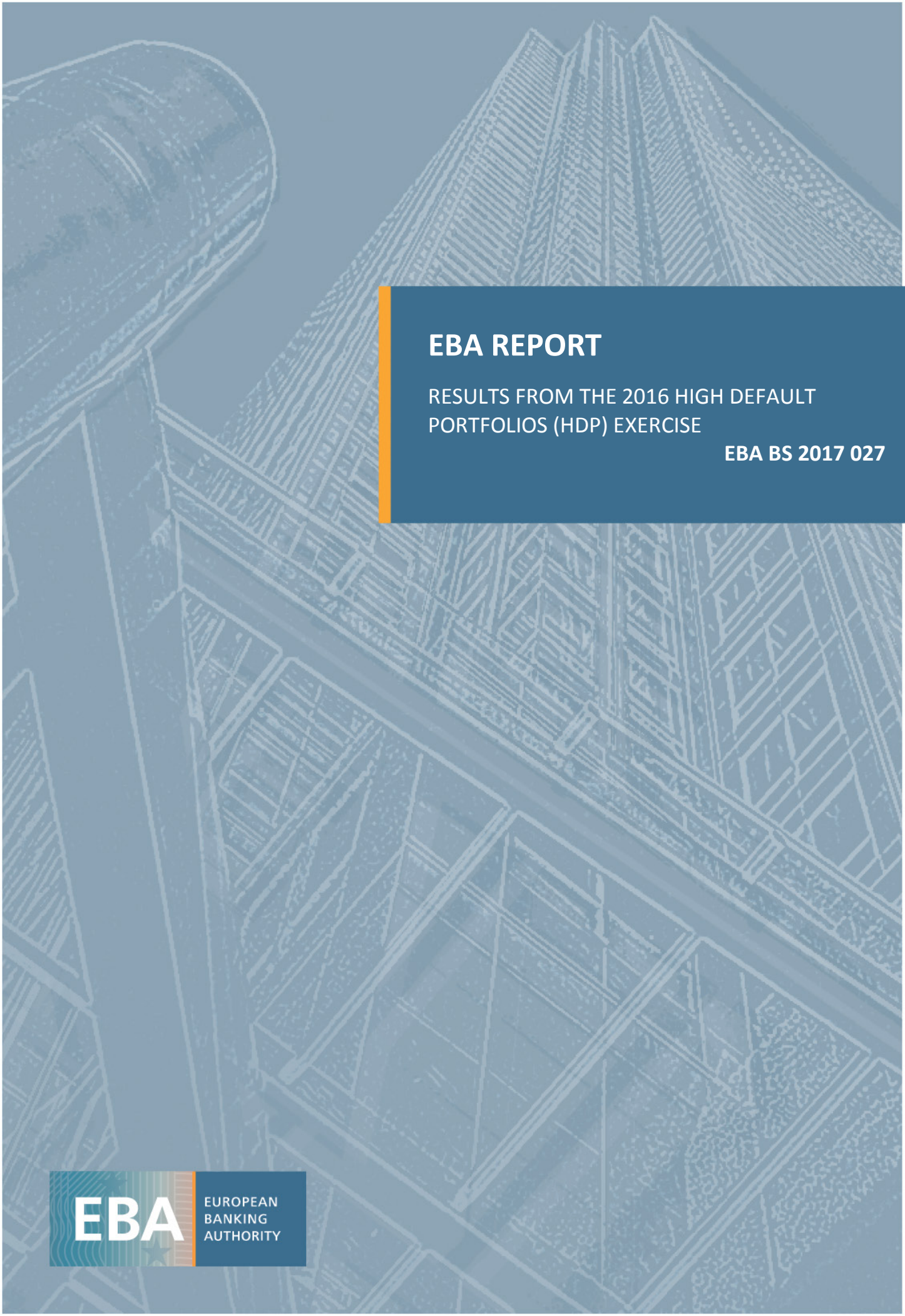

EBA REPORT

RESULTS FROM THE 2016 HIGH DEFAULT PORTFOLIOS (HDP) EXERCISE

EBA BS 2017 027

EBA EUROPEAN BANKING AUTHORITY

Contents

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Abbreviations

AIRB	advanced internal ratings-based
CA	competent authority
CCF	credit conversion factor
CET1	Common Equity Tier 1
COREP	Common Reporting
CRD	Capital Requirements Directive
CRM	credit risk mitigation
CRR	Capital Requirements Regulation
EAD	exposure at default
EBA	European Banking Authority
EL	expected losses
ELBE	expected loss best estimate
FIRB	foundation internal ratings-based
GC	global charge
HDP	high default portfolio
IRB	internal ratings-based
ITS	implementing technical standards
LDP	low default portfolio
LGD	loss given default
LTV	loan to value
PD	probability of default
RTS	regulatory technical standards
RW	risk weight
RWA	risk-weighted asset
SA	Standardised Approach
SMEs	small and medium-sized enterprises
UL	unexpected losses

1. Executive summary

This report presents the results of the supervisory benchmarking exercise for residential mortgage, SME retail, SME corporate and corporate-other portfolios (collectively referred to as 'high default portfolios'). The analysis is based on data reported at the highest level of consolidation, ensuring that the same data is used only once in the calculation of the benchmarks. The reference date for the data of this report is 31 December 2015, and 114 institutions participated in this exercise across 17 EU countries (covering, for the first time, the entire population of banks authorised to use credit risk internal models for calculating own funds requirements), a significant increase in the number of banks[1] in comparison with the number in previous EBA reports.

The aim of this study is to not only assess the overall level of variability in RWAs, but also examine and highlight the different drivers of the dispersion observed. Additional qualitative information on specific aspects was collected through interviews with a sample of 10 banks, allowing a better understanding of the approaches used by banks to calculate RWs and allowing key factors that can explain the observed differences.

In this report, two main indicators are employed: the average RW, or RWA density, and the average GC.[2] To quantify the variability, the standard deviation of the indicators observed at bank level is computed. Complementary metrics of the variability employed in this study are the interquartile range and the maximum versus minimum distance.

Two main approaches were developed to explain the drivers of RW variability, complemented by a more in-depth cross-sectional benchmarking exercise, a top-down approach and an outturns (backtesting) approach. Given the limitations and assumptions of the different approaches, their findings should be considered concurrently. In addition, some data quality issues, which are identified throughout the report, suggest that the results of the analysis should be interpreted with caution.

Main findings from the top-down approach

Beginning by considering the concept of GC variability, based on the standard deviation across banks, the EBA took a top-down approach to quantifying the proportion of this variability that can be explained, by controlling for some key drivers (default status, country of the counterparty and portfolio-mix, i.e. the proportions of different portfolios).

The results of this exercise are broadly in line with those of previous exercises on HDPs. Overall, the GC increased – if compared with previous exercises – to, on average, 75% (67% in the 2013 HDP report, which involved a smaller sample of larger banks). The GC variability[3] is also greater

[1] The previous reports on HDPs were published by the EBA in December 2013 and June 2014. In December 2013, 43 banks in 14 EU countries participated in the exercise, as in previous exercises, on a voluntary basis.

[2] GC, for IRB exposures, is computed as (12.5 * EL + RWA) / EAD.

[3] The GC provides the information for both EL and UL for IRB exposures.

than in previous exercises, ranging from 8% to 293% (14% to 174% in the 2013 HDP report). The RW average per institution varies from 7% to 129%, with a simple average of 37.3%.

The percentage of GC variability that can be explained by the drivers of heterogeneity and that is possible to control for with the available data is 82%, slightly higher than that in the 2013 HDP report (78%). A key finding is that a large part of the observed GC variability can be explained by only a few factors, namely the proportion of defaulted exposures, the proportion of non-EU exposures and the portfolio-mix. This confirms previous findings that RWA variability can be explained, to a large extent, by looking at some measurable features of banks' portfolios. However, in case banks have a value of zero for a specific cluster, this analysis assumes that those banks have the median of the GC for the bucket, and this may underestimate the possible variability. The remaining 18% of GC variability can be attributed to other reasons: first, the underlying credit risk (i.e. the risk profile in one portfolio) of each bank. Other possible reasons are the modelling assumptions and practices used by banks and supervisory practices.

Main findings from the cross-sectional approach

The cross-sectional (distribution analysis) approach was used to take an in-depth look at risk parameters and portfolios. For EU non-defaulted exposures, the RW interquartile ranges[4] show significant variability per portfolio, in particular for the two asset classes SME corporate and corporate-other. The country of the counterparty is an important driver of RW variability. Exposures located in EU countries that have experienced stressed macro-economic conditions tend to have higher average RWs. For different asset classes, the interquartile ranges broken down by country of the bank are in line with the EU benchmarking figures; however, they are higher in some EU countries. In general, the comparison between regulatory approaches (i.e. the FIRB and AIRB approaches) does not show significant differences for RWs. However, for risk parameters, there are differences between the FIRB and AIRB approaches (i.e. LGDs under the AIRB approach seem, in general, to be lower than under the FIRB approach, whereas the PDs for the FIRB approach are smaller than for the AIRB approach). Given the lower LGDs and CCFs for banks under the AIRB approach, possible compensations based on the estimation of PDs may be a reason for lower PDs under the FIRB approach.

Main findings from the outturn ('backtesting') approach

The outturn ('backtesting') approach compares observed values with estimated values for the individual banks. This approach shows that the estimated values for PDs and LGDs are, in general, higher than the observed default rates and loss rates, which suggests that banks are, on average, conservative.[5] However, some banks present observed values (latest year and the average of the past 5 years) of defaults and losses above the estimated values of PDs and LGDs and these banks need to be more closely analysed. The analysis confirms that the country of the reporting bank and of the counterparties is an important driver of RW variability and this may be due not only to the underlying risk but also to bank and supervisory practices. When interpreting the findings, it is

[4] The difference between the 25th and 75th quantiles, i.e. the range in which ordered values will cover 25% to 75% of all cases.

[5] It is not a 'real' backtesting approach, as there is a mismatch between the reference dates for observed and estimated values, as well as a weighting issue (exposure versus case weighted).

important to understand the limitations of this approach, which are described in this report. Therefore, the outcome from this exercise should be used in conjunction with supervisor knowledge and bank- or country-specific circumstances.

