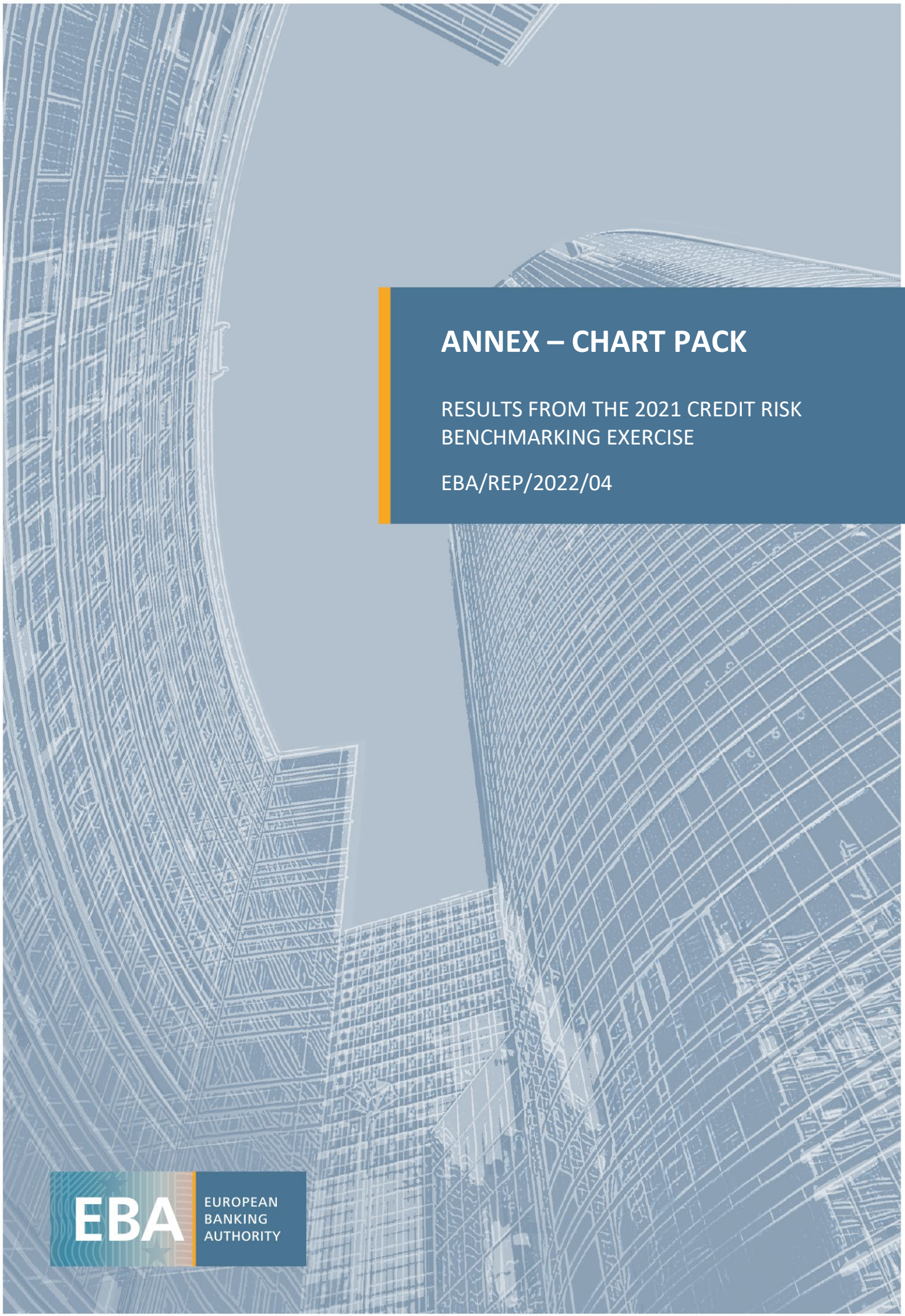


# ANNEX – CHART PACK

RESULTS FROM THE 2021 CREDIT RISK BENCHMARKING EXERCISE

EBA/REP/2022/04

EBA EUROPEAN BANKING AUTHORITY

# Contents

# Figures

# Tables

# Abbreviations

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

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

# Introduction and legal background

1. This chart pack aggregates the results of the SVB exercise for internal models used by both HDPs and LDPs across a sample of EU institutions. The reference date for the data is 31 December 2020.

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

3. The data collection is based on technical standards specifically designed for annual SVB exercises and covers different breakdowns of portfolios by, for instance, country, type of collateral, loan-to-value ratio and sector to help to understand the impact of these factors on the different key risk drivers such as PD, LGD, CCF and RW estimates.

4. The chart pack is organised as follows:

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

    - The second section contains a quantitative analysis of the variability of the collected data, replicating the three analyses conducted in the previous reports: starting from a high-level analysis with a top-down approach to the whole portfolio, before moving to a deeper analysis with the common counterparties analysis for 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.

# 1. General description

## 1.1 Dataset and assessment methodology

### 1.1.1 Dataset

5. Altogether, 106 institutions (at highest consolidation level) from 15 EU Member States had approval for the use of credit risk internal models at 31 December 2020 and are therefore within the scope of the 2021 SVB exercise (the full list of institutions can be found in Appendix 1). In comparison with previous studies, the number of institutions in the sample is decreased due to the exclusion of the UK's banks. The figures presented in this report are at the highest level of consolidation in the EU. One hundred and four institutions submitted data for at least one counterparty or one portfolio (4 of them have been excluded due to data quality issues). The number of institutions differs depending on the template due to the different business models as well as in some instances due to data quality: the full details of the sample size and the different rules for data cleaning are set out in Appendices 2 and 3.

6. The underlying framework is designed by the EBA via the final draft ITS published by the EBA in May 2020 [1]. In accordance with the ITS, the report relies on data collected on SVB [2] (complemented by COREP data when necessary) through six different templates:

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

- Template C 102.00 provides the information on LDPs[3]. As in previous exercises, there is no information on SA exposures (either on a roll-out plan or under the permanent partial use allowance). However, reporting the RWAs as if they were calculated under the SA for these IRB exposures is mandatory since the ITS 2020.

[1] https://www.eba.europa.eu/regulation-and-policy/supervisory-benchmarking-exercises/its-package-2021-benchmarking-exercise

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

[3] LDPs consist of sovereigns, institutions and specialised lending exposures and large corporates. The last are defined as firms with annual sales exceeding EUR 200 million and do not include the specialised lending exposures, which are now collected separately as a separate exposure class.

- Template C 103.00 provides the same information as template C 102.00 with the addition of some backtesting parameters for the HDPs[4]. Since the 2019 SVB exercise the RWAs calculated under SA have been collected in this template.

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

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

### 1.1.2 Challenges encountered when analysing the variability of IRB model outcomes

### 1.1.3 Analysis performed

8. 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

[4] HDPs include the remaining corporate exposures (i.e. with annual sales below EUR 200 million), broken down into corporates SME and corporates non-SME (SME defined as corporates with annual sales below EUR 50 million) as well as retail exposures, broken down into retail SME and retail non-SME and by CRR categories (Mortgages, 'other' and revolving).

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

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

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

- **A survey used to collect additional information on a specific topic for further analysis.** This survey is usually launched after the official deadline of submission of the regular ITS templates, if needed. Due to the COVID outbreak in 2020, the analysis of the 2020 and 2021 benchmarking exercise have not been complemented by a dedicated survey.

- **Joint EBA - CA interviews** with outlier institutions to gather additional information. The selection of institutions for the interviews is generally based on the computed benchmarks on risk parameters and portfolios, with a special focus on conspicuous results. The aim of these interviews is to better understand the approaches used by individual institutions to calculate own funds requirements and to identify key factors and drivers that can explain observed differences. Interviews are generally attended by CAs from different jurisdictions to ensure a more harmonised application of the supervisory framework within the EU countries. No interviews were held in 2020 and2021 due to the COVID pandemic.

[5] 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.

- **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 the scope of the exercise to and via this 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 the EU.

## 1.2 Portfolio composition and characteristics of institutions in the sample

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

### 1.2.1 Use of regulatory approaches

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

| | Exposure Class | AIRB | FIRB | SLSC | Number of participating institutions |
|---|---|---|---|---|---|
| LDP | LCOR | 53 | 47 | 0 | 83 |
| | COSP | 27 | 17 | 35 | 63 |
| | CGCB | 17 | 27 | 0 | 37 |
| | INST | 23 | 38 | 0 | 51 |
| HDP | CORP | 53 | 45 | 0 | 82 |
| | SMEC | 53 | 45 | 0 | 81 |
| | SMOT | 67 | 0 | 0 | 67 |
| | RETO | 73 | 0 | 0 | 73 |
| | RSMS | 66 | 0 | 0 | 66 |
| | MORT | 82 | 0 | 0 | 82 |
| | RQRR | 35 | 0 | 0 | 35 |
| **ALL** | **ALL** | **94** | **55** | **35** | **100** |

### 1.2.2 Portfolio composition and representativeness

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

13. Last year (2020) SVB data collection contained for the first time more granular specialised lending (SLE) portfolios (aligned to the slotting approach risk categories of SLE) as well as the HDP retail portfolios consumer credits (RETO) and qualified revolving exposures (RQRR). Thus, the share of IRB exposure analysed in the SVB has increased. Nevertheless Figure 1 shows that some institutions still do not have any of their IRB exposures reported under this year's SVB exercise. These are most probably IRB exposures under PPU (i.e. sovereign exposures, intragroup exposures, exposures belonging to an institutional protection scheme, etc.).

**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)**

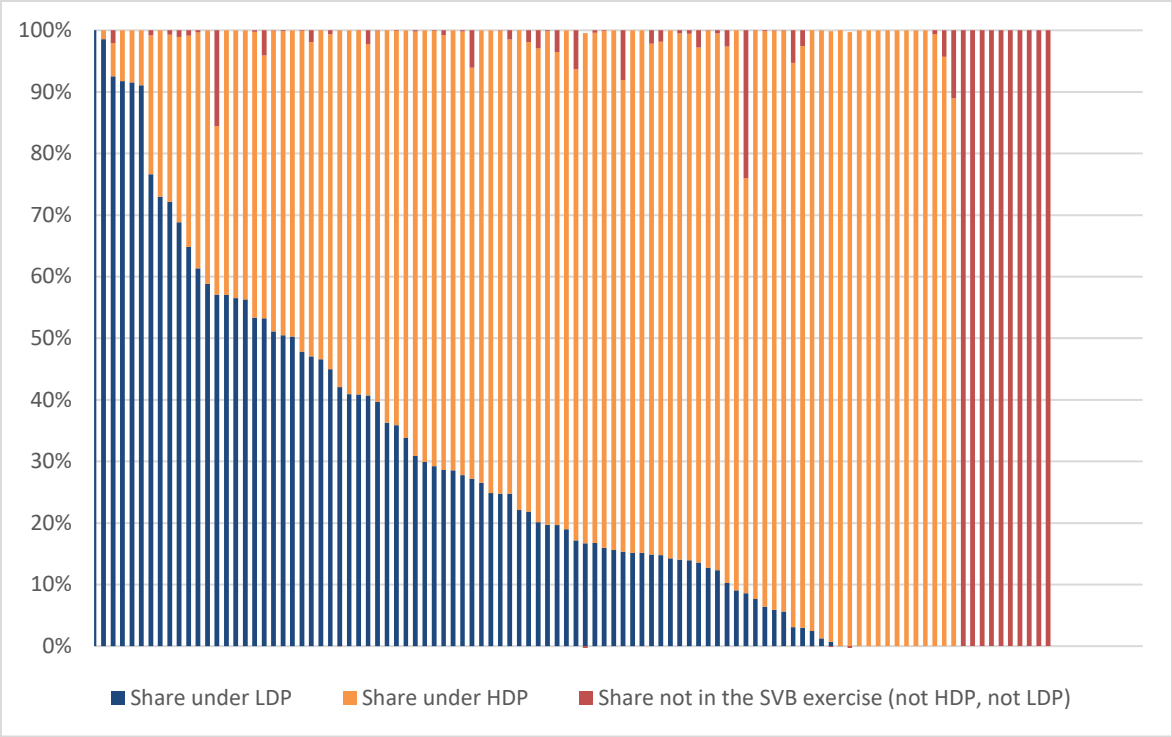



**Table 2: Summary statistics on the proportion of exposures under LDP, HDP or outside the scope of the SVB exercise (%)**

| | LDP | HDP | Other |
|---|---|---|---|
| **Minimum** | 0% | 0% | 0% |
| **25th centile** | 1% | 27% | 0% |
| **50th centile** | 19% | 69% | 0% |
| **75th centile** | 47% | 85% | 2% |
| **Maximum** | 100% | 100% | 100% |

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

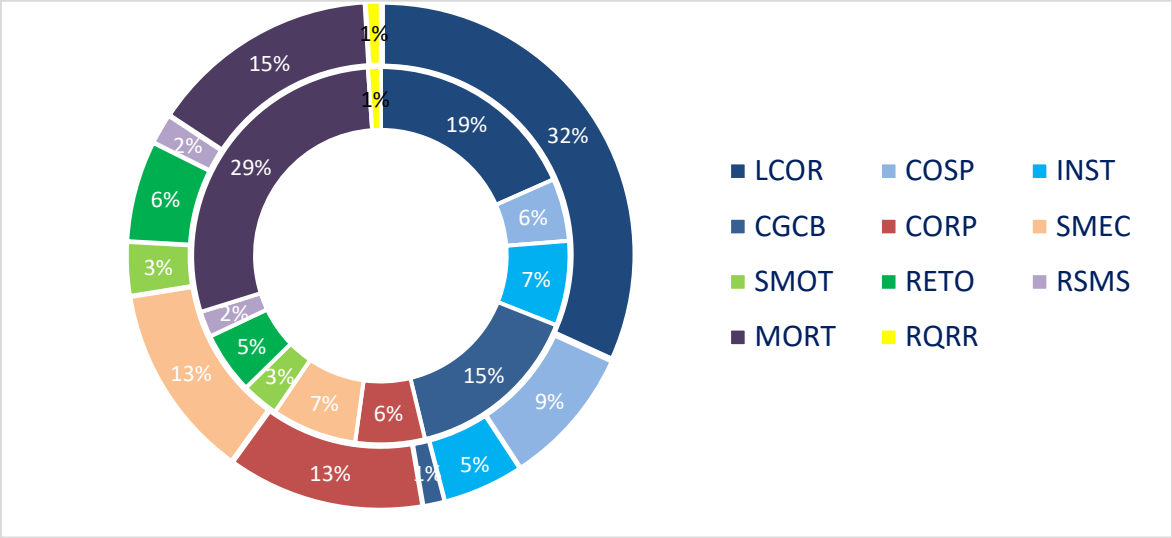



**Figure 3: Portfolio composition of LDPs: proportion of large corporates, institutions and sovereigns in LDPs (sorted by proportion of specialised lending exposures in LDPs from smallest to largest)**

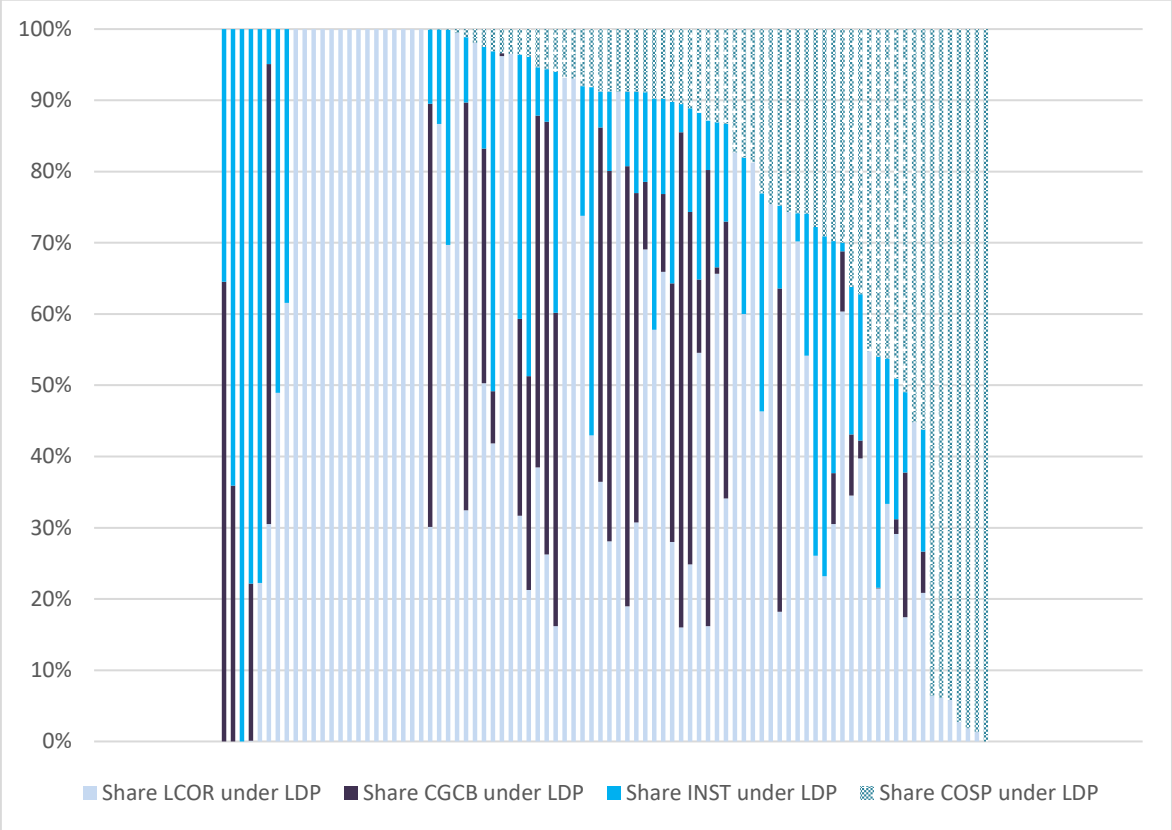
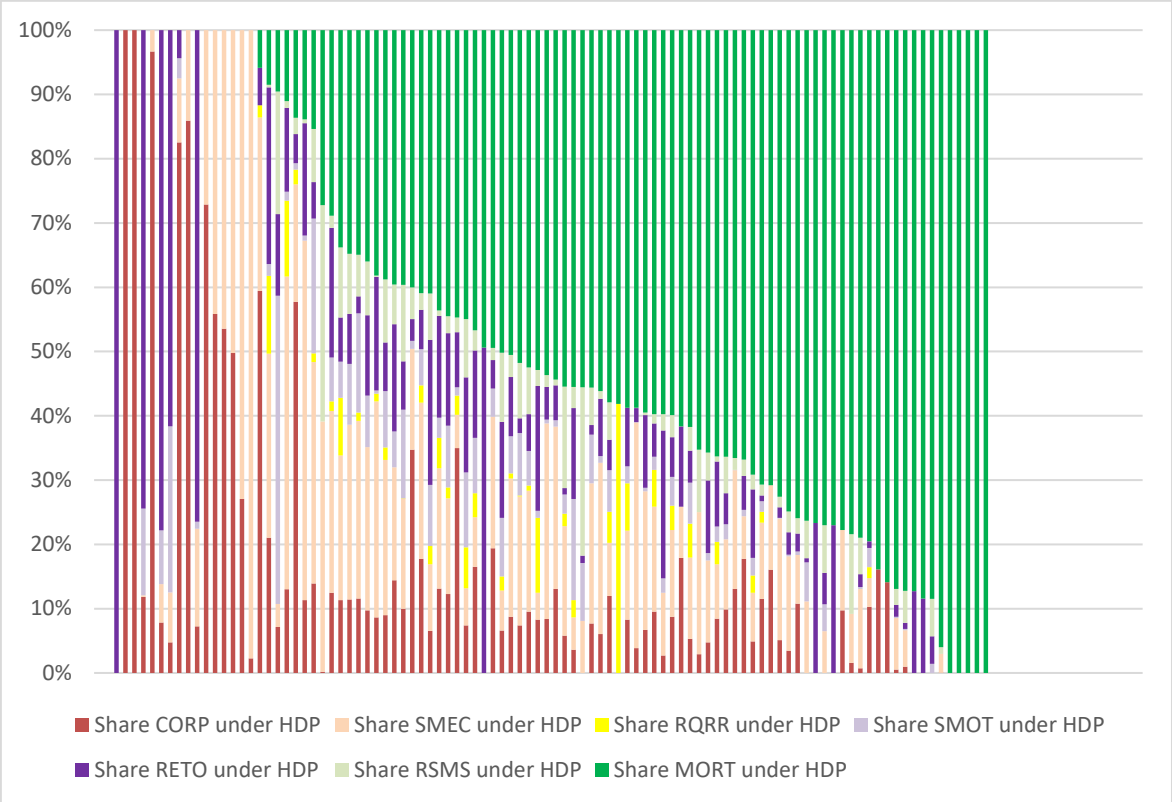


**Figure 4: Portfolio composition of HDPs: proportion of residential mortgages, SME retail, SME corporate and corporate-other exposures in HDPs (sorted by proportion of mortgages in HDPs from smallest to largest)**




14.Complementary statistics are given in Appendix 5.

## 1.3 Key risk metrics and temporal evolution

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

| | | LCOR | | 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 | | 53 | 47 | 26 | 17 | 35 | 23 | 38 | 17 | 26 | 53 | 45 | 53 | 45 | 67 | 73 | 66 | 82 | 35 |
| GC (%) | Q1 | 40% | 45% | 33% | 43% | 78% | 15% | 20% | 1% | 1% | 48% | 51% | 39% | 44% | 34% | 26% | 19% | 10% | 12% |
| | Median | 47% | 66% | 42% | 53% | 91% | 19% | 23% | 6% | 4% | 66% | 79% | 49% | 73% | 43% | 38% | 27% | 15% | 30% |
| | Q3 | 58% | 84% | 59% | 80% | 104% | 28% | 27% | 13% | 13% | 74% | 105% | 70% | 91% | 60% | 55% | 37% | 22% | 40% |
| | Q3-Q1 | **18%** | **39%** | **26%** | **37%** | **27%** | **13%** | **8%** | **11%** | **11%** | **26%** | **54%** | **31%** | **47%** | **27%** | **29%** | **19%** | **12%** | **28%** |
| RW (%) | Q1 | 36% | 43% | 30% | 40% | 71% | 15% | 19% | 1% | 1% | 43% | 47% | 33% | 39% | 24% | 20% | 16% | 9% | 8% |
| | Median | 44% | 62% | 39% | 51% | 81% | 18% | 23% | 6% | 4% | 59% | 73% | 42% | 62% | 31% | 31% | 22% | 14% | 20% |
| | Q3 | 53% | 77% | 52% | 74% | 89% | 27% | 27% | 13% | 12% | 66% | 94% | 57% | 75% | 42% | 45% | 30% | 19% | 26% |
| | Q3-Q1 | **17%** | **34%** | **23%** | **34%** | **18%** | **12%** | **7%** | **11%** | **11%** | **23%** | **47%** | **24%** | **36%** | **18%** | **25%** | **14%** | **10%** | **17%** |
| PD (%) | Q1 | 0.51% | 0.35% | 0.89% | 0.42% | 0.00% | 0.12% | 0.09% | 0.03% | 0.00% | 0.87% | 0.61% | 1.28% | 0.87% | 1.96% | 1.11% | 1.48% | 0.48% | 0.63% |
| | Median | 0.77% | 0.67% | 1.54% | 0.53% | 0.00% | 0.18% | 0.13% | 0.06% | 0.01% | 1.62% | 1.08% | 2.21% | 1.96% | 2.58% | 1.55% | 1.94% | 0.86% | 1.37% |
| | Q3 | 1.28% | 1.07% | 2.20% | 1.11% | 0.67% | 0.32% | 0.23% | 0.09% | 0.02% | 2.24% | 1.59% | 2.80% | 2.80% | 3.79% | 2.20% | 2.89% | 1.24% | 2.14% |
| | Q3-Q1 | **0.77%** | **0.72%** | **1.31%** | **0.69%** | **0.67%** | **0.20%** | **0.14%** | **0.06%** | **0.02%** | **1.37%** | **0.98%** | **1.52%** | **1.93%** | **1.83%** | **1.09%** | **1.41%** | **0.76%** | **1.51%** |
| LGD (%) | Q1 | 27% | 41% | 15% | 40% | 0% | 20% | 24% | 9% | 45% | 23% | 39% | 22% | 38% | 29% | 27% | 14% | 11% | 42% |
| | Median | 33% | 44% | 20% | 43% | 0% | 26% | 29% | 25% | 45% | 29% | 43% | 25% | 40% | 38% | 41% | 17% | 16% | 59% |
| | Q3 | 38% | 45% | 25% | 44% | 37% | 37% | 42% | 34% | 45% | 34% | 44% | 34% | 43% | 49% | 51% | 21% | 21% | 67% |
| | Q3-Q1 | **11%** | **4%** | **10%** | **4%** | **37%** | **17%** | **19%** | **25%** | **0%** | **11%** | **5%** | **12%** | **5%** | **20%** | **23%** | **7%** | **10%** | **25%** |

15. Figures 5-9 give insights into the evolution of risk parameters for each exposure class and regulatory approach. As in previous reports, the charts focus on the non-defaulted portfolios only. This focus allows a better understanding of the trend of risk estimates (compared with statistics at the top portfolio level, which include PDs for defaulted assets). Graphs at total level are nonetheless presented in Appendix 6.

16. It should be noted that the grey-shaded fields indicate that the parameters PD and LGD are not obligatory for SLSC and the reported figures should thus be interpreted with care.

## 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 the 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 5: Change in EAD by regulatory approach (million EUR), non-defaulted exposures**

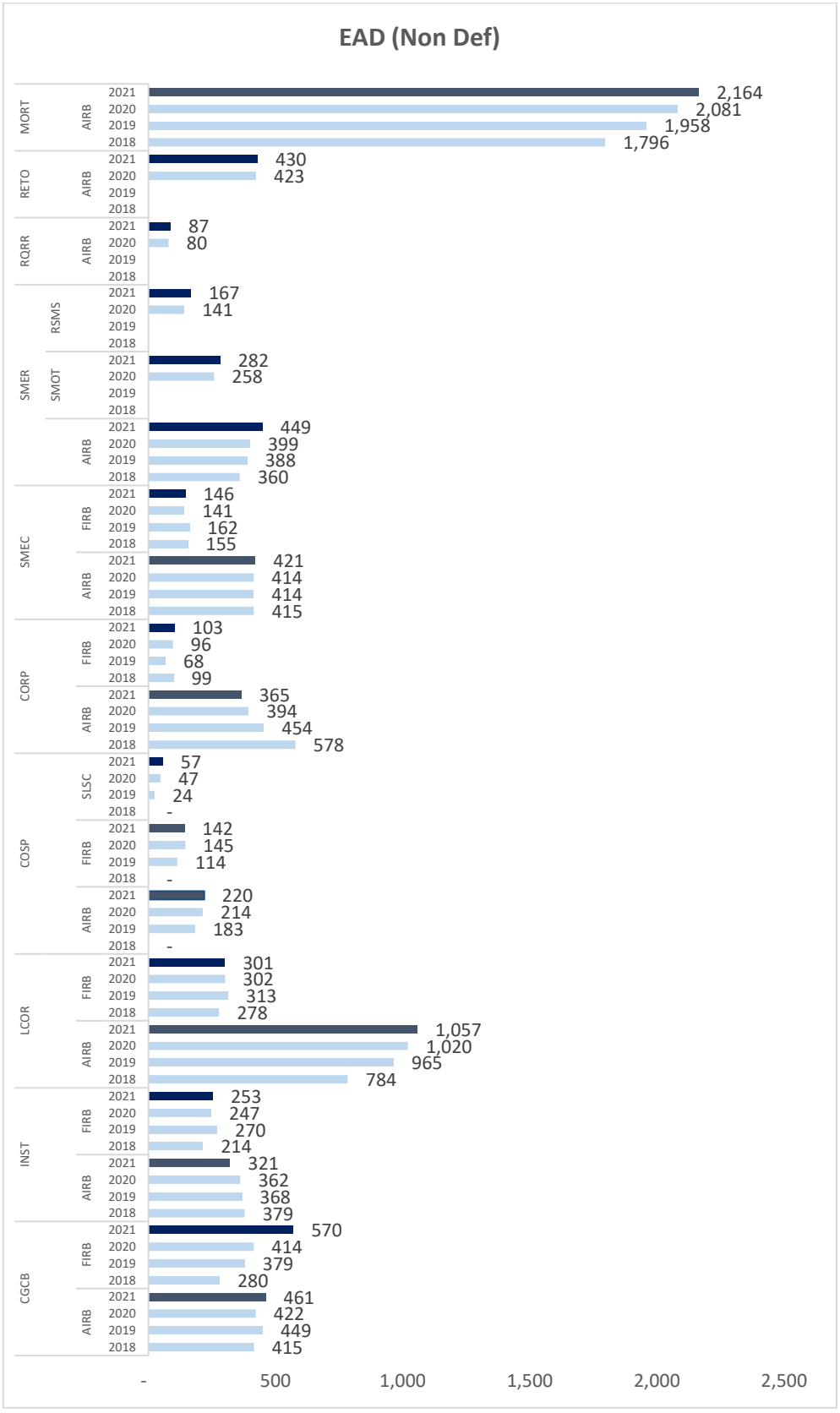
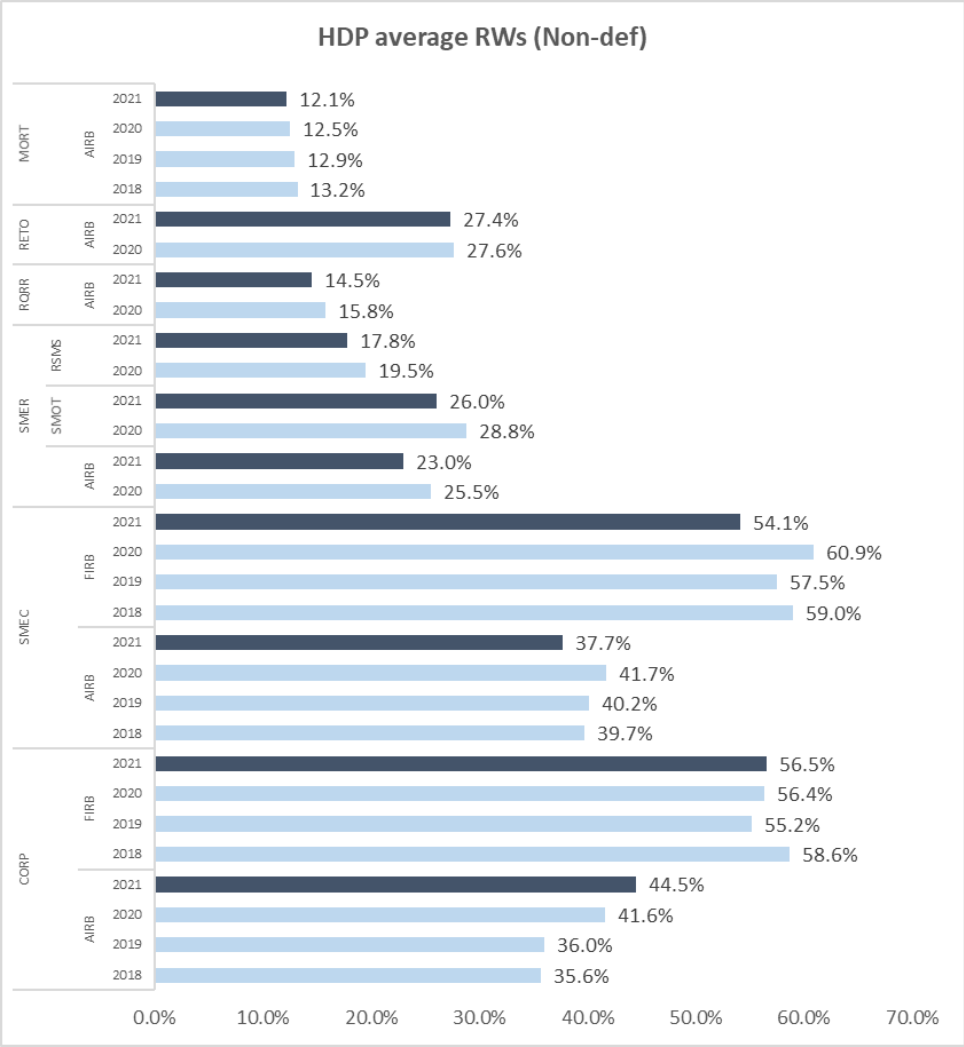


**Figure 6: Change in EAD-weighted RW by regulatory approach, non-defaulted exposures**



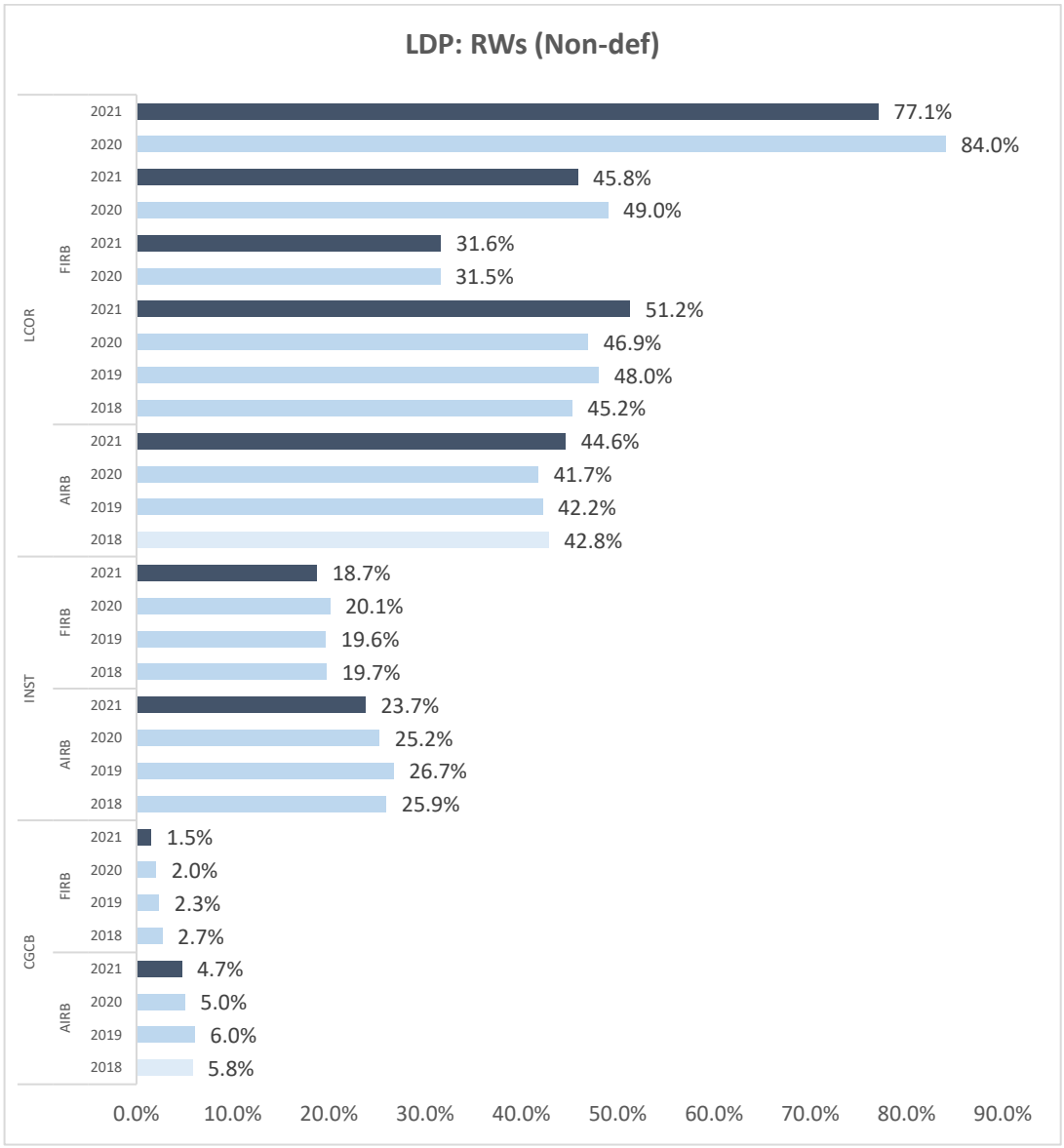
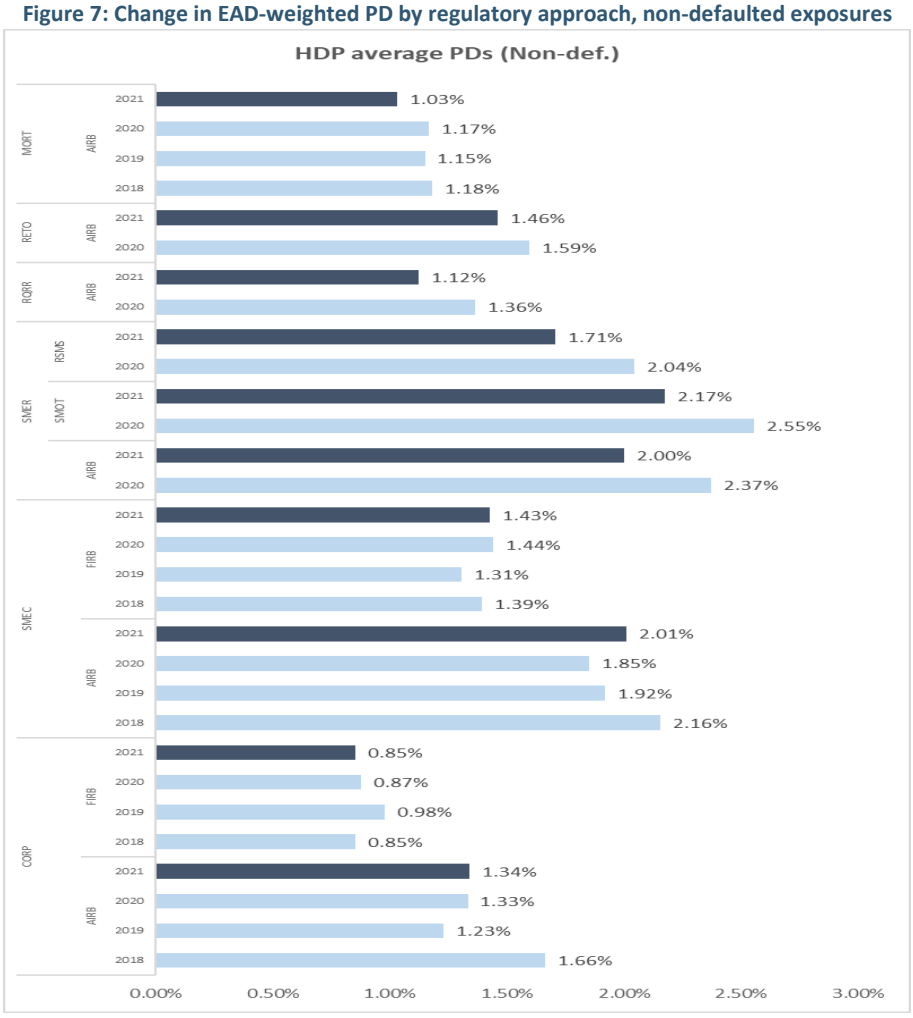

