Argentaria, S.A.	ES	Yes
Banco de Sabadell, S.A.	ES	Yes
Banco Santander, S.A.	ES	Yes
Bankinter, S.A.	ES	Yes
CaixaBank, S.A.	ES	Yes
Credit Suisse Bank (Europe), S.A.	ES	Yes
Unicaja Banco, S.A.	ES	Yes
Aktia Bank Abp	FI	Yes
Ålandsbanken Abp	FI	Yes
Nordea Bank Abp	FI	Yes
OP Osuuskunta	FI	Yes
BNP Paribas	FR	Yes
Confédération Nationale du Crédit Mutuel	FR	Yes
Groupe BPCE	FR	Yes
Groupe Crédit Agricole	FR	Yes
HSBC Continental Europe	FR	Yes
RCI Banque	FR	Yes
SFIL	FR	Yes
Société générale	FR	Yes

Institution name	Country	Submits Credit Risk?
Eurobank Ergasias Services and Holdings S.A.	GR	Yes
AIB Group plc	IE	Yes
Bank of Ireland Group plc	IE	Yes
Barclays Bank Ireland plc	IE	Yes
Permanent TSB Group Holdings Plc	IE	Yes
Ulster Bank Ireland Designated Activity Company	IE	Yes
Banca Monte dei Paschi di Siena S.p.A.	IT	Yes
BANCA POPOLARE DI SONDRIO, SOCIETA' COOPERATIVA PER AZIONI	IT	Yes
BANCO BPM SOCIETA' PER AZIONI	IT	Yes
BPER Banca S.p.A.	IT	Yes
CREDITO EMILIANO HOLDING SOCIETA' PER AZIONI	IT	Yes
Intesa Sanpaolo S.p.A.	IT	Yes
Mediobanca - Banca di Credito Finanziario S.p.A.	IT	Yes
UNICREDIT, SOCIETA' PER AZIONI	IT	Yes
Banque et Caisse d´Epargne de l´Etat, Luxembourg	LU	Yes
Banque Internationale à Luxembourg	LU	Yes
ABN AMRO Bank N.V.	NL	Yes
Coöperatieve Rabobank U.A.	NL	Yes
de Volksbank N.V.	NL	Yes
ING Groep N.V.	NL	Yes
LP Group B.V.	NL	Yes
NIBC Holding N.V.	NL	Yes
RBS Holdings N.V.	NL	Yes
Van Lanschot Kempen N.V.	NL	Yes
BN BANK ASA	NO	Yes
DNB BANK ASA	NO	Yes
Sparebank 1 Nord-Norge SPA	NO	Yes
Sparebank 1 Østlandet	NO	Yes
SpareBank 1 SMN	NO	Yes
SPAREBANK 1 SR-BANK ASA	NO	Yes
Sparebanken Møre SPA	NO	Yes
Sparebanken Vest SPA	NO	Yes
Bank BPH SA	PL	Yes
Banco Comercial Português, SA	PT	Yes
LSF Nani Investments S.à r.l.	PT	Yes
Aktiebolaget Svensk Exportkredit	SE	Yes
Bergslagens Sparbank AB	SE	Yes
Landshypotek AB - gruppen	SE	Yes

Institution name	Country	Submits Credit Risk?
Länsförsäkringar Bank AB - gruppen	SE	Yes
Ölands Bank AB	SE	Yes
SBAB Bank AB - Grupp	SE	Yes
Skandiabanken Aktiebolag (publ)	SE	Yes
Skandinaviska Enskilda Banken - gruppen	SE	Yes
Sparbanken Rekarne AB	SE	Yes
Sparbanken Sjuhärad AB (publ)	SE	Yes
Sparbanken Skåne AB (publ)	SE	Yes
Svenska Handelsbanken - gruppen	SE	Yes
Swedbank - Grupp	SE	Yes
Volvofinans Bank AB	SE	Yes

2.7.2 Appendix 2: Data quality

Data Quality has been and remains a paramount element for the benchmarking exercise, and the attention from banks and competent authorities on this matter shall not diminish. In fact, issues with DQ still shape to some extent the sample of banks that can be taken into account for the analysis. This leads to changing samples over the years and thus to temporal analysis that is hard to interpret. Further, it is important to identifyDQ issues in order to distinguish outliers driven by data errors versus those related to business model specificity or different modeling practices. Against this backdrop, EBA has paid even more attention in current exercise to data quality, complementing the high-level horizontal analysis with an analysis of single observations for individual banks and portfolios. The data analysis activity led to the identification of the following issues:

- Brexit Institutions: After Brexit, several UK banks have established new subsidiaries or third-country branches in the (post-Brexit) EU countries in order to service their clients in these countries. These new "Brexit" institutions have to apply now for IRB approval in their respective EU host countries, despite the fact that for the considered exposures there were IRB approval Pre-"Brexit". However, divergences in the terms and conditions of the temporary tolerance have been identified resulting in divergent reporting submissions.