CAs' assessments based on supervisory benchmarks

CAs provided individual assessments on the quality of the benchmarked models for each bank. For the majority of the banks, the RW deviations from the EU benchmarks were deemed by the CAs to be justified and not significant. In the remaining cases, the assessment shows that residential mortgages are deemed to be one of the most important portfolios to monitor because of their importance for banks and their potential impact on RWAs. CAs also consider that both corporate-other and residential mortgage portfolios present the highest numbers of possible underestimations when using benchmarking values, for which there are no immediate justifications, and comprehensive analyses are necessary with possible supervisory actions. The report also highlights that banks' internal validations had not identified most of the potential underestimations.[6] By contrast, most CAs noted that possible underestimations were identified in advance, in particular for both corporate-other and SME corporate portfolios, and that supervisory actions were being taken to address such issues.

Possible impact on the CET1 ratio based on observed defaults instead of PD estimates

The study concludes with an estimation of the possible impacts in terms of the CET1 ratio.[7] This analysis shows that, if the RWAs were replaced by higher RWAs driven by both PDs and observed default rates, rather than estimated PDs alone, the average CET1 ratio would decrease only slightly, by 17 bps. This impact should be interpreted with caution because of both the data quality issues and the fact that the higher RWAs were not designed to estimate possible impacts.[8] In addition, the additional possible impact of using the observed loss rates (instead of original LGDs) is not considered. The impact determined in this exercise does not suggest the existence of a shortfall of this particular magnitude.

[6] As part of the ongoing validations and audits of internal models.

[7] For this impact analysis, only potential negative variations (i.e. the reduction of the CET1 ratio) are considered; therefore, possible positive variations and the consequent compensation effects are not included.

[8] The alternative higher RWAs are not designed as a measure of conservatism and the data quality issues identified on the templates submitted by participating institutions (see annex for more details) are connected in part to the use of new definitions introduced by the ITS and the parameters calculated by institutions for the purpose of the exercise only.

2. Introduction and legal background

As part of the EBA's programme that investigates RWA variability across banks and the drivers of differences between banks, this report presents the results of the 2016 supervisory benchmarking exercise of internal approaches for calculating own funds requirements for HDPs.[9] The reference date for the data is 31 December 2015. Previous reports on the same topic (HDPs) were published by the EBA in December 2013[10] and June 2014,[11] and similar studies, although focused on LDPs, were published in February 2013, August 2013 and July 2015.[12]

The EBA's focus, in accordance with Article 78 of the CRD,[13] is twofold: (i) the calculation and delivery of benchmarks to support the work of the CAs related to the regular assessment of internal approaches applied by the institutions for calculating own funds requirements and (ii) the identification of situations with significant RWA variability for the same type of exposure and potential significant underestimations of capital requirements. This information serves as a useful input for CAs' assessments and possible supervisory actions.

The data collection is based on technical standards specifically designed for annual supervisory benchmarking exercises and covers different breakdowns of portfolios by, for instance, country, type of collateral, LTV ratio or sector to help understanding the impact of these factors on the different key risk drivers, such as PD, LGD, CCF and RW estimates. In addition, some qualitative information and more in-depth information on specific aspects – such as banks' modelling methodologies, data sources, lengths of time series, definitions of risk parameters, and number and scope of internal models – have been collected through interviews with a sample of 10 banks in the exercise.

In accordance with Article 78 of the CRD, CAs need to, at least annually, make an assessment of the quality of the institutions' internal approaches. Each CA shared the outcome of its assessment with the EBA and the other relevant CAs (home and host CAs). The regular supervisory benchmarks on internal approaches developed by the EBA and shared with the CAs are considered a useful monitoring supervisory tool to support the CAs' assessments of internal models. The exercise applies, for the first time, the new framework designed by the EBA via the ITS and RTS published in March 2015.

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[9] HDPs include residential mortgage, SME retail, SME corporate and corporate-other portfolios.

[10] EBA report 'Third interim report on the consistency of risk-weighted assets: SME and residential mortgages'. https://www.eba.europa.eu/documents/10180/15947/20131217+Third+interim+report+on+the+consistency+of+risk-weighted+assets+-+SME+and+residential+mortgages.pdf

[11] EBA report 'Fourth report on the consistency of risk-weighted assets: Residential mortgages drill-down analysis'. http://www.eba.europa.eu/documents/10180/15947/20140611+Fourth+interim+report+on+the+consistency+of+risk-weighted+asset.pdf

[12] 'Review on the consistency of Risk Weighted Assets'. http://www.eba.europa.eu/risk-analysis-and-data/review-of-consistency-of-risk-weighted-assets

[13] Capital Requirements Directive > TITLE VII > CHAPTER 2 > Section II > Sub - Section 2 > Article 78. https://www.eba.europa.eu/regulation-and-policy/single-rulebook/interactive-single-rulebook/-/interactive-single-rulebook/article-id/300

From 2018 onwards, these studies will form part of yearly supervisory benchmarking exercises and requirements for institutions, CAs and the EBA concerning setting up a regular benchmarking process to assess the internal models used to compute own funds requirements (with the exception of operational risk).

Technical standards produced by the EBA establish requirements for the CAs' assessments of institutions' internal approaches used for the calculation of own funds requirements. They also establish standards for the submission of relevant information by institutions and the procedures for sharing CAs' assessments among CAs and the EBA.

The main objective of this report is to provide an update on the monitoring of RWA variability in order to understand drivers of such variability and to define possible measures for addressing them.

The EBA provides feedback to participating institutions on benchmark parameters in order to complement the information available to institutions for monitoring of their internal models. The EBA considers that feedback on benchmark parameters provides positive incentives for institutions to continuously improve the data quality of their regular data submissions in future supervisory benchmarking exercises.

The report is organised as follows: Chapters 3 and 4 introduce the details regarding the dataset, assessment methodology, portfolio composition and characteristics of participating institutions; Chapter 5 provides a top-down analysis of the current RW variability and shows that a significant part of this variability can be explained, with the main drivers for such variability presented; Chapter 6 provides an analysis of IRB parameters using benchmark parameters and outturns (backtesting), with some additional details given regarding RW variability; Chapter 7 presents an impact analysis using the CET1 ratio, taking into account some assumptions; Chapter 8 summarises the CAs' assessments based on the benchmarks; and Chapter 9 gives conclusions and discusses future work.

3. Dataset and assessment methodology

Altogether, 114 institutions[14] from 17 EU countries participated in this study and submitted data as of 31 December 2015. For this report, the analysis is based on data reported at the highest level of consolidation only.[15] The data allowed two types of analyses to be performed: a top-down analysis of institutions' actual portfolios and an analysis of IRB parameters based on different techniques, namely a cross-sectional (distribution analysis) approach and an outturn (backtesting analysis) approach. After some data cleansing, the number of institutions was reduced to 99.[16]

Data

The HDP-specific data used for top-down analysis provides information on each institution's actual exposure values and IRB parameters, broken down by their default status, by whether they are in EU or non-EU countries, by portfolio and by each EU country. In contrast to previous HDP reports, no information on exposures rated under the SA (either on a roll-out plan or under the permanent partial use allowance) and no information on portfolios other than the HDPs was collected.

The report relies on data collected according to the ITS on supervisory benchmarking,[17] complemented by COREP[18] data when necessary. The reference date is 31 December 2015.

In general, the HDPs have been defined as all of the remaining portfolios not considered as LDPs (governments, financial institutions and large corporate portfolios). Further breakdowns in the categories (e.g. SME retail) follow the regulatory definitions. For the 2016 HDP exercise, the data included residential mortgage, SME retail, SME corporate, and corporate-other portfolios (not including the remaining HDPs, for instance credit card portfolios or consumer credits).

In addition, the number of institutions is not stable across portfolios and sub-portfolios; consequently, institutions that did not report exposures for certain portfolios (e.g. some

[14] EBA list of institutions (published). See Annex 1 for details.

[15] Banks also reported at a solo level basis. This data at a solo level basis is used by several CAs to produce additional analysis at the country level. The use of only consolidated level data ensures that the same data is used only once in the calculation of the benchmarks.

[16] See Annex 3 for details.

[17] Annex I of the ITS provides the definitions of the supervisory benchmarking portfolios that are required for the 2016 exercise. Annex III of the ITS provides the instructions and details on exposures, that is, the data collected. Both ITS annexes have the same name (i.e. template code) for the definitions and details on exposures, i.e. Template C 103.00. In addition, Annex III also provides further details of internal models and the mapping of internal models (Templates 105.1 and 105.2, respectively; see annexes) to portfolios (Annexes II and IV of the ITS, Template 103).

[18] Common supervisory reporting requirements are specified by the EBA via the ITS, which was adopted by the EU Commission as Regulation 680/2014.

institutions do not have certain types of exposures in their portfolio-mix) were excluded from the analyses.

Data quality

The data collection for this exercise was based on a larger sample than in previous exercises and on new technical standards and definitions, so there are data quality constraints and the findings should be interpreted with caution. The way in which different banks interpreted some of the data fields (e.g. loss rate) was noted during the interviews with banks, as this may also have an impact on data quality. While not strictly data errors, different interpretations would potentially explain some outlier values. Regarding the possible impact on CET1, the findings may require some data quality improvements.

Use of the benchmarking exercise

During the exercise, the EBA computed benchmarks on risk parameters and portfolios and provided detailed feedback and institution-specific reports to the CAs. The benchmarking exercise allowed CAs to assess the outcomes of institutions' internal models compared with a wider scope of institutions. Using additional bank- and model-specific information from regular ongoing supervisory functions and previous CAs' assessments of internal models also helped to identify potential non-risk-based variability across participating institutions. CAs are requested to share the evidence they have gathered among colleges of supervisors, as appropriate, and to take appropriate corrective actions to overcome drawbacks when deemed necessary. CAs' assessments of individual institutions in their jurisdictions were shared with the EBA and key findings of these assessments were used to support some findings from specific analyses throughout the report. A summary of the findings from CAs' assessments is presented in Chapter 8.

Moreover, interviews were carried out with a sub-sample of 10 participating banks to gather qualitative information. The selection of participating banks for the interviews was based on the computed benchmarks on risk parameters and portfolios, with a special focus on conspicuous results. The aim of those interviews was to better understand the approaches used by individual institutions to calculate own funds requirements and to identify key factors and drivers that can explain observed differences.

Assessment methodology

The report starts with a top-down approach similar to that used and discussed in previous EBA supervisory benchmarking reports. This methodology tries to disentangle the impact of some key determinants of the GC[19] on variability. In contrast to previous reports and due to different bases

[19] GC, for IRB exposures, is computed as (12.5 * EL + RWA) / EAD.

for data collection, it was not possible to determine the proportion of partial use of the SA[20] (permanent and roll-out) and the difference in the GC for exposures under the SA in the current study. Hence, direct comparisons with previous reports may not always be possible.