LDP: RWs (Non-def)
LCOR
FIRB
2021 77.1%
2020 84.0%
AIRB
2021 45.8%
2020 49.0%
INST
FIRB
2021 31.6%
2020 31.5%
AIRB
2021 51.2%
2020 46.9%
CGCB
FIRB
2021 1.5%
2020 2.0%
AIRB
2021 4.7%
2020 5.0%
2019 48.0%
2018 45.2%
2019 42.2%
2018 42.8%
2019 26.7%
2018 25.9%
2019 6.0%
2018 5.8%
2019 19.6%
2018 19.7%
2019 2.3%
2018 2.7%
0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0% 90.0%

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



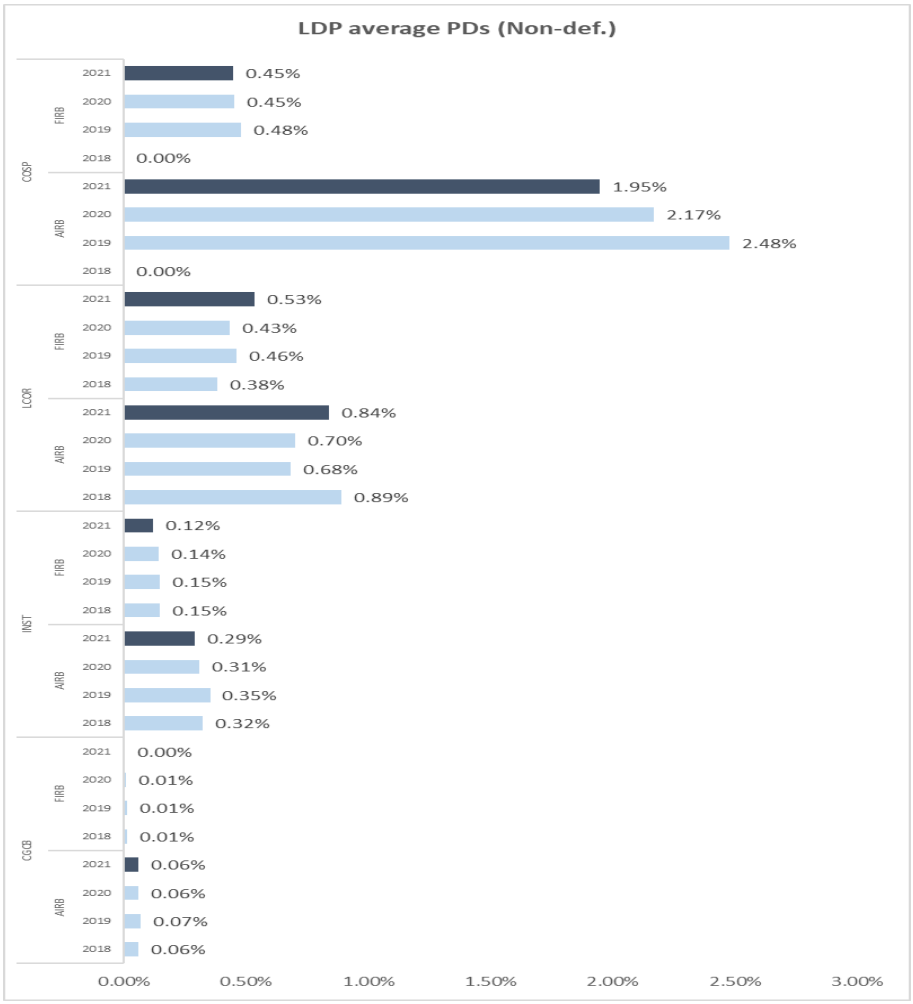
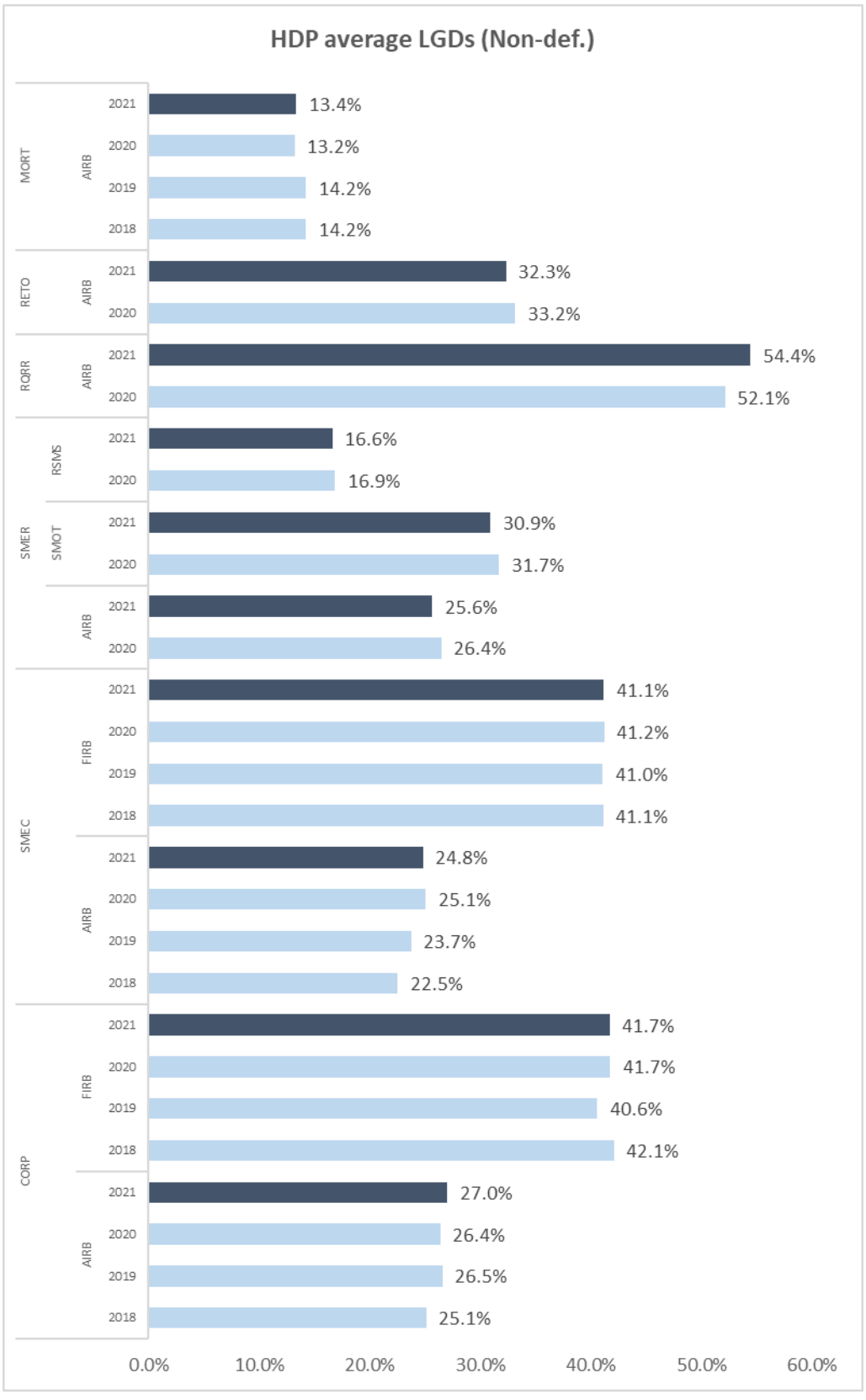

LDP average PDs (Non-def.)
CGSP
FIRB
2021 0.45%
2020 0.45%
2019 0.48%
2018 0.00%
AIRB
2021 1.95%
2020 2.17%
2019 2.48%
2018 0.00%
LCOR
FIRB
2021 0.53%
2020 0.43%
2019 0.46%
2018 0.38%
AIRB
2021 0.84%
2020 0.70%
2019 0.68%
2018 0.89%
INST
FIRB
2021 0.12%
2020 0.14%
2019 0.15%
2018 0.15%
AIRB
2021 0.29%
2020 0.31%
2019 0.35%
2018 0.32%
CGCB
FIRB
2021 0.00%
2020 0.01%
2019 0.01%
2018 0.01%
AIRB
2021 0.06%
2020 0.06%
2019 0.07%
2018 0.06%
0.00% 0.50% 1.00% 1.50% 2.00% 2.50% 3.00%

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



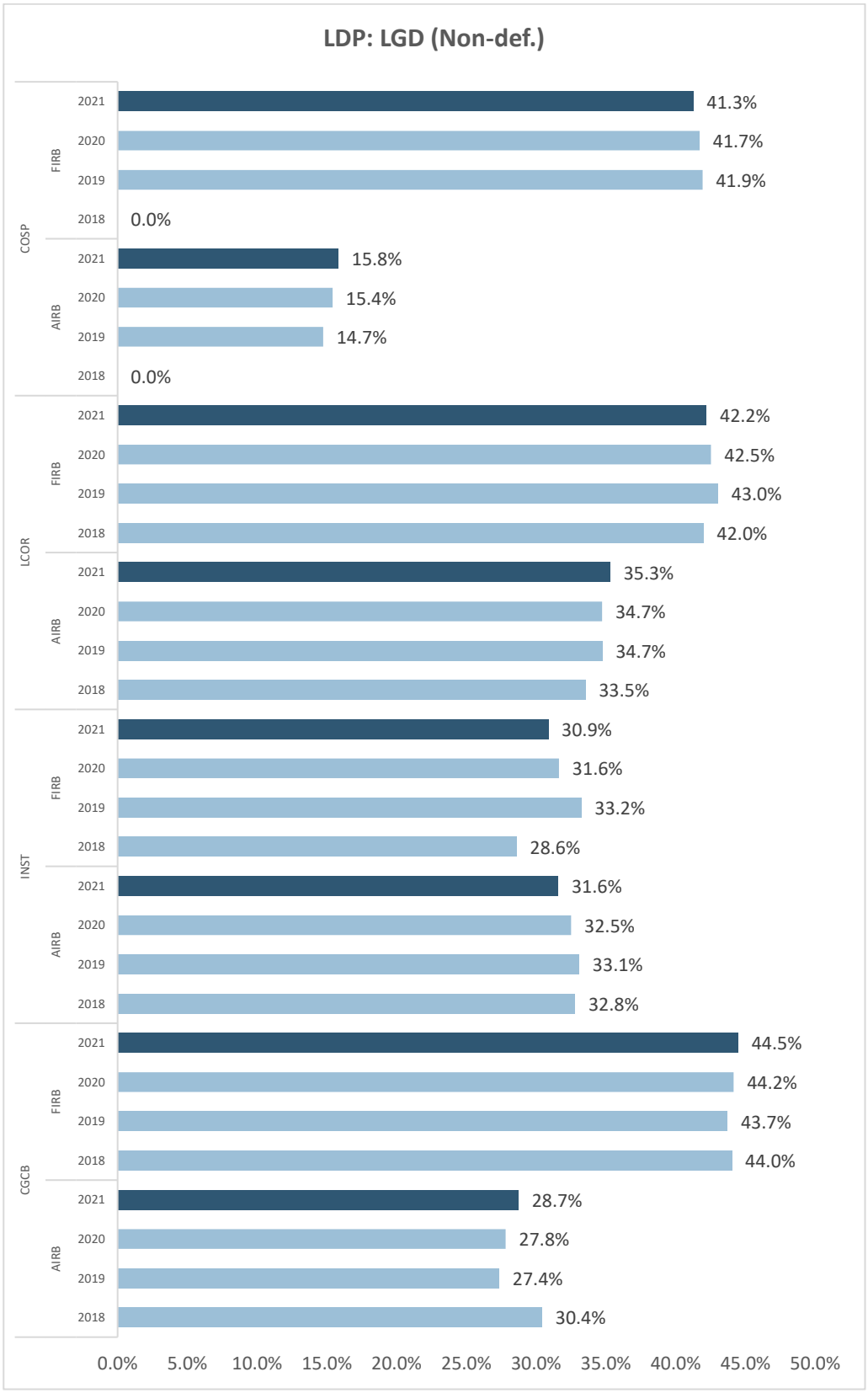
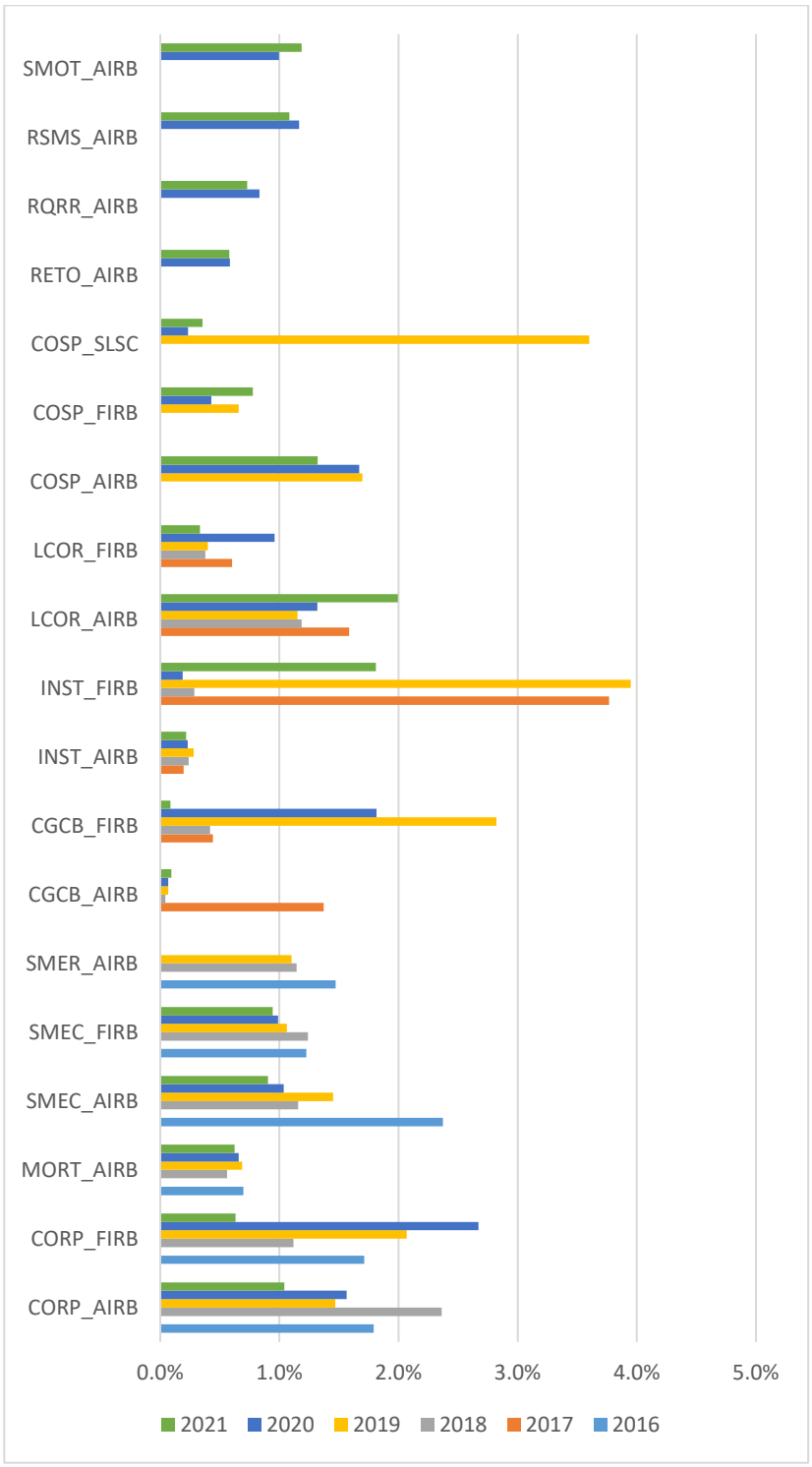

LDP: LGD (Non-def.)
COSP
FIRB
2021 41.3%
2020 41.7%
2019 41.9%
2018 0.0%
AIRB
2021 15.8%
2020 15.4%
2019 14.7%
2018 0.0%
LCOR
FIRB
2021 42.2%
2020 42.5%
2019 43.0%
2018 42.0%
AIRB
2021 35.3%
2020 34.7%
2019 34.7%
2018 33.5%
INST
FIRB
2021 30.9%
2020 31.6%
2019 33.2%
2018 28.6%
AIRB
2021 31.6%
2020 32.5%
2019 33.1%
2018 32.8%
CGCB
FIRB
2021 44.5%
2020 44.2%
2019 43.7%
2018 44.0%
AIRB
2021 28.7%
2020 27.8%
2019 27.4%
2018 30.4%
0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0% 40.0% 45.0% 50.0%

**Figure 9: Change in the standard deviation of the weighted PD by regulatory approach, non-defaulted exposures**



# 2. Quantitative analysis

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

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

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

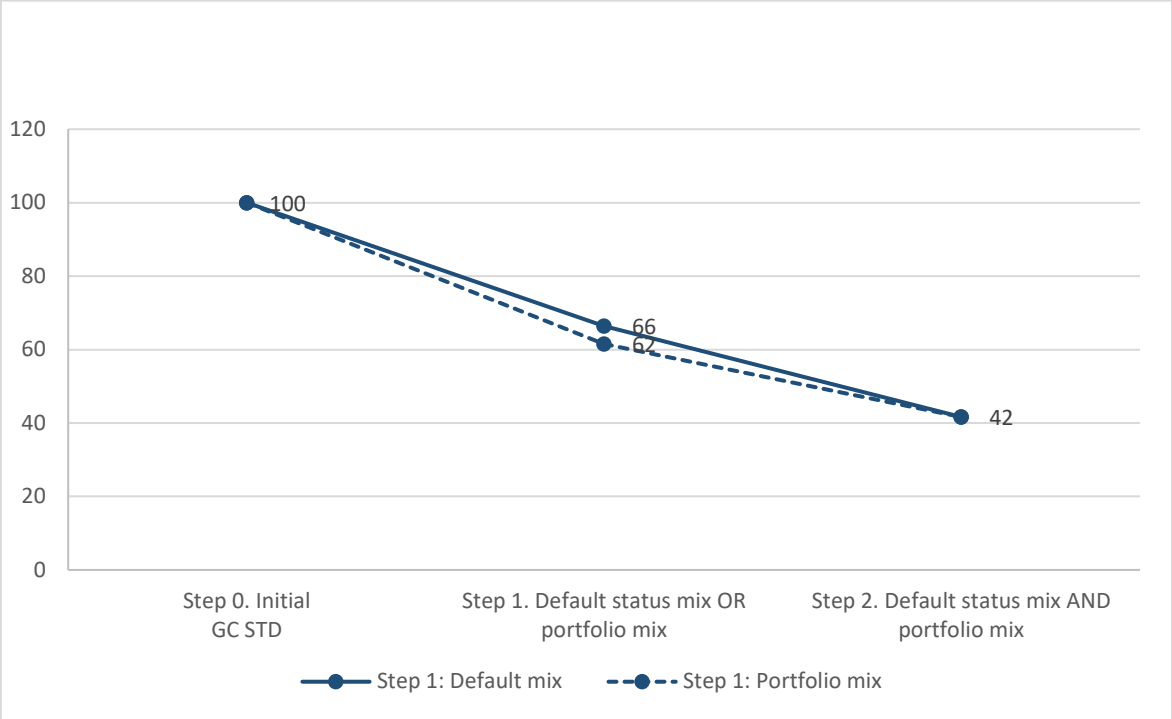
The standard deviations are computed using GC_total and GC_total DEF NON DEF. They are normalised by the standard deviation of GC_total to produce the graph with a 100-starting point.

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 stems both from differences in institutions' modelling practices and from risk-taking behaviour.

The top-down approach shows the extent to which the riskiness of portfolios (e.g. the portfolio composition) contributes to differences in average GC. However, a top-down approach does not explain the remaining differences, i.e. if these stem from individual practices, interpretations of regulatory requirements, business strategies or modelling choices or are caused by other effects, such as idiosyncratic variations in the riskiness within an exposure class, CRM (i.e. the business and risk strategy of the institutions) and the IRB risk parameters estimation (e.g. institutional and supervisory practice). 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.**

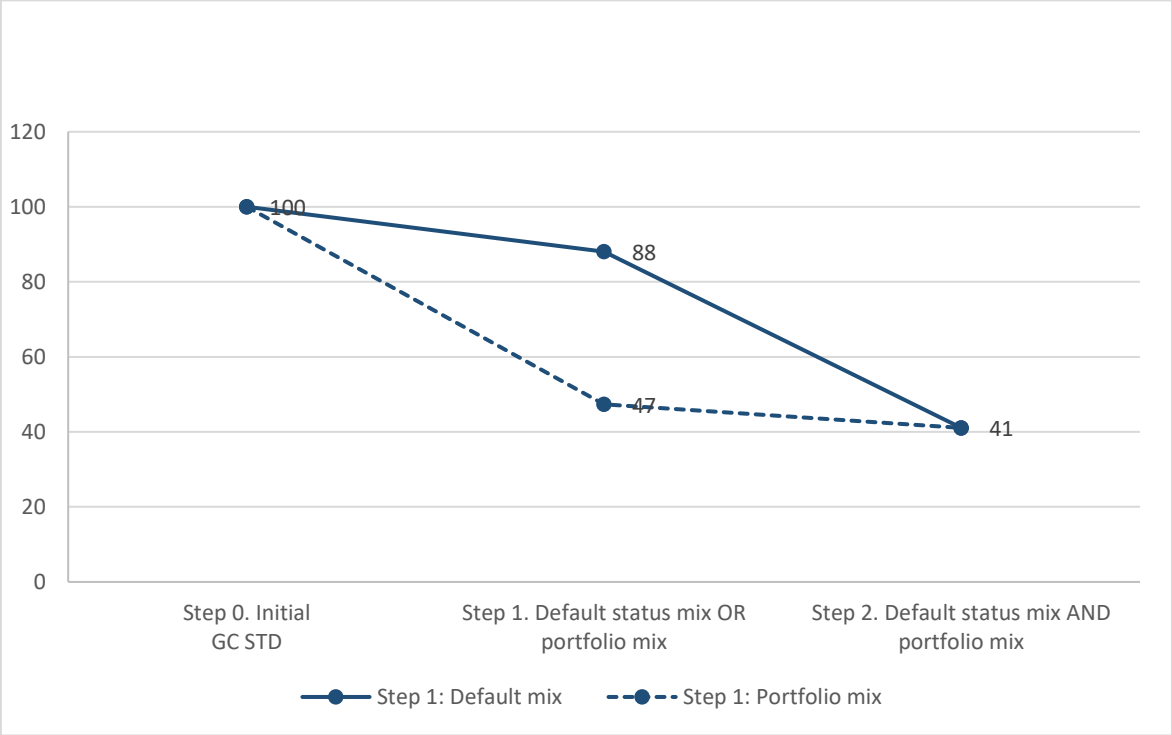
### 2.1.1 Results on the latest collected data

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



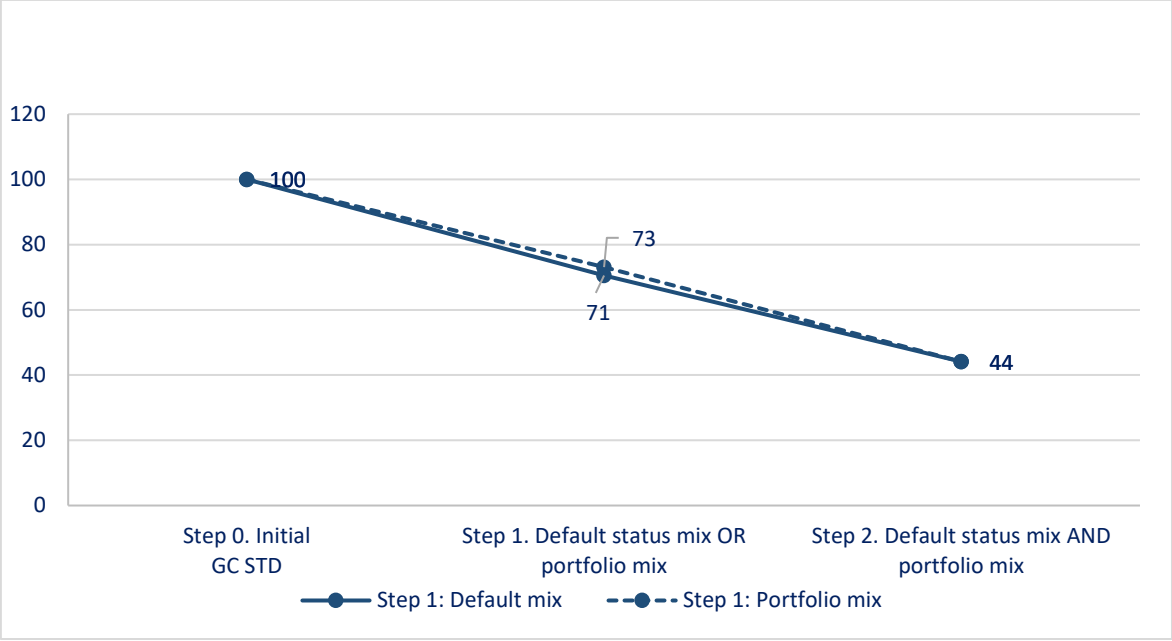

*Sample: 84 institutions; for the missing variables the median values have been used, initial standard deviations 25%.*
*Note: When the GC is missing, it is assumed to be equal to the benchmark value.*

**Figure 11: Decomposition of the GC standard deviation index – LDP**




*Sample: 86 institutions. Initial standard deviation 28% (last year 34%)*
*Note: When the GC is missing, it is assumed to be equal to the benchmark value.*

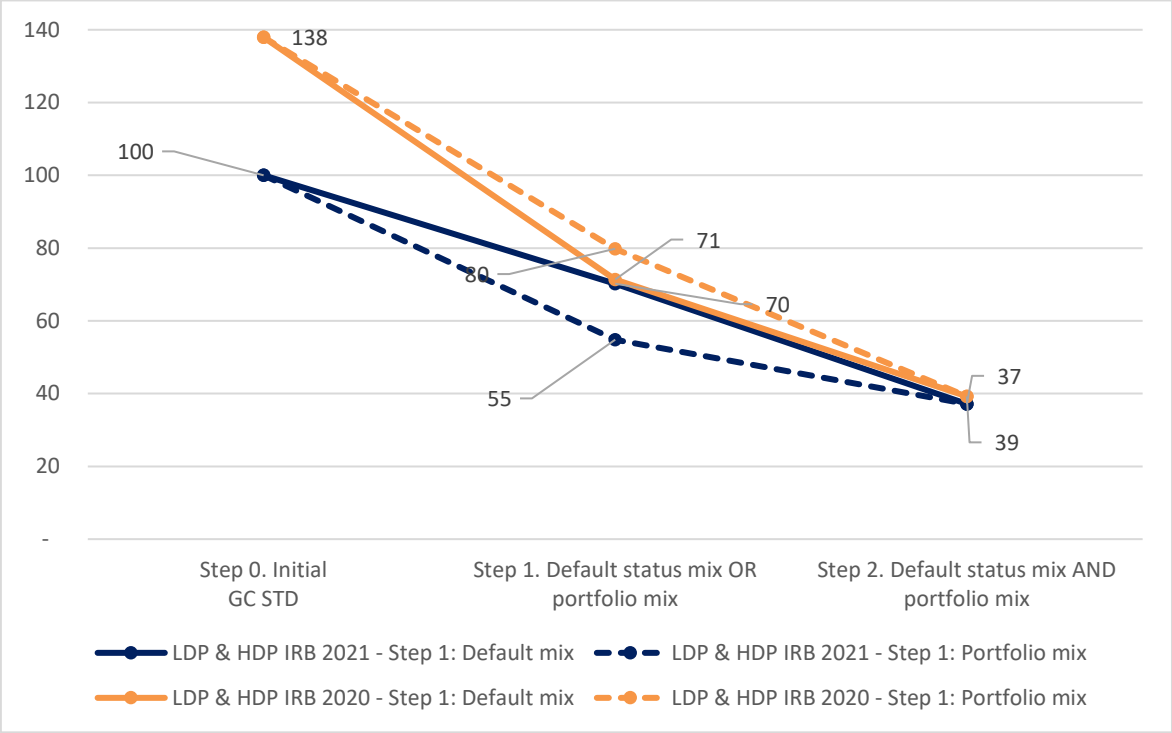
**Figure 12: Decomposition of the GC standard deviation index – HDP**




*Sample: 98 institutions. Initial standard deviation 28% (last year 38%)*
*Note: When the GC is missing, it is assumed to be equal to the benchmark value.*

### 2.1.2 Results compared with previous exercise

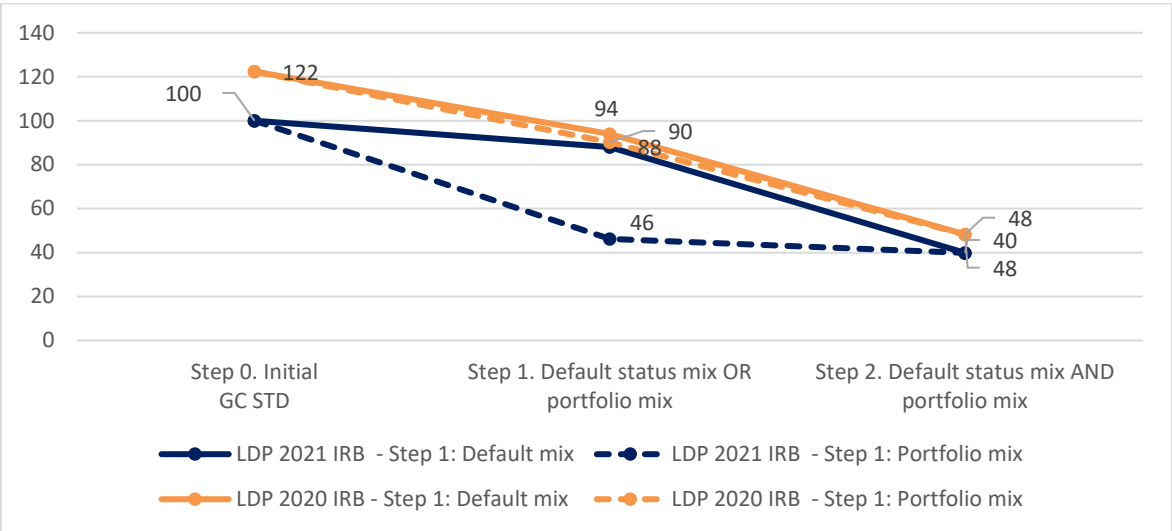
**Figure 13: Comparison of the top-down analysis, HDPs and LDPs, 2020 and 2021 exercises (common sample)**




*Sample: 82 institutions (only common institutions between 2020 and 2021 are kept). Initial STD 26%*

*For comparison, the explained variability in last year's sample was 65% for both HDPs & LDPs (Figure 12 of the 2020 chart pack). Based on the common 2020-2021 sample, the 2020 share of explained variability is 61% but considering the different initial STD (that is equal to 138 instead of 100) the explained variability with this year common sample is (100 – 39/138*100 =) 72%.*

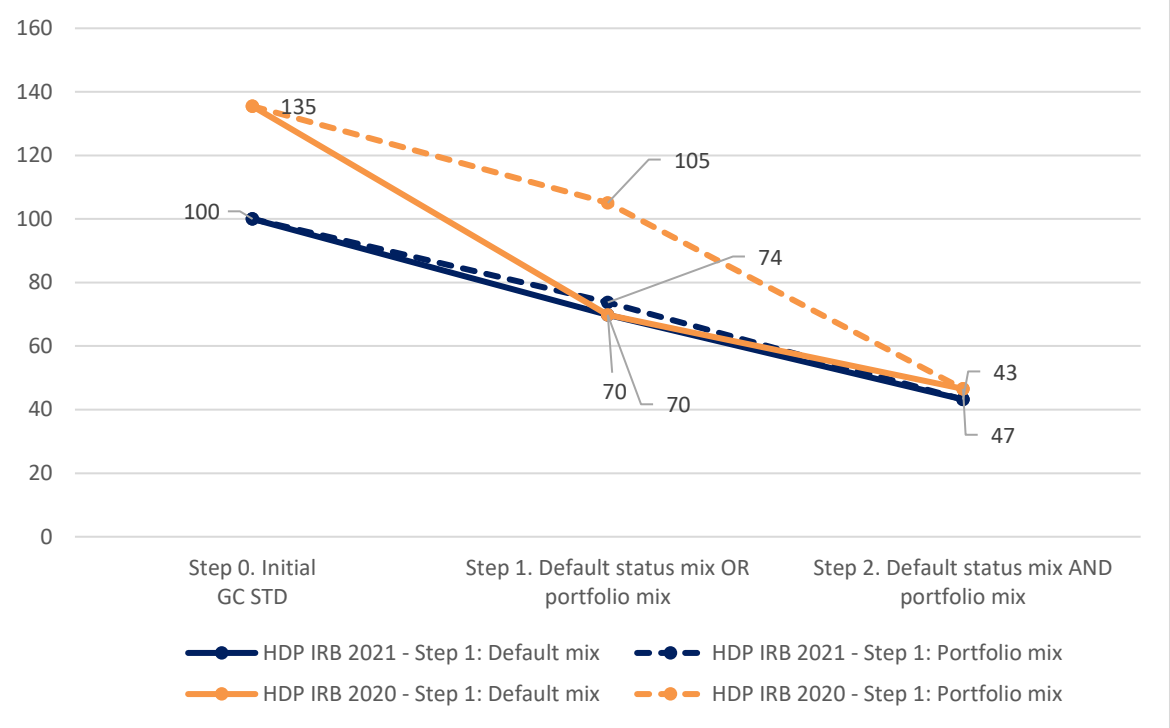
**Figure 14: Comparison of the top-down analysis, LDPs, 2020 and 2021 exercises (common sample)**




*Sample: 82 institutions (only common institutions between 2020 and 2021 are kept). Initial standard deviation (CY) 29%*

*For comparison, the explained variability in last year's sample was 77% for LDPs (Figure 13 of the 2020 chart pack). Based on the common 2020-2021 sample, the 2020 share of explained variability is equal to 100- 48/122 = 43%.*

**Figure 15: Comparison of the top-down analysis, HDPs, 2020 and 2021 exercises (common sample)**




*Sample: 91 institutions (only common institutions between 2020 and 2021 are kept). Initial standard deviations CY 29%*
*For comparison, the explained variability in last year's sample was 73% for HDPs (Figure 14 of the 2020 chart pack). Based on the common 2020-2021 sample, the 2020 share of explained variability for last year is equal to (100- 47/135 * 100 = 65%).*

## 2.2 Analysis of IRB parameters for common counterparties (LDP)

18. 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)[6].