- Norwegian Banks submission: For all IRB institutions located in Norway no data has been received by the EBA, due to the fact that the relevant DPM framework was not legally adopted.

- A banks merger: The data submission of one Belgic institution is missing due to a recent merger.

- EAD Misalignment between IRB exposure reported in COREP and Benchmarking: The data quality assessment had identified an EAD misalignment (deviation more than 20%) between relevant IRB exposure reported in COREP and in the BM data submission for 10 institutions.

- Significant jumps in average IRB risk parameters (while EAD remained stable) between last and this year's data submission: In the current benchmarking exercise, EBA has introduced a comparative analysis between the data submission of 2022 (ref. date 31.12.2021) and the data submission of 2021 (ref. date 31.12.2020). In particular, the analysis checks the portfolios for which there was a significant drop in the risk parameters (PD, LGD or RW), while observing a change in exposure of less than 5%. This analysis led to the identification of data quality issues and represented a driver for identifying the banks to be interviewed for further investigation.

- 105 data quality: it has been identified poor data quality in the templates 105.01 and 105.02.

The above evidence further highlights the centrality of data quality activities and requires to strengthen the current validation rules and data quality framework in general by all the stakeholders involved in the process.

2.7.3 Appendix 3: Data cleaning

Of the institutions that have had 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, C 103.00, C 105.01, C 105.02, C 105.03 on their balance sheet at the reference date of Q4 2021.

The cut-off date for the extraction of the data for this report was 30 September 2022.

The records with a portfolio ID or counterparty code not in the list in Annex 1 were excluded from the analysis throughout this report. In general, the records with PDs that were 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% or defaulted exposures with PD different from 100%).

2.6.3.1 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 9 gives the main statistics on the sample of counterparties (considering only one type of risk18). Note that specialised lending exposures are not included in template C 101.00 in Annex 1.

Table 14: Number of counterparties in the common counterparty analysis, by regulatory approach

Exposure class	Count			With LEI		
	Total	AIRB	FIRB	Total	AIRB	FIRB
LCOR	3518	1759	1759	3232	1616	1616
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 were excluded;
- if an institution submitted the same counterparty ID more than once with different rating grades (see Q&A 2017_3635), that counterparty ID was excluded for that institution.

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 were considered;

- all the counterparties that were classified as in default by at least one institution were excluded (no benchmarks have been computed for them);
- the counterparties of any particular institution were considered only if the institution submitted at least 10 counterparties with EAD greater than zero;
- counterparties reported with LGD greater than 150% or RW greater than 1250% were excluded.

Table 15: Sample of institutions, countries and counterparties in the common counterparty analysis (LDP) – after the data cleaning

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
Institutions sample	62	13	814	602	34
Large corporate sample	71	13	6747	2054	29
Sovereign sample	34	10	322	128	42

2.6.3.2 Templates C 102 and C 103

In 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 computing the **benchmarks** (median of the values) at portfolio level:

- only portfolio IDs not related to the rating breakdown were considered (those portfolios were 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 were considered for the quality check, top-down and all other analyses but not for computing 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 were considered for the quality check, top-down and all other analyses but not for computing the benchmarks);

- records reported with LGD greater than 150% or RW greater than 1 250% were excluded from 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), 87 out of 101 institutions reported at least 1 record with EAD >0 for this template (before the exclusion).

Table 16: 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	38	10	234	109
INST	60	13	312	153
LCOR	80	14	350	159
COSP	57	14	367	158

In template C 103, which covers HDPs (corporate-other, residential mortgages, SME retail and SME-corporate and retail other, RQRR), 97 out of 101 institutions reported at least 1 row with EAD> 0 for this template (before the exclusion).