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

The top-down analysis is followed by:

i) **The cross-sectional approach** – a distribution analysis which covers partly Article 3(2a) and (2b) and Article 9 of the RTS. The distribution analysis allows the institutions' estimates to be examined. Moreover, it identifies extreme values and values below the first quartile or above the third quartile for important parameters of the sample.

ii) **The outturns approach** – a comparison using the (backtesting) outturns approach (i.e. a comparison of observed values with estimated values for important parameters).

The cross-sectional approach has advantages and shortcomings and its results should be taken in conjunction with the findings of the other approaches. The main advantage is that it allows outliers to be easily identified, after controlling for some portfolio characteristics. In addition, this type of 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 EU-country 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.

On the other hand, and in contrast to the exercise for LDPs, for HDPs it is not possible to compare the same counterparties across institutions, but it is only possible to control for some of the key features of exposures. At the same time, retail exposures are more country driven, so the comparisons across countries are more difficult to develop. The distribution analysis at the cluster level allows a set of counterparties that are as similar as possible, but not counterparties and exposures that are exactly the same, to be compared (as in the case of the use of real and hypothetical portfolios). This is an important limitation and the reason why the outturn (backtesting) approach is a good and valuable process for comparison among banks, despite this approach also having some shortcomings. In addition, being in the first quartile for the different parameters may simply be a reflection of the level of risk.

[20] Difference in the proportion of exposure classes treated under the SA and the IRB approach.

Moreover, regulatory floors need to be taken into account (e.g. from Article 164(4) of the CRR: LGD floors for residential property are 10% and LGD floors for commercial property are 15%) and possible differences per jurisdiction (national discretions from Article 164(5): CAs may increase the regulatory floors).

The outturns approach allows observed and estimated values to be compared and provides information about banks' realised credit performance history (default rates, loss rates and actual defaulted exposures, as well as averages of the past 5 years for default and loss rates) and the corresponding IRB parameters (PD, LGD and RWA), as well as PD backtesting results (RWA* and RWA**).[21] These comparisons allow an analysis to be conducted on possible misalignments between IRB estimated and observed parameters for the same bank.

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

Using the information provided by banks according to the ITS,[22] it is possible to compare, for the same bank and across banks, the estimated parameters with the observed parameters, namely the following indicators:

- estimated parameters (IRB parameters): PD, LGD and RWA;
- observed parameters: the default rate of the latest year, the default rate (average) of the past 5 years, the loss rate of the latest year and the loss rate of the past 5 years; and
- backtesting results: RWA* and RWA**.

The main indicator is the ratio between the observed value and the estimated value for comparable parameters. A result above 1 indicates a bank with an observed value higher than the bank's estimate for the same (comparable) parameter. This ratio is calculated at the portfolio level[23] per bank. Backtesting at the bank level is already informative for supervisors, but additional information can be derived from the comparison of results across banks (e.g. looking at key descriptive statistics). Observed–estimated value ratios can thus be compared for the same portfolio per country of the bank (see Annex 4 for details).

[21] The risk-weighted exposure amounts, after applying the SME supporting factor, that would result from the application of PD* (derived from the case-weighted default rate of the latest year for the rating grade) and PD** (derived from the case-weighted default rate of the past 5 years for the rating grade and the PD) instead of the original PD on the rating grade level shall be reported. See Commission Implementing Regulation (EU) 2016/2070, OJ L 328, 2.12.2016 (Annex IV, Part II: Template Related Instructions, C 103 — Details on exposures in High Default Portfolio (Column 230 and 240)) for details.

[22] Annex IV, Template C 103.00, of the ITS.

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

The computed ratios between comparable observed values and the estimated values are the following:

Outturn approach

Default rate (latest year) / PD	(...)	Default rate (past 5 years) / PD	(...)	Loss rate (latest year) / LGD	(...)	Loss rate (past 5 years) / LGD	(...)	RWA* / RWA	(...)	RWA** / RWA	(...)
190/060	(...)	200/060	(...)	210/130	(...)	220/130	(...)	230/170	(...)	240/170	(...)

The persistence of banks as outliers for both periods, i.e. 1-year rate and the average of 5 years, and across comparable parameters can be examined by the CAs.

PD estimates are required by Article 180 of the CRR to be representative of the long term. As such, a direct comparison between PD estimates and the default rates observed in the past 5 years to identify a potential underestimation needs to take that into consideration (i.e. the past 5 years might not be representative of the long term). In addition, the LGD estimates should be appropriate for downturn conditions and include considerations of collection-related costs, appropriate discounting, etc. As a result, a direct comparison between LGD estimates and recent loss rates to identify potential risk underestimation should also take such differences into account.

In addition, the observed parameters reported by banks are also influenced by the country characteristics. In particular, for retail exposures, given the domestic focus of most participating banks, the counterparties' creditworthiness is influenced by several country-specific factors, such as the macro-economic cycle, accounting framework and judicial system. Jurisdictions under a downturn macro-economic cycle tend to show a growth in observed default rates and loss rates, and the comparison with risk parameters will reflect the credit quality deterioration. Furthermore, the realised losses on defaulted exposures are influenced by the wide variation in loss recognition practices across jurisdictions, which influence the timing and the amounts of recorded losses, as well as by the limitations in the data used for estimations (i.e. limited to provisions raised and write-offs in the year of the default event). Therefore, the breakdown by jurisdiction (country of counterparty) is useful to control for such aspects. Moreover, the data allowed only the comparison of PDs at the reference date (31 December 2015) with the default rate observed during 2015 (and also an average of the past 5 years), whereas it would be best to compare this default rate with the PD at the beginning of the observation period (31 December 2014). The use of the EAD-weighting of loss and default rates in the backtesting is another issue, as the EAD weights are often not relevant for the calibration of models in banks. Further issues include the different time periods for capturing observed and realised values and the complexity of the model landscape in large banks.

4. Portfolio composition and representativeness

In this chapter, the characteristics of the samples and the participating institutions are described, presenting the level of representativeness for possible extrapolations, the type of regulatory approaches used by participating banks and the portfolio composition. The 2016 supervisory benchmarking exercise includes, for the first time, all banks that use internal approaches for calculating own funds requirements for HDPs. This significantly increases the representativeness of the exercise. The information in this chapter should be interpreted in conjunction with the remaining chapters, as portfolio composition and other characteristics might help to explain RW variability.

Use of regulatory approaches

Institutions participated in the 2016 HDP supervisory benchmarking exercise if they used the IRB approach for at least one of the HDPs, or sub-portfolios, for calculating own funds requirements as of 31 December 2015. Few institutions use different approaches (i.e. a mixed approach) within a given type of portfolio, for instance in the case of consolidation of entities and portfolios from different countries (in the interviews with banks, it was also possible to discuss the situation in which some jurisdictions allow the use of FIRB and AIRB approaches in one asset class based on banks' internal definition of sub-portfolios). For HDPs, most of the institutions reported the use of the AIRB approach.

Figure 1: Overview of the number of institutions and the use of regulatory approaches, by portfolio, for calculating own funds requirements as of 31 December 2015[24]

Portfolios	AIRB	FIRB	Total
Residential Mortgage	77	-	77
SME Retail	62	-	62
SME Corporate	43	30	73
Corporate-Other	48	33	81

The proportion of institutions using the AIRB approach for HDPs is almost identical to that in previous HDP reports. Regarding the use of the SA, detailed information was not requested via

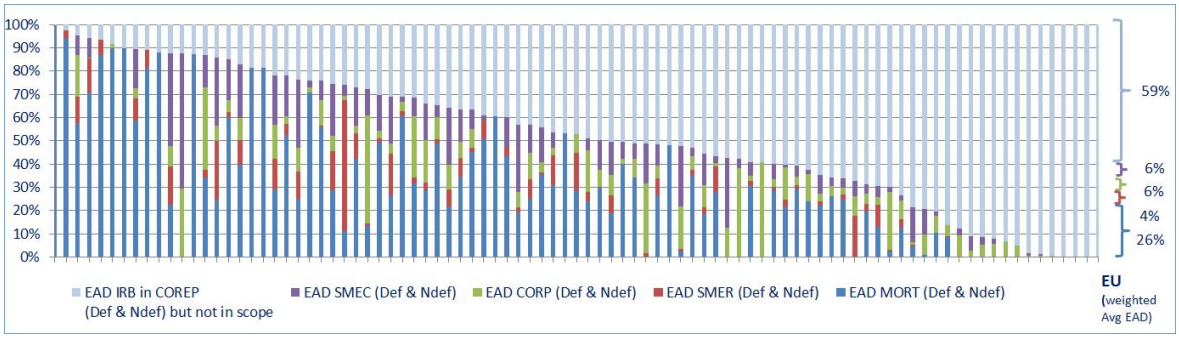
[24] Commission Implementing Regulation (EU) 2016/2070, OJ L 328, 2.12.2016 (Annex IV, Part II: Template Related Instructions, C 103 — Details on exposures in High Default Portfolio): the regulatory approach used for calculating own funds requirements shall be reported under the FIRB approach only if exposures under this approach represent 50% or more of the IRB exposures to the counterparty. For residential mortgages, one bank applied the FIRB approach for corporate exposures, and part of the retail exposure secured by real estate was reported as the FIRB approach, because the exposures were actually assigned to a corporate customer due to a pooling approach. However, for calculation of own funds requirements, the exposures are correctly included in the AIRB portfolio in Figure 1. For SME retail, one bank incorrectly reported as being under the FIRB approach; however, for the overview of the number of banks, it is correctly considered as under the AIRB approach.

HDP data collections, and COREP figures were not available at the EBA for all participating institutions.

Portfolio composition and representativeness

The relative EAD-weighted proportions of the different portfolio types for the banks in the sample, comparing data submitted for the HDP exercise with COREP data [25] as of 31 December 2015, provides information on the portfolio composition by bank.[26]

Figure 2: HDP exposure compared with total IRB exposure, by bank[27]



At bank level, there are significant differences in the use of internal approaches and the portfolio composition among the participating institutions. In terms of EAD, the proportion of the overall IRB HDP compared with institutions' total IRB credit risk portfolio differs considerably between institutions (from less than 1% to 100%).

The use of internal models for both HDPs and LDPs is significant, with very few participating institutions using internal approaches only for HDPs. For almost 50% of the participating institutions in the exercise, the HDPs represent only 50% of the total EAD under the IRB approach of those participating institutions. For more than 20 participating institutions, the HDPs represent less than 40% of the total EAD under the IRB approach. This highlights the scope of this exercise and the importance of LDPs and other HDPs not covered (e.g. credit card portfolios) in terms of total EADs under internal approaches and when drawing conclusions about the internal models in general.