19. 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. For the reader's convenience, its main features are recalled here:

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

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

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

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

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

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

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

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

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

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

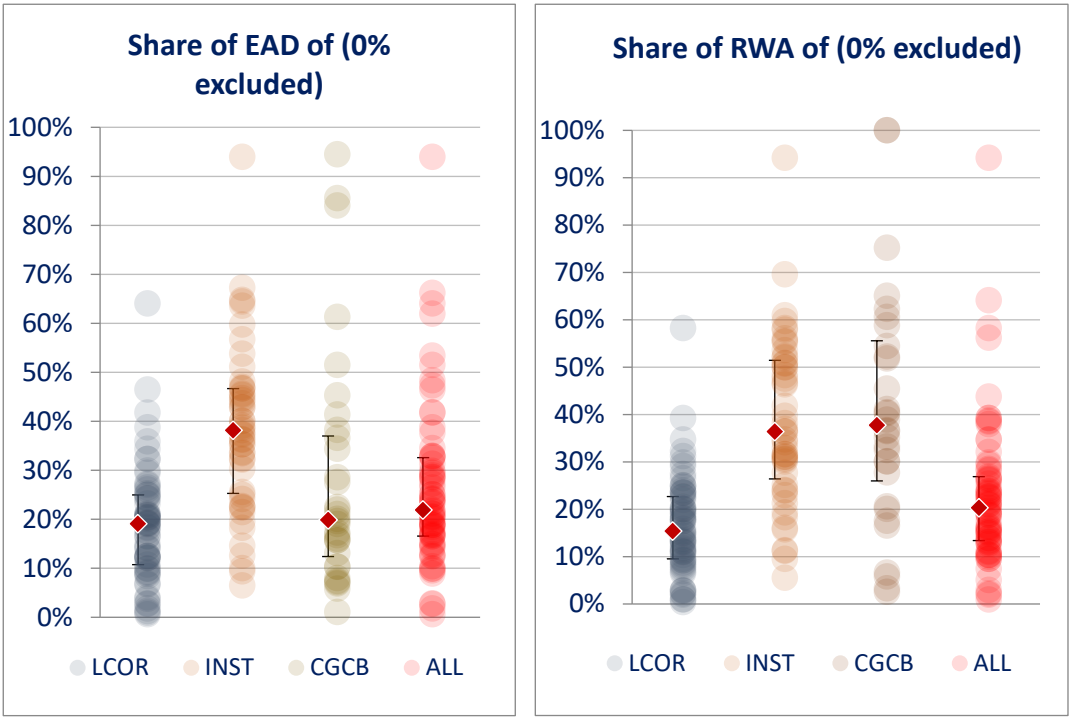
One limitation of this approach is that it does not take into account regulatory measures (such as add-ons) currently in place at RWA level. Hence, for some institutions in jurisdictions where such supervisory measures are in place, the recomputed RWAs are not directly comparable with the RWAs actually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

Furthermore, the subset of common counterparties may not be fully representative of the total IRB portfolio of the individual institutions; therefore, the results of this exercise may not be transferable to the total IRB portfolios and should be interpreted with care. **Figure 16** shows that,

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

generally speaking, 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 16: LDP common counterparties EAD and RWAs compared with corresponding total IRB EAD and RWAs**




### 2.2.1 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 2020 and 2021 exercise**

| | | AIRB | | | | | FIRB | |
|---|---|---|---|---|---|---|---|---|
| | | Dev 1 (ALL) | Dev2 (PD) | Dev3 (LGD) | Dev4 (M) | Dev5 ($LGD_{unsec}$) | Dev 1 (ALL) | Dev2 (PD) |
| **Large corporates** | **2021** | **8%** | **7%** | **6%** | **6%** | **6%** | **8%** | **6%** |
| | **2020** | 9% | 8% | 6% | 7% | 5% | 8% | 5% |
| **Sovereigns** | **2021** | **9%** | **2%** | **2%** | **2%** | **2%** | **3%** | **3%** |
| | **2020** | 8% | 2% | 4% | 3% | 4% | 3% | 4% |
| **Institutions** | **2021** | **8%** | **3%** | **5%** | **4%** | **8%** | **5%** | **4%** |
| | **2020** | 9% | 3% | 7% | 6% | 7% | 7% | 5% |

*NB: this table presents a gross comparison of the metrics between 2020 and 2021, without controlling for the sample composition of institutions and counterparties reported (see next section).*

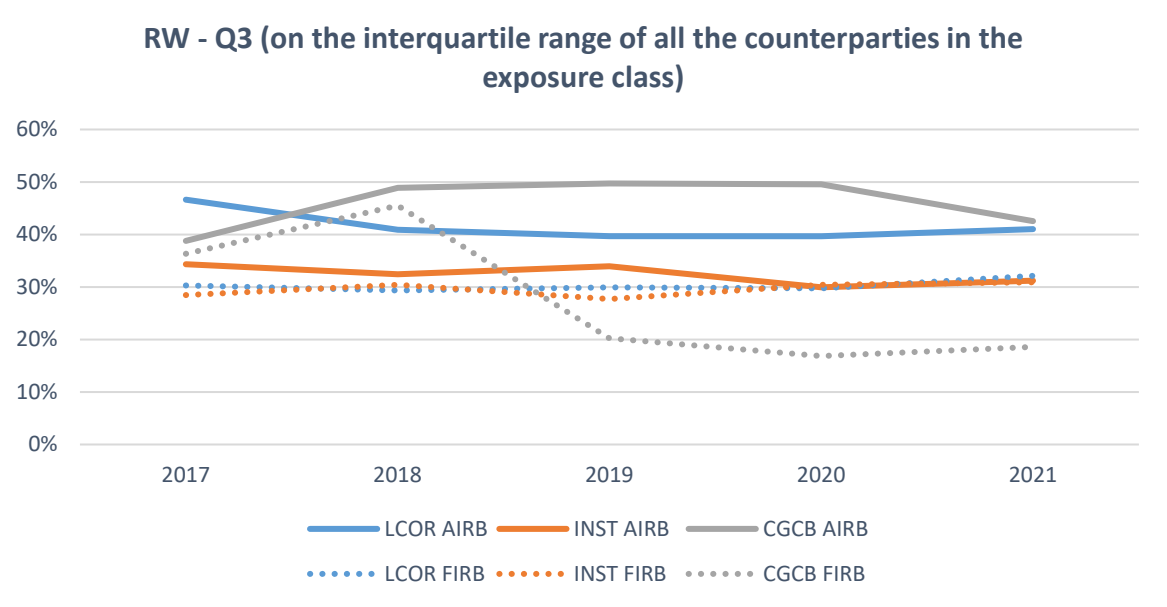
In terms of relative deviation, the following metrics are observed:

| | | AIRB | | | FIRB | |
|---|---|---|---|---|---|---|
| | | Dev 1 (ALL) | Dev2 (PD) | Dev3 (LGD) | Dev 1 (ALL) | Dev2 (PD) |
| Large corporates | Q1 | -14% | -10% | -13% | -14% | -13% |
| | Q3 | 9% | 11% | 11% | 27% | 11% |
| | (1+Q3)/(1+Q1) -1 | **27%** | **23%** | **27%** | **47%** | **28%** |
| Sovereigns | Q1 | -59% | -11% | -58% | -78% | -17% |
| | Q3 | 86% | 78% | 74% | 26% | 30% |
| | (1+Q3)/(1+Q1) -1 | **353%** | **101%** | **315%** | **461%** | **55%** |
| Institutions | Q1 | -22% | -9% | -23% | -24% | -14% |
| | Q3 | 25% | 14% | 15% | 11% | 17% |
| | (1+Q3)/(1+Q1) -1 | **60%** | **25%** | **49%** | **47%** | **36%** |

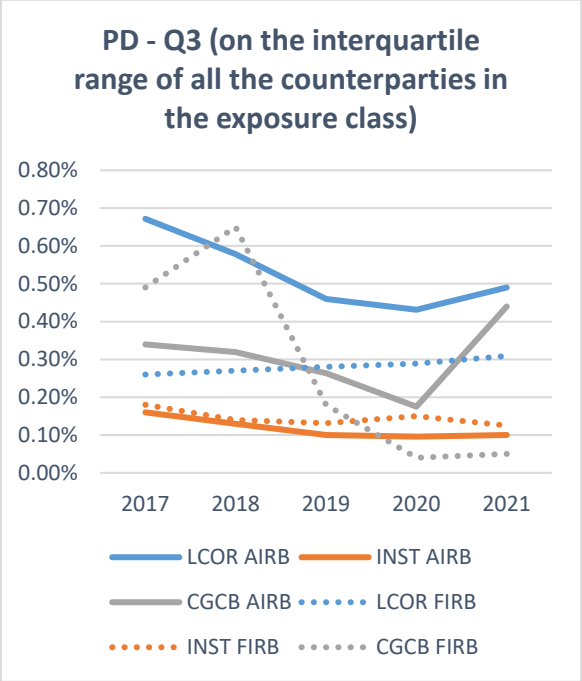
### 2.2.2 Results compared with previous exercise

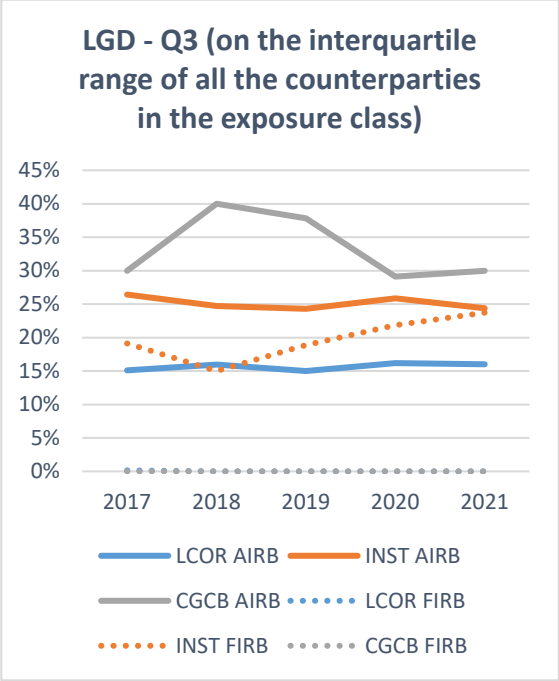
20. In this section, the interquartile range of risk estimates (RW, PD and LGD) for one counterparty is used as a measure of the variability. Figure 17 shows the evolution of the variability for the worst counterparties, i.e. where the interquartile range of risk estimates is the highest[7].

**Figure 17: Evolution of RW, PD and LGD variability**




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




### 2.2.3 Variability in risk differentiation (ranking)

21. 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[8], and second as the variability of the ranking of the counterparties (i.e. variability of the risk parameters relative to each other)[9]. This distinction between the variability deriving from risk differentiation and from risk quantification is very relevant to policymakers, as it triggers different corrective measures[10]. This section analyses the second dimension, i.e. the variability of the ranking.

## Methodology and assumptions

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

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

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

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

[10] 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.

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% |

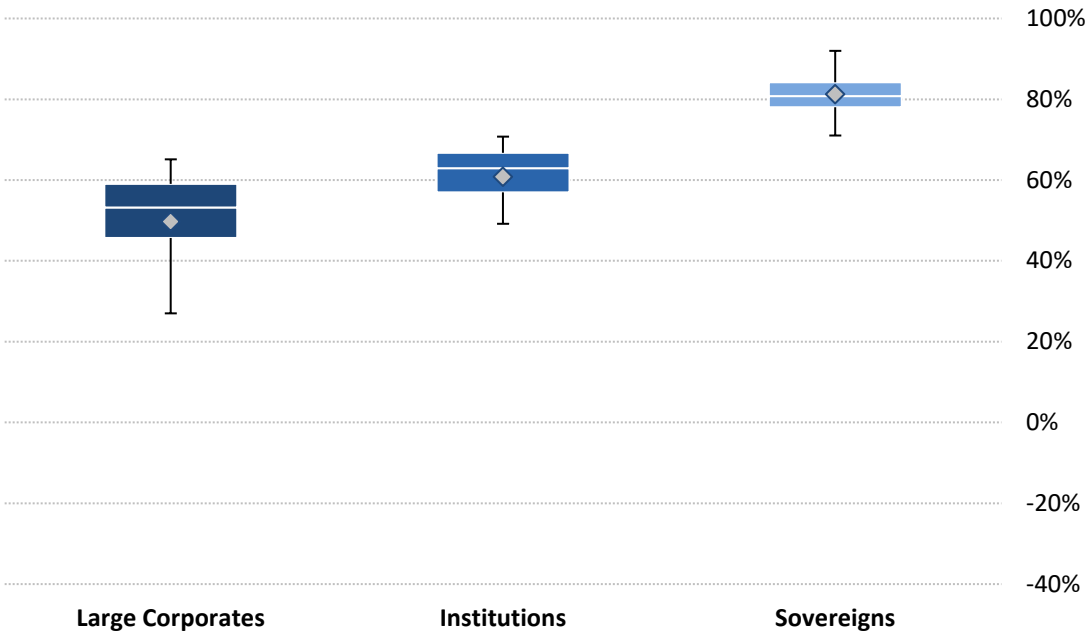
The four estimates per bank give six pairs of rankings: [1-2], [1-3], [1-4], [2-3], [2-4], [3-4].

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

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

22. Generally speaking, Figure 18 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 18: Interquartile range, median and average of Kendall tau metrics**



## 2.3 Outturns (backtesting) approaches (HDP)

23. 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)[11] – PD and LGD;
- observed[12] 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:

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

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

- For the 1-year rates, the data collected allowed only the comparison of PDs (and LGDs) at the reference date (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.

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

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

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

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

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

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

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

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

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

This normalised position can be interpreted in the following manner:

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

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

### 2.3.1 Results of the latest collected data

24. 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[13]. Generally speaking, the former show lower backtesting ratios (i.e. more conservative calibration), which is consistent with the general margin of conservatism (MoC) principle (the fewer the data an institution has, the more conservative it must be in its estimation).

[13] As a consequence, for Figure 19 and Figure 20 the following percentages of portfolios are excluded from the analysis: 21% of the portfolios for CORP AIRB, 20% for CORP FIRB, 6% for SMEC AIRB, 11% for SMEC FIRB, 1% for RETO and 3% for RSMS and 0% for MORT, RETO and SMOT.

**Figure 19: 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**

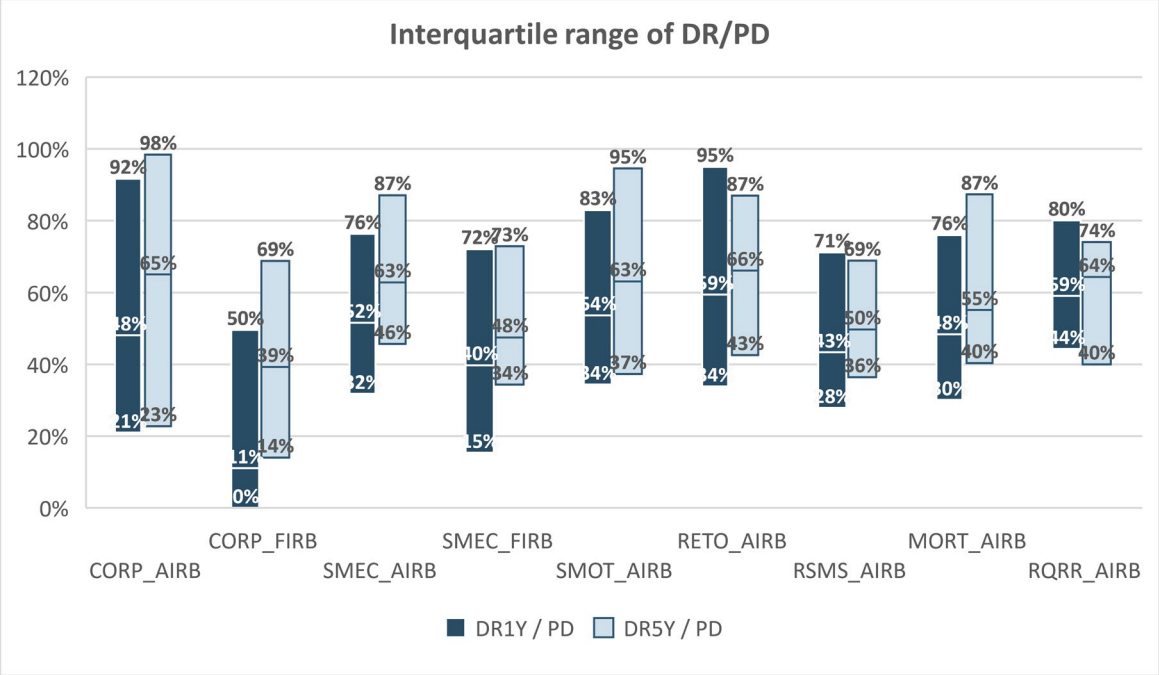



**Figure 20: Interquartile range of the ratio between LR 1Y and LGD and the ratio between LR 5Y and LGD, for non-defaulted exposures, by portfolio and regulatory approach**

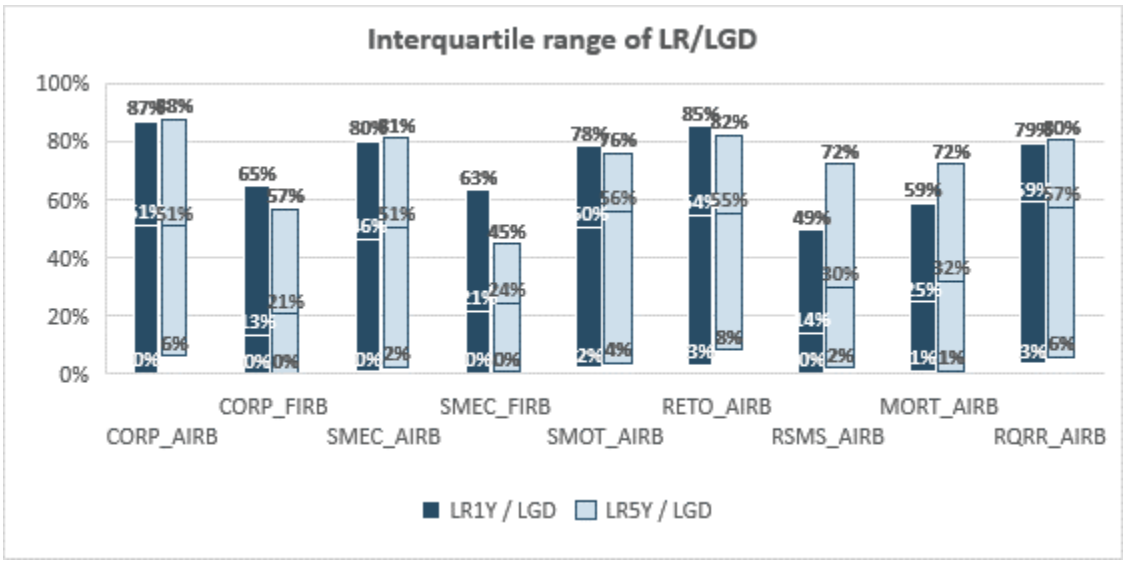


**Table 7: Key backtesting metrics at portfolio level**

| | | CORP | | SMEC | | SMOT | RETO | RSMS | MORT | RQRR |
|---|---|---|---|---|---|---|---|---|---|---|
| | | AIRB | FIRB | AIRB | FIRB | AIRB | AIRB | AIRB | AIRB | AIRB |
| Position normalised 1 - based on RWA + and RWA-, i.e. DR1Y | Q1 | -0.2 | -0.5 | 0.1 | -0.4 | -0.5 | -1.0 | -0.3 | -0.5 | -1.0 |
| | **Median** | **0.5** | **0.0** | **0.9** | **0.8** | **1.2** | **3.0** | **1.4** | **2.8** | **3.8** |
| | Q3 | 1.5 | 1.2 | 3.4 | 1.8 | 4.7 | 9.9 | 3.8 | 9.7 | 14.5 |
| | sample size | 37 | 32 | 47 | 37 | 61 | 67 | 58 | 76 | 33 |
| Position normalised 2 - based on RWA ++ and RWA--, i.e. DR5Y | Q1 | -0.8 | -0.4 | 0.5 | -0.4 | 0.1 | -1.0 | 0.1 | -0.6 | -1.0 |
| | **Median** | **0.5** | **0.3** | **1.1** | **0.4** | **1.8** | **2.1** | **2.3** | **2.8** | **2.4** |
| | Q3 | 2.7 | 0.9 | 4.1 | 1.6 | 5.5 | 12.1 | 4.6 | 9.5 | 10.6 |
| | sample size | 38 | 33 | 46 | 38 | 61 | 67 | 58 | 76 | 33 |

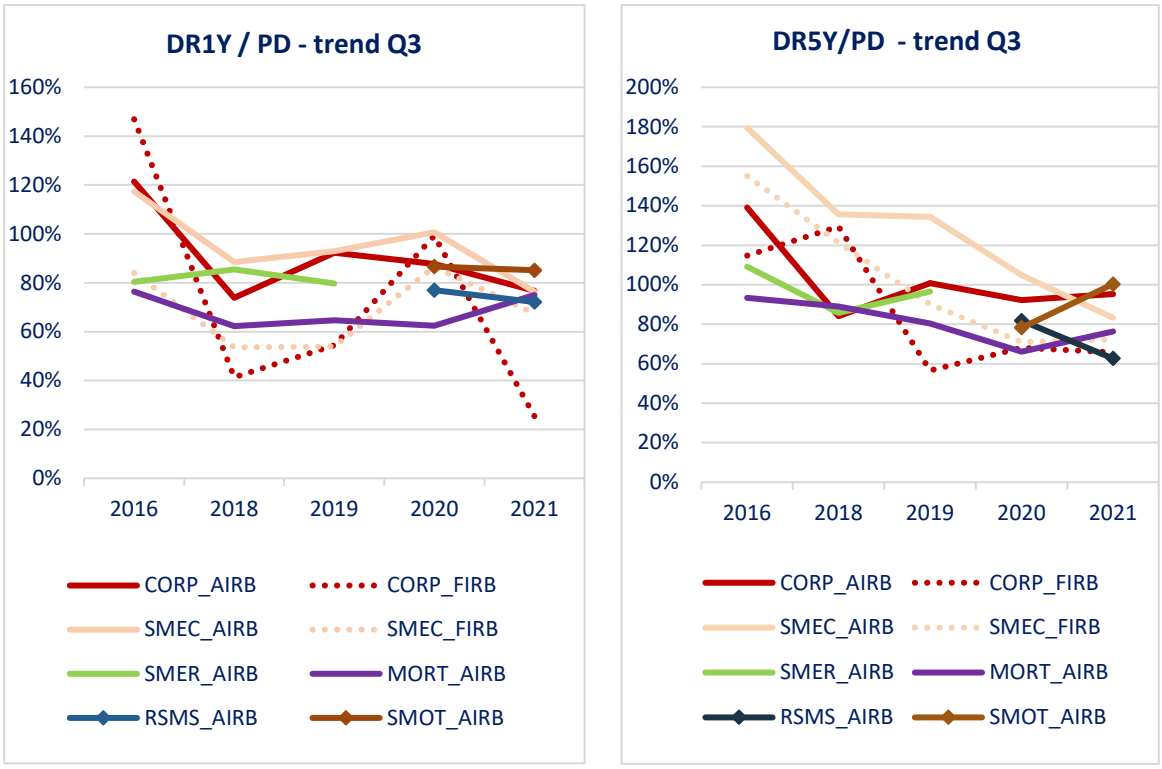
**Legends:**

| Colour and value | |
|---|---|
| Below -1 | PD estimates calibrated in a rather progressive way. |
| Below < 0 | PD estimates generally consistent with observed default rate (slightly progressive) |
| Above > 0 | PD estimates generally consistent with observed default rate (slightly conservative) |
| Above 1 | PD estimates calibrated in a rather conservative way. |

### 2.3.2 Results compared with previous exercise

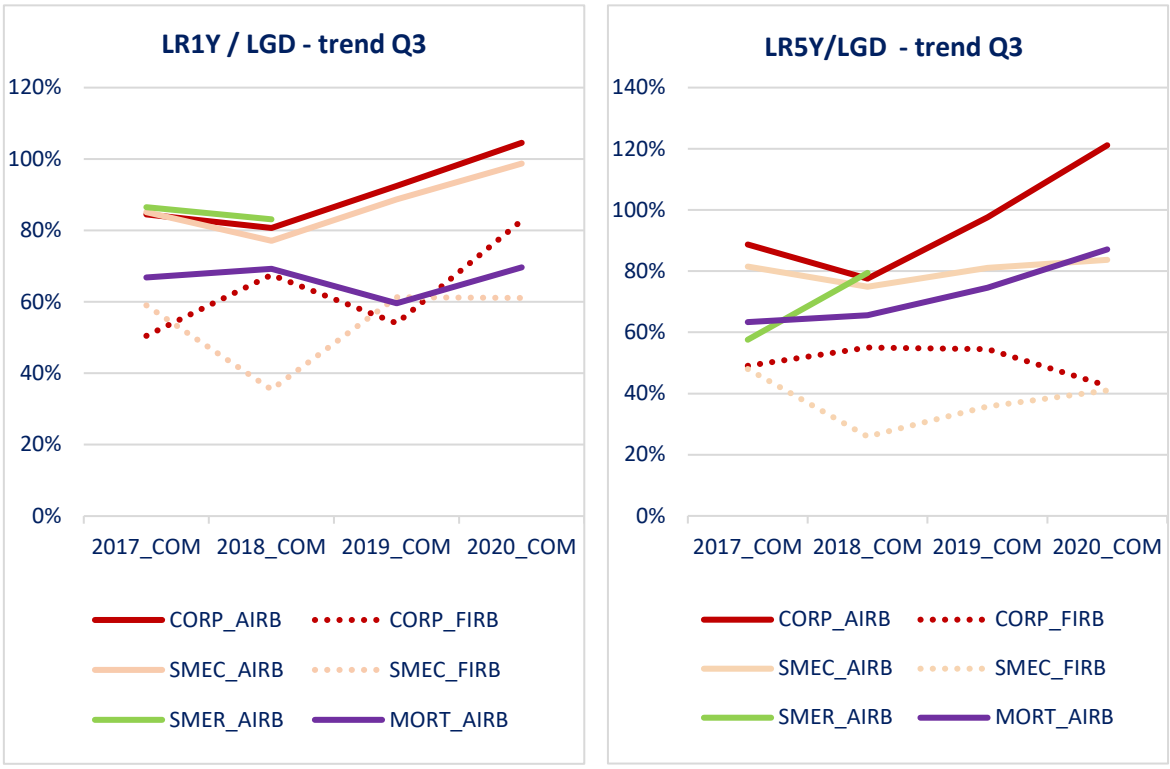
25. Figure 21 and Figure 22 show the evolution of the backtesting ratios for the worst institutions, i.e. where the ratio is the highest[14] . The evolution for RETO and RQRR cannot be shown, as they were not collected in previous years.

**Figure 21: Default rate to PD ratio trends**




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

Figure 22: Loss rate to LGD ratio trends




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

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

### Methodology and assumptions

Under the IRB approach, the cost of capital of an exposure is twofold: first, the expected loss triggers deductions in capital[15], and second, the unexpected loss implies own fund requirements measured via the risk weighting of the exposures. This aggregated cost, the global charge (GC), is especially important to consider when assessing the variability at the institution level, since the cost of capital of defaulted assets under the FIRB approach comes entirely from the expected loss (hence, only looking at RW variability would strongly overestimate the variability of cost of

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

capital). Although a similar concept can be defined for the standardised approach, via a sum of the RWA and the accounting provisions, the latter is not collected in the SVB exercise. Therefore:

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

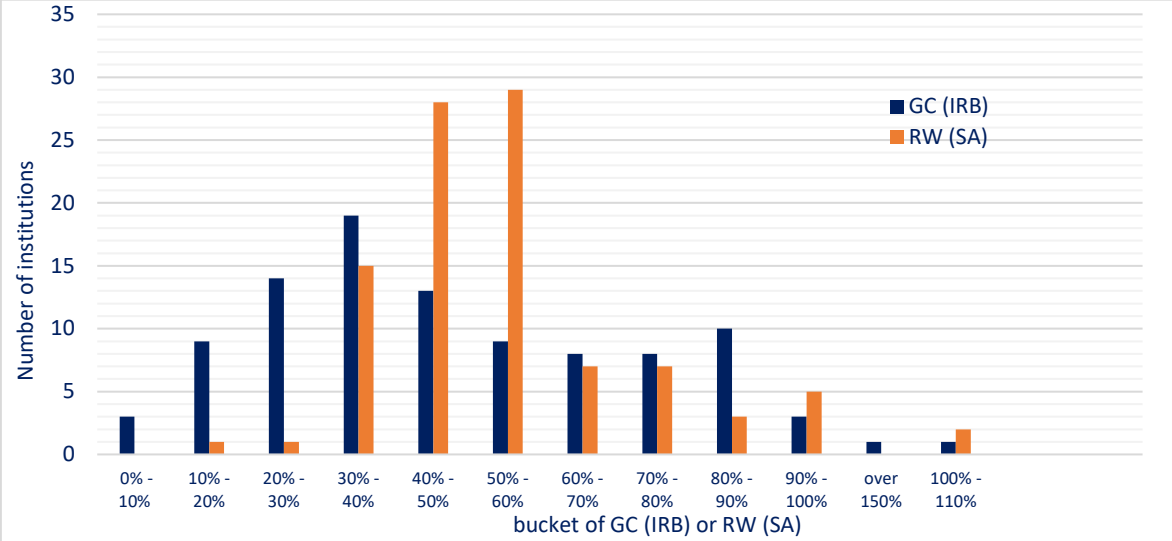
- In the section 'Variability analysed within the exposure classes', where the total costs of capital are compared between the different approaches for non-defaulted exposures only, the RW metric will be used for both approaches.

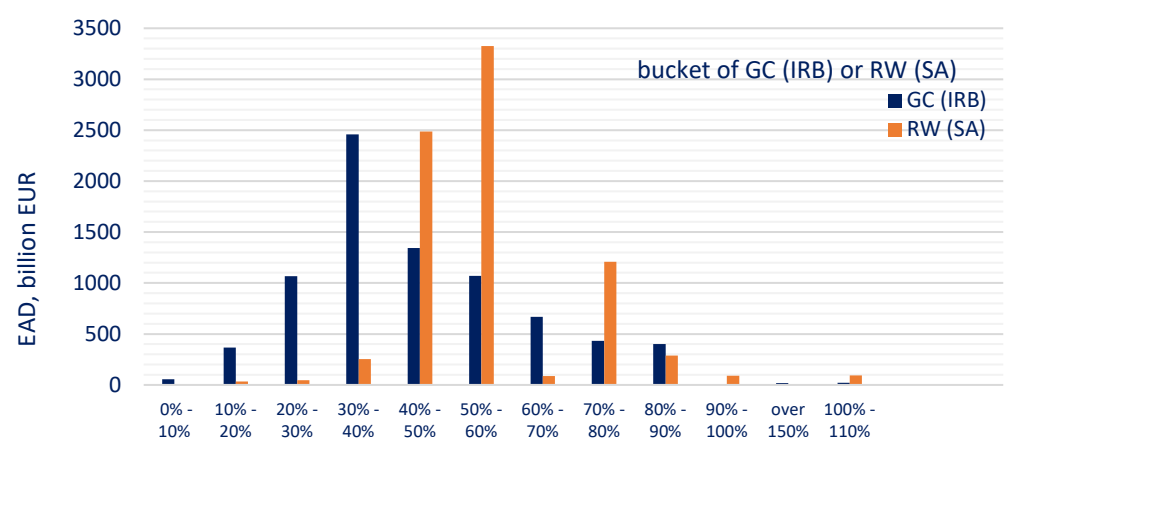
With respect to the calculation of the RW under the SA, it should be noted that it is based on the division of the RWAs calculated under the SA with the exposure value used under the IRB approach. Given this, the 'RW under SA' is not exactly the RW given by Chapter 2 of the CRR, as the exposure value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

### 2.4.1 Variability analysed across exposure classes

27. A first visualisation of the distribution of weights applied to the exposures already gives a hint of the variability under the different approaches. At the EU level, the aggregate of the distribution (at institution level) of the total GC (IRB) and total RW (SA) is shown in Figure 23.

**Figure 23: Distribution of GC (IRB) and RW (SA), number weighted (top) and exposure weighted (bottom)**

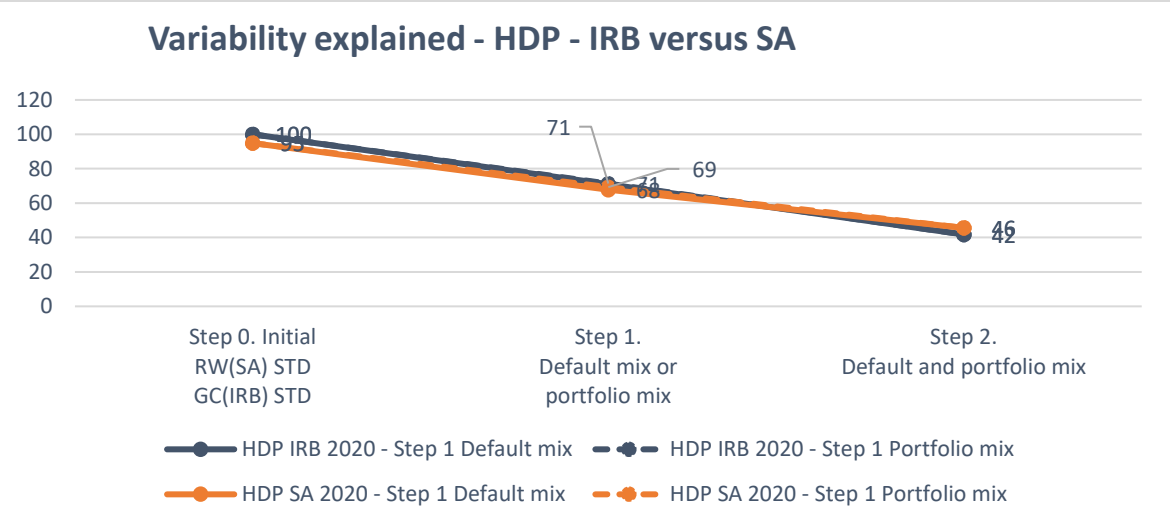





*NB: Each institution is allocated to one bucket based on its average GC (IRB) and RW (SA). The upper chart is based on the simple sum of the institutions per bucket; the lower chart adds up the exposure value of each institution per bucket.*

28. Figure 23 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 24: Top-down analysis – SA versus IRB**

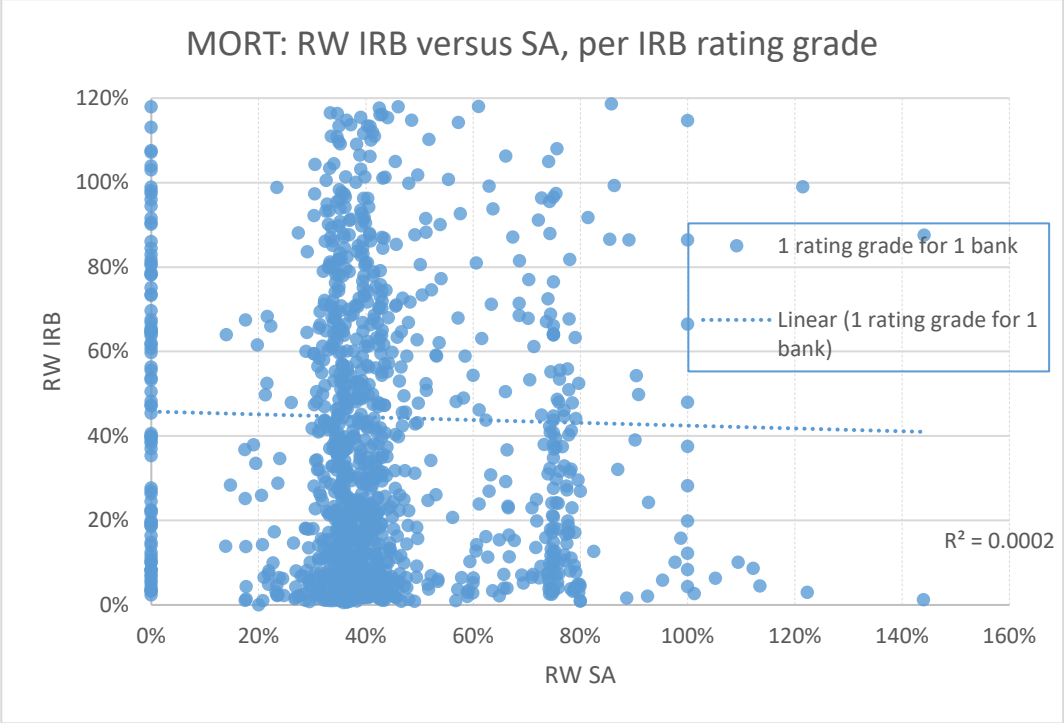



*Sample contains 104 institutions. For data quality reasons one outlier bank reporting unreasonable RWA SA has been removed from the sample.*

### 2.4.2 Variability analysed within the exposure classes

29. The values of RW calculated under the SA and under the IRB can be compared at the rating grade level. Figure 25 to Figure 28 focus on mortgages, where the highest number of data points is observed, although the same conclusions can be drawn for the other exposure classes.

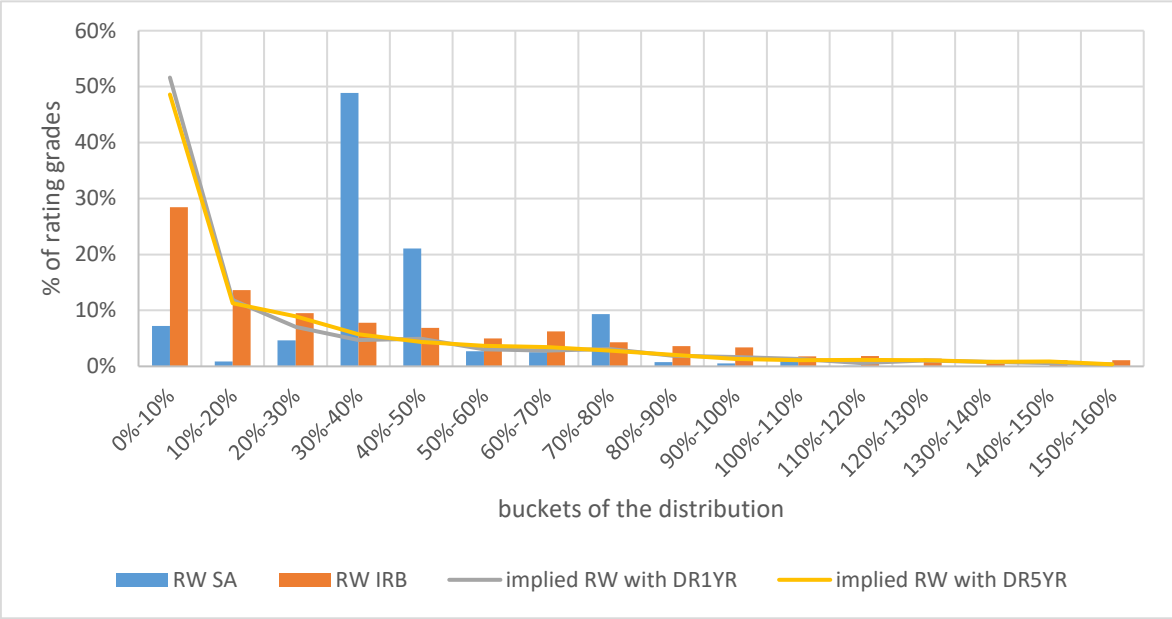
**Figure 25: RW (IRB) versus RW (SA) at the grade level, mortgages portfolio**




30. In order to assess the appropriateness of the approaches, it is therefore relevant to add to this analysis a proxy for the level of risk. One simple and convenient way to visualise how the RW under the IRB approach and the RW under the SA relate to the underlying level of risk is to compare their related distributions with the distributions of 'implied RW', defined as the average RW recalculated using the observed default rates[16] at grade level (Figure 26). The distributions are based on the exposure value within each rating grade.