Table 17: 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	79	14	3170	135
MORT	80	14	2859	67
SMEC	79	14	3089	127
RSMS	57	14	1615	58
SMOT	64	14	2244	58
RETO	74	14	3077	58
RQRR	34	10	3313	57

2.6.3.3 General exclusions (submissions as of 30 Sep 2022)

In the current exercise, 111 banks were expected to participate. For the purpose of the analysis, the following banks have been made:

- 8 banks didn't submit data (Norwegian banks) because of issues with the EBA Data Point Model (DPM).

- 1 bank submitted data at a lower level of consolidation compared to what was expected (Crelan).
- 1 bank submitted exclusively template 105 (Polish bank BPH S.A).

The final sample consists of 101 institutions.

And the following records:

1) Template C101.00: a. 42522: records with missing PD
b. 72: records due to counterparty not in scope (STDA instead of IRB)

2) Template C 102.00: a. 134: records with regulatory approach IRB but missing PDs,
b. 42: records for defaulted portfolios with PDs different from 100%
c. 12: records with wrong ID
d. 35: record with non-default status and PD 100%

3) Template C 103.00: a. 562: records with PD out of range
b. 169: with EAD missing
c. 9: records with wrong ID
d. 10: record with non-default status and PD 100%
e. 1692: records with missing PD
f. 2: records for defaulted portfolios with PDs different from 100%

2.7.4 Appendix 4: Methodologies used

2.6.4.1 Top-down analysis

The methodology for presenting the percentage of total GC variability that can be explained once its main drivers are controlled for (some interdependency is possible for each driver) 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:[13]

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

Then, the standard deviation of the total GC is calculated as:

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

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 by the institutions in the sample. Two intermediate calculations are performed:

- First, the GC of the sub portfolios is calculated for each institution. For example, for the 1st step, the split between defaulted and non-defaulted exposures, the following parameter has been computed:

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

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

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

- Second, the average EAD proportions for the non-defaulted and defaulted portfolios are calculated:

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

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

These parameters are then used to compute a 'normalised' GC at bank level, which is calculated as the exposure weighted average GCs, using the institution's own estimates for the GCs and the sample average for the EAD (used for the weights). In this particular example, the normalised GC at total bank (i) level is computed as follows:

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

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 (or more accurately the portfolio composition for that particular split/step) are the same across institutions and equal to the sample weighted averages.

In case the $\%GC_{bank_i,def}$ or the $\%GC_{bank_i,non\ def}$ was not available for that particular bank (i) then the benchmark GC for that split has been used.

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

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

The difference between the standard deviation of the % total GC and the standard deviation of the % GC standard deviation $_{(DEF,\ NONDEF)}$ gives the proxy of 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/split that might be 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 is not intended to estimate the specific variability for each cluster or dimension at the individual level (e.g. it is not designed to make comparisons at the portfolio level), but is instead only intended to provide a proxy for 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.

2.6.4.2 Analysis of IRB parameters for common counterparties

Institutions were instructed to provide risk parameters for a predefined list of counterparties, which were identified by internationally accepted identifiers (the most widely used is the LEI[14]). 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 deviation 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 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:

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

[14] 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.

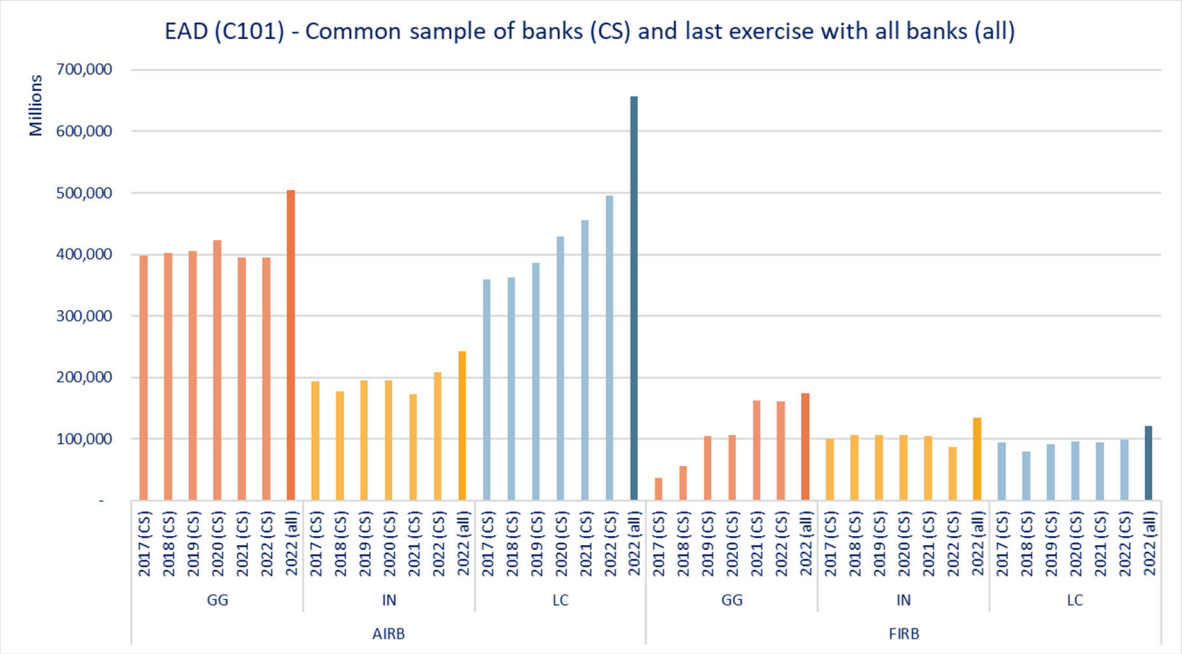
Since the regulatory LGD estimated by the institution is used in the computation of these differences, the LGD effect also includes the impact of CRM. Therefore, the analysis has been repeated using the hypothetical senior unsecured LGD (without negative pledge) for the AIRB institutions only, where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