For the banks in the sample, residential mortgage represents 62% of the HDP EAD, SME retail represents 9%, SME corporate represents 14% and corporate-other represents 15%. The findings of this report are valid for HDPs only and cannot be generalised to other portfolios.

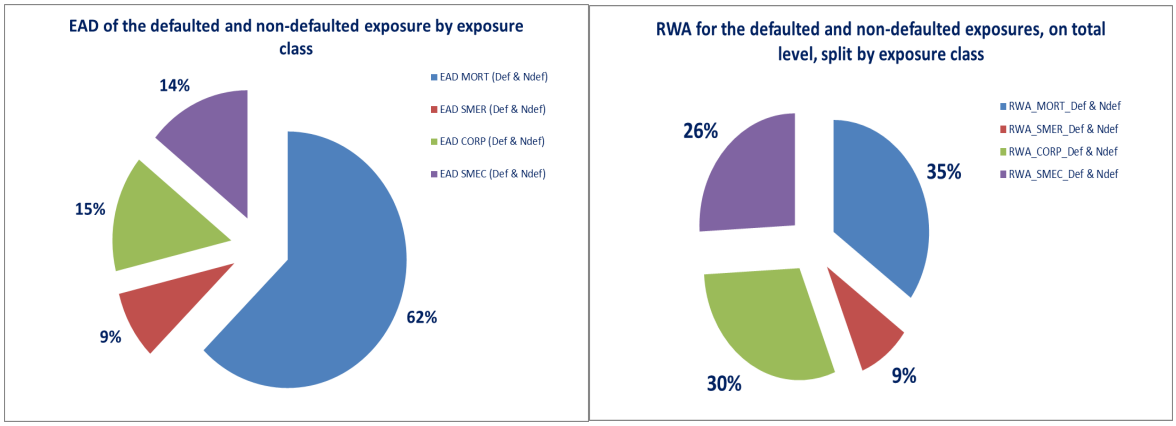
[25] Total EAD under the IRB approach in COREP = total EAD for HDPs and LDPs.

[26] Institutions that did not provide COREP data or institutions that did not pass quality checks were excluded from the comparisons with COREP. Exposures not submitted for this HDP exercise include large corporate portfolios, institutions, sovereigns and retail exposures, such as credit card exposures.

[27] EAD (of HDPs – Def and Ndef – under the IRB approach) for exposure class (residential mortgages, SME retail, SME corporate and corporate-other) and total IRB portfolio by COREP C 08.1a.001 and C 08.1a.002 for the December 2015 data. Participating banks that did not submit Template C 08.1a.001 and/or Template C 08.1a.002 or that submitted an EAD greater than the one in those templates were excluded from this figure and the EU portion.

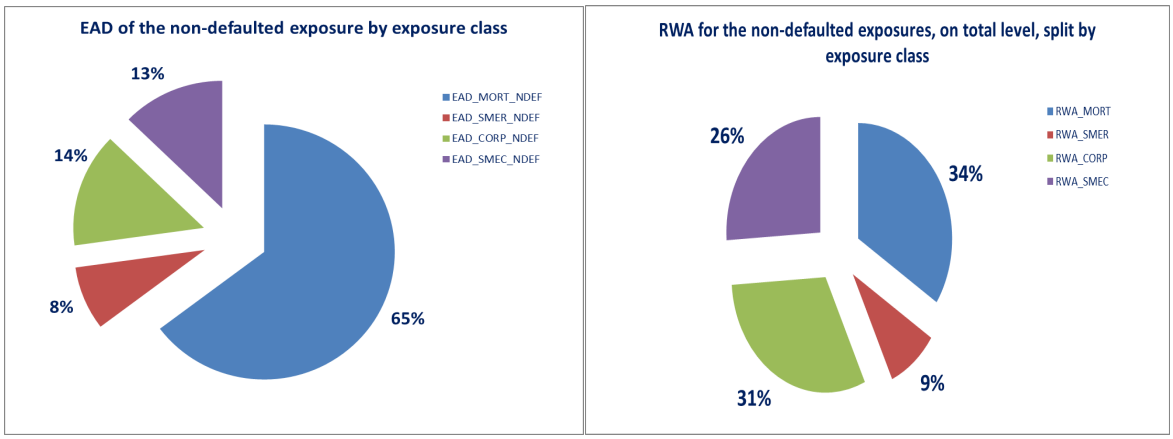
In contrast to the above, interpreting the RWA figures for defaulted exposures from a combination of approaches is inherently different and should be taken into account. For defaulted exposures under the AIRB approach, the RWs can be significantly different from zero, and are not directly comparable to defaulted exposures under the FIRB approach.[28]

Figure 3: Portfolio composition of the HDPs



The analysis of non-defaulted exposures shows, as expected, that the RWAs from the four types of HDPs are not directly proportional to the EAD. Residential mortgage represents 62% of the total EAD but only 34% of the total RWA. On the other hand, both SME corporate and SME retail portfolios show a higher proportion of RWA in comparison with the EAD (e.g. SME corporate represents 14% of the total EAD and 26% of the total RWA). This reflects the importance of the portfolio-mix as a driver for RW levels and possible RW variability.

Figure 4: Credit risk composition (% of total EAD) and RWA for non-defaulted exposures, by portfolio (residential mortgage, SME retail, SME corporate and corporate-other portfolios)



The EAD distribution across the four HDPs shows that some institutions are exposed to only one portfolio, namely residential mortgage (12 institutions) or corporate-other (eight institutions).

[28] AIRB {RW = max [0; 12.5 * (LGD – ELBE)]} and FIRB (RW = 0).

Other institutions show only two types of portfolios, i.e. corporate-other and SME corporate (nine institutions) or residential mortgage and SME retail (three institutions). The remaining (namely the majority) of participating institutions report a HDP mix of three or four main HDPs. These differences reflect the importance of the portfolio-mix as a driver of RW variability.

Figure 5: EAD distribution of non-defaulted exposures, for residential mortgage, SME retail and SME corporate portfolios, for IRB approaches, by bank

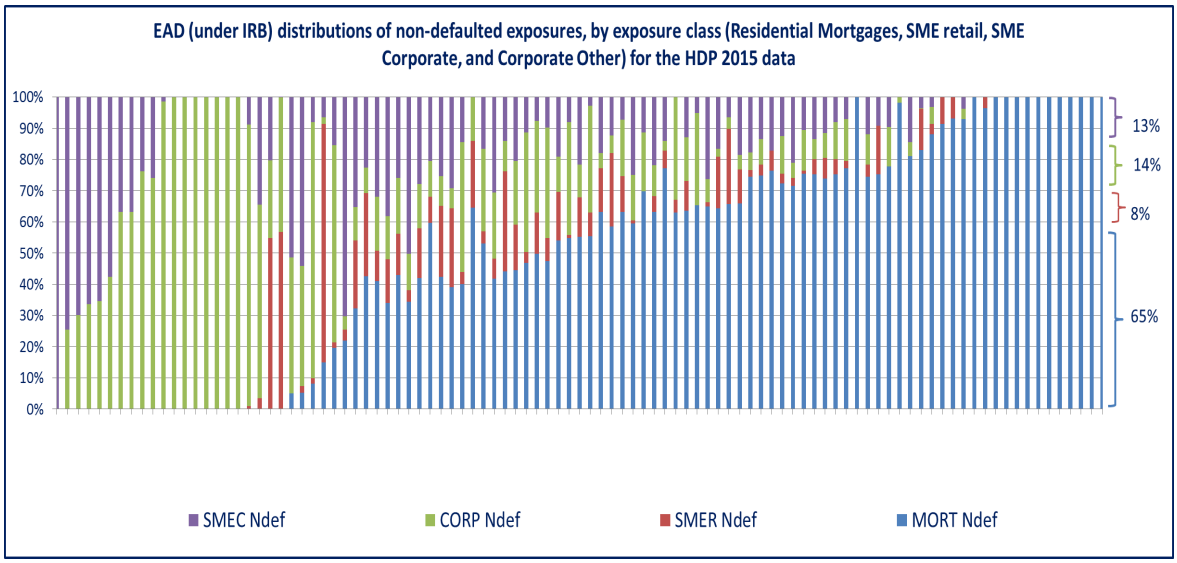
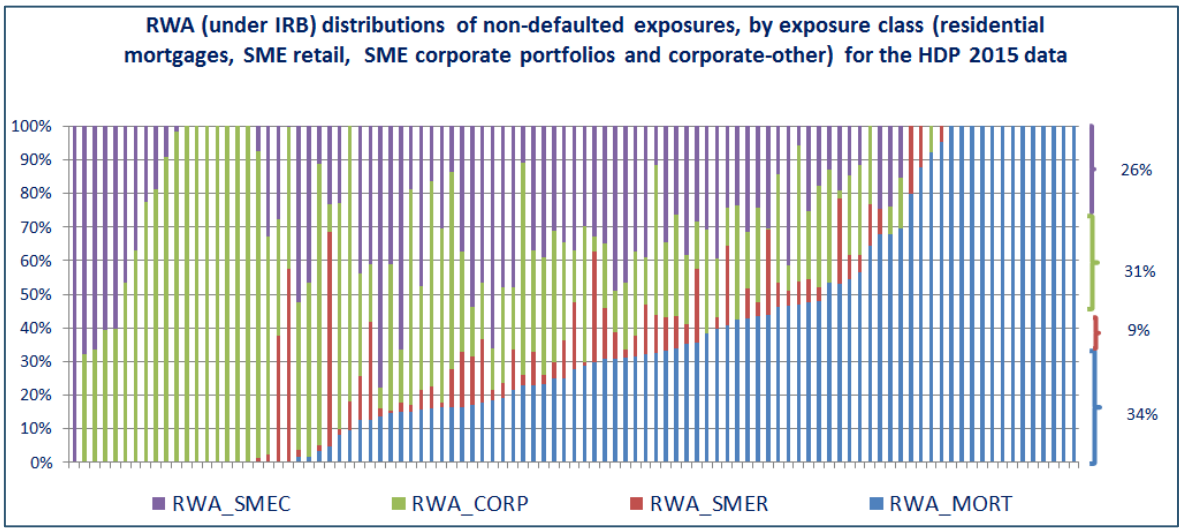


Figure 6: RWA distribution of non-defaulted exposures, for residential mortgage, SME retail, SME corporate and corporate-other portfolios, for IRB approaches, by bank



5. Top-down approach

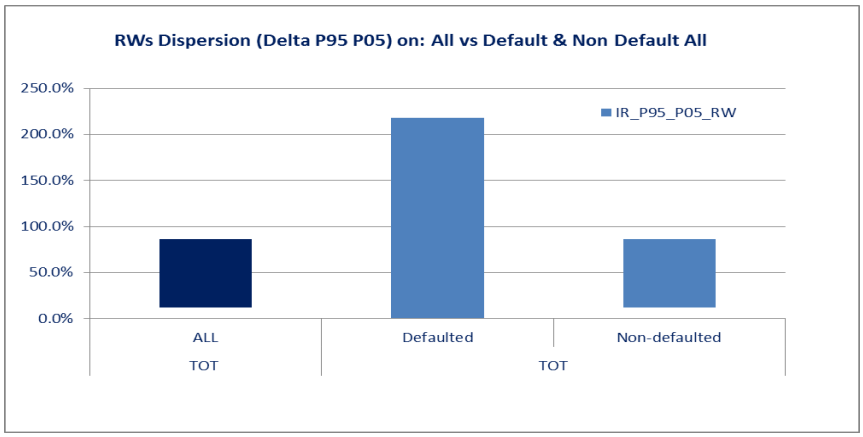
This chapter aims to determine and analyse the main drivers behind RW variability across the participating institutions. In the top-down approach, two indicators are used to summarise the results of the variability: the GC,[29] taking into account both EL and UL, and the RW (for the UL).