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

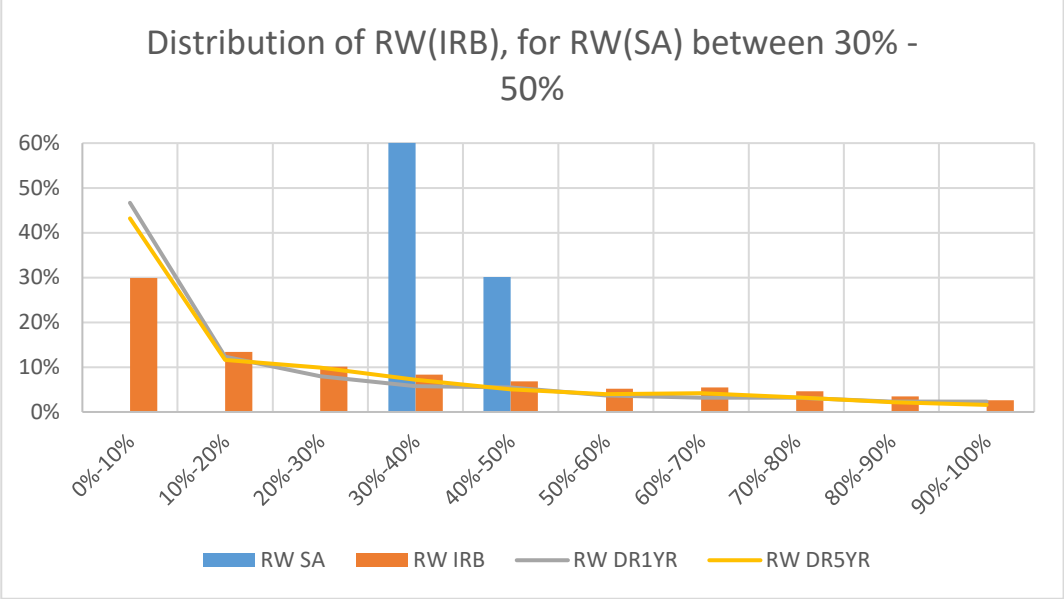
**Figure 26: Distribution of RW (IRB), RW (SA) and implied RW, mortgage portfolio**




*Missing values due to y axis being capped at 80%: RW (DR5Y) between 0% and 10%, 80%.*

31. 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 27 replicates Figure 26, but only keeping the rating grades with RW (SA) between 30% and 50%.

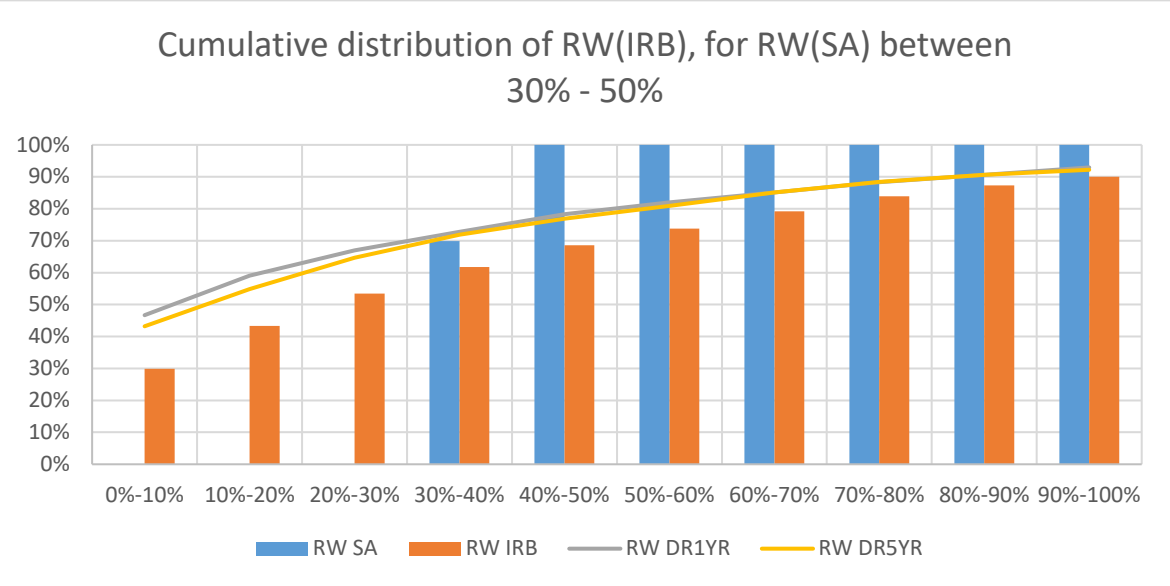
**Figure 27: Distribution of RW (IRB) for exposures with RW (SA) between 30% and 50%**




*Missing values due to y axis being capped at 80%: RW (DR1Y) and RW (DR5Y) between 0% and 10% respectively at 80% and 73%.*

32. This distribution analysis can be complemented by the cumulative distribution (Figure 28).

**Figure 28: Cumulative distribution of RW (IRB) for exposures with RW (SA) between 30% and 50%**



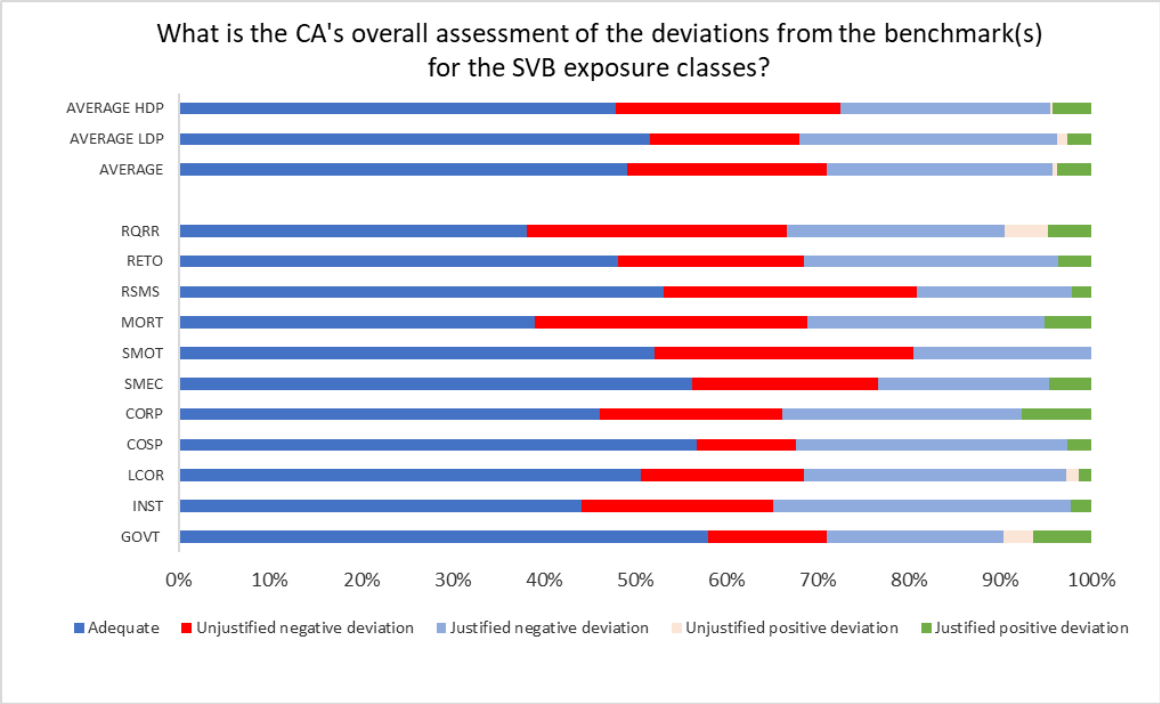
# 3. Qualitative analysis

## 3.1 Competent authority assessments

33. 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 100 institutions. This section summarises the key information derived from these assessments.

34. In order to allow comparison of the numbers, the same graphs as last year are shown in this report.

**Figure 29: CA's overall assessment of the deviations from the benchmark(s) for the SVB exposure classes**



### Figure 30: Justification for negative deviations


HDP
RQRR
RETO
RSMS
MORT
SMOT
SMEC
CORP
EAD/CCF
LGD
PD
RW
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
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.
[COVID-19 justification 1] Mitigating measures due to the COVID crisis (such as state guarantees) had an over-proportionately positive impact on estimates and/or outcomes compared to other instit
[COVID-19 justification 2] The institution benefitted from its specific portfolio composition with regards to the economic sectors of the obligors.
[COVID-19 justification 3] The institution benefitted from its specific portfolio composition with regards to the country/ regions of the obligors.
[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
[IRB roadmap implementation]
Other (to be specified in the comment)

**Figure 31: Reasons identified for unjustified negative deviations**

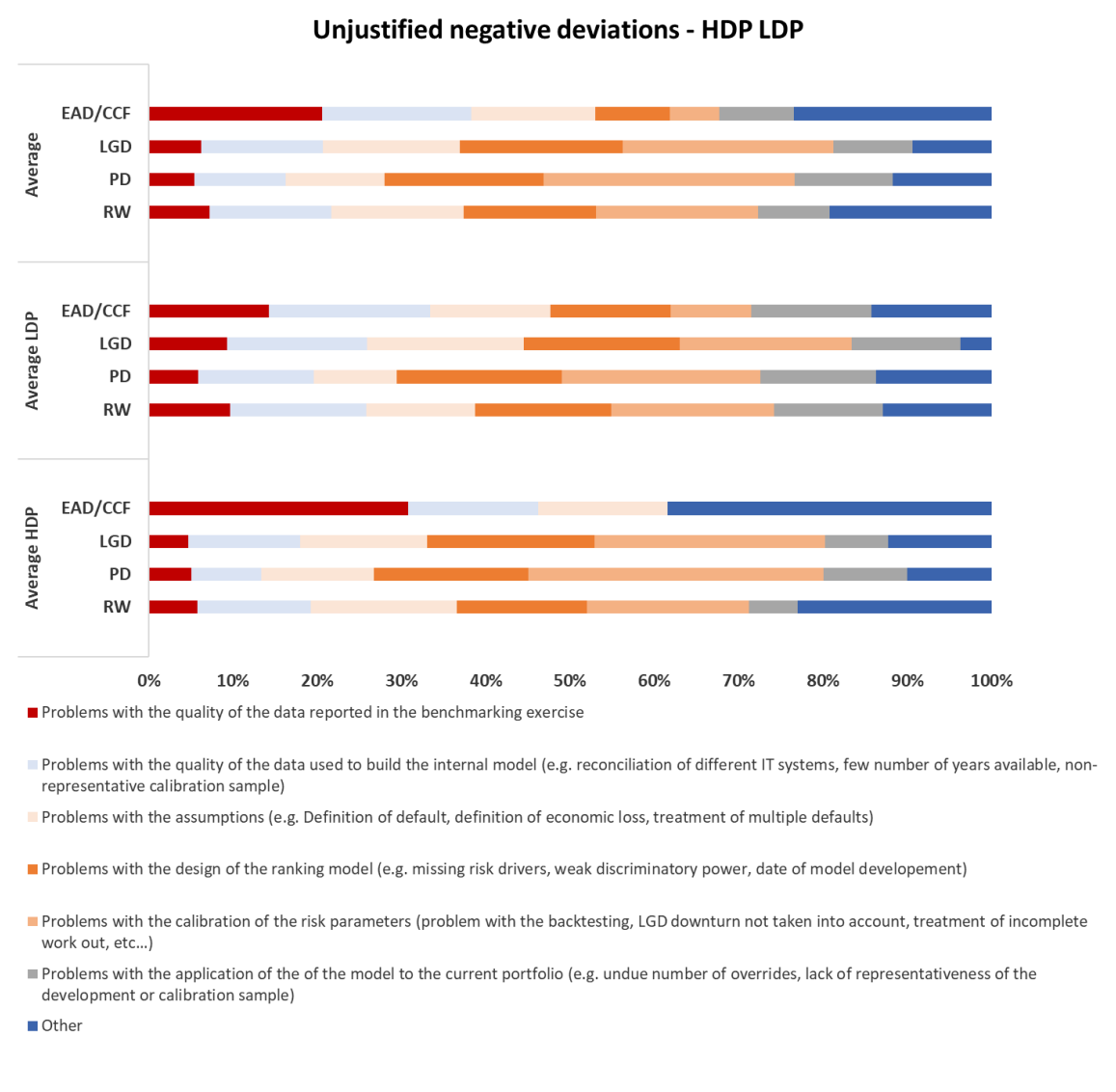


**Figure 32: Has the institution's internal validation of the model identified the most relevant unjustified negative deviations?**

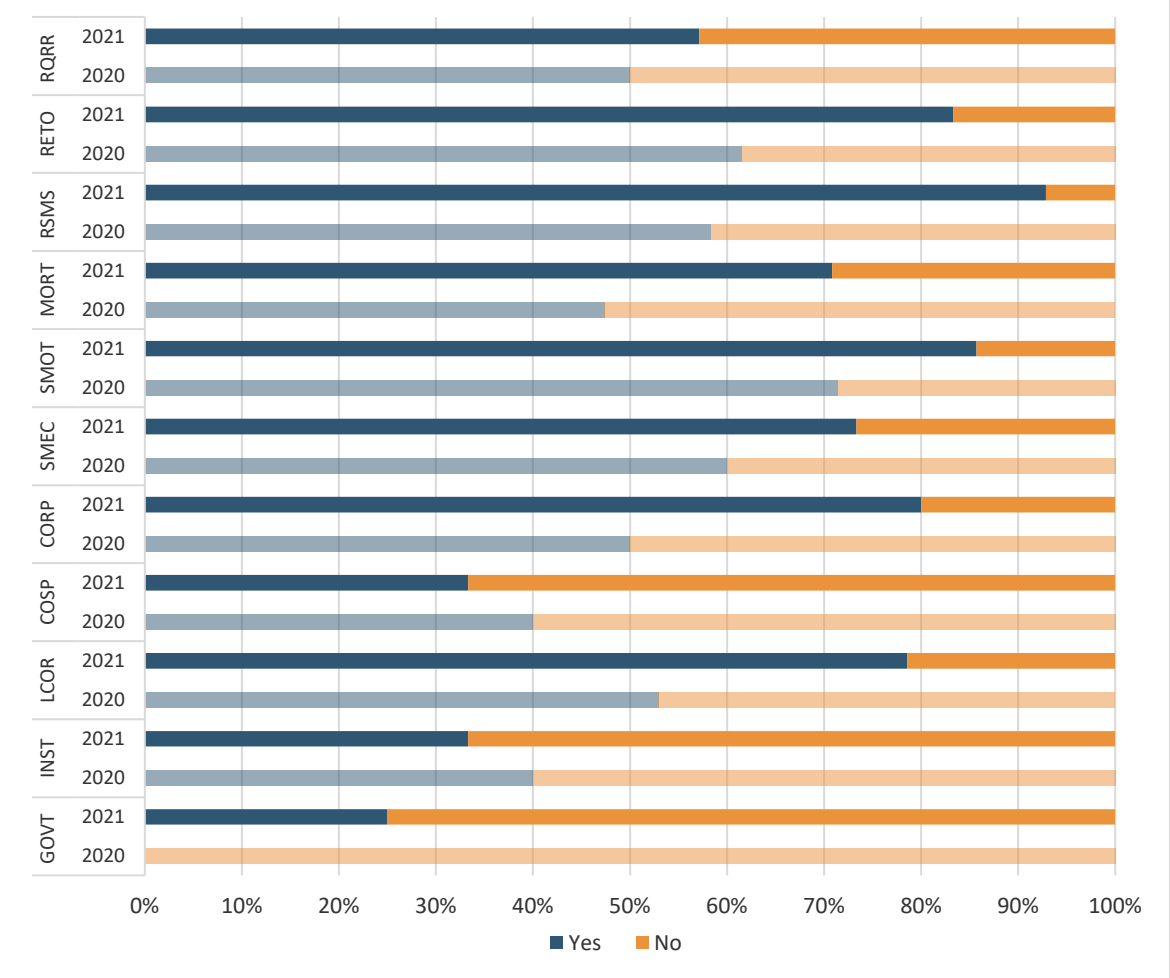


**Figure 33: Are any actions planned by the CA following the SVB results?**

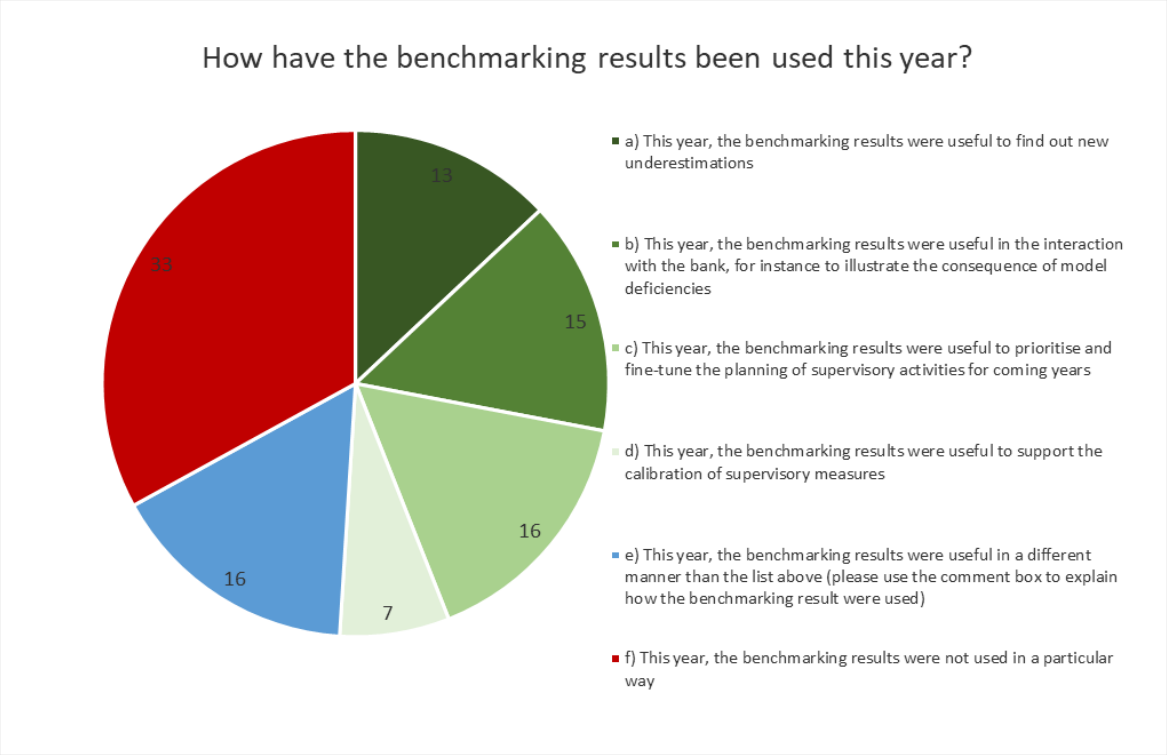



**Figure 34: Will the action lead to capital add-ons under Pillar 2?**

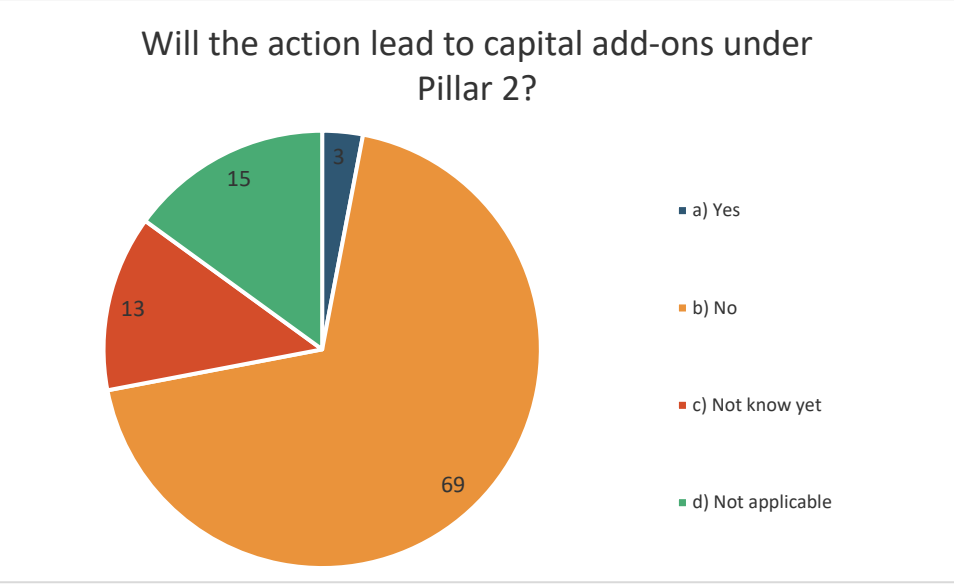


**Figure 35 Change in the definition of default**

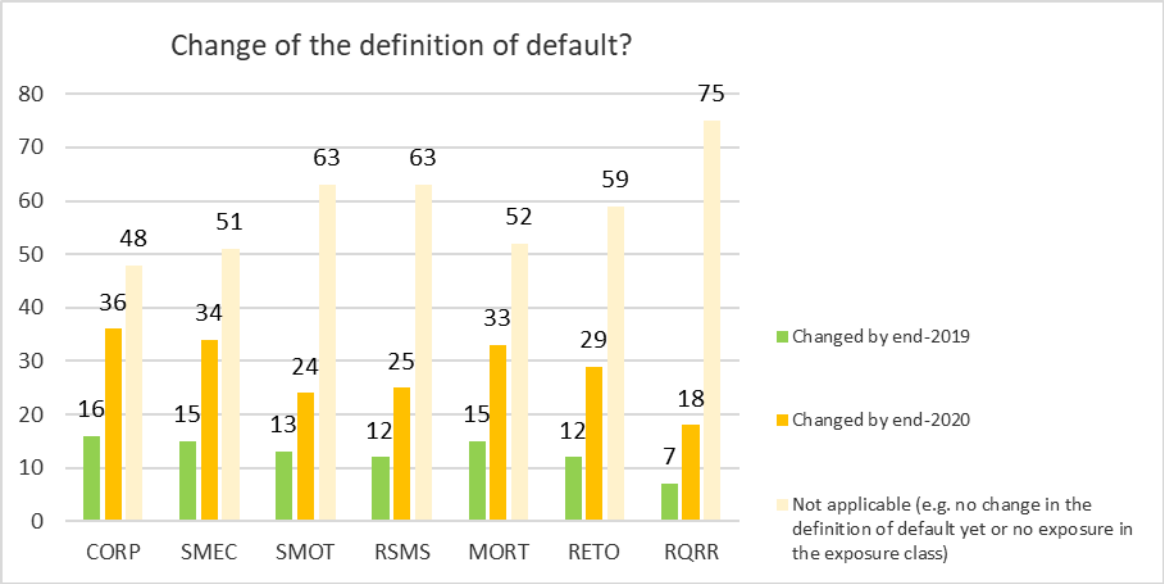



**Figure 36 Impact of the changes in DoD.**

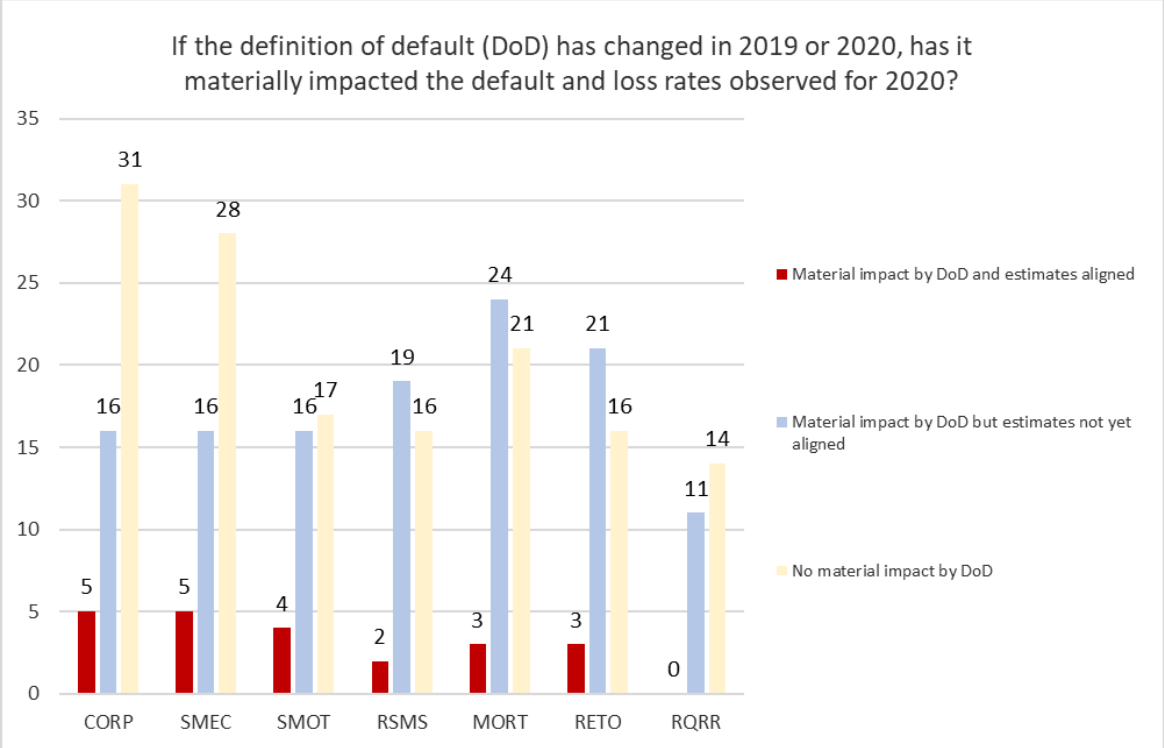
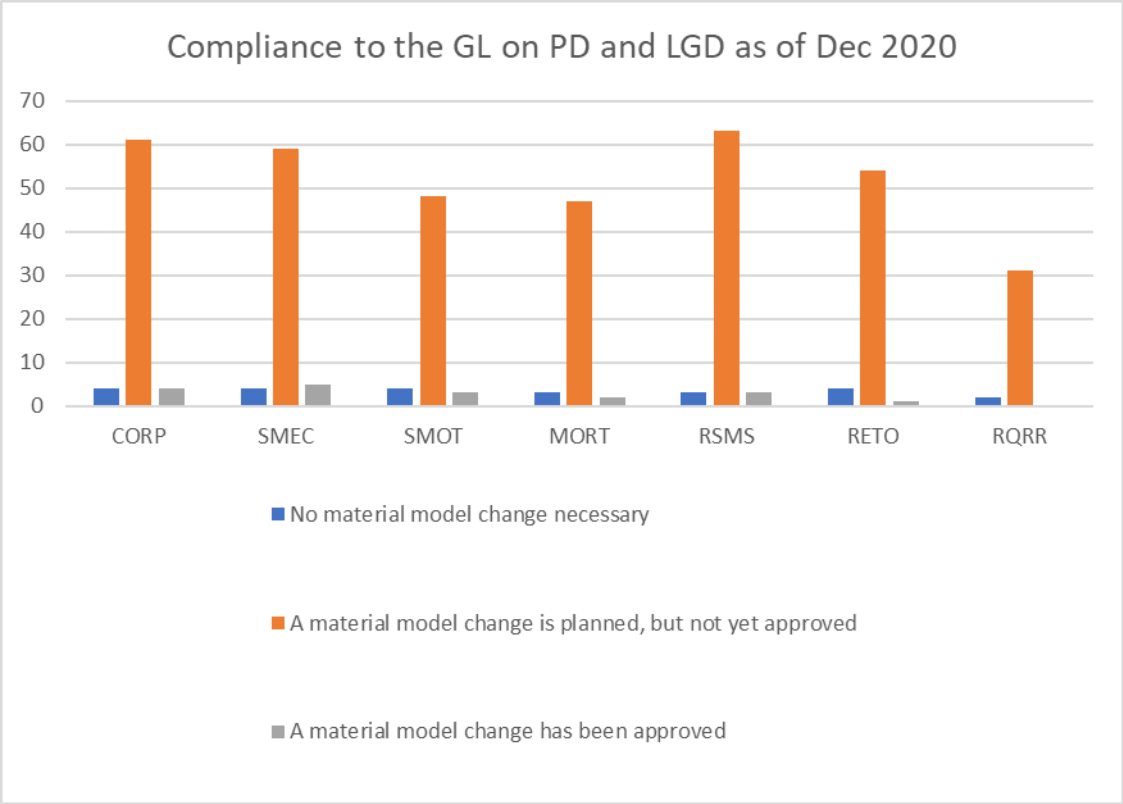


**Figure 37 State of compliance with the GL on PD and LGD**



# Appendix 1: List of participating institutions

The participant institutions in scope of the SVB exercise are the ones that at 31 December 2020 had approval for the use of the credit risk internal models[17].

**Table 8: List of institutions participating in this exercise**

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

[17] 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? |
|---|---|---|
| Aareal Bank AG | Germany | Yes |
| ALTE LEIPZIGER Bauspar AG | Germany | Yes |
| Bayerische Landesbank | Germany | Yes |
| BMW Bank GmbH | Germany | Yes |
| Commerzbank AG | Germany | Yes |
| Degussa Bank | Germany | Yes |
| DekaBank Deutsche Girozentrale | Germany | Yes |
| Deutsche Apotheker- und Ärztebank eG | Germany | Yes |
| Deutsche Bank AG | Germany | Yes |
| Deutsche Bausparkasse Badenia AG | Germany | Yes |
| Deutsche Pfandbriefbank AG | Germany | Yes |
| Deutsche Zentral-Genossenschaftsbank AG | Germany | Yes |
| Erwerbsgesellschaft der S-Finanzgruppe mbH & Co. KG | Germany | Yes |
| HSH Nordbank AG (Hamburg Commercial Bank from Feb 2019) | Germany | Yes |
| IKB Deutsche Industriebank AG | Germany | Yes |
| KfW Beteiligungsholding | Germany | Yes |
| Landesbank Baden-Württemberg | Germany | Yes |
| Landesbank Hessen-Thüringen Girozentrale | Germany | Yes |
| Landesbank Saar | Germany | Yes |
| LBS Bayerische Landesbausparkasse | Germany | Yes |
| Münchener Hypothekenbank eG | Germany | Yes |
| NORD/LB Norddeutsche Landesbank Girozentrale | Germany | Yes |
| Oldenburgische Landesbank AG | Germany | Yes |
| Süd-West-Kreditbank Finanzierung GmbH | Germany | Yes |
| TOYOTA Kreditbank GmbH | Germany | Yes |
| Wüstenrot Bausparkasse AG | Germany | Yes |
| Eurobank Ergasias Services and Holdings S.A. | Greece | Yes |
| AIB Group plc | Ireland | Yes |
| Bank of Ireland Group plc | Ireland | Yes |
| Barclays Bank Ireland plc (*) | Ireland | Yes |
| Permanent TSB Group Holdings Plc | Ireland | Yes |
| Ulster Bank Ireland Designated Activity Company (*) | Ireland | Yes |
| Banca Monte dei Paschi di Siena SpA | Italy | Yes |
| Banca Popolare di Sondrio, SCpA | Italy | Yes |
| Banco BPM | Italy | Yes |
| BPER Banca SpA | Italy | Yes |
| Credito Emiliano Holding SpA | Italy | Yes |
| Credito Valtellinese | Italy | Yes |
| Intesa Sanpaolo SpA | Italy | Yes |
| Mediobanca – Banca di Credito Finanziario S.p.A. | Italy | Yes |
| UniCredit SpA | Italy | Yes |

| Institution name | Country | Submits credit risk? |
|---|---|---|
| Banque et Caisse d'Epargne de l'Etat, Luxembourg | Luxembourg | Yes |
| Banque Internationale à Luxembourg | Luxembourg | Yes |
| ABN AMRO Bank N.V. | Netherlands | Yes |
| Coöperatieve Rabobank U.A. | Netherlands | Yes |
| ING Groep N.V. | Netherlands | Yes |
| LP Group B.V. | Netherlands | Yes |
| NIBC Holding N.V. | Netherlands | Yes |
| RBS Holdings NV | Netherlands | Yes |
| Van Lanschot Kempen N.V. | Netherlands | Yes |
| Volksbank N.V. | Netherlands | Yes |
| DNB BANK ASA | Norway | Yes |
| Sparebank 1 Nord-Norge SPA | Norway | Yes |
| Sparebank 1 SMN SPA | Norway | Yes |
| SPAREBANK 1 SR-BANK ASA | Norway | Yes |
| Sparebanken Hedmark SPA (SpareBank 1 Østlandet SPA) | Norway | Yes |
| Sparebanken Møre SPA | Norway | Yes |
| Sparebanken Vest SPA | Norway | Yes |
| Banco Comercial Português SA | Portugal | Yes |
| LSF Nani Investments S.à.r.l | Portugal | Yes |
| Banco Bilbao Vizcaya Argentaria, SA | Spain | Yes |
| Banco de Sabadell, SA | Spain | Yes |
| Banco Santander SA | Spain | Yes |
| Bankinter SA | Spain | Yes |
| BFA Tenedora De Acciones, S.A. | Spain | Yes |
| CaixaBank, S.A | Spain | Yes |
| Aktiebolaget Svensk Exportkredit | Sweden | Yes |
| Landshypotek Bank AB (publ) | Sweden | Yes |
| Länförsäkringar Bank AB (publ) | Sweden | Yes |
| SBAB Bank AB - group | Sweden | Yes |
| Skandiabanken Aktiebolag (publ) | Sweden | Yes |
| Skandinaviska Enskilda Banken - group | Sweden | Yes |
| Svenska Handelsbanken - group | Sweden | Yes |
| Swedbank - group | Sweden | Yes |
| Volvofinans Bank AB (publ) | Sweden | Yes |
| HSBC Trinkaus & Burkhardt AG (*) | Germany | Yes |
| BN Bank ASA | Norway | Yes |

*Data are provided by the CAs, and reflect the situation at 31 December 2020, slightly changes have been done after due to late communication/agreements with CAs.*
*(*) Additional institutions representing the highest level of consolidation in the EU/EEA as of 31 December 2020.*

# Appendix 2: Data quality

The LDP and HDP information constitutes a subset of the SVB exercise related to credit risk, as laid down in the ITS drafted by the EBA, pursuant to Article 78 of Directive 2013/36/EU (CRD IV) from the European Commission.

# 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 2020.

**The cut-off date for the extraction of the data for this report was 22 September 2021.**

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%).

## 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 risk[18]). Note that specialised lending exposures are not included in template C 101.00 in Annex 1.

**Table 9: 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:

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

- 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 1 250% were excluded.

**Table 10: 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 |
|---|---|---|---|---|---|
| **INST sample** | 53 | 13 | 819 | 617 | 33 |
| **LCOR sample** | 86 | 15 | 7342 | 2072 | 30 |
| **CGCB sample** | 38 | 10 | 322 | 131 | 41 |

### 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), 91 out of 110 institutions reported at least 1 record with EAD >0 for this template.

**Table 11: 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 | 230 | 46 |
| **INST** | 53 | 13 | 306 | 120 |
| **LCOR** | 86 | 15 | 343 | 129 |
| **COSP** | 65 | 15 | 369 | 96 |

**In template C 103**, which covers HDPs (corporate-other, residential mortgages, SME retail and SME-corporate and retail other, RQRR), 101 out of 110 institutions reported at least 1 row with EAD> 0 for this template.

**Table 12: Sample of institutions, countries and counterparties in the portfolio analysis (HDP) (C 103)**

| Exposure class | Number of institutions | Number of countries of the institutions | Number of different portfolios reported | Number of portfolios with a benchmark computed |
|---|---|---|---|---|
| **CORP** | 85 | 15 | 3129 | 104 |
| **MORT** | 85 | 15 | 2838 | 64 |
| **SMEC** | 83 | 15 | 3055 | 89 |
| **RSMS** | 68 | 15 | 1342 | 38 |
| **SMOT** | 68 | 15 | 2115 | 56 |
| **RETO** | 76 | 15 | 3142 | 57 |
| **RQRR** | 36 | 11 | 3163 | 50 |

## General exclusions (submissions as of22 Sep 2021) zpp

For the purpose of the analysis the following banks have been excluded:

1) Wrong unit reported in comparison to COREP

- BANK_037
- BANK_035

2) Amount different from COREP (more than 7600%)
   - BANK_095

3) Different amount between total and 1st level split (more than 16%) strange/wrong data for the RWA SA reported that caused a GC recomputed that is over the 1127%

- BANK_068

And the following records:

1) Template C101.00:
   a. 4458: records with missing PD
   b. 42: records due to a counterparty reported multiple times
2) Template C 102.00:
   a. 121: records with regulatory approach IRB but missing PDs
   b. 10: records for defaulted portfolios with PDs different from 100%
   c. 5: records with wrong ID
   d. 1: record with non-default status and PD 100%

3) Template C 103.00:
   a. 562 records with PD out of range
   b. 133 with EAD missing
   c. 3 records with wrong ID

# Appendix 4: Methodologies used

## Top-down analysis

The methodology for presenting the percentage of total GC variability that can be explained once its main drivers are controlled for (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[19]:

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

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:

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

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

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

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

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

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

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:

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

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.

## 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[20]). 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:

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

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

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

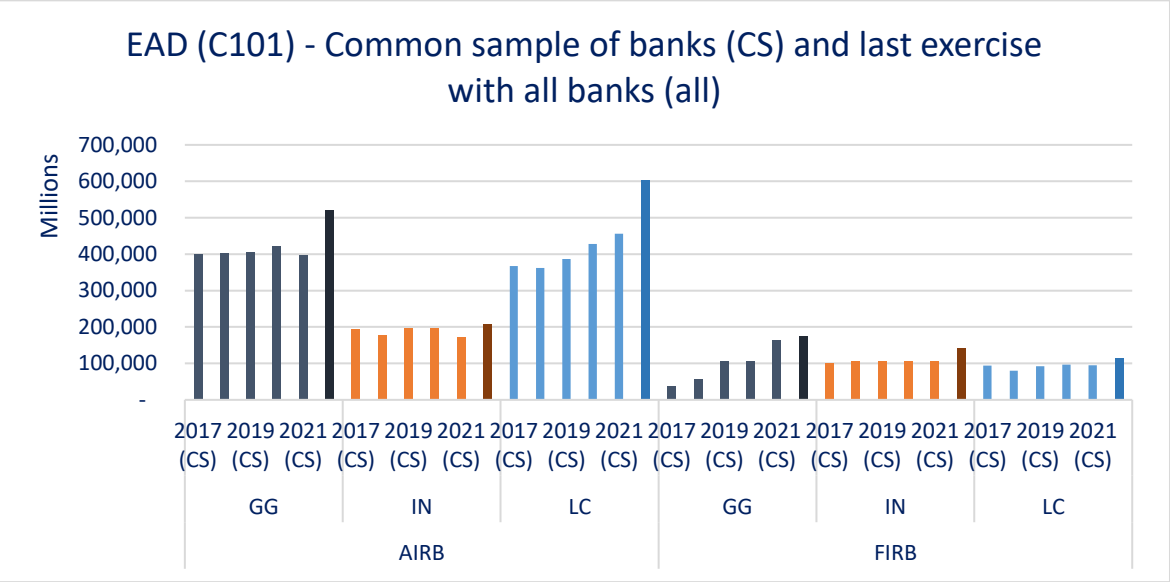
institutions only, where the values were provided assuming that the exposure to a given obligor was a senior unsecured exposure.