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

The list of counterparties has not been updated from that used in the 2018 LDP exercise but their representativeness is more or less constant. The graphs below show the evolution of the counterparty exposure coverage, due to the change in exposures of institutions.

Figure 56: Evolution of EAD by SVB portfolio and regulatory approach



For this analysis, a common subsample of 46 institutions has been identified (i.e. institutions that participated in all six 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 (it range from 11 to 46 (clean dataset), and neither is the number of counterparties (see Figure 57 below) that ranges from 53 to 1541 (clean dataset). The comparison focused on a subset of counterparties that were reported by at least five institutions in the five exercises.

Figure 57: Proportion of EAD in the common subsample

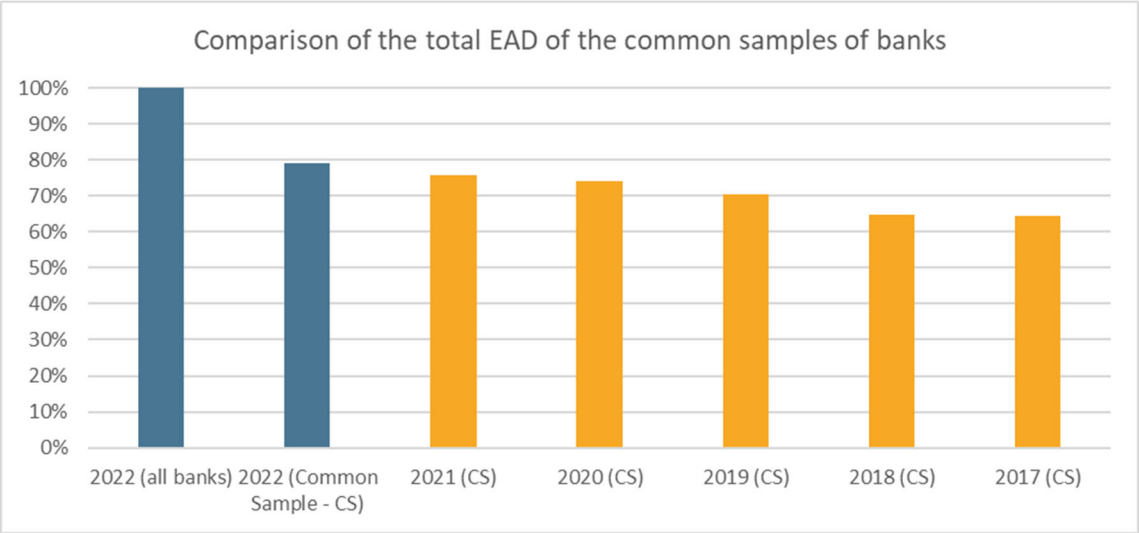
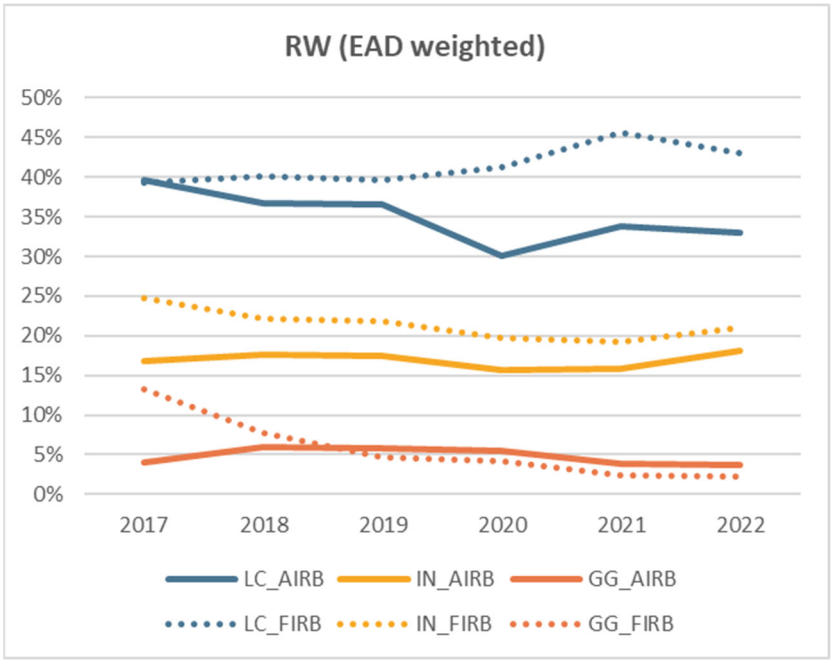
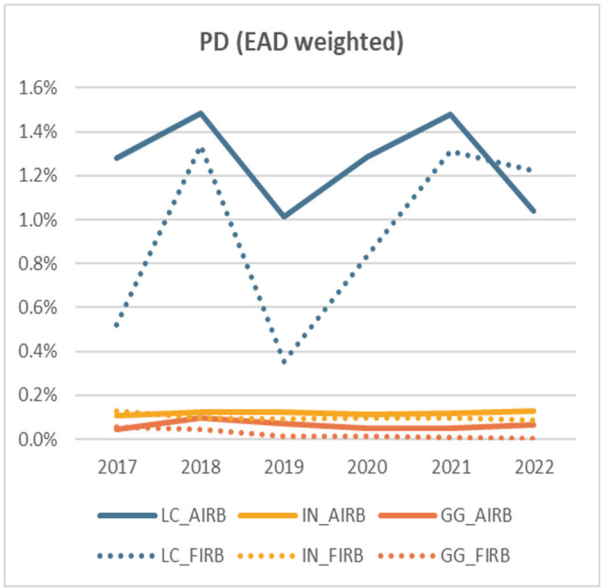


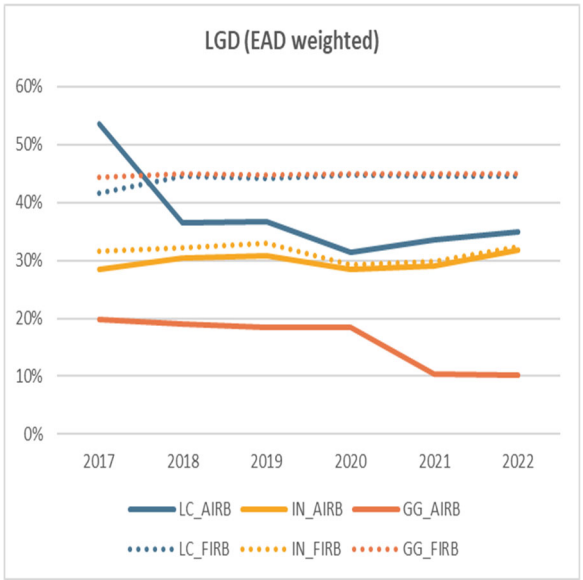
Figure 58: Evolution of the common subsample risk metrics, from the 2017 to the 2022 exercise, by SVB exposure class



2.6.4.3 Outturns (backtesting) approach

The analysis presents 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[15] 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:





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

- PD (column 0060): 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 0130): 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 are excluded.
- DR1Y (column 0190): 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 0200): 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 0210): 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 0220): the EAD-weighted average of the loss rates observed in the last 5 years preceding the reference date.
- RWA- and RWA+ (columns 0250 and 0260): 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

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

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

- RWA-- and RWA++ (columns 0270 and 0280): 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 making this comparison, in particular for the comparison at 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[16]).
    - The loss rates collected use accounting data as the 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 computed at the grade and pool levels or at the calibration segment level, resulting in a potential lack of homogeneity across time.