Risk weights

The average RW per institution varies from 7% to 129%, with a simple average RW of 37.3% (and a weighted average of 25%) across the sample. This compares to a simple average of 35% reported in the 2014 LDP report and 32% in the 2013 HDP report.

The RW variability is much higher for defaulted exposures (the difference between the 5th and 95th percentiles above 200%) than for non-defaulted exposures (lower than 90%). The regulatory approach may explain, in part, this higher degree of variation given that, for the FIRB approach, the RWs for defaulted exposures are 0%; however, the RW variability is also higher for defaulted exposures than for non-defaulted exposures for the AIRB approach.

Figure 7: RW variability, by status (defaulted exposures and non-defaulted exposures)[30]

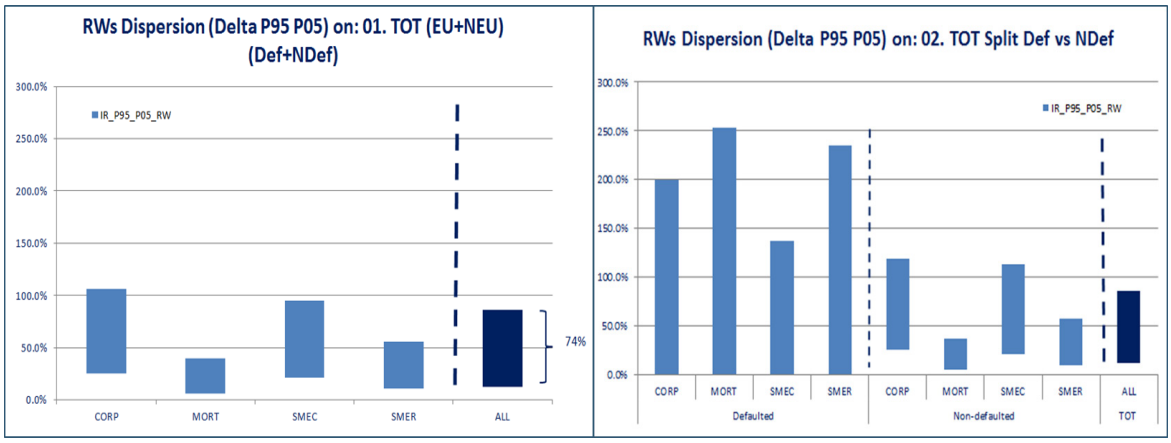


The various asset classes also show significant differences in RW variability. Considering both defaulted and non-defaulted exposures, the quantile differences between the 5th and 95th percentiles for the RWs is higher for both corporate-other and SME corporate portfolios than the other portfolios. The same applies if only non-defaulted exposures per type of portfolio are considered. For defaulted exposures per type of portfolio, the analysis shows higher variability for both residential mortgage and SME retail portfolios than the other portfolios.

[29] GC, for IRB exposures, is computed as (12.5 * EL + RWA) / EAD.

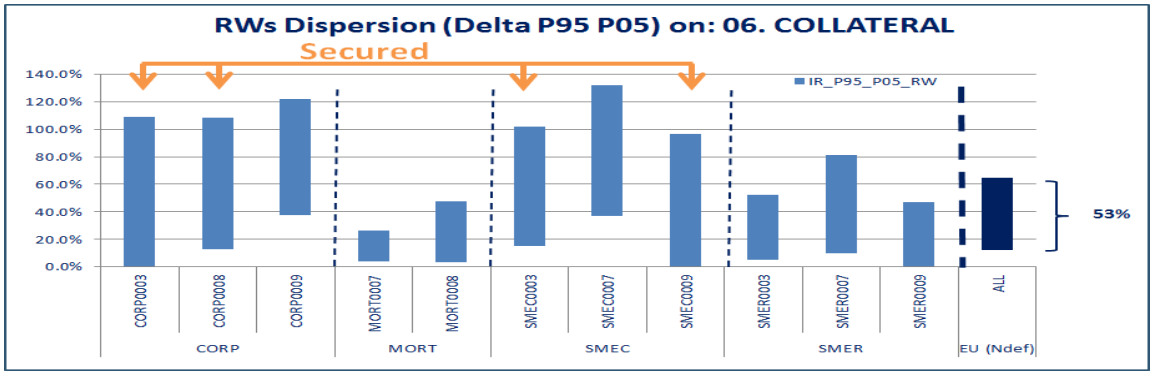
[30] RW dispersion (Delta P95 P05) on all versus defaulted and non-defaulted all.

Figure 8: RW variability, by status (defaulted exposures and non-defaulted exposures), by portfolio (residential mortgage, SME retail, SME corporate and corporate-other portfolios)



The type of collateral per portfolio, for non-defaulted exposures, for both SME corporate and corporate-other portfolios show a higher degree of RW variability for more collateralised portfolios (namely non-real-estate-funded collateral[31] and other eligible collateral real estate,[32] as well as non-real-estate-funded collateral[33] and other eligible[34]), which can be partly explained by different collateralisation levels. The data should, however, be interpreted with caution, given that there are some data quality constraints and different interpretations were made of the collateral split during the data collection, as highlighted during the interviews with banks. Ultimately, this hampered the ability to draw definite conclusions about the amount of RWA variability explained by this dimension.

Figure 9: RW variability, by portfolio (residential mortgage, SME retail, SME corporate and corporate-other portfolios)[35]



[31] CORP0003.

[32] CORP0008.

[33] SMEC0003.

[34] SMEC0009.

[35] CORP003, 'corporate-other non-defaulted secured, non-real-estate-funded collateral'; CORP008, 'corporate-other non-defaulted secured, other eligible collateral: real estate'; CORP009, 'corporate-other non-defaulted unsecured'; MORT0007, 'real estate collateral, other funded CRM and/or personal guarantees'; MORT0008, 'real estate collateral and other unfunded CRM'.

Methodology and assumptions

The methodology for presenting the percentage of total GC variability that can be explained once its main drivers are controlled for (for each, some interdependency is possible) is based on the standard deviation (% total GC standard deviation). As a starting point, the total GC for each participating bank is computed as:

$$\%\ \text{total GC bank}_{\ i} = (12.5 * \text{EL}_{\text{bank i}} + \text{RWA}_{\text{bank i}}) / \text{EAD}_{\text{bank i}}$$

The standard deviation[36] of the total GC is:

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

Where total GC bank $_i$ represents each bank's GC (as a percentage), total GC average is the mean of the GC in the sample and *N* is the number of participating banks in the sample.

The standard deviation of the total GC is then broken down successively to control for the characteristics of the exposures. First, the GC standard deviation is computed for defaulted exposures and non-defaulted exposures separately. In this exercise, and in previous exercises, the RW variability is much higher for defaulted exposures than for non-defaulted exposures, thus justifying the first breakdown.

For defaulted exposures, a % GC at the bank level is calculated (% $GC_{i, DEF}$). The GC of each bank is then weighted by the proportion of EADs that was reported as defaulted exposures in the sample (6%):

$$\%\ \text{GC bank}_{\text{i, DEF}} = [(12.5 * \text{EL}_{\text{bank i, DEF}} + \text{RWA}_{\text{bank i, DEF}}) / \text{EAD}_{\text{bank i, DEF}}] * \%\ \text{EAD}_{\text{DEF}}$$

For non-defaulted exposures, a similar calculation at the bank level is carried out:

$$\%\ \text{GC bank}_{\text{i, NONDEF}} = [(12.5 * \text{EL}_{\text{bank i, NONDEF}} + \text{RWA}_{\text{bank i, NONDEF}}) / \text{EAD}_{\text{bank i, NONDEF}}] * \%\ \text{EAD}_{\text{NONDEF}}$$

A weighted average (but based on the average proportion of EAD_{DEF} and EAD_{NONDEF} for the sample) is then calculated, assuming that the percentage of defaulted and non-defaulted assets is the same across banks and equal to the sample averages:

$$\%\ \text{GC bank}_{\text{i, DEF, NONDEF}} = \%\ \text{GC bank}_{\text{i, DEF}} + \%\ \text{GC bank}_{\text{i, NONDEF}}$$

This allows for effects derived from specific EADs for each bank to be controlled and for 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 bank, based on its own estimates of the risk parameters, but

36 $\sqrt{\frac{\sum (x-\mu)^2}{N}}$.

assuming that the percentage of defaulted and non-defaulted assets is the same across banks and equal to the sample averages.

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

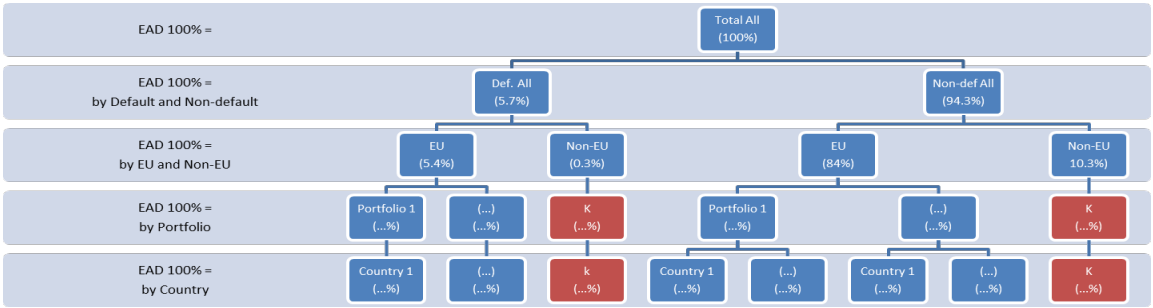
$$Standard\ deviation\ of\ \%\ GC\ (DEF, NONDEF) = \sqrt{\frac{\sum\left(\%\ GC\ bank_{\ i,DEF,NONDEF} - \%\ GC\ average\right)^2}{N}}$$

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

As a second step, exposures are further broken down based on the region of the counterparty into two groups: EU countries and non-EU countries.