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

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

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 38: Evolution of EAD by SVB portfolio and regulatory approach**




For this analysis, a common subsample of 48 institutions has been identified (i.e. institutions that participated in all four 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 45 (clean dataset), and neither is the number of counterparties (see Figure 39 below) that ranges from 53 to 4541 (clean dataset). The comparison focused on a subset of counterparties that were reported by at least five institutions in the five exercises.

**Figure 39: Proportion of EAD in the common subsample**

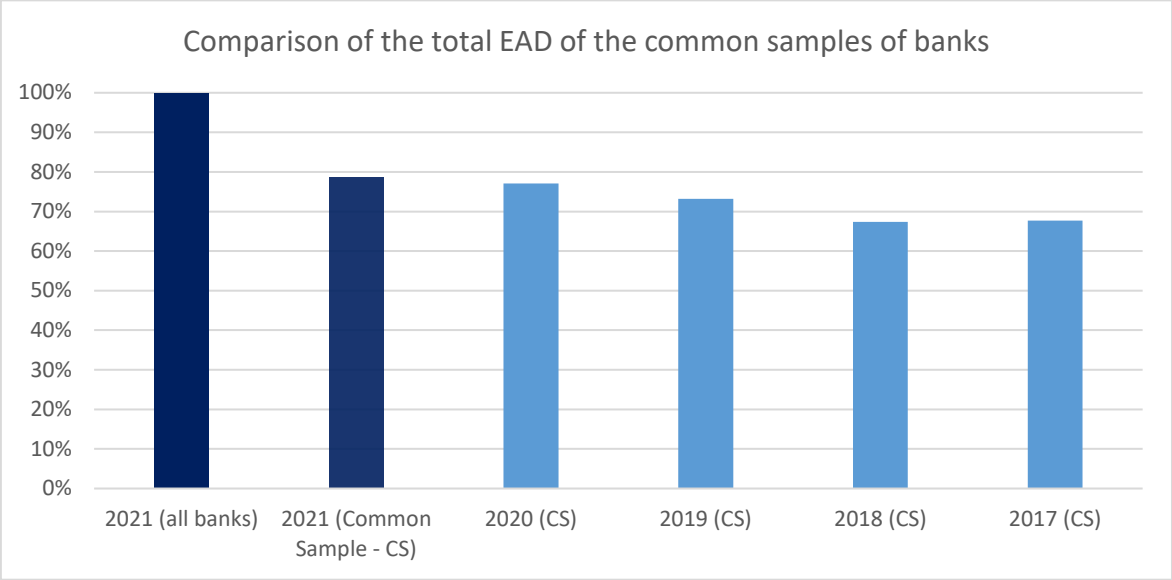
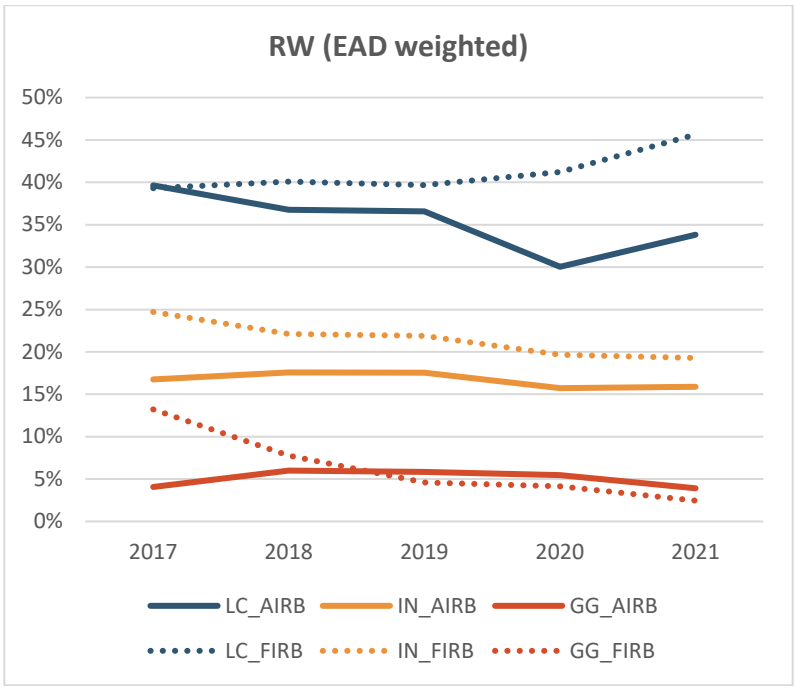
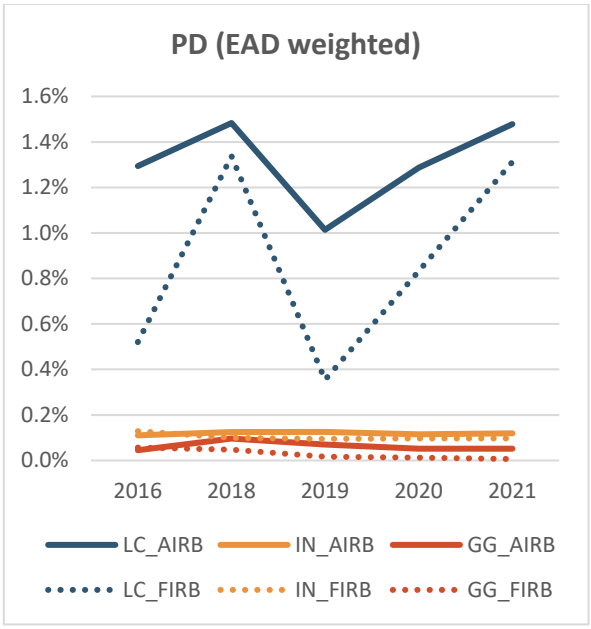
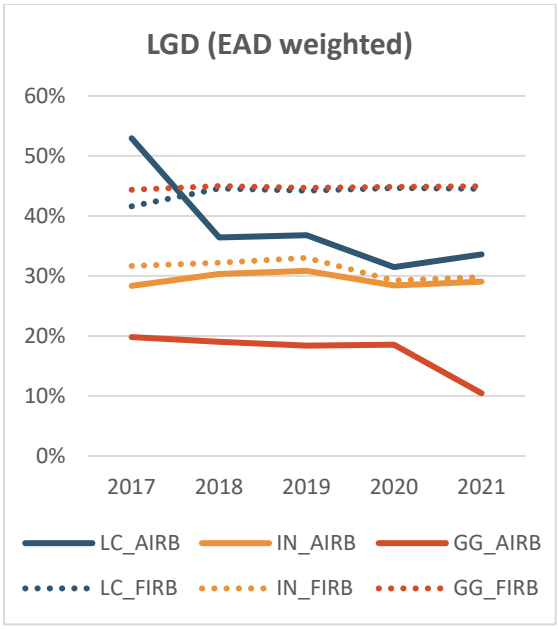


**Figure 40: Evolution of the common subsample risk metrics, from the 2017 to the 2021 exercise, by SVB exposure class**



## 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[21] for each institution. The complete definition of the data points collected can be found in Annex IV, template C 103.00, of the ITS. In short, they were:

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

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

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

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

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

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

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

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

The persistence of institutions as outliers in both periods, i.e. 1-year rate and the average of 5 years, and across comparable parameters can be examined by the CAs. However, there are a couple of caveats that should be kept in mind when 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[22]).
    - 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.

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

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

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

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

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

# Appendix 5: Complementary RW statistics

## RW dispersion:

**Figure 41: GC dispersion (delta Q3-Q1), split by default status, for LDP and HDP exposures**

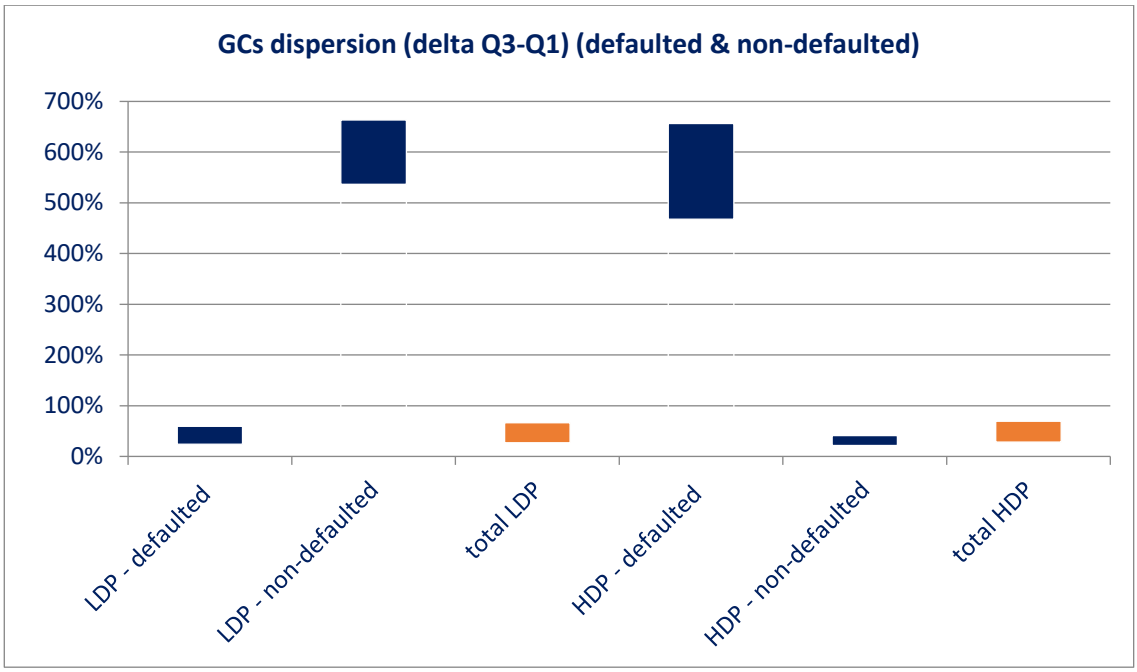


Figure 42: RW dispersion (delta Q3-Q1) for the different SVB exposure classes (defaulted and non-defaulted exposures)

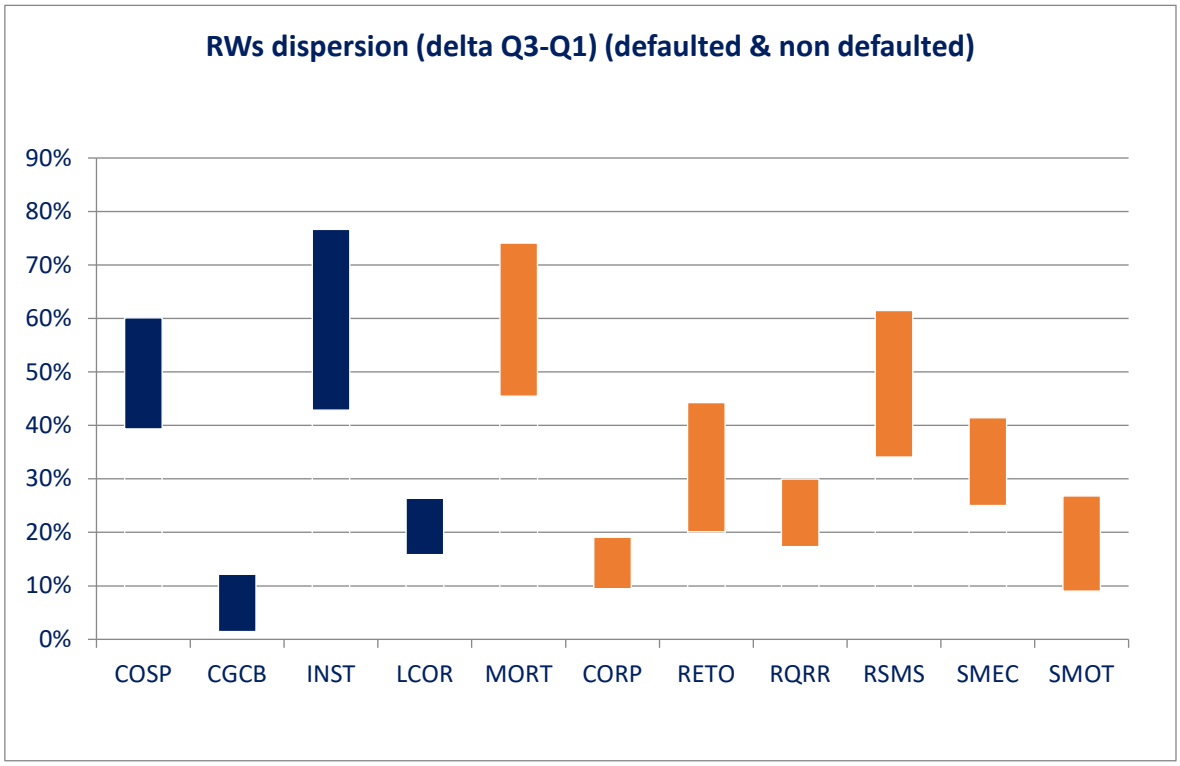
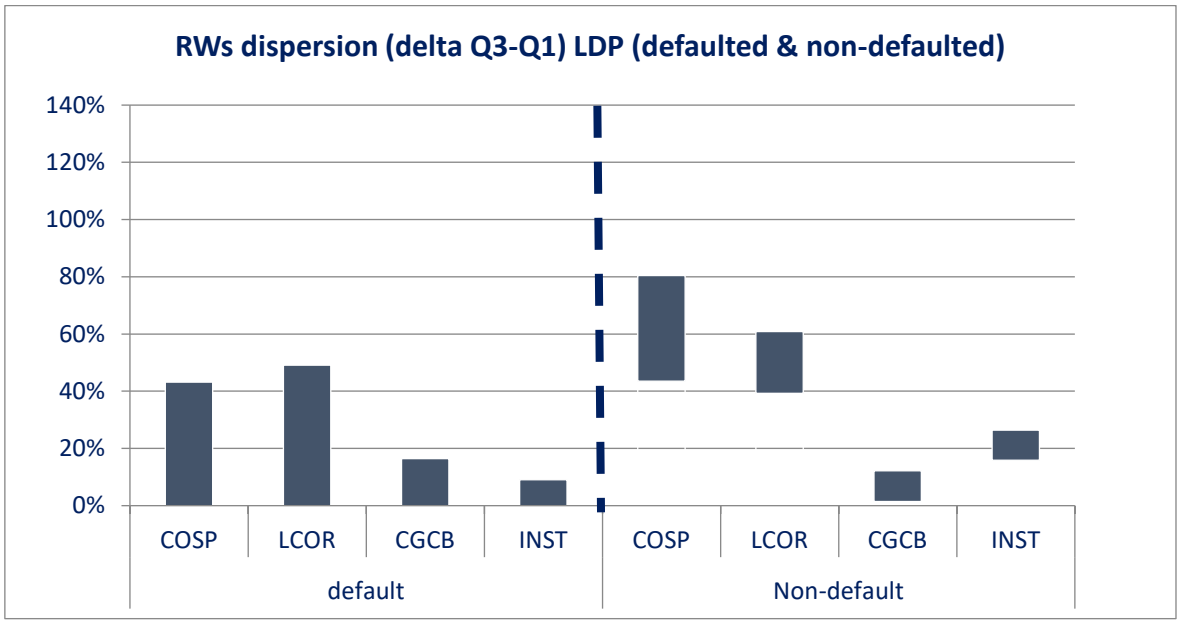
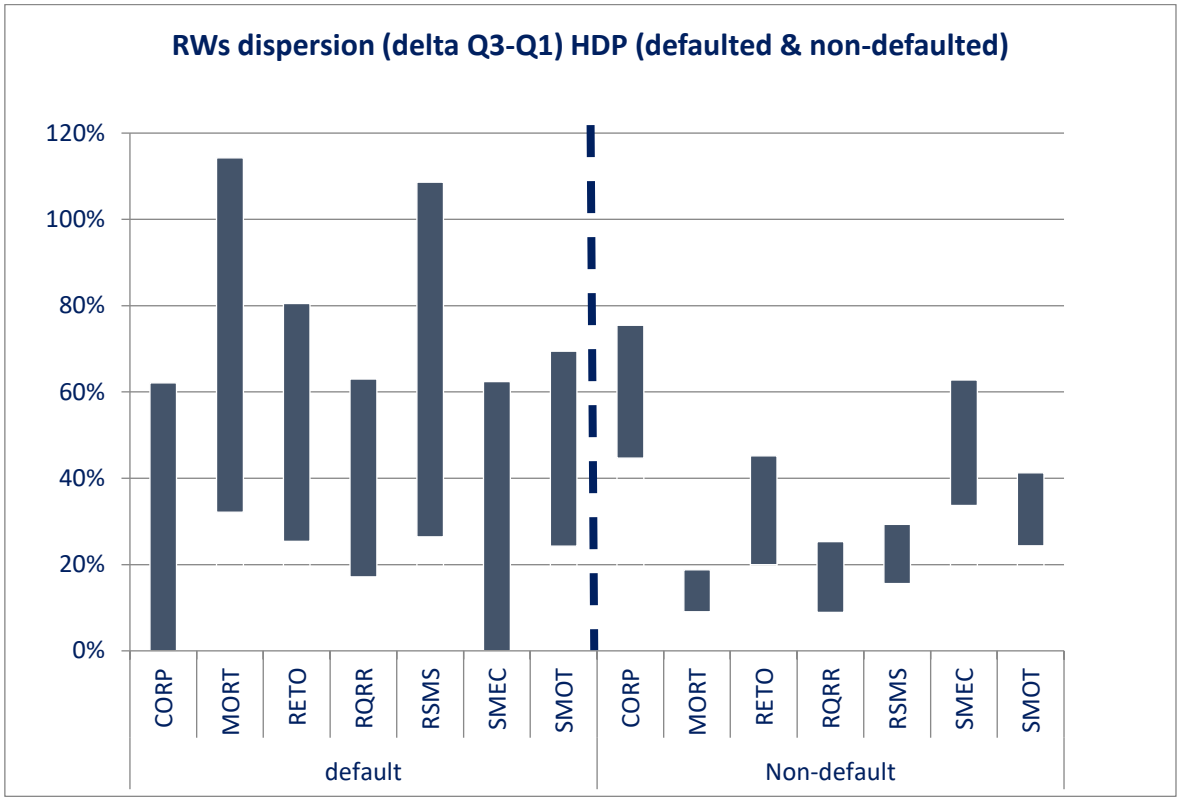



Figure 43: RW dispersion (delta Q3-Q1) for the different SVB exposure classes and default statuses (LDP and HDP)




RWs dispersion (delta Q3-Q1) HDP (defaulted & non-defaulted)
120%
100%
80%
60%
40%
20%
0%
CORP
MORT
RETO
RQRR
RSMS
SMEC
SMOT
CORP
MORT
RETO
RQRR
RSMS
SMEC
SMOT
default
Non-default

# Appendix 6: Complementary graphs on the evolution of the portfolios

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

**Figure 44: Common EAD in the 2018, 2019, 2020 and 2021 SVB exercises (EUR million)**

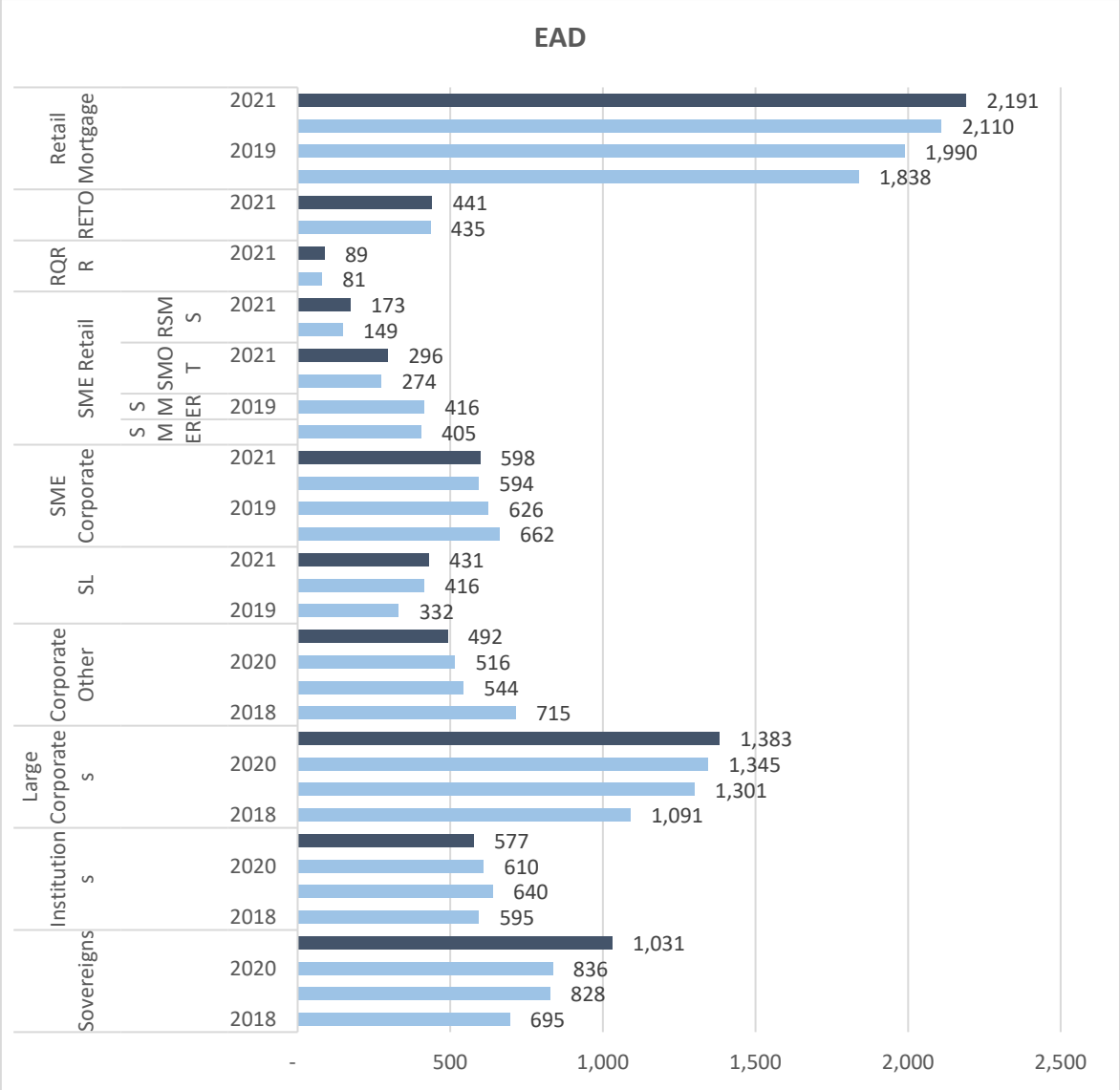


**Figure 45: Comparison of risk weights, PD and LGD between current and previous SVB exercises (defaulted and non-defaulted exposures)**

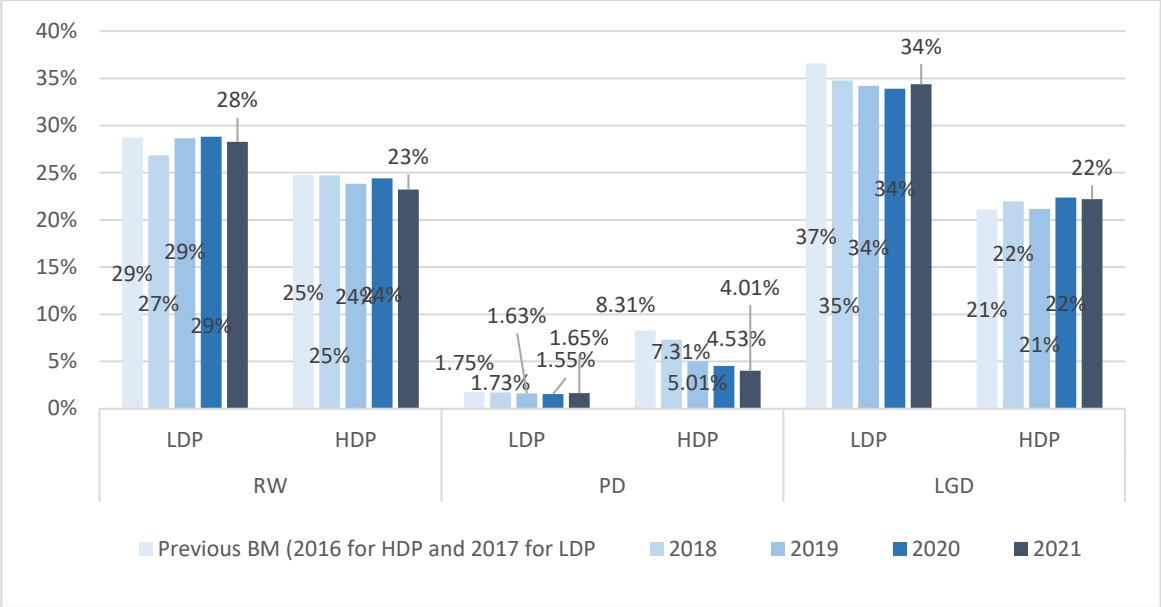


**Figure 46: Comparison of risk weights by SVB exposure class between current and previous SVB exercises (defaulted and non-defaulted exposures)**

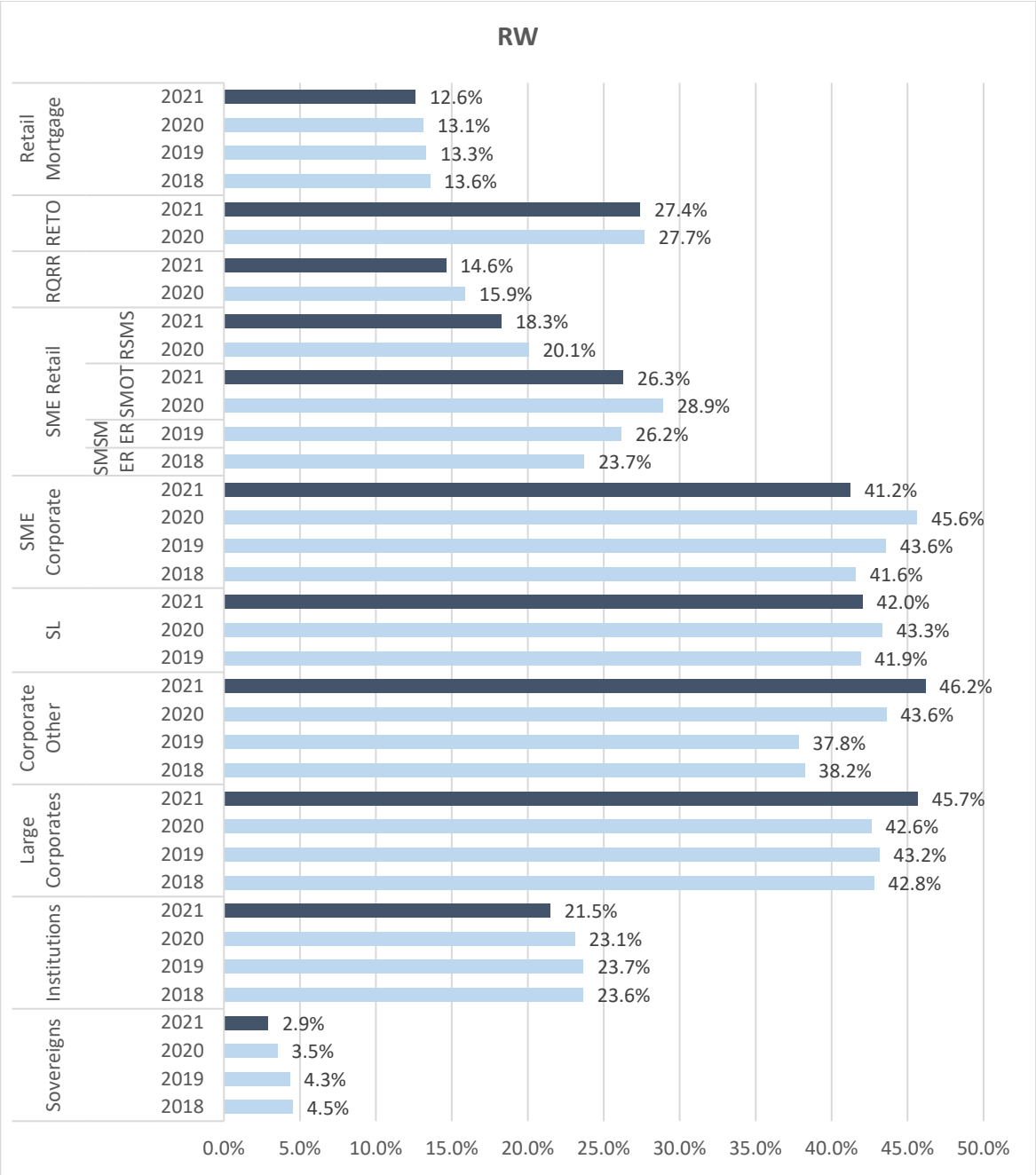


**Figure 47: Comparison of PDs by SVB exposure class between current and previous SVB exercises (defaulted and non-defaulted exposures)**

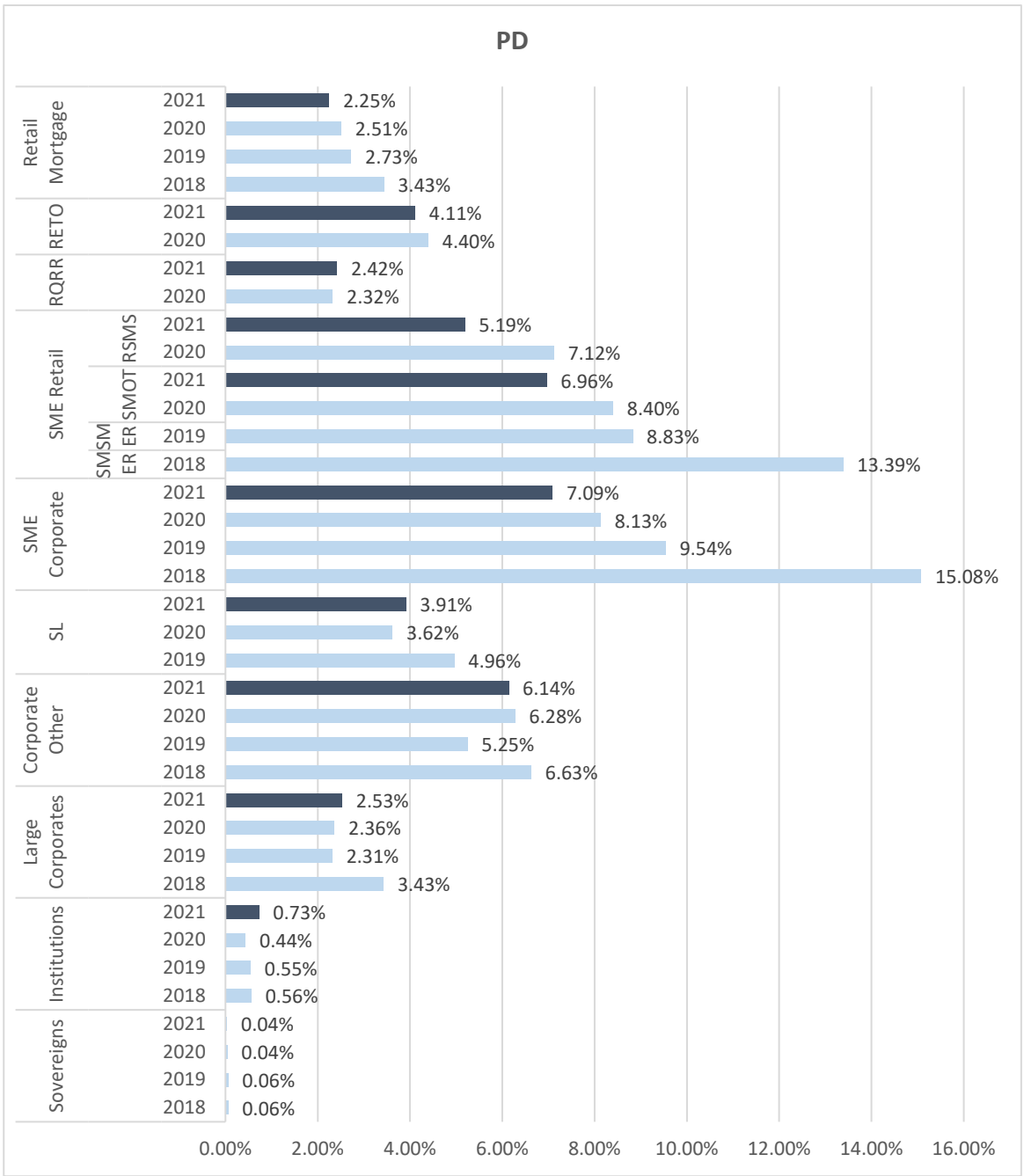
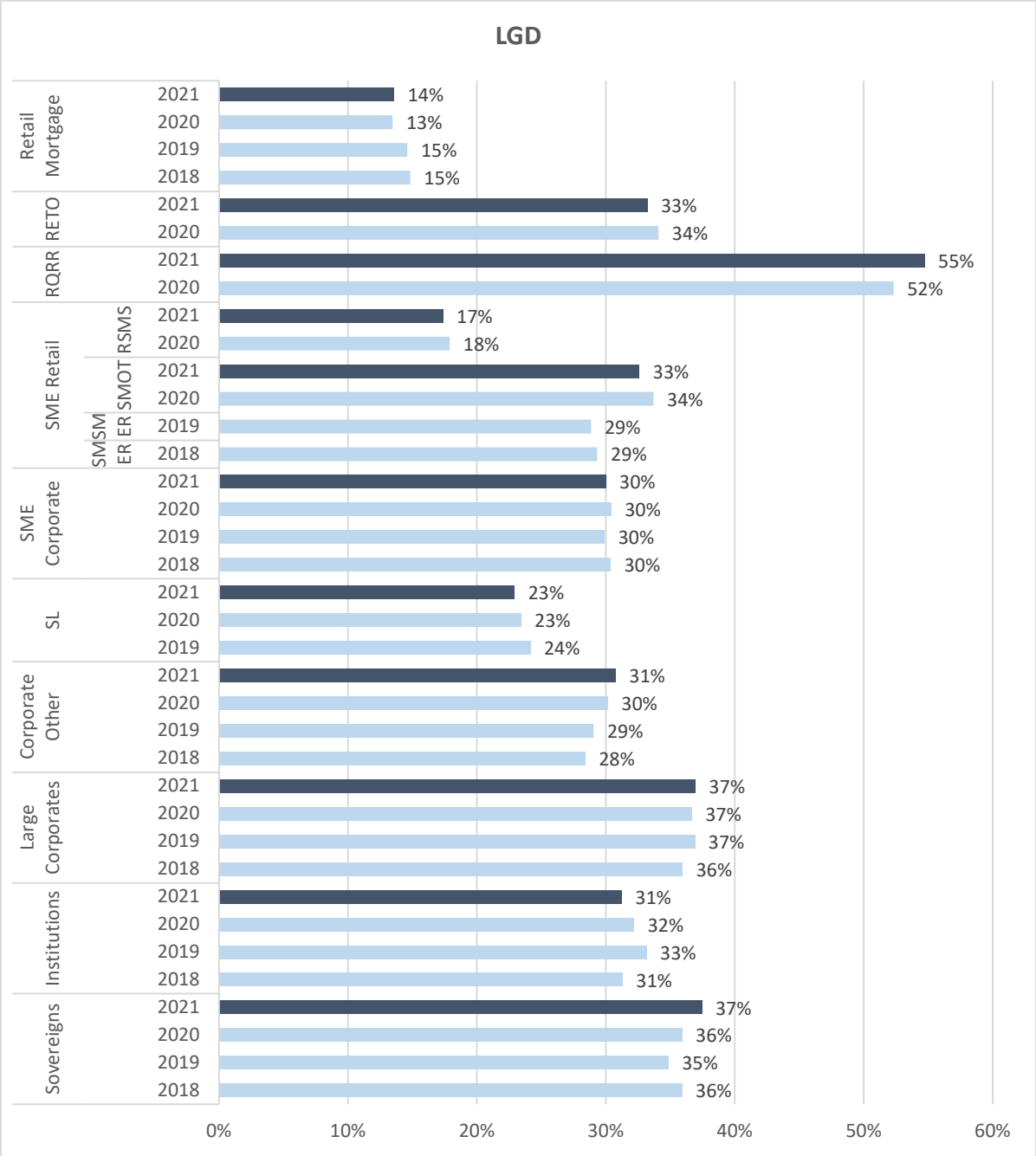


**Figure 48: Comparison of LGDs by SVB exposure class between current and previous SVB exercises (defaulted and non-defaulted exposures)**