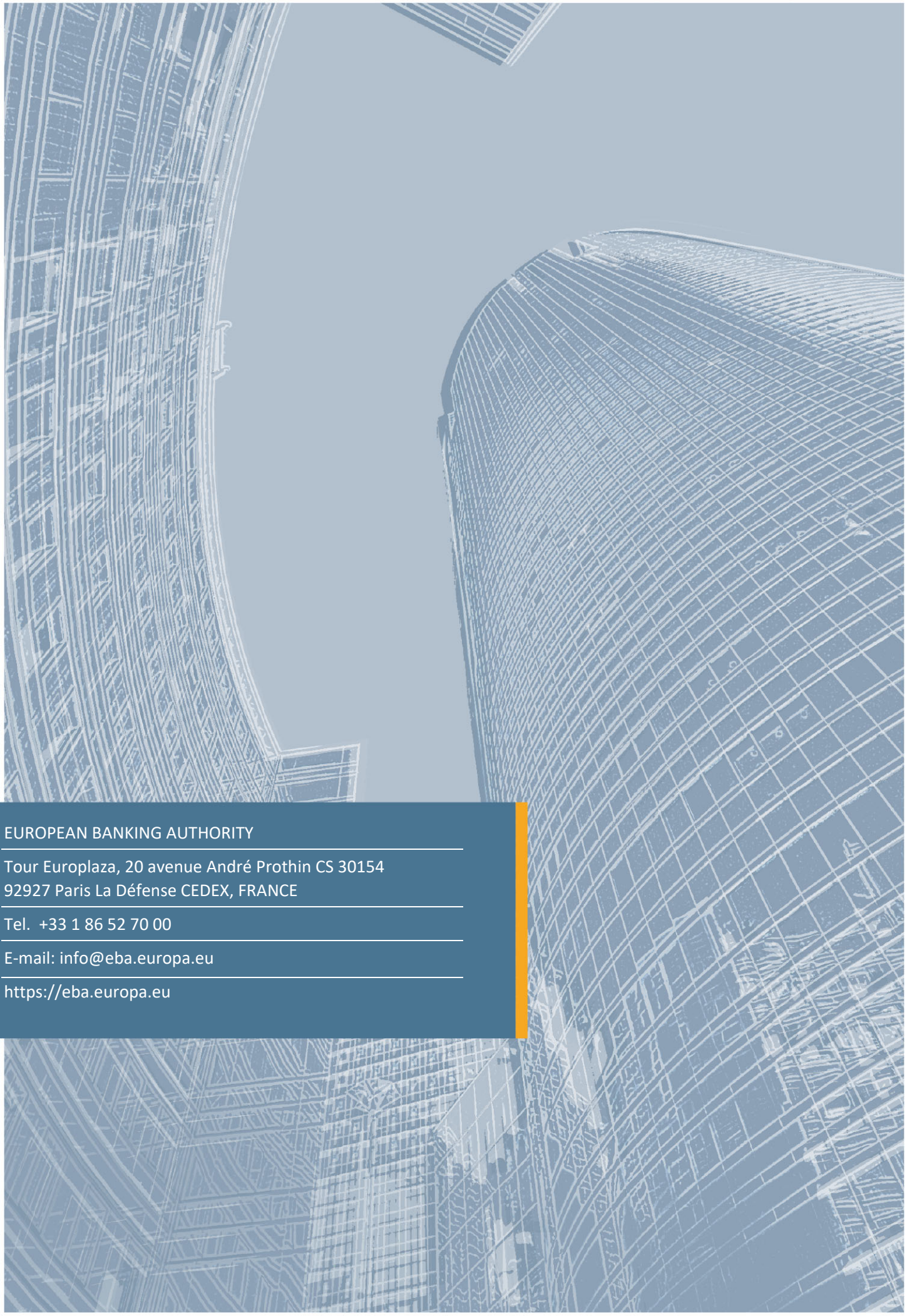
- Differences between the long-run averages and the risk parameters.
    - Both PD and LGD should incorporate a margin of conservatism (further details are available in section 4.4.3 of the Guidelines on PD and LGD estimation).
    - LGD estimates should be appropriate for downturn conditions as per 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.
    - For the 1-year rates, the data collected allowed only the comparison of PDs (and LGDs) at the reference date (YYYY) with the default rate (and loss rate) observed during the same year (YYYY), 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.

16 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

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.



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