The same methodology is repeated for controlling for additional dimensions seen as drivers of GC variability, namely all portfolios (asset classes) and all countries of the counterparty for EU exposures, as shown in Figure 10. The methodology does not intend to estimate the specific variability for each cluster or dimension at the individual level (e.g. it does not intend to make comparisons at the portfolio level), but instead intends only to provide the general contribution of the main drivers as a whole, i.e. the total GC variability.

Figure 10: Breakdown of the sample according to main characteristics



The total EAD and the number of banks are maintained across the breakdowns (EAD 100% in Figure 10). This allows the same basis of the initial total GC standard deviation to be maintained and then a subsequent and more direct split of such variation in different clusters of each breakdown (e.g. defaulted exposures and non-defaulted exposures, etc.).

However, to maintain the same sample of the initial total GC standard deviation in the case of participating banks that have a value of zero for a specific cluster, those banks are assumed to have the median of the GC for the bucket. This assumption may underestimate the possible variability. On the other hand, this assumption is mainly used at lower levels of the breakdown, namely by country of the counterparty (i.e. not all banks, especially smaller ones, have exposures across all EU countries). A summary of the number of banks reporting clusters with values of zero

for specific clusters (and for the % total EAD for the cluster) is provided. The highest number of missing buckets is found for the lower percentages of EADs (weighted average) and, therefore, this does not significantly influence the main buckets (level 2 non-defaults, level 3 EU non-defaults and level 4 non-defaults for different portfolios).[37]

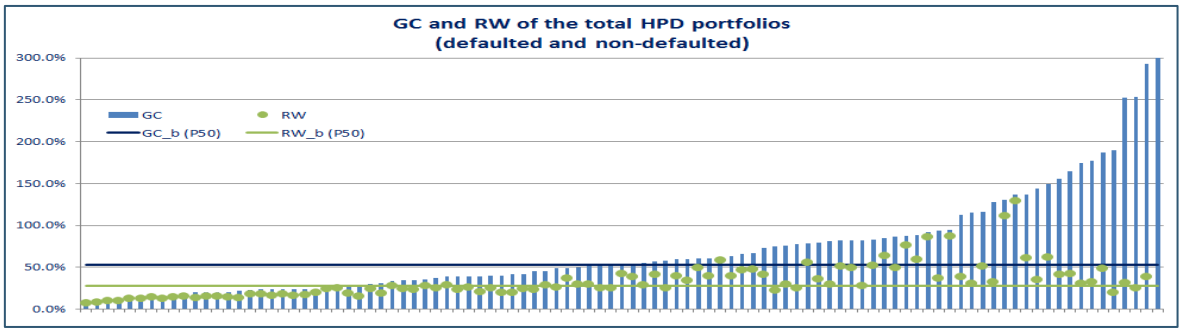
Figure 11: Summary of the number of banks reporting clusters with values of zero for specific clusters

	%EAD:	% of EAD (weighted average)	N Bank with missing bucket
LEV 2	Default	5.7%	8
	Non Default	94.3%	0
LEV 3	Default NEU	0.3%	42
	Non in Default NEU	10.3%	34
	Default EU	5.4%	8
	Non in Default EU	84.0%	3
LEV 4	Default NEU	0.3%	42
	Default CORP EU	0.9%	29
	Default SMEC EU	2.1%	32
	Default SMER EU	1.0%	44
	Default MORT EU	1.5%	23
	Non in Default NEU	10.3%	34
	Non in Default CORP_EU	10.0%	21
	Non in Default SMEC_EU	10.7%	29
	Non in Default SMER_EU	7.1%	40
	Non in Default MORT EU	56.2%	23

Global charge

The initial total GC standard deviation is 82%. The difference between the GC standard deviation in this report and that in previous reports can be explained by changes in the type of exposures (e.g. the previous standard deviation included total exposures under the IRB approach and the SA, whereas the current one includes only IRB exposures along with not only residential mortgage, SME retail and SME corporate portfolios but also the corporate-other portfolio), a broader and more diversified sample of participating institutions (for the top-down approach, from 43 institutions across 14 EU jurisdictions, in December 2012, to 99 institutions across 17 EU jurisdictions, in December 2015) and adjustments in the methodology to calculate the changes in the standard deviation index.

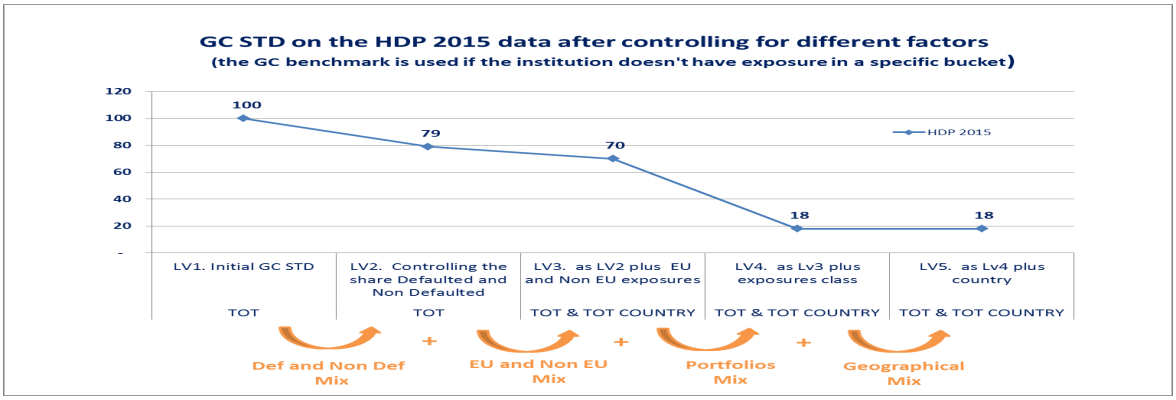
Figure 12: GC and RW, for defaulted and non-defaulted exposures, per bank



[37] Other assumptions were also tested, namely using a GC value of zero instead of the median of the bucket and assuming 50% of the maximum variation (i.e. GC variability for bank $_i$ = 50% * (GC average – 0) = 50% * GC average). To maintain a stable EAD and the same number of banks for comparison purposes, such banks were not excluded. No significant differences were found in the final figures of the GC standard deviation when using different assumptions for banks with values of zero for a specific cluster.

To summarise the findings, the GC standard deviation was normalised at 100 to present a deviation index. The same deviation index was used in previous supervisory benchmarking reports.

Figure 13: Decomposition of the GC standard deviation index

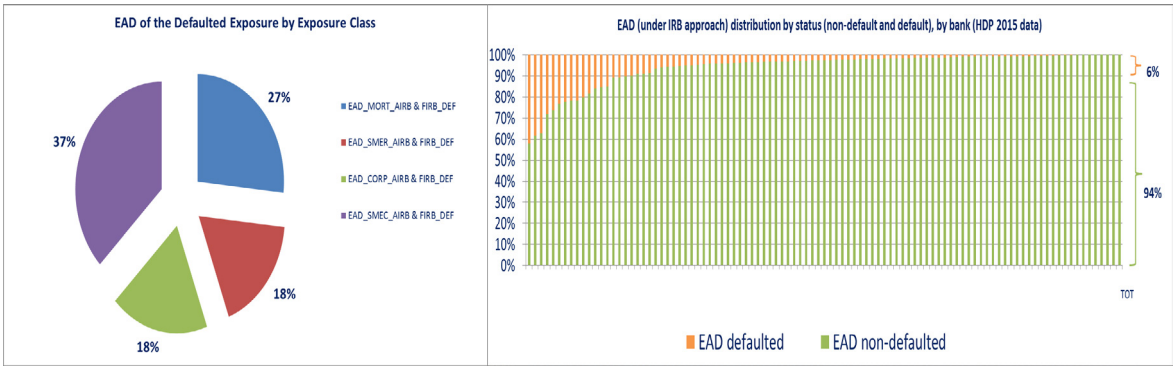


Drivers of differences in GC and RW

The result of this report is in line with that of previous reports. A key finding is that 82% of the GC variability across participating institutions' portfolios can be explained by only a few factors: the proportion of defaulted assets, the proportion of non-EU exposures and the effect of the portfolio-mix. The decomposition of the GC standard deviation index allows an understanding to be gained of the overall impact of differences in GC, but not the impact of each driver, as the analysis is order dependent. The portfolio-mix is based on the main portfolios of the exercise and, as presented before, the significant differences and variability of RWs among such portfolios (e.g. higher RWs for corporate-other than for residential mortgage portfolios) and the weight for each bank (portfolio-mix) are main drivers for differences in GC.

The **proportion of defaulted exposures** is one of the main drivers of GC and RW variability within each bank's portfolio. The interviews with banks highlighted that the treatment of defaulted assets is heterogeneous among banks. Across all participating institutions, on average, 6% of the total EAD for the HDPs is in default. Within the HDP sample, most defaulted exposures (37% of total defaulted exposures) stem, as expected, from the SME corporate portfolio.