# Appendix 7: Complementary graphs on the top-down analysis

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

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

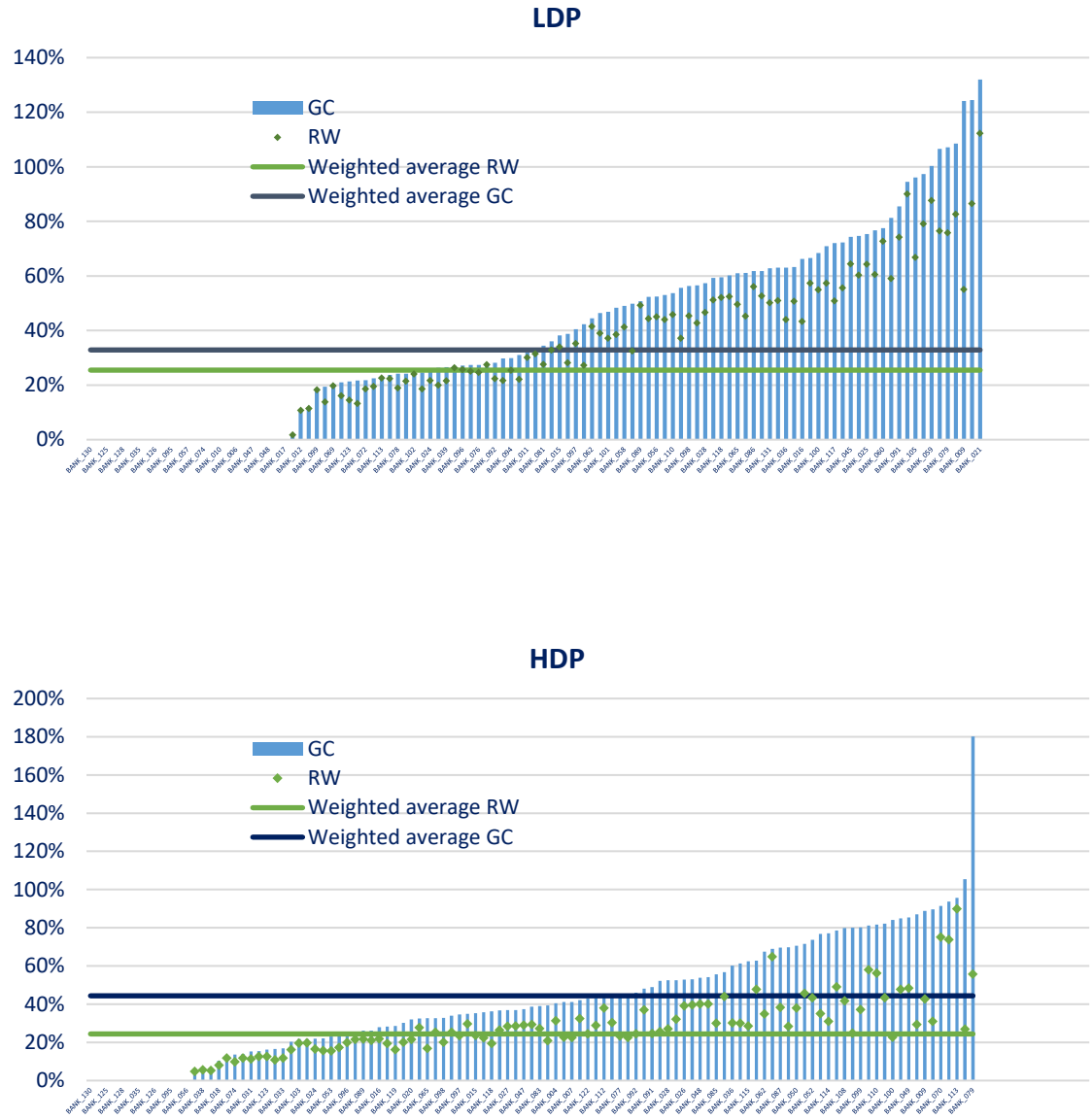
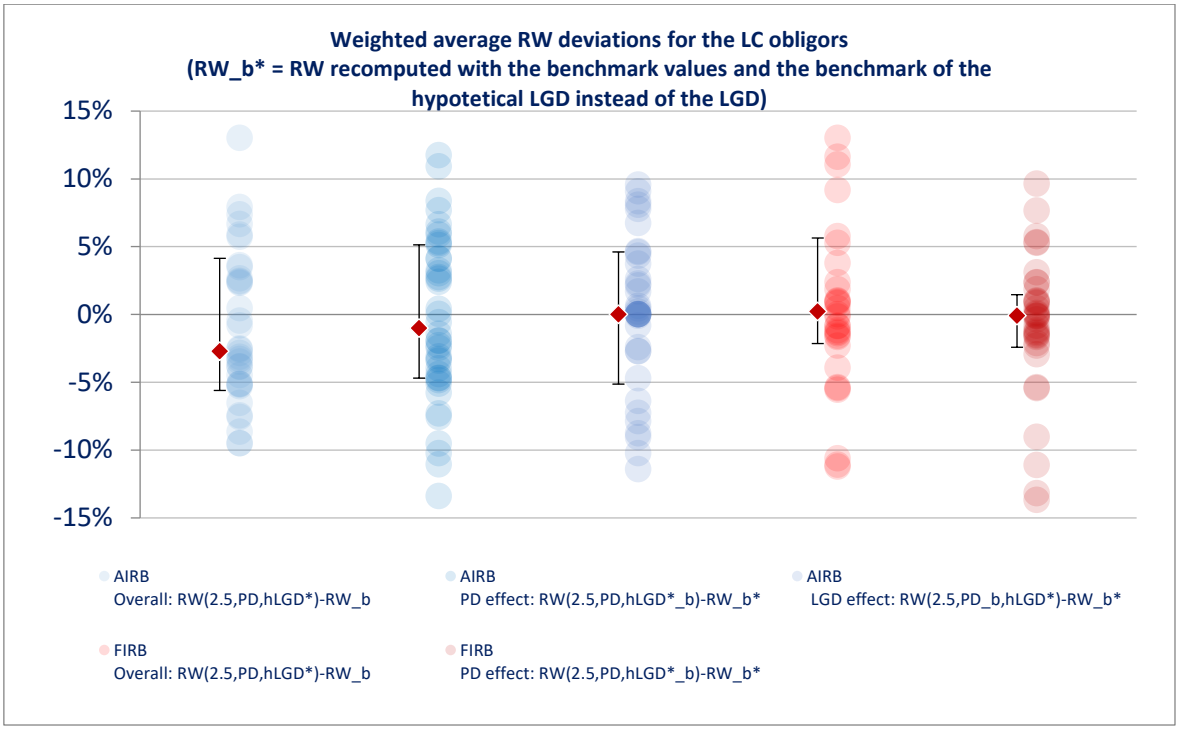


**Figure 50: Adjusted GC and RW, for defaulted and non-defaulted exposures, by institution, LDP and HDP**

# Appendix 8: Complementary graphs on the common obligors' analysis

**Where NORA that is an abbreviation for "NO Regulatory Approach" indicate that the PD benchmark has been computed over all the counterparties reported, regardless of the regulatory approach.**

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



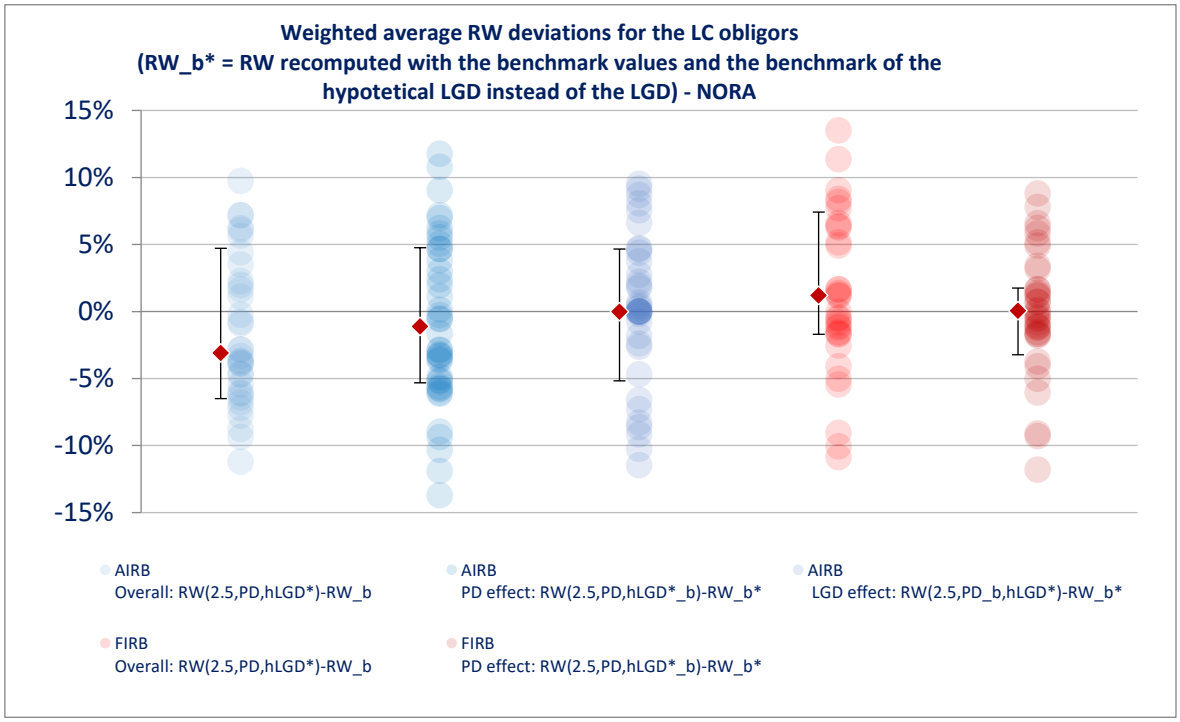
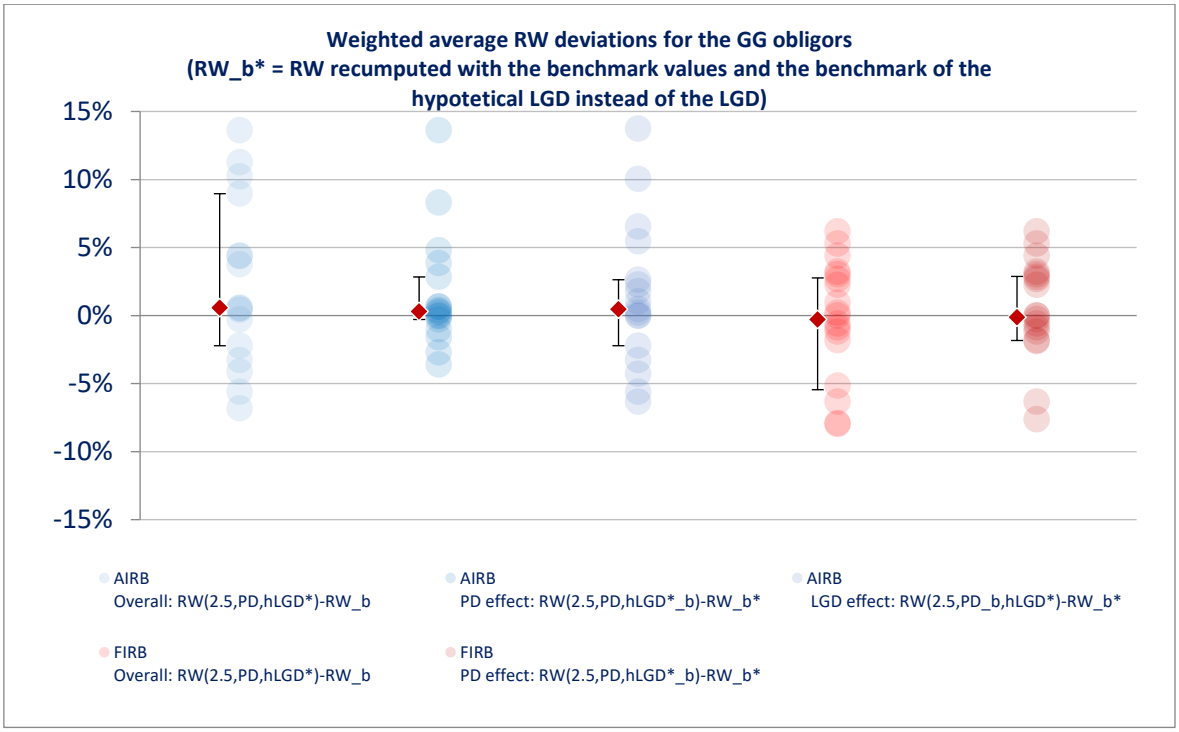

Weighted average RW deviations for the LC obligors
(RW_b* = RW recomputed with the benchmark values and the benchmark of the hypotetical LGD instead of the LGD) - NORA
15%
10%
5%
0%
-5%
-10%
-15%
AIRB
Overall: RW(2.5,PD,hLGD*)-RW_b
AIRB
PD effect: RW(2.5,PD,hLGD*_b)-RW_b*
AIRB
LGD effect: RW(2.5,PD_b,hLGD*)-RW_b*
FIRB
Overall: RW(2.5,PD,hLGD*)-RW_b
FIRB
PD effect: RW(2.5,PD,hLGD*_b)-RW_b*

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



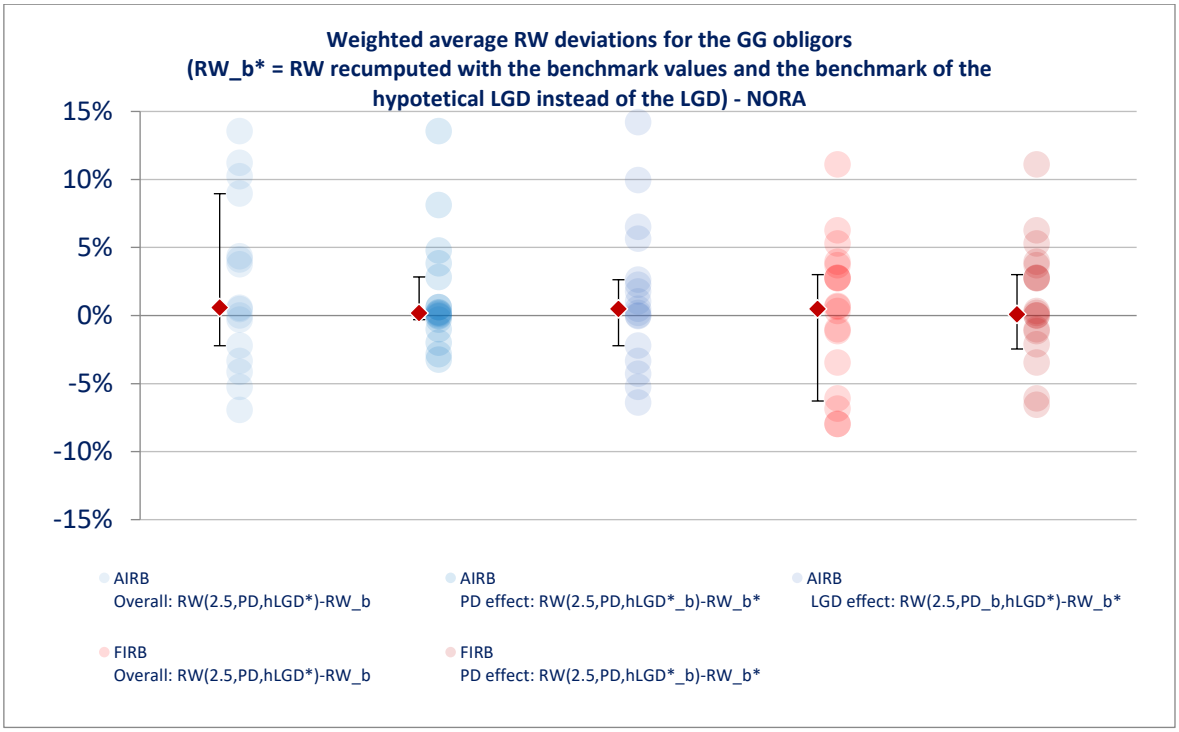
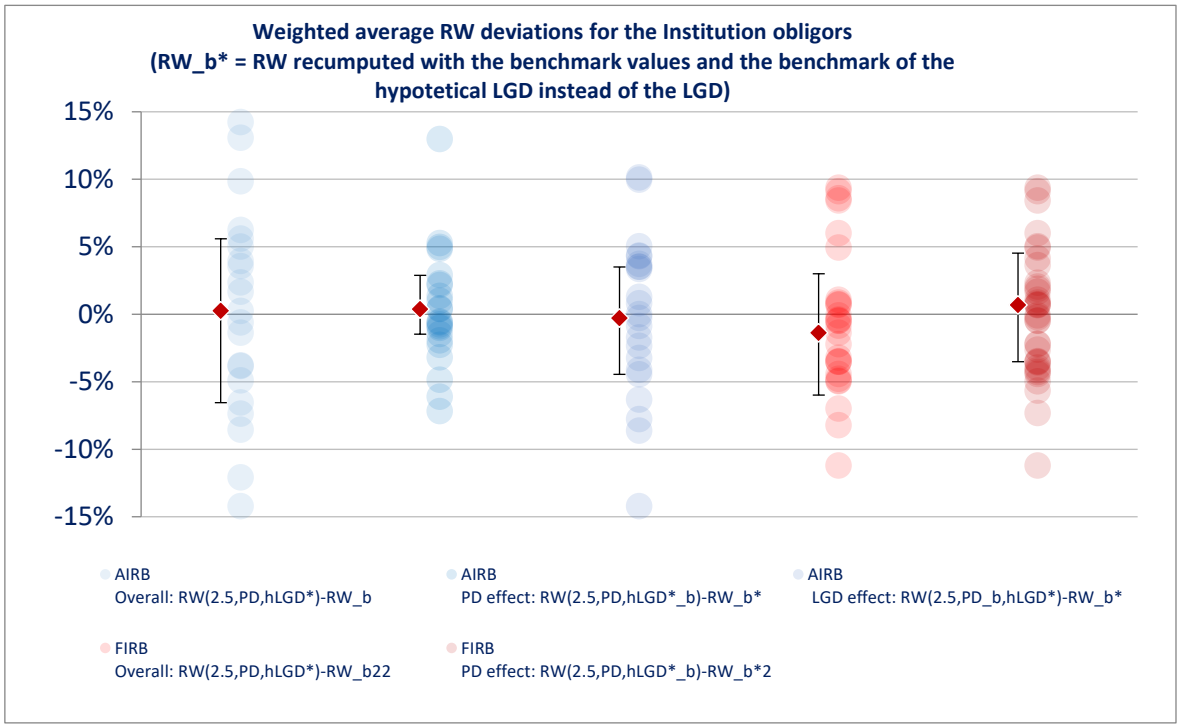
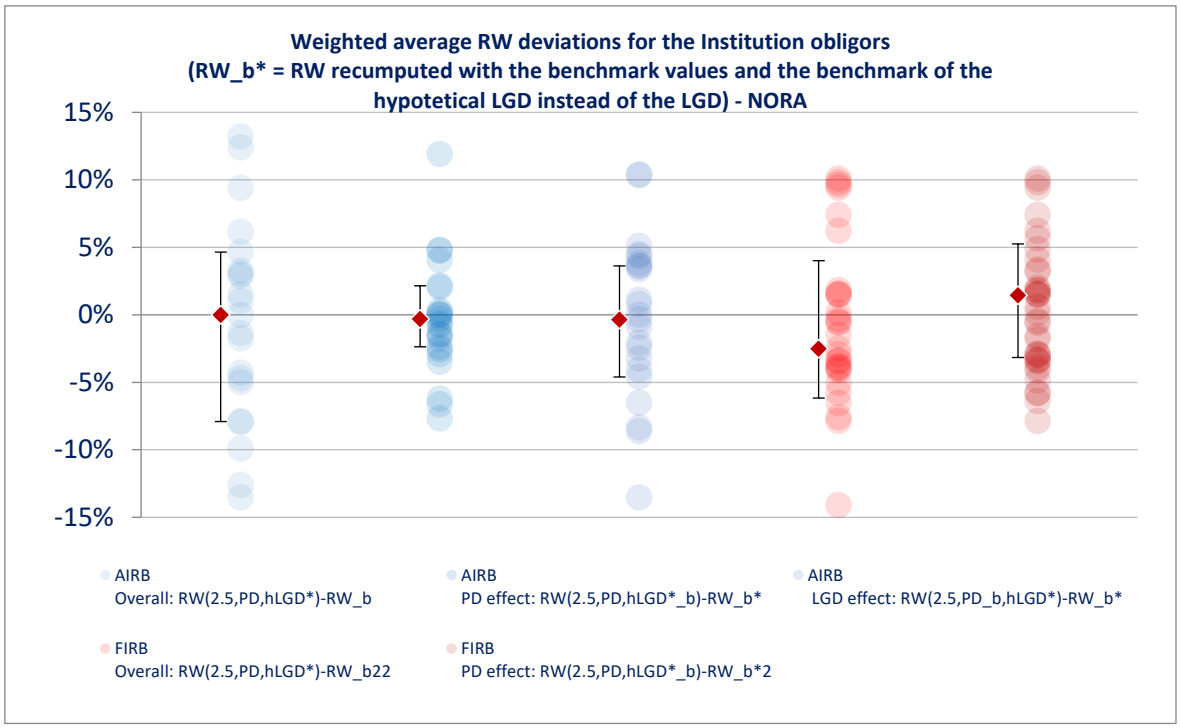



Figure 53: RW deviations for INST counterparties (AIRB and FIRB)



# Appendix 9: Complementary graphs on the outturn analysis

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

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

- Differences between the observed risk parameters used for prudential purposes and the data collected.
    - The default rate collected is an exposure-weighted ratio, whereas the default rate used for the PD estimation should be an obligor ratio (further details are available in Section 5.3.2 of the Guidelines on PD and LGD estimation[23]).
    - 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 181of the CRR to be representative (PD) or at least equal (LGD) to the long-run average. However:
    - The past 5 year(s) might not be representative of the long term (further details are available in Section 5.3.4 of the Guidelines on PD and LGD estimation).
    - The long-run average should be the arithmetic yearly average for the PD and a default-weighted average for the LGD. The data collected are an exposure-weighted average of the DR for DR5Y and an EAD-weighted average of the yearly LR for LR5Y (further details are available in Sections 5.3.3 and 6.3.3.2 of the Guidelines on PD and LGD estimation).
    - The averages are not necessarily 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).

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

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

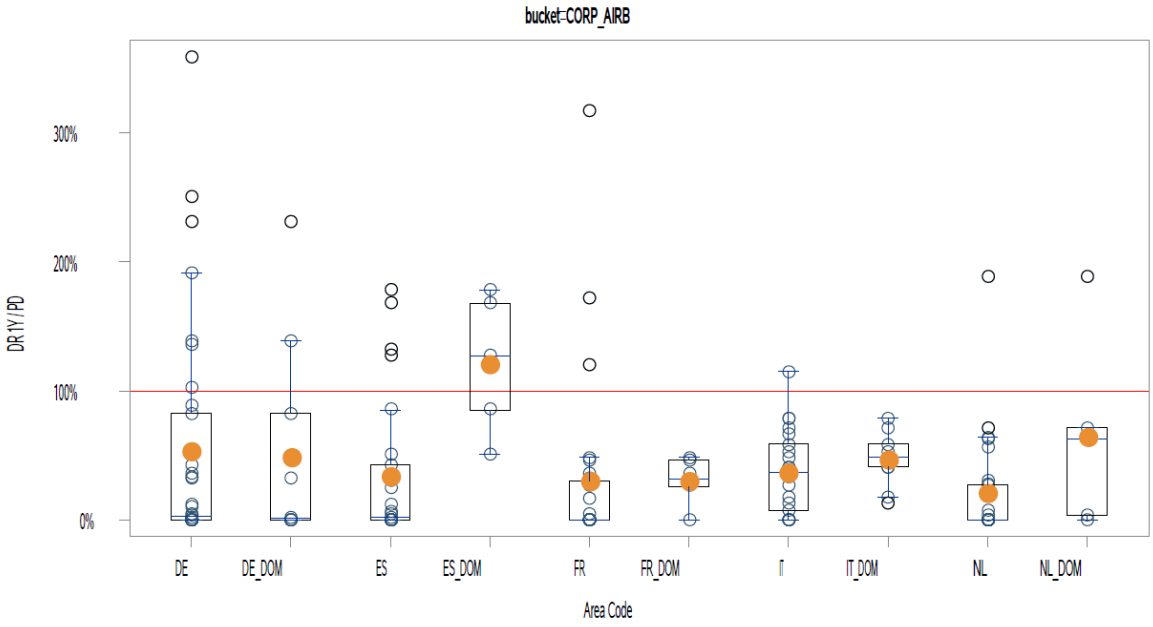
- Potential lack of representativeness due to the computation on non-homogeneous pools.

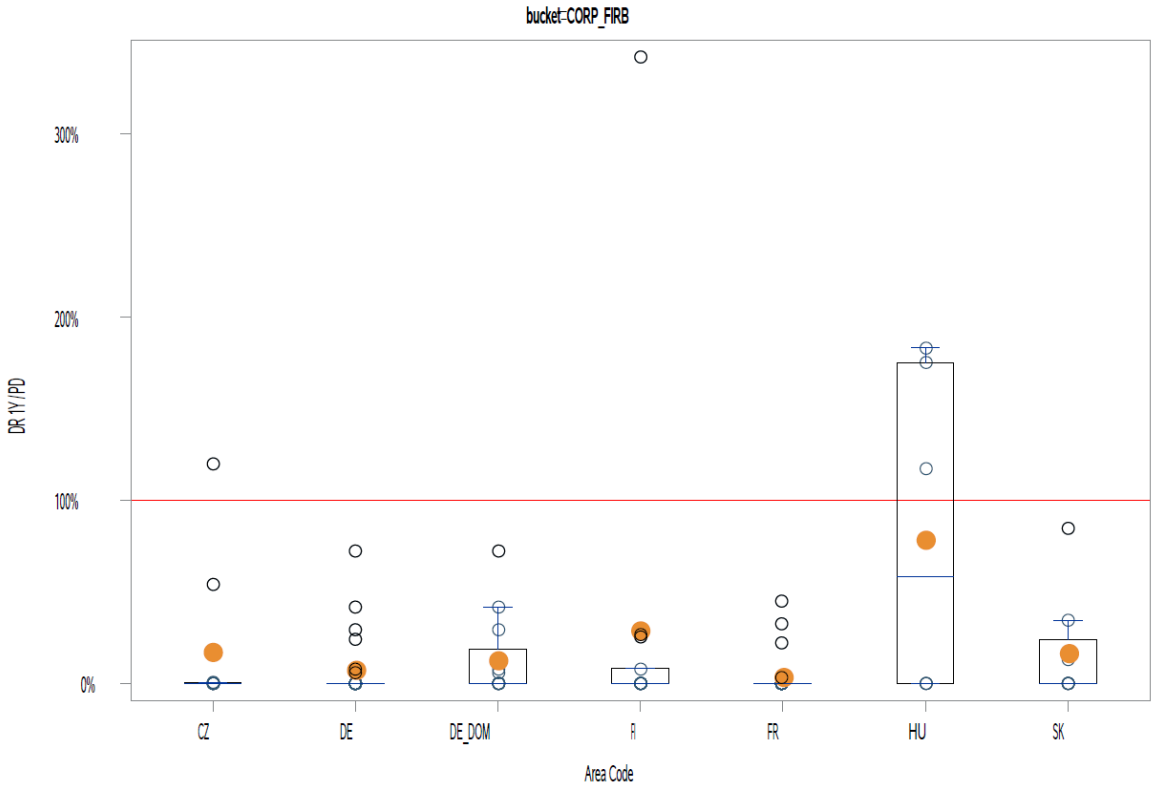
  - For the 1-year rates, the data collected allowed only the comparison of PDs (and LGDs) at the reference date (2018) with the default rate (and loss rate) observed during the same year (2018), whereas it would be more consistent to compare this default rate (and loss rate) with the PD (and LGD) at the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

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

## Corporate-other

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




bucket=CORP_FIRB
300%
200%
100%
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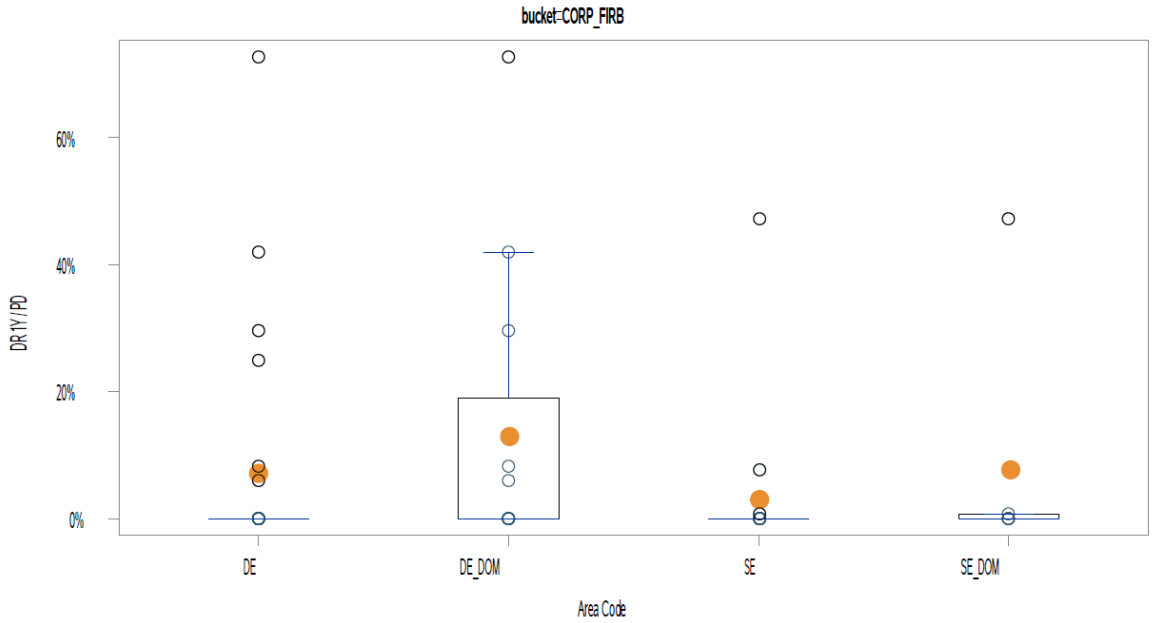
DR 1Y / PD
CZ
DE
DE_DOM
R
FR
HU
SK
Area Code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60%
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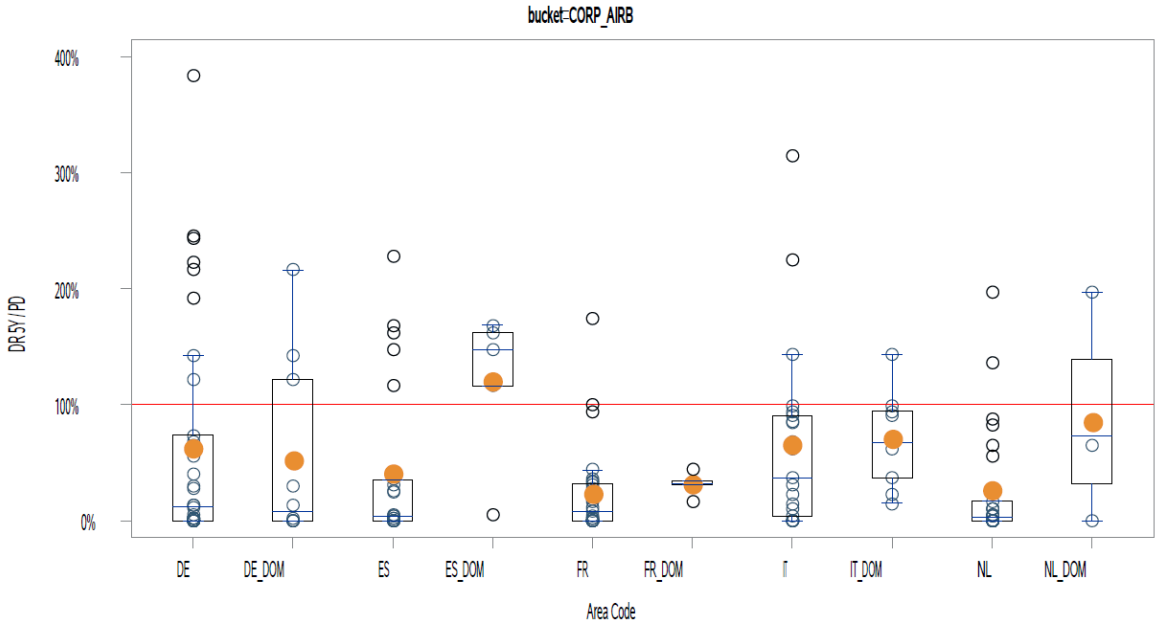
0%
DR 1Y / PD
DE
DE_DOM
SE
SE_DOM
Area Code


bucket=CORP_AIRB
DR5Y/PD
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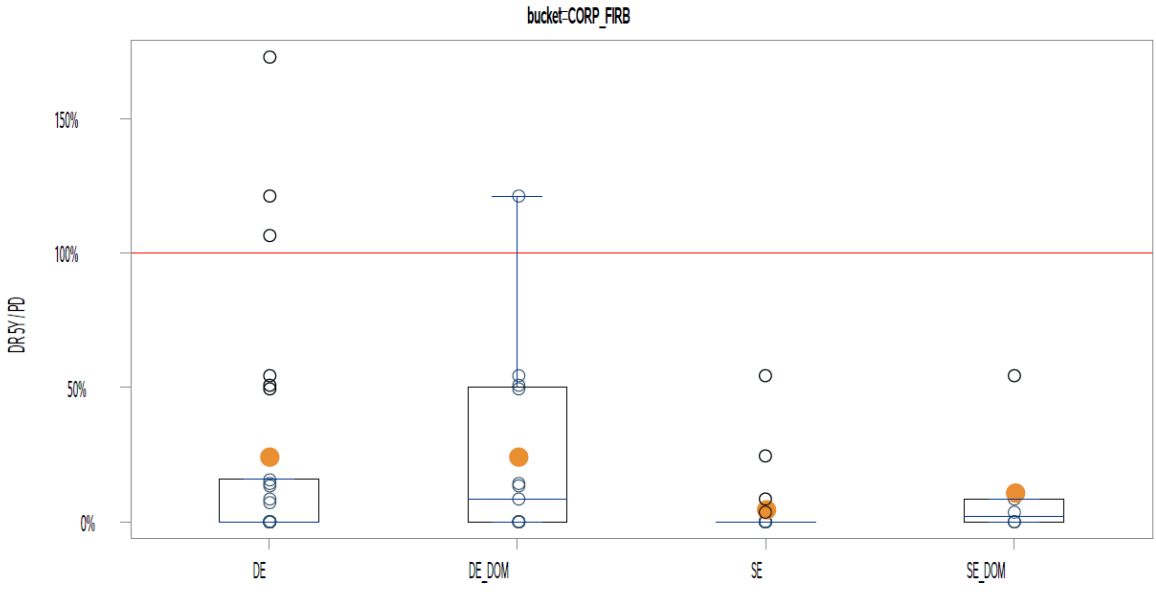
IT
IT_DOM
NL
NL_DOM
Area Code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DR5Y/PD
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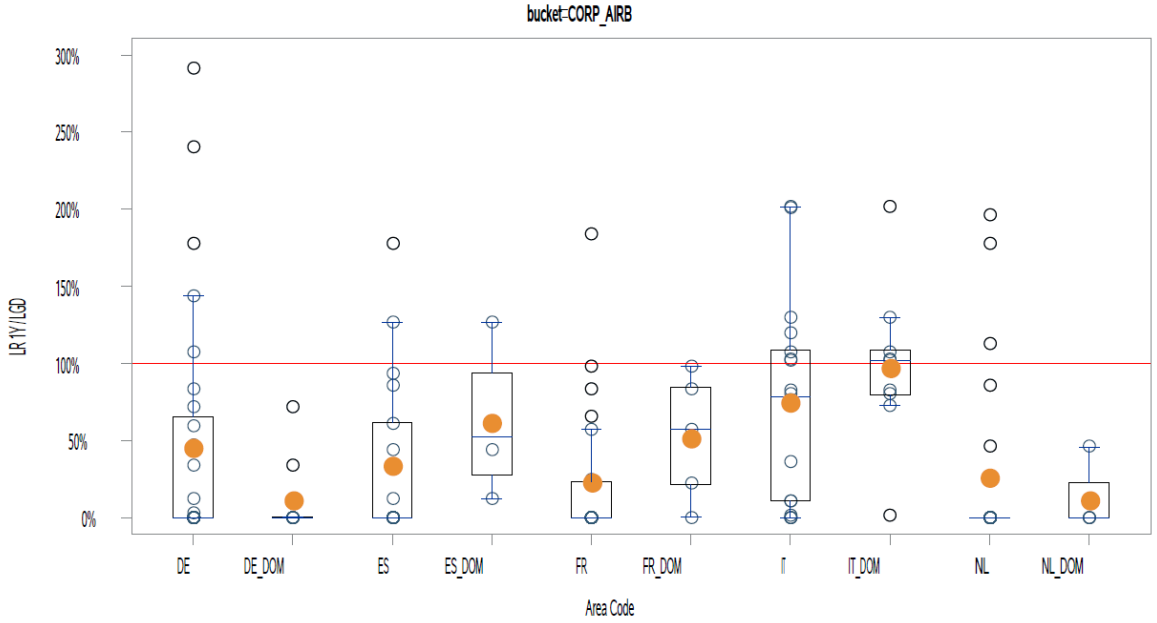
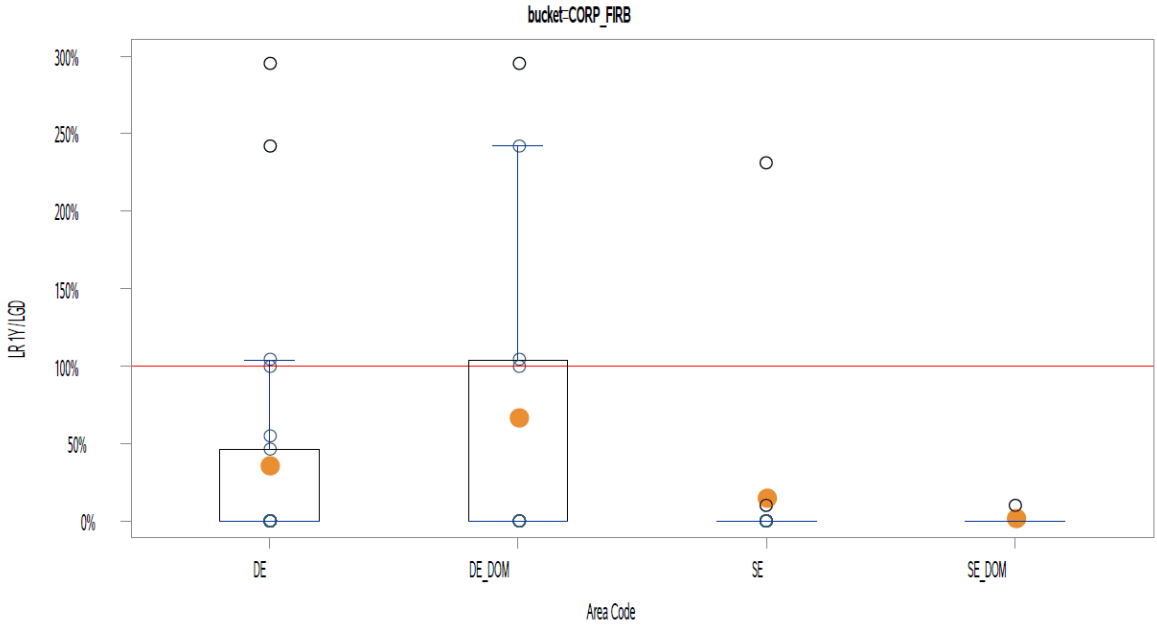
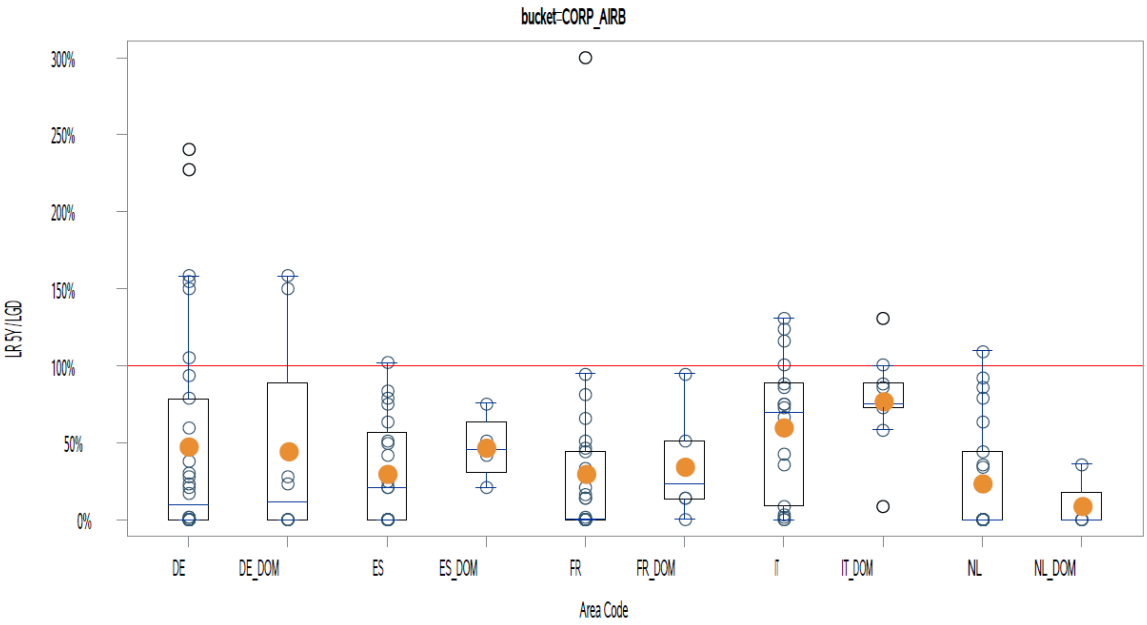
DE_DOM
SE
SE_DOM

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




bucket=CORP_AIRB
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LR5Y/LGD
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DE_DOM
ES
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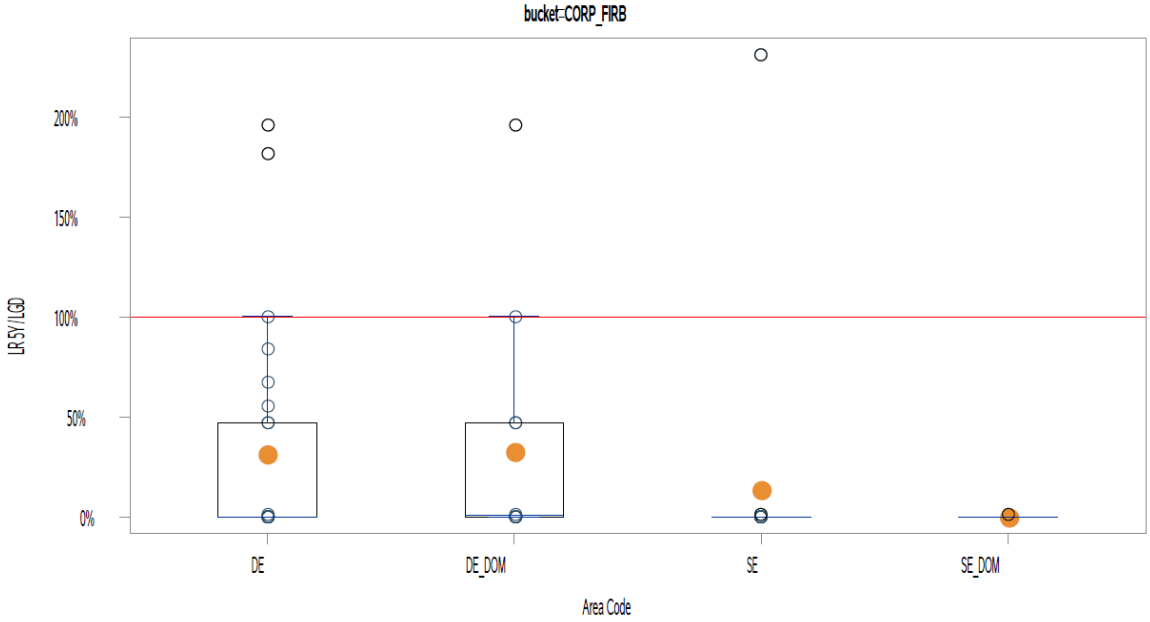
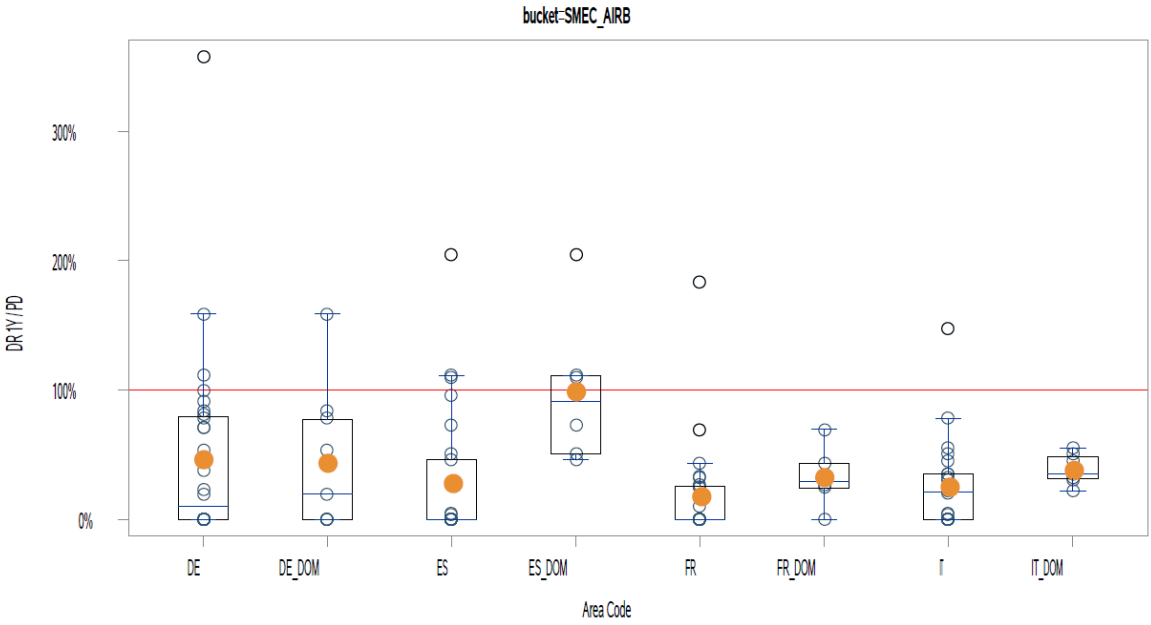
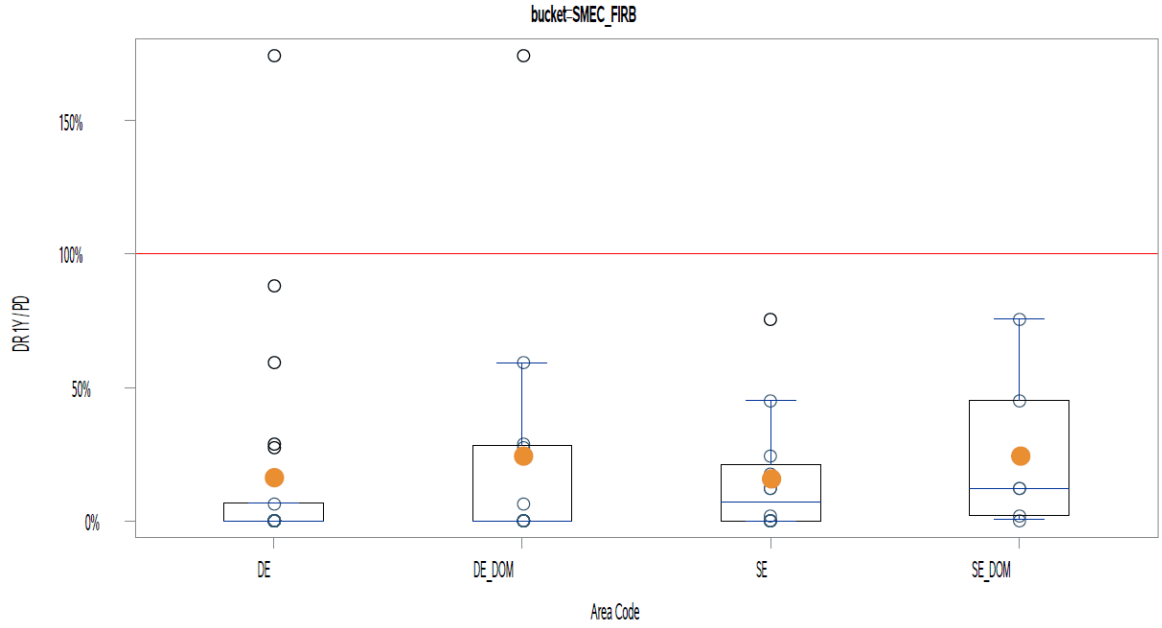
FR_DOM
IT
IT_DOM
NL
NL_DOM
Area Code




## SME corporate

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




bucket=SMEC_FIRB
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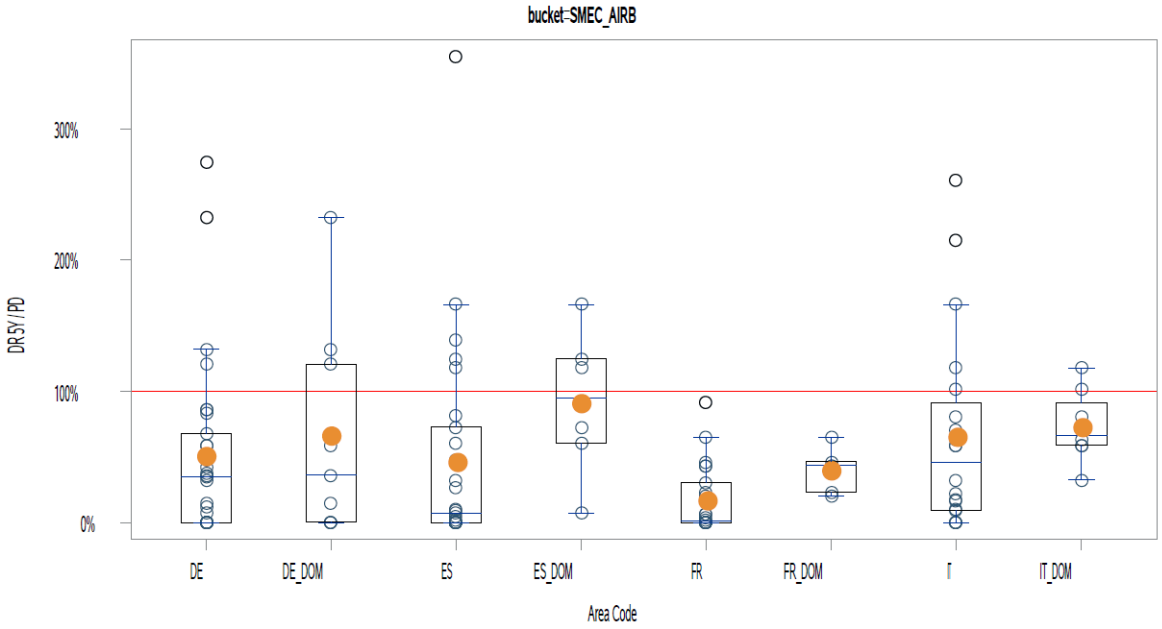
DR1Y/PD
DE
DE_DOM
SE
SE_DOM
Area Code


bucket=SMEC_AIRB
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DR5Y/PD
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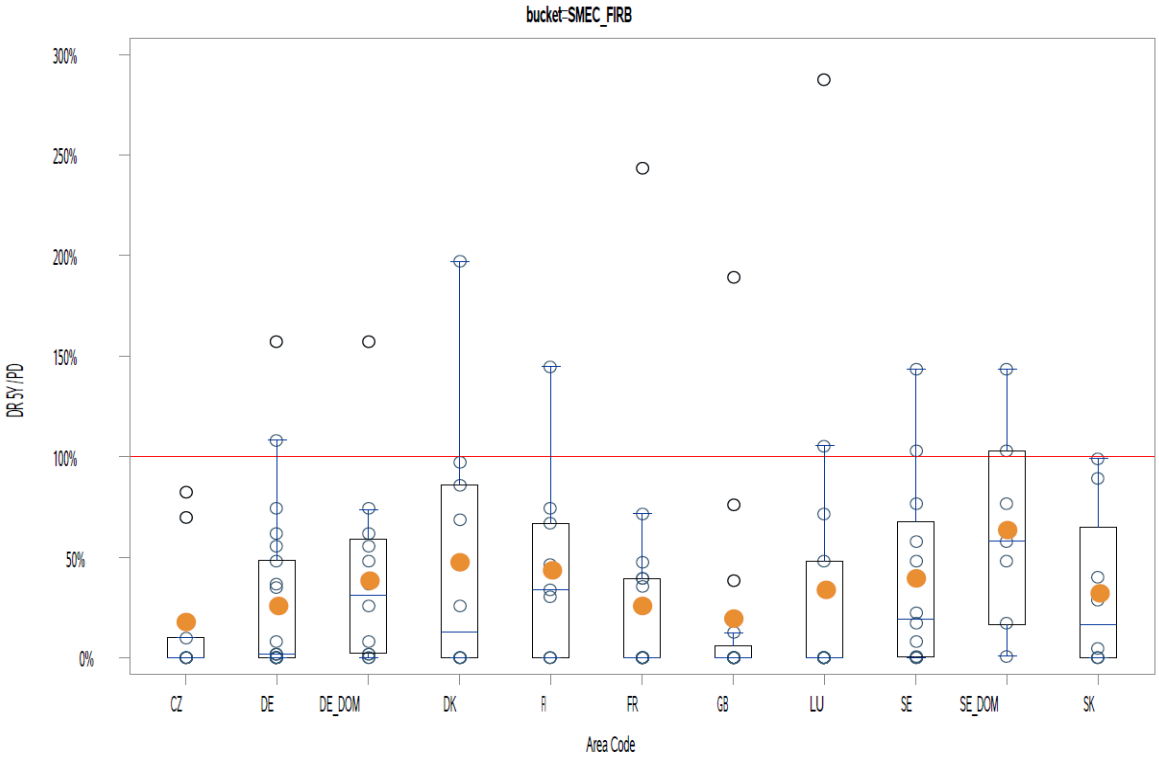
IT_DOM
Area Code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DR5Y/PD
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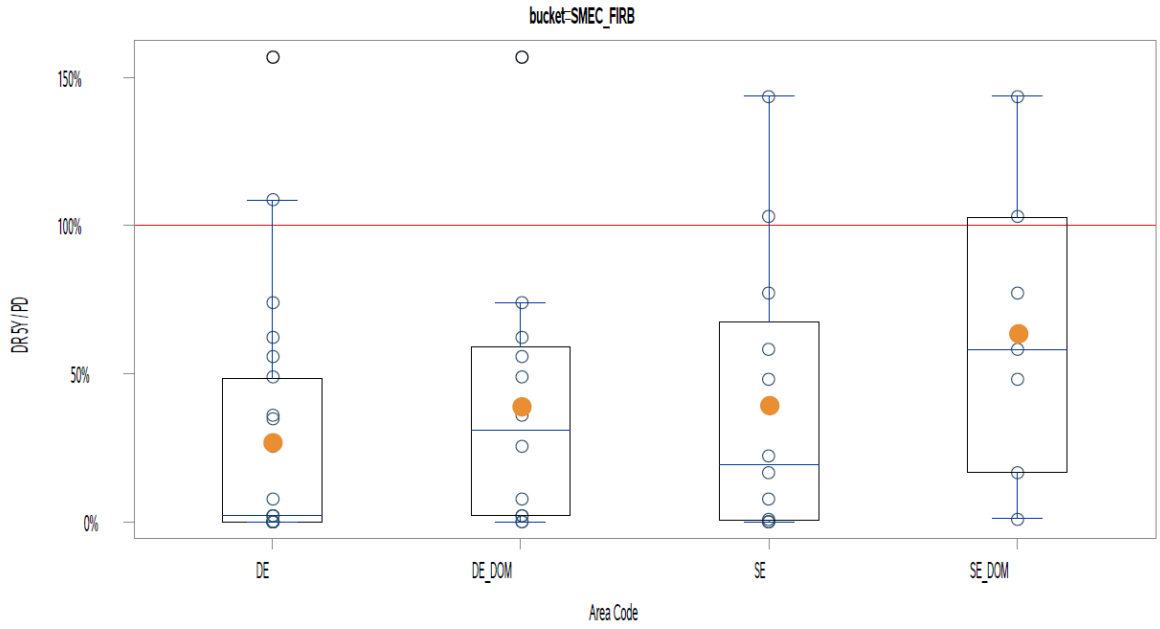
SK
Area Code


bucket=SMEC_FIRB
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DR5Y/PD
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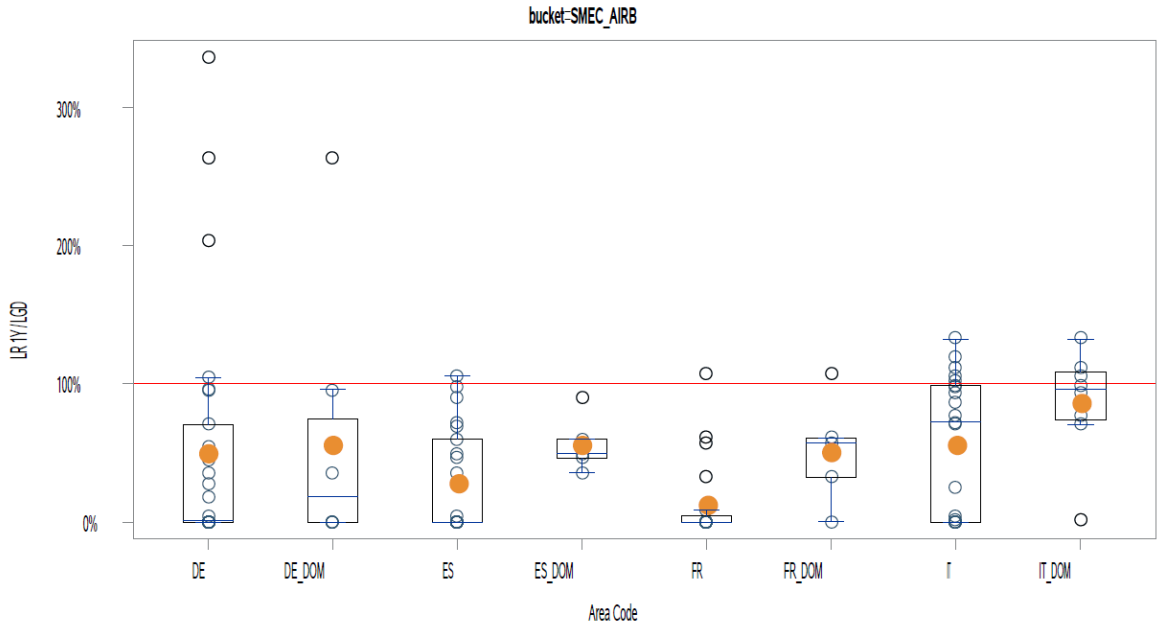
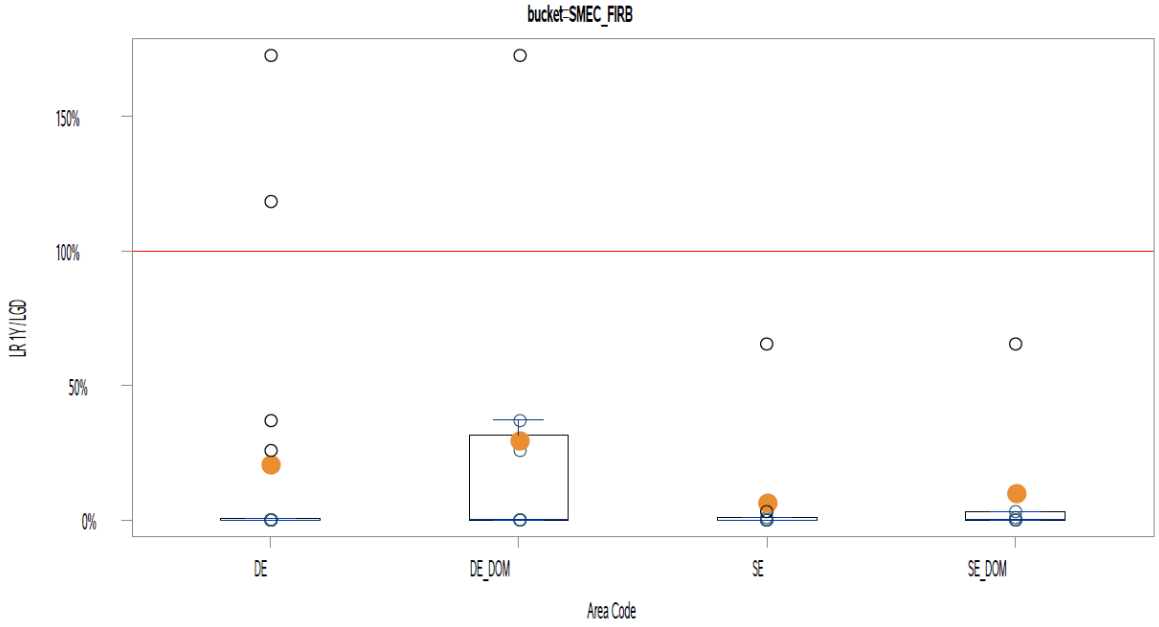
SE_DOM
Area Code

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




bucket=SMEC_FIRB
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LR1Y/LGD
DE
DE_DOM
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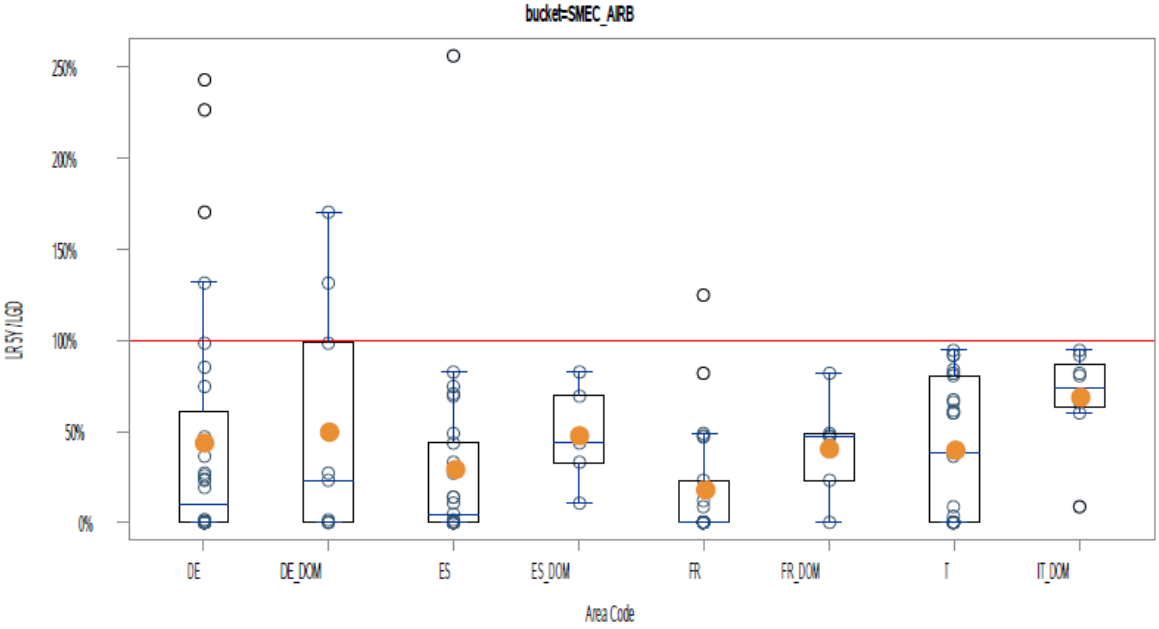
SE_DOM
Area Code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LR5Y/LGD
DE
DE_DOM
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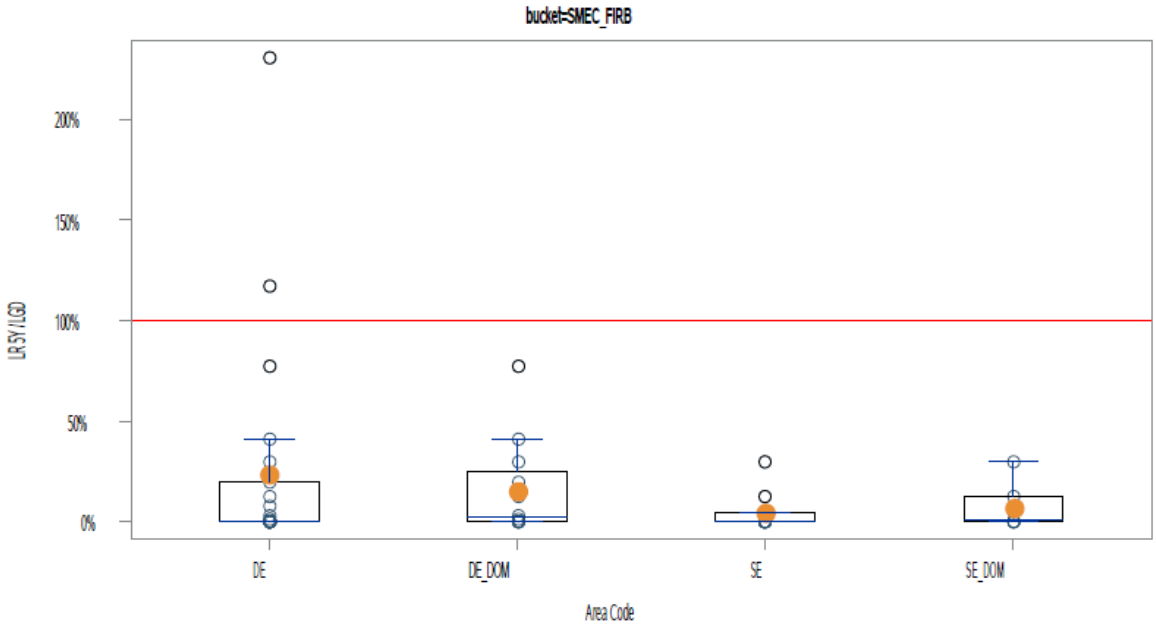
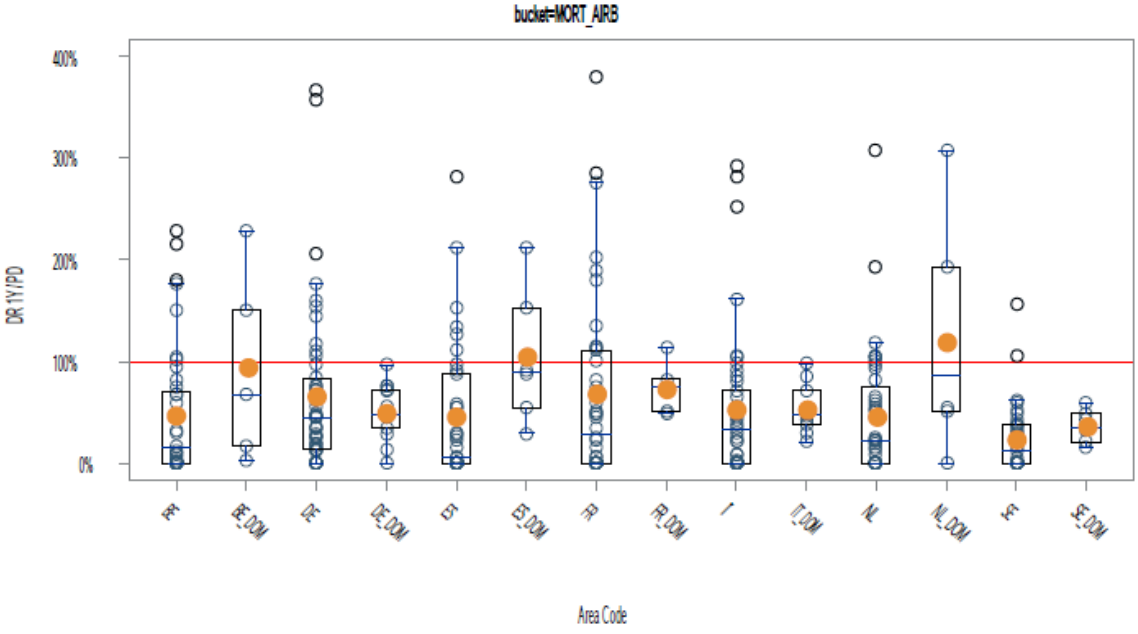
IT_DOM
Area Code




## Retail – Residential mortgages – Non-SME

**Figure 58: Comparison of PD and default rate (latest year and past 5 years), for the residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**



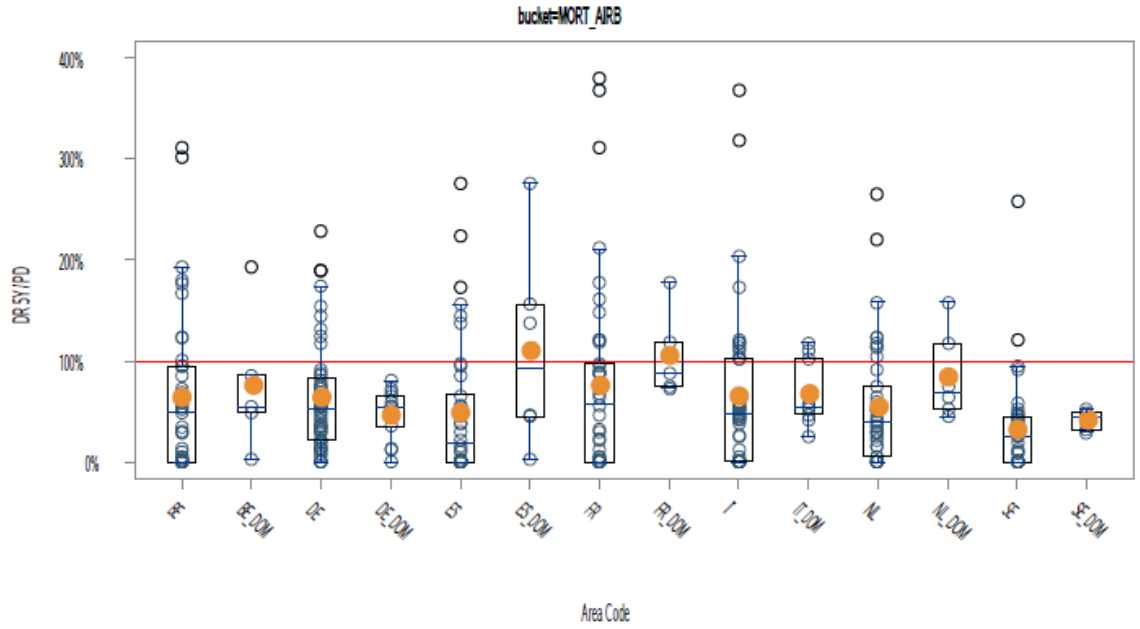
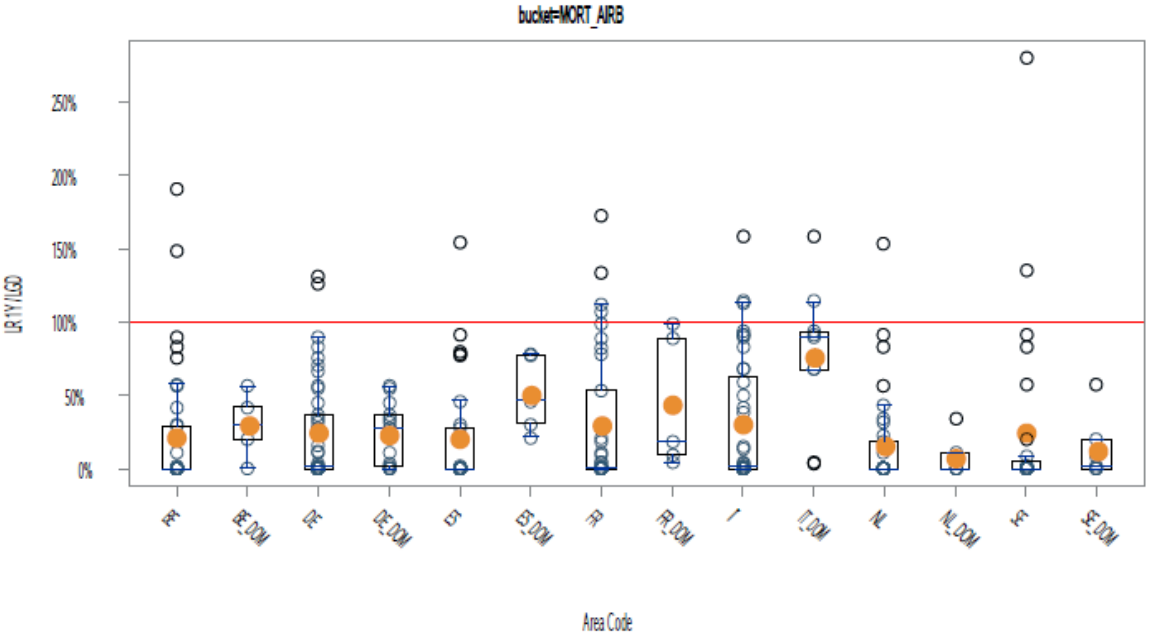
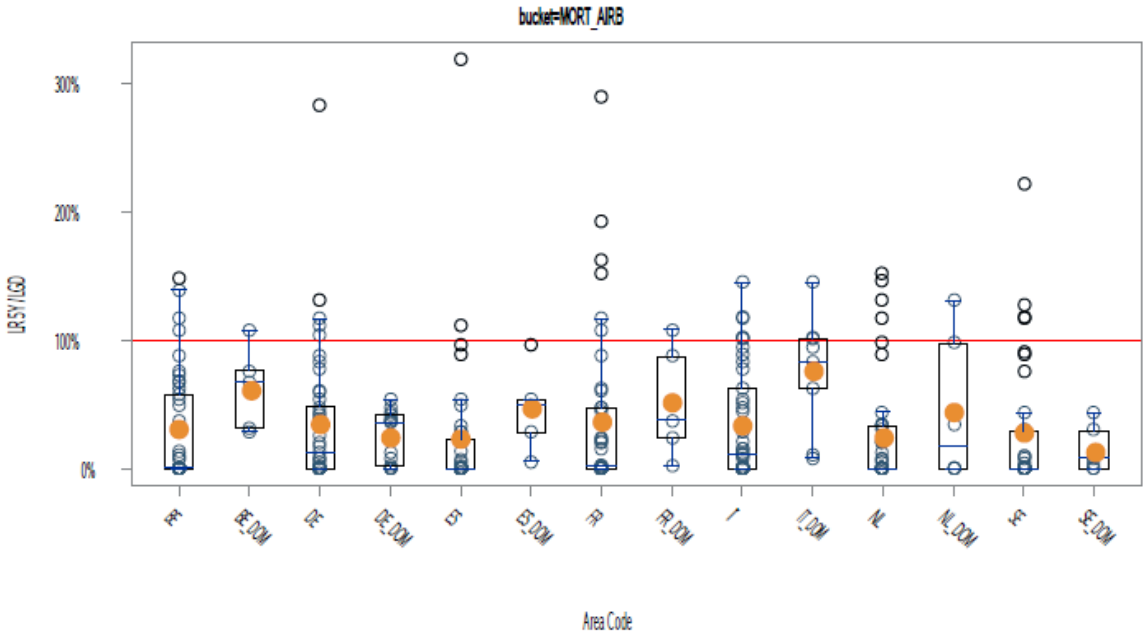


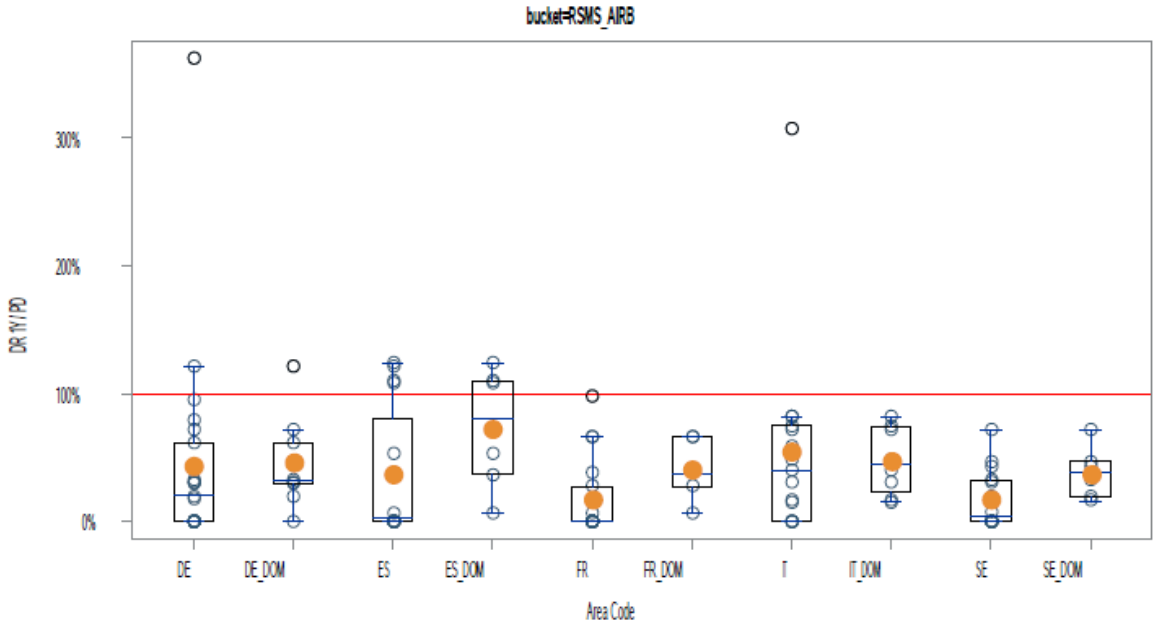

**Figure 59: Comparison of LGD and loss rate (latest year and last 5 years), residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**