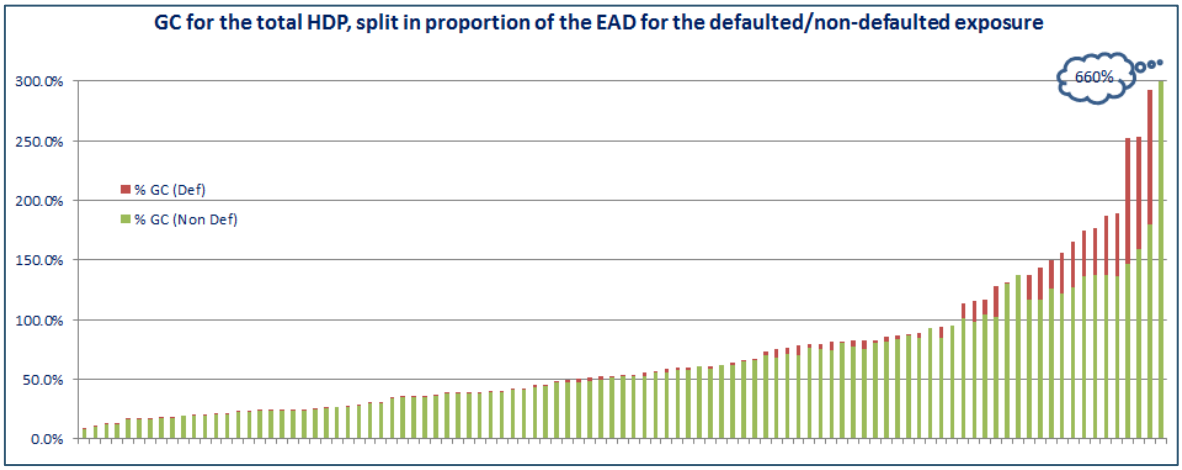
Figure 14: Distributions of EAD, for defaulted exposures, by portfolio (residential mortgage, SME retail, SME corporate and corporate-other portfolios) and by bank



Regarding the SME corporate portfolio, the GC differences among banks are very high, with a wide range in the proportion of defaulted exposures, indicating that there are potential differences in banks' macro-economic conditions, as well as in credit policies, risk profiles, investment strategies and workout processes.

For the total HDP sample, and for many participating banks, the contribution from defaulted exposures to GC variability is significant and, in several cases, represents a high proportion of the entire bank contribution.

Figure 15: Contribution from defaulted exposures to GC variability, by bank



The RW variability and the contribution from defaulted exposures is also significant (the minimum being 0% and the maximum being 263.8%) for a RW average of 58.8%.

Regarding the **proportion of non-defaulted exposures**, the differences in GC and RW can be caused by idiosyncratic variations in the level of risk within an exposure class for non-defaulted IRB assets, EU jurisdiction (e.g. legal framework, macro-economic environment, supervisory practices), credit risk mitigation (e.g. dependent on the business and risk strategy of each institution) and IRB risk parameter estimations (i.e. institution practices). The analysis of non-defaulted exposures includes the following: different proportions of the four main portfolios (residential mortgage, SME retail, SME corporate and corporate-other portfolios), differences in the country of the counterparty and differences in the type of exposure (e.g. collateralised and non-collateralised exposures).

The remaining GC variability may be due to differences in bank-specific factors, such as IRB parameters (e.g. different risk profiles in the remaining clusters) and risk management practices, among other factors. For HDPs, the differences in bank-specific factors can be better controlled by using the outturn (backtesting) approach, using the distribution analysis only as complementary benchmarks.

6. Cross-sectional (distribution analysis) and outturns (backtesting) approaches

The main focus of this analysis is on EU non-defaulted exposures, with their importance given in terms of EAD and RWA. A distribution analysis was developed by studying the evolution below the first quartile or above the third quartile and identifying outliers for each portfolio. In addition, and more useful for comparison purposes in the context of HDPs, an outturns (backtesting) approach is also used.

This chapter gives an overview of and analyses the main HDPs, namely SME retail, SME corporate, corporate-other and residential mortgage portfolios. For country-level analysis, the benchmarks are based on the median[38] at the EU level, whereas the interquartile ranges, as well as the minimums and maximums, are calculated at the country level. A summary of the outturn (backtesting) approach with the main descriptives is also presented.

Figure 16: Outturns (backtesting) descriptives, per IRB portfolio

Observed/Expected ratios		SME Retail	SME Corporate	Corporate Other	Residential mortgage
Default rate latest year / PD	Q1 = 1st quartile	0.22	0.32	0.02	0.39
	Median	**0.54**	**0.74**	**0.60**	**0.58**
	Q3 = 3rd quartile	0.75	1.05	1.11	0.78
Default rate latest 5 years / PD	Q1 = 1st quartile	0.27	0.56	0.25	0.49
	Median	**0.64**	**0.88**	**0.71**	**0.73**
	Q3 = 3rd quartile	0.99	1.47	1.27	1.13
Loss rate latest year / LGD	Q1 = 1st quartile	0.10	0.02	0.01	0.03
	Median	**0.53**	**0.25**	**0.16**	**0.34**
	Q3 = 3rd quartile	0.79	0.54	0.65	0.79
Loss rate latest 5 years / LGD	Q1 = 1st quartile	0.15	0.07	0.03	0.08
	Median	**0.52**	**0.32**	**0.36**	**0.41**
	Q3 = 3rd quartile	0.85	0.66	0.72	0.79

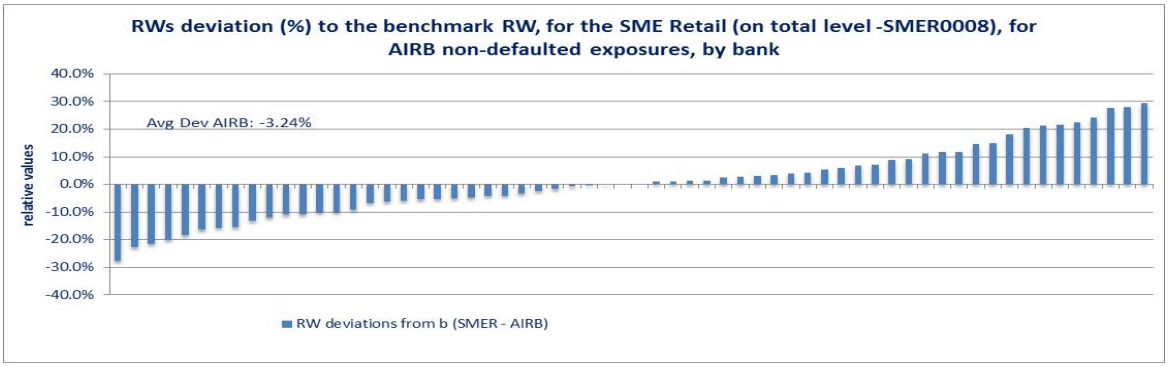
[38] The EU RW benchmark is the median of all single reported portfolios, in the clean dataset, across all countries and banks.

6.1 SME retail

6.1.1 IRB risk weights

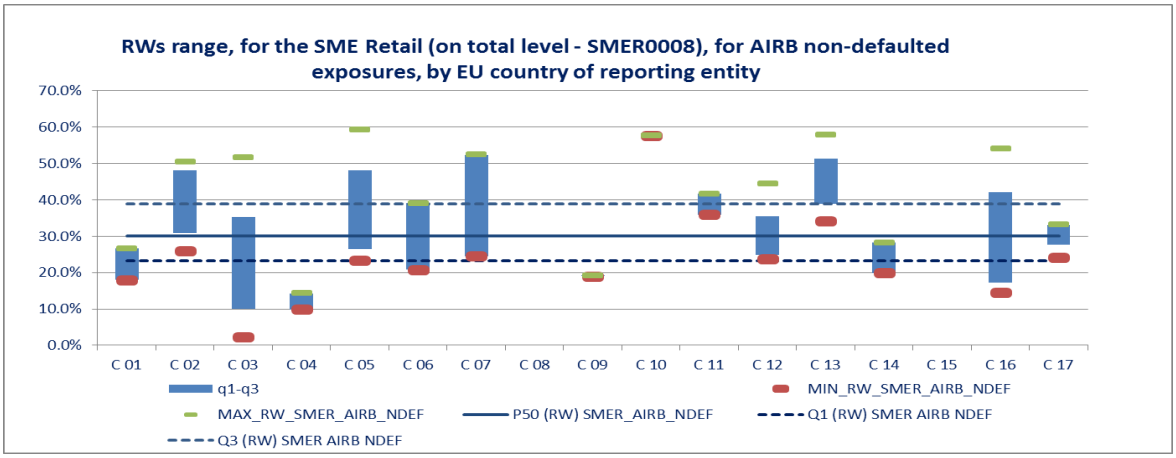
The interquartile range of the RWs, for the total portfolio, is 16%. The RW deviations (as a percentage) from the EU RW benchmark vary significantly at the bank level, ranging from around –30% to +30%. The negative RW deviations, i.e. RWs lower than the RW benchmark, are observed more frequently and are more significant than the positive deviations, producing an average deviation of –3.2%.

Figure 17: RW deviations (%) from the RW benchmark, for the SME retail portfolio, for non-defaulted exposures, for the AIRB regulatory approach, by bank



The interquartile range of the RWs is 16% at the EU level. The interquartile range broken down by country of the bank is in line with the EU figures; however, it is higher than 25% in some EU countries.

Figure 18: RW range, for the SME retail portfolio, for non-defaulted exposures, for the AIRB approach, by EU country of the bank[39]

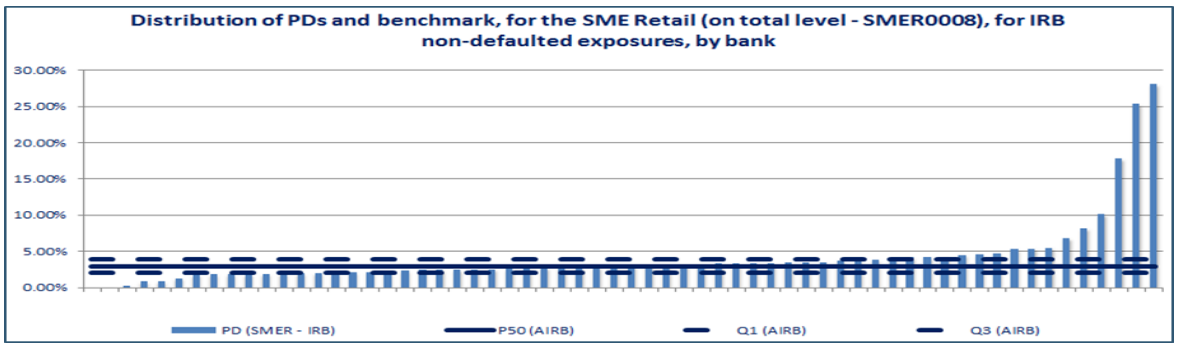


[39] Very few EU countries reported just one participating institution (i.e. the minimum being equal to the maximum), and these are retained for comparison purposes with the remaining EU countries (although not for analysis of the interquartile ranges within countries).

6.1.2 PD and default rate

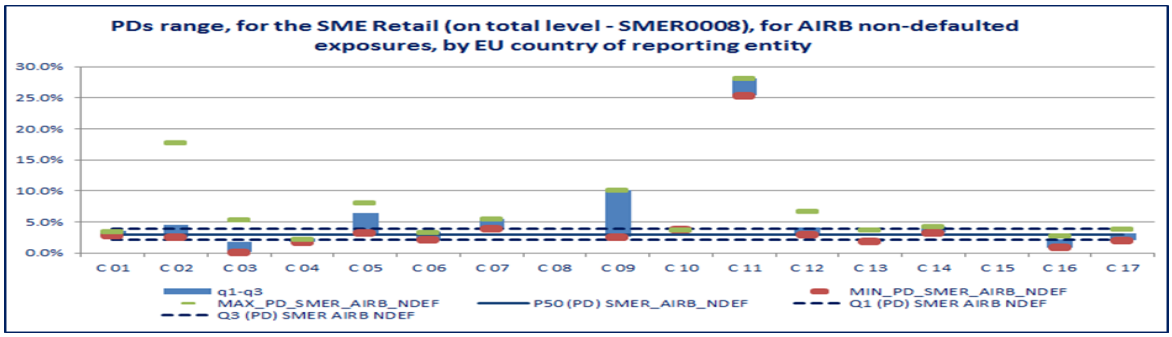
The PD deviations from the EU PD benchmark vary at the bank level, ranging from almost 0% to 28%. A few banks show extreme positive PD deviations, i.e. PDs much higher than the PD benchmark. This could also be due to data quality issues.

Figure 19: PDs (%) and the EU PD benchmark, for the SME retail portfolio, for non-defaulted exposures, for the AIRB approach, by bank



The low interquartile range of the PDs is also visible at the level of the country of the bank, with most of the participating institutions showing PDs around the EU PD benchmark and without significant differences between and within EU countries.

Figure 20: PD range, for the SME retail portfolio, for non-defaulted exposures, for the AIRB approach, by EU country of the bank



The outturns (backtesting) approach shows that the majority of the medians of the ratios between the default rate and the PD, for both the latest year and the 5-year average, are below 1. That is, in general, the estimated values (PDs) are higher than the observed values (default rates).

However, there are countries in which banks do have a ratio above 1 (i.e. they are potentially underestimating their PD). The results from the benchmarking analysis indicate that the appropriateness [40] of the PD parameter needs to be investigated further by the CA, i.e. to assess if the PDs are consistently below the observed default rates (observed values compared with both

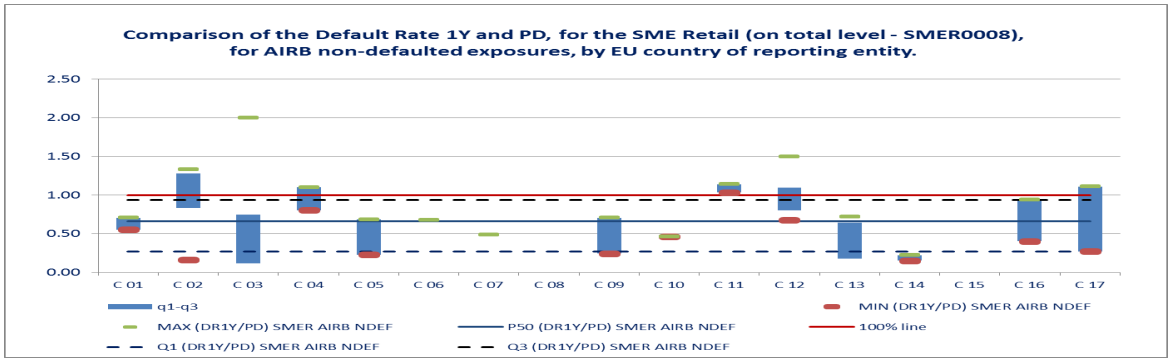
[40] It is not a 'real' backtesting approach, as there is a mismatch between the reference dates for the observed and estimated values.

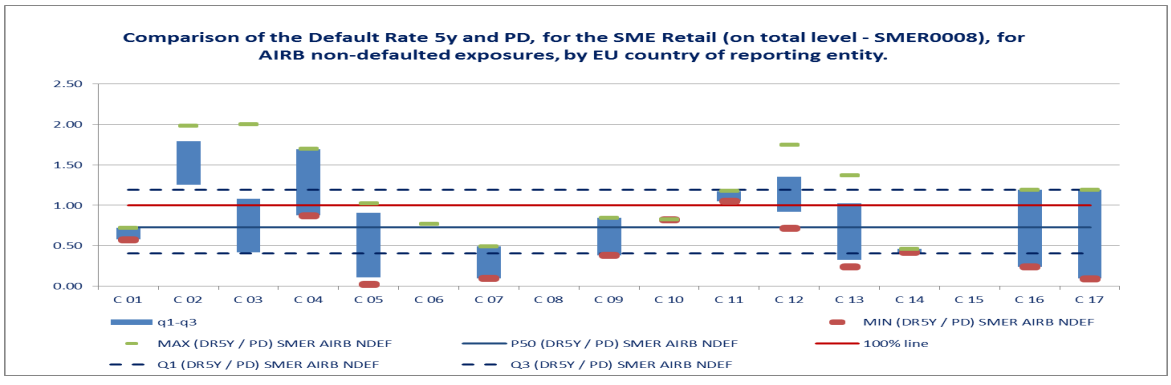
the 1-year PD and the 5-year average PD) or there are specific justifications, including the impact of severe recessions over recent years. From the interviews with some institutions, it emerged that there might also be different interpretations of the PD and default rate definitions (number-weighted versus exposure-weighted values), something that should be clarified in the future releases of the ITS.

It should also be noted that the PDs reported by the institutions and used in the analysis might not necessarily capture the subsequent impact of mitigation actions imposed by the CA to address deficiencies identified in the models in scope.

The PD interquartile range of the ratio between the default rate and the PD is higher for the 5-year average than for the latest year. The larger time span for the ratio seems to increase the difference between the estimations and observed values. As the past 5 years include economic downturns in many EU countries, the differences between PD estimations (at the end of 2015) and default rates may also reflect macro-economic developments affecting credit quality and the value of the collateral. At the same time, many banks were not able to provide a 5-year history because data was not available in the required breakdown, a point that was discussed during the interviews with banks. The latest year seems to show more comparability between estimations and observed values (i.e. there are lower and more stable interquartile ranges for the latest year than for the 5-year average).

Figure 21: Comparison of the PD and the default rate (latest year and past 5 years), for the SME retail portfolio, for non-defaulted exposures, for the AIRB approach, by EU country of the bank

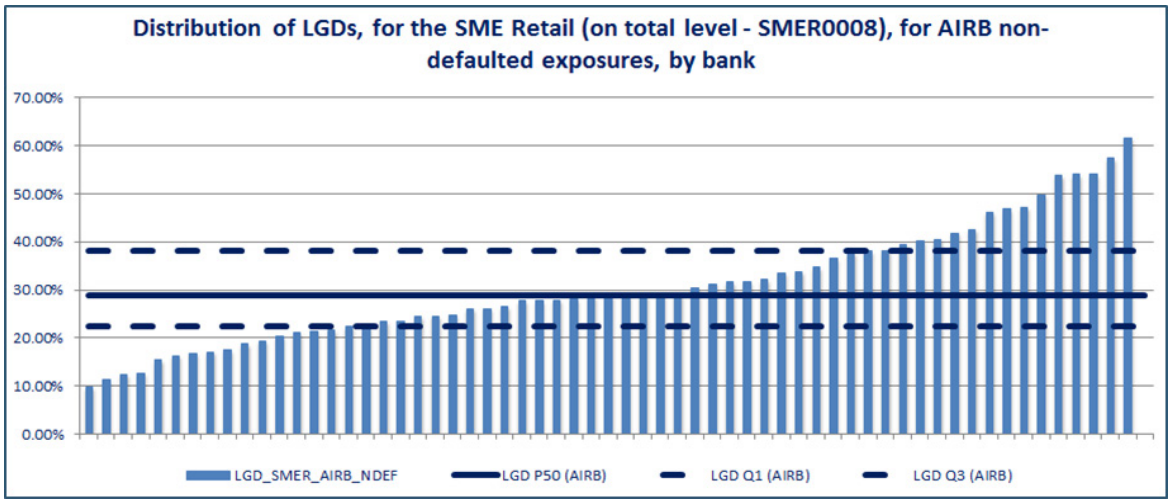




6.1.3 LGD and loss rate

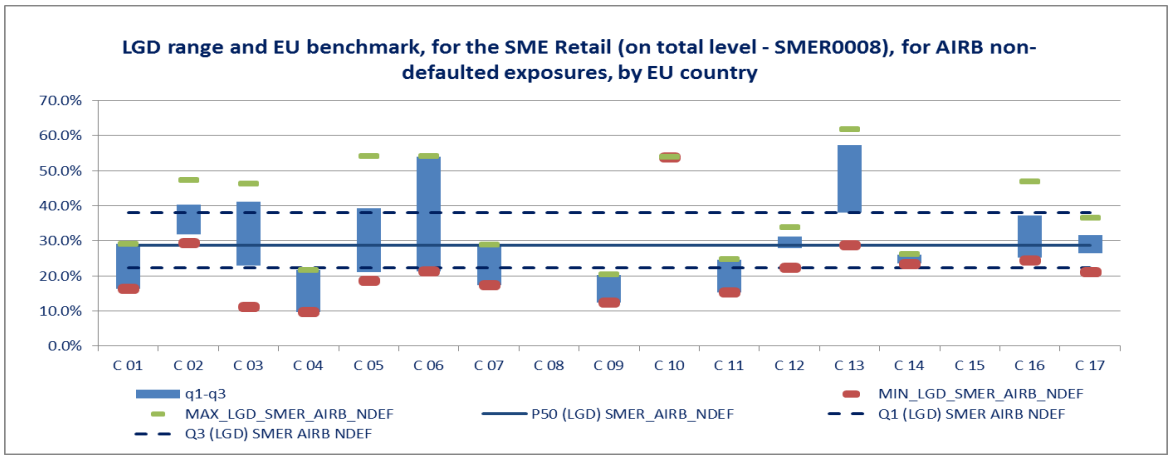
The LGDs range from 10% to 62%. Several banks show extreme values of LGDs, i.e. LGDs well below or above the interquartile extremes.

Figure 22: LGD (%) and the EU LGD benchmark, for the SME retail portfolio, for non-defaulted exposures, for the AIRB regulatory approach, by bank



The high interquartile range of the LGDs is also visible at the country level, with a higher degree of LGD variability and greater differences not only per country but also within some EU countries than for PDs. Nevertheless, similarly to PDs, despite higher LGD interquartile ranges across EU countries, the participating banks show LGDs in line with the EU LGD benchmark for most of the EU countries.

Figure 23: LGD range, for the SME retail portfolio, for non-defaulted exposures, for the AIRB approach, by EU country of the bank