## Retail – Residential mortgages - SME

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



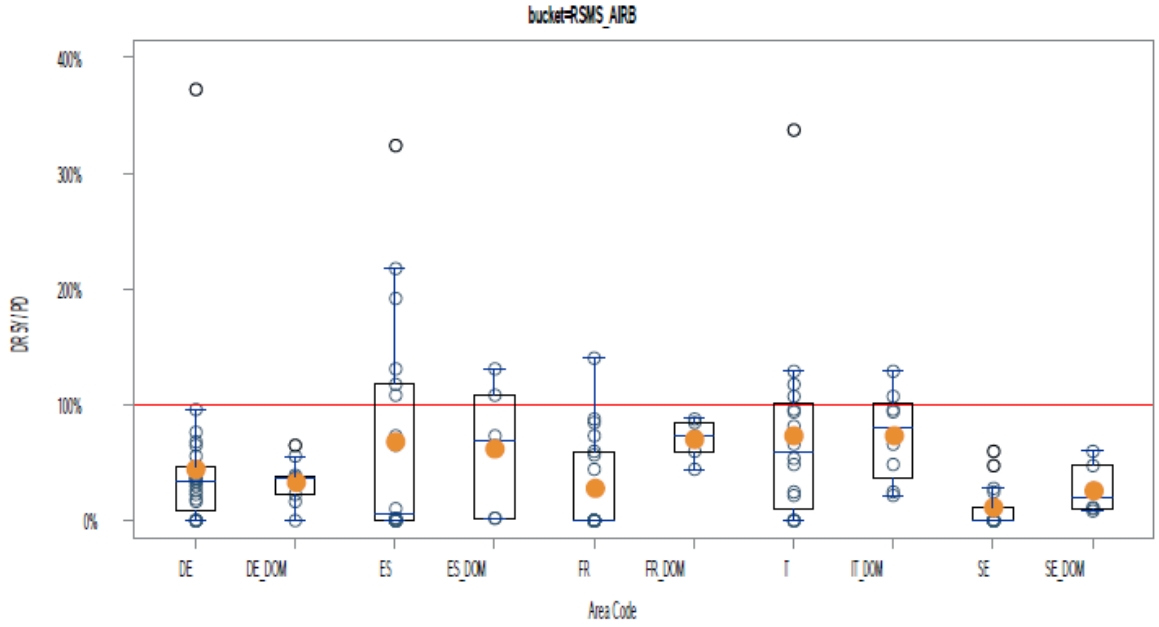
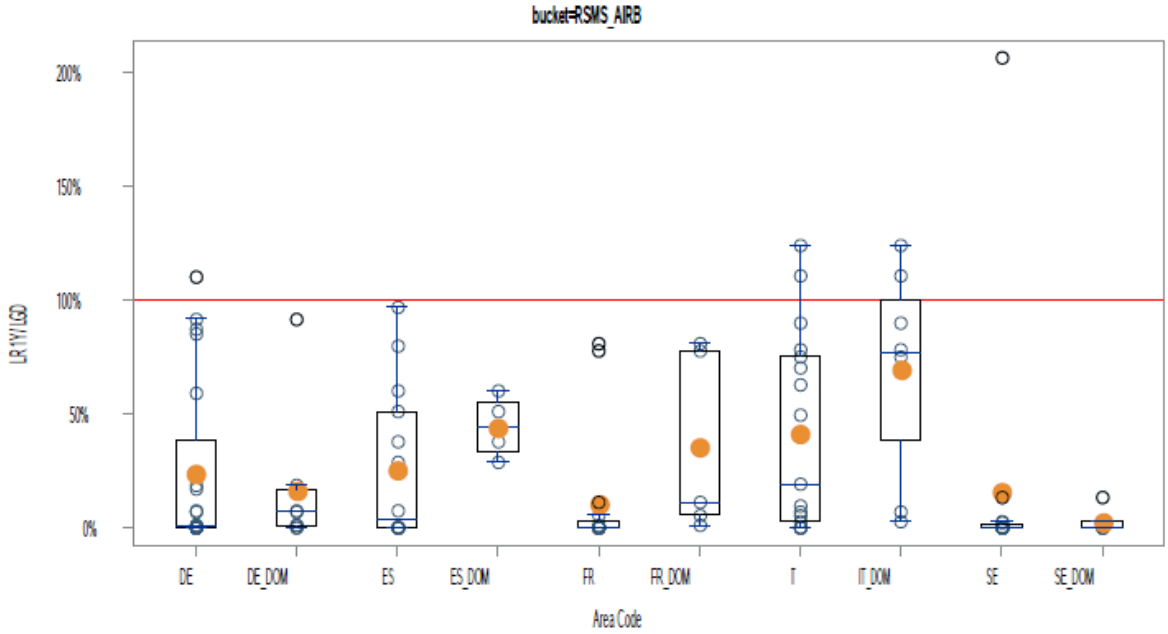
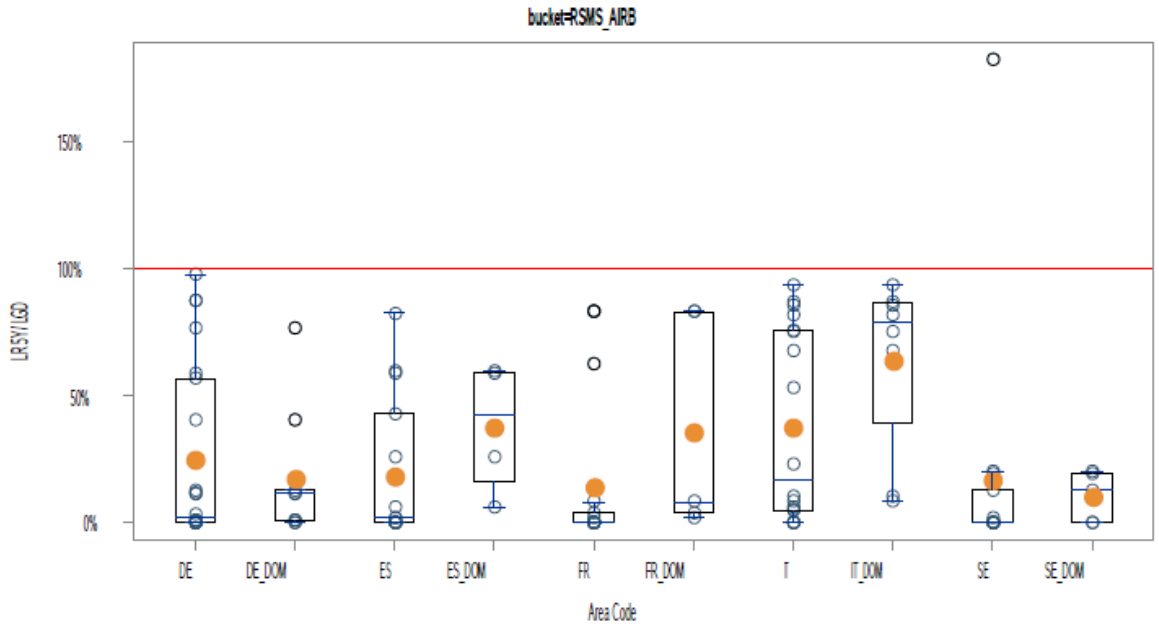


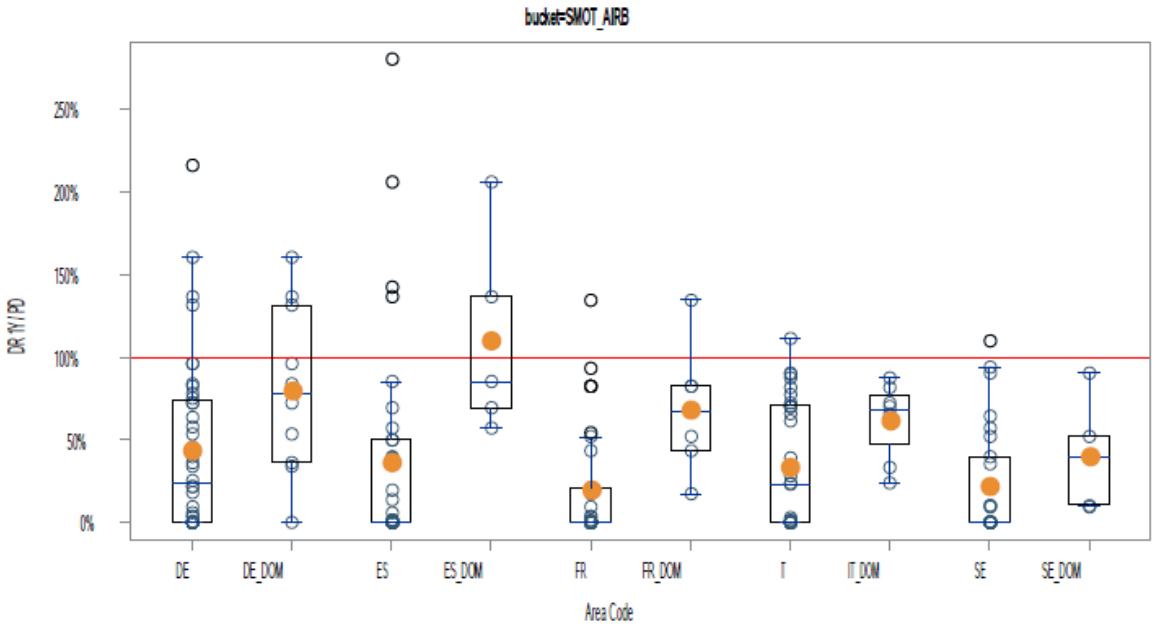

**Figure 61: Comparison of LGD and loss rate (latest year and last 5 years), residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**






## Retail – others - SME

**Figure 62: Comparison of PD and default rate (latest year and past 5 years), for the residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**



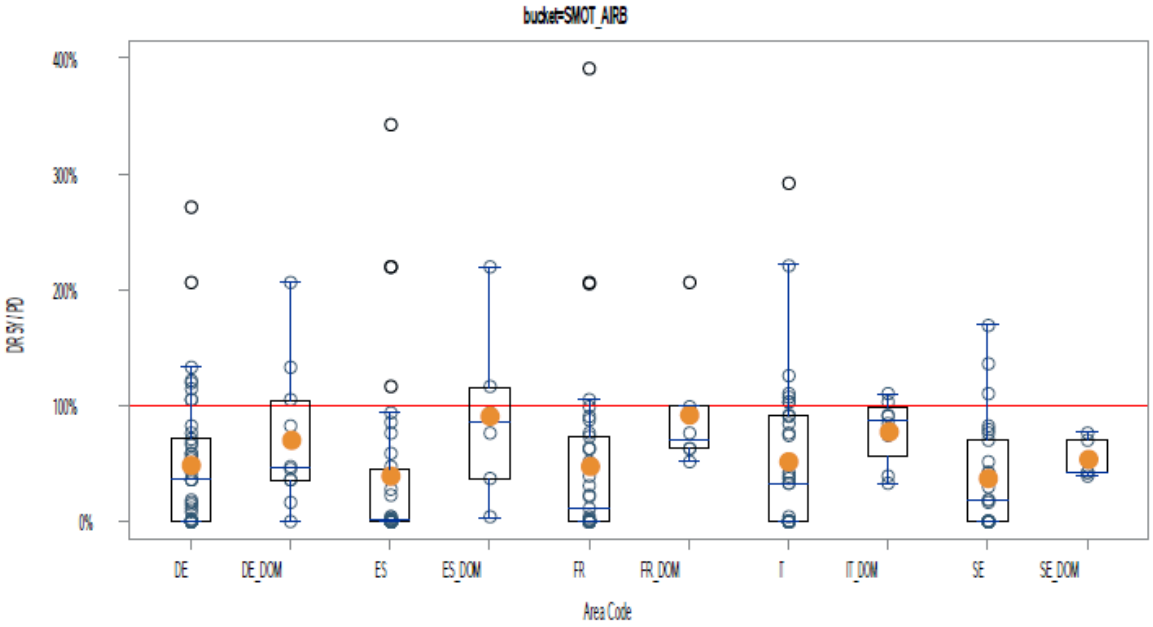
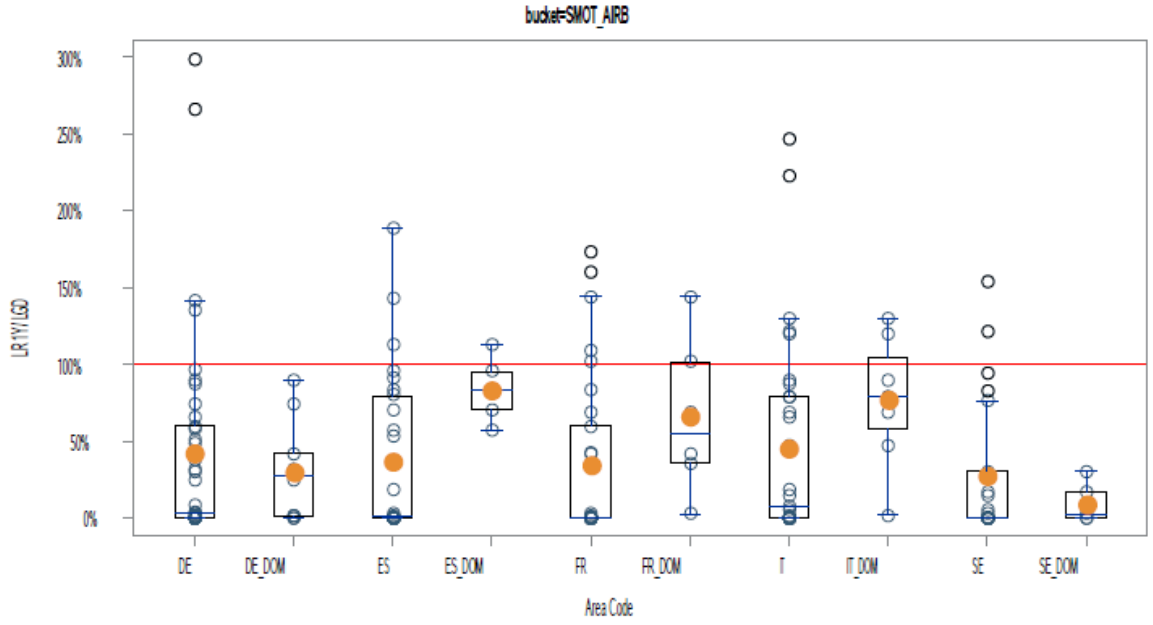
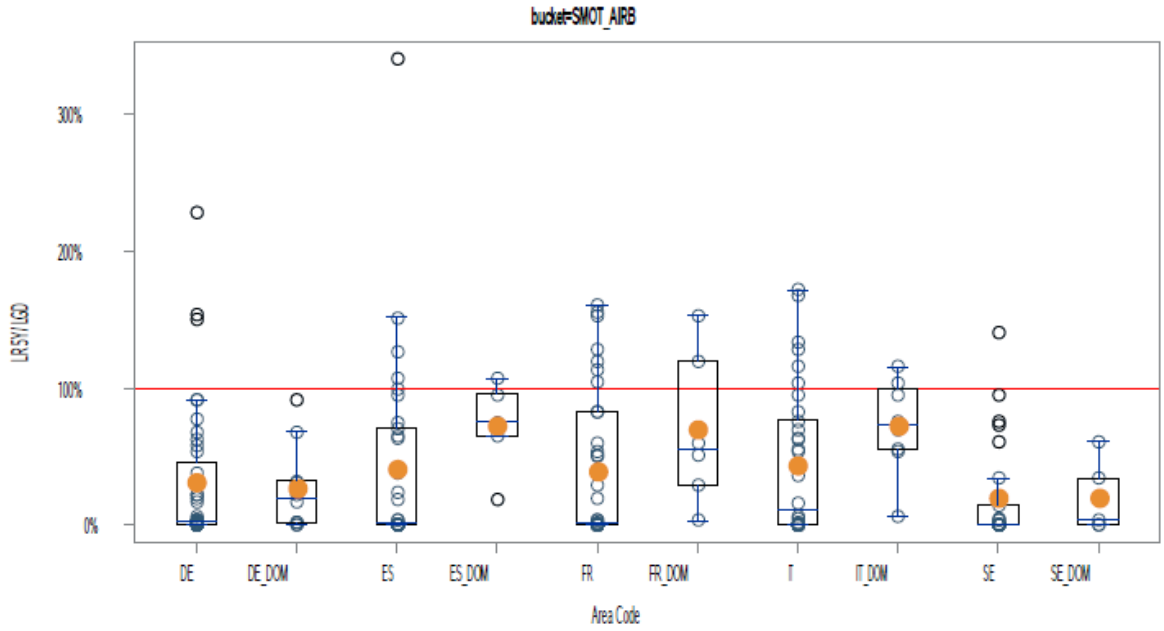


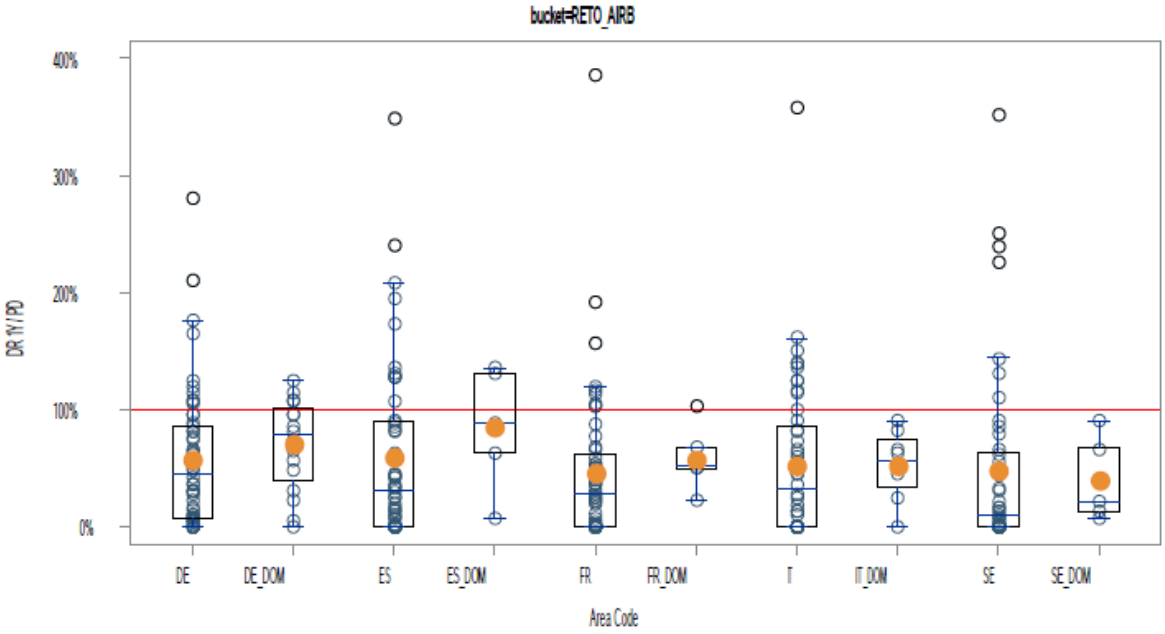

**Figure 63: Comparison of LGD and loss rate (latest year and last 5 years), residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**






## Retail – others – non-SME

**Figure 64: Comparison of PD and default rate (latest year and past 5 years), for the residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**



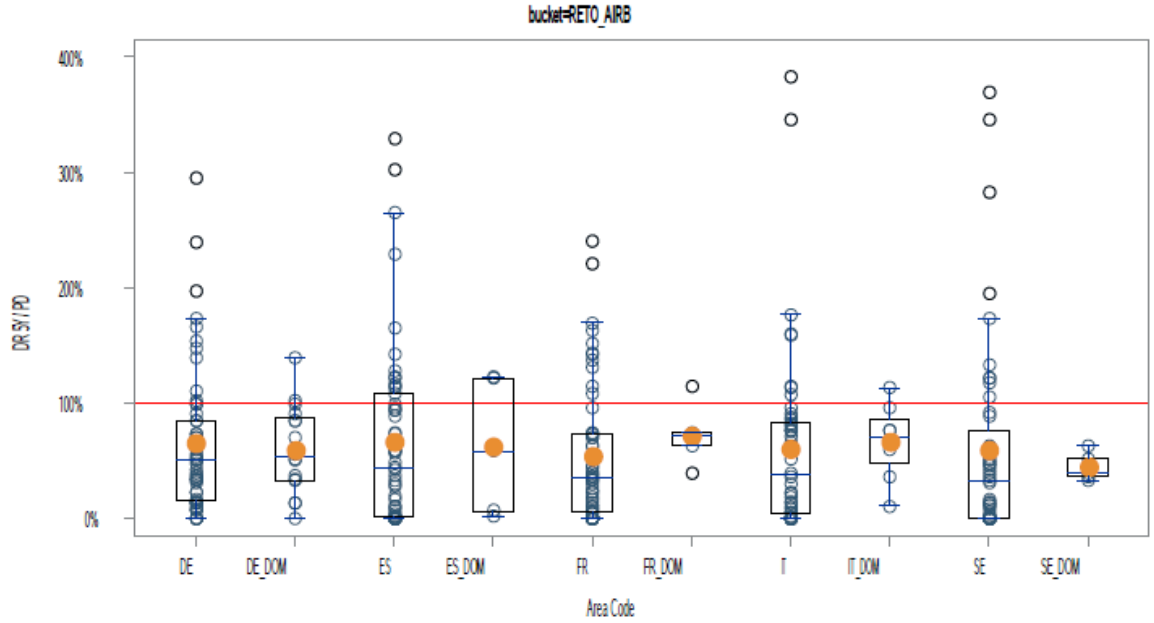
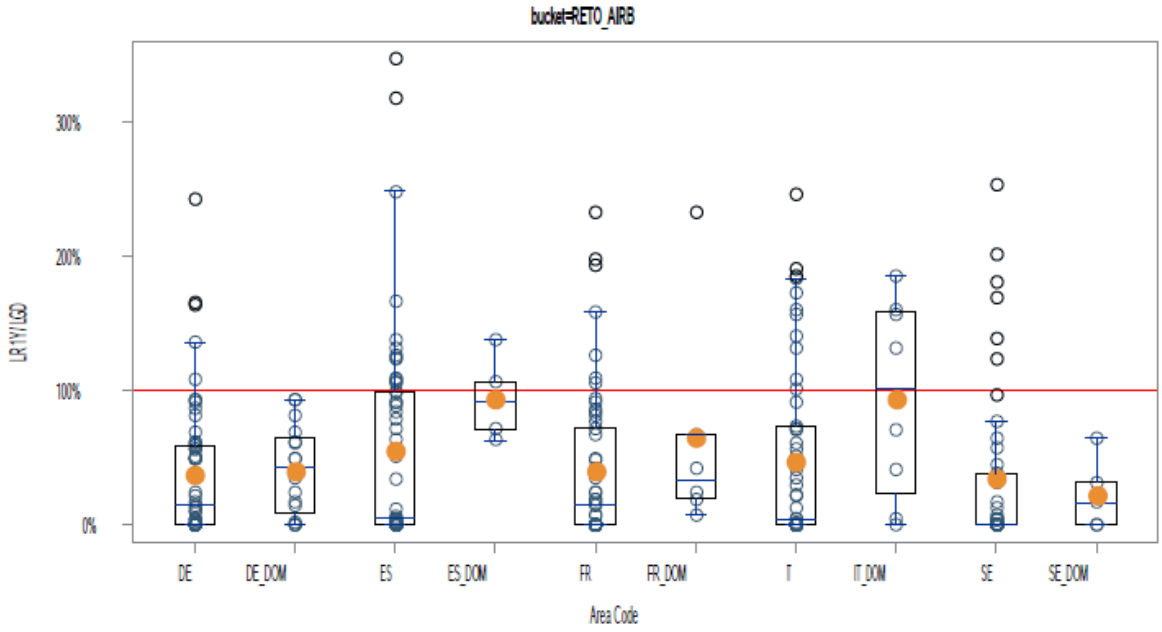
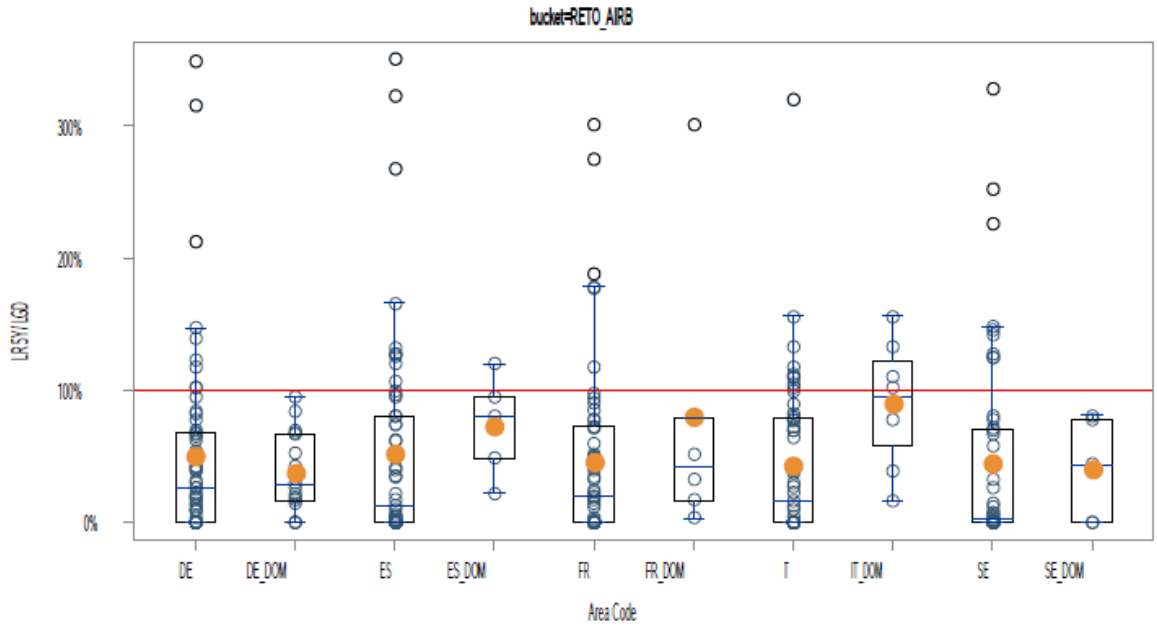


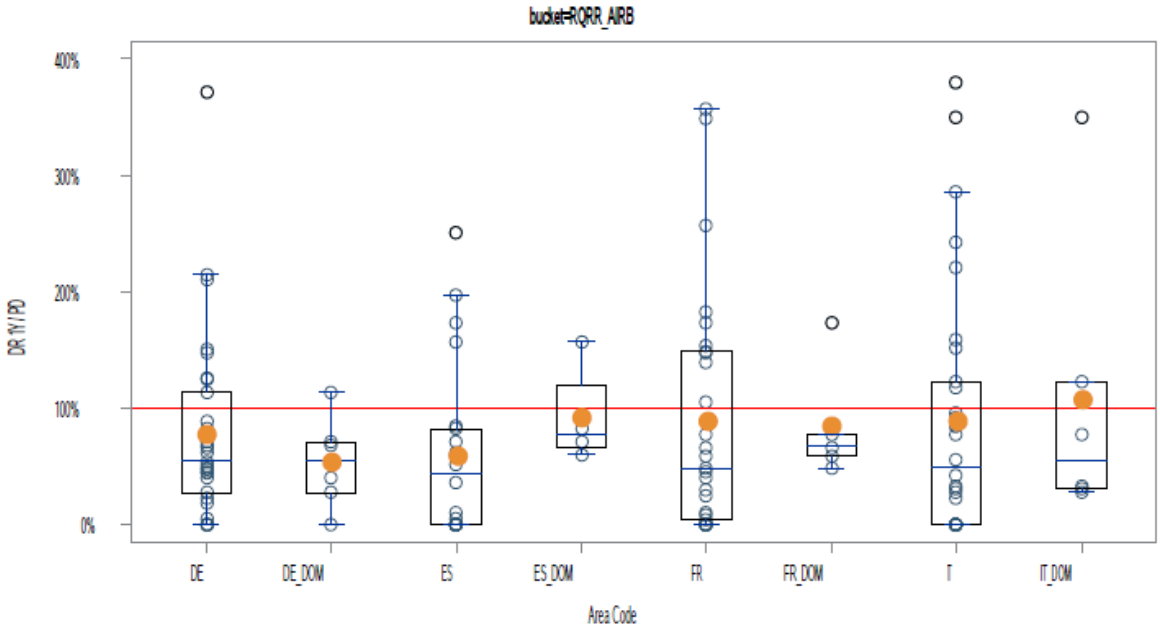

**Figure 65: Comparison of LGD and loss rate (latest year and last 5 years), residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**






## Retail – Revolving

**Figure 66: Comparison of PD and default rate (latest year and past 5 years), for the residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**



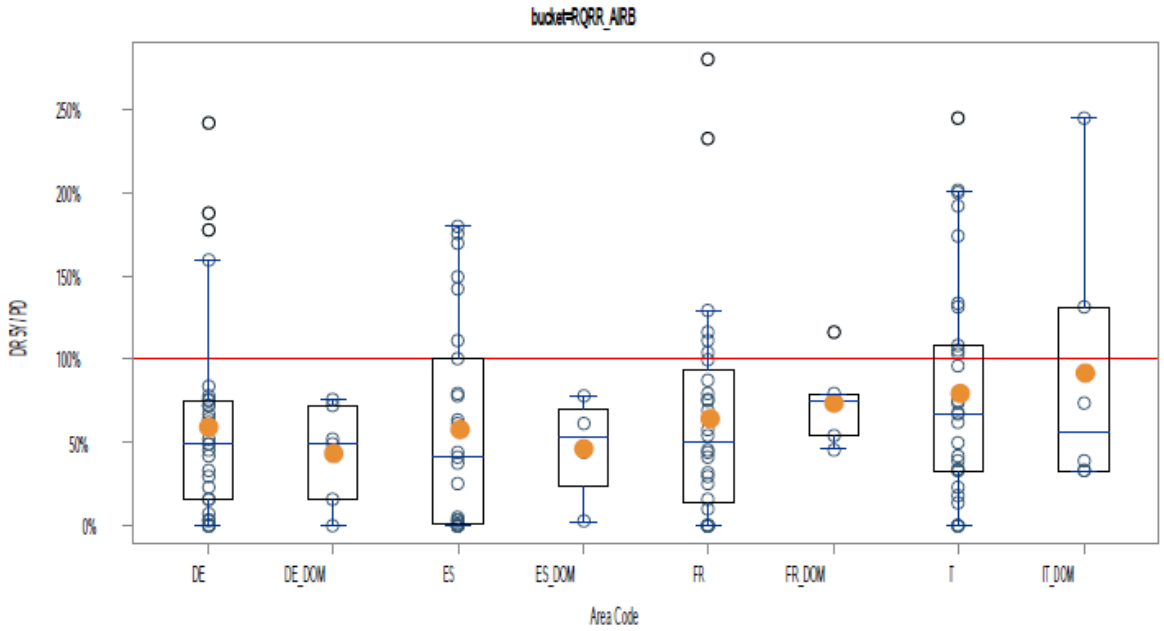
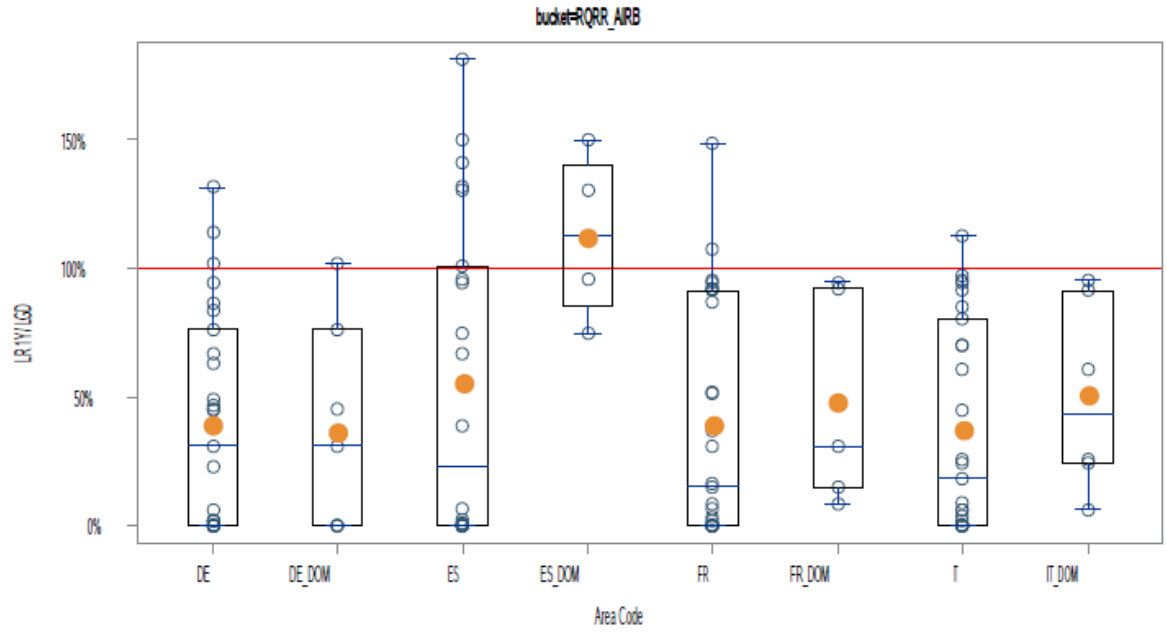
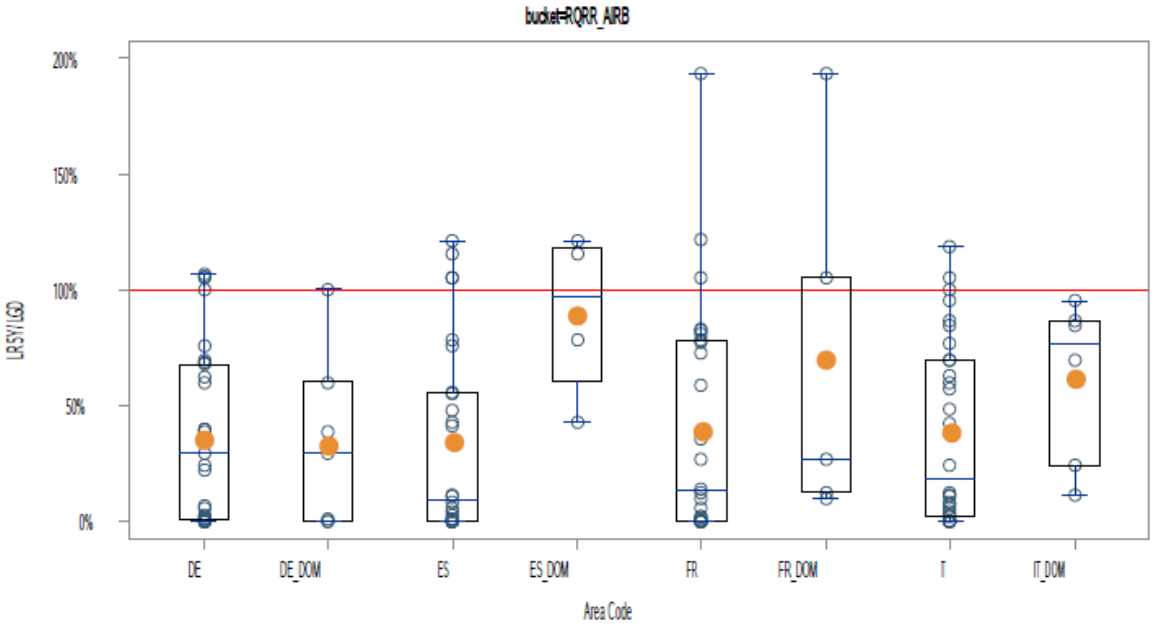



**Figure 67: Comparison of LGD and loss rate (latest year and last 5 years), residential mortgages portfolio, non-defaulted exposures, by country of residence of the counterparties**




bucket=RQRR_AIRB
200%
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LR5YLGD
DE
DE_DOM
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ES_DOM
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FR_DOM
IT
IT_DOM
Area Code

# Appendix 10: List of banks excluded from the analysis

Please find here listed the banks that have been excluded due to data quality issues:

- Wrong unit reported in comparison to COREP
  - BANK_037
  - BANK_035
- Amount different from COREP (more than 600%)
  - BANK_095
- Strange/wrong data for the RWA SA reported that caused a GC recomputed that is over the 1127%
  - BANK_068

Data quality problems present as of 22 September 2021:

| reason | TOT_rec |
|---|---|
| C 102 + C 103 - TOT prtf EAD > COREP | 7 |
| C 103 - EAD > COREP | 1107 |
| C 102 - EAD > COREP | 353 |
| C 101 - ABS(CT - (CR + CC)) >500000 | 1 |
| C 101 - wrong default status | 4326 |
| C 101 - negative RWA | 49 |
| C 101 - Duplicated PRFT ID | 21 |
| C 102 - wrong combination PD | 35 |
| C 102 - wrong portfolio ID | 5 |
| C 102 - CORP NFC/OFC Split vs Country - EAD | 10 |
| C 102 - if (PD, CCF, LGD <> 0) and PD <>1 and (Collateral value < EAD) | 32 |
| C 102 - RW >= 12.5 - Warning | 3 |
| C 102 - LGD < 0 or > 150% | 1 |
| C 103 - wrong portfolio ID | 3 |
| C 103 - DR(1Y) >= 1 for non-defaulted | 18 |
| C 103 - MORT_ALL tot non-def vs LTV split | 13 |
| C 103 - QC_SVB2021_22 - RETO_ALL tot non-def vs facility split | 13 |
| C 103 - QC_SVB2021_23 - RQRR_ALL tot non-def vs facility split | 1 |

**EUROPEAN BANKING AUTHORITY**

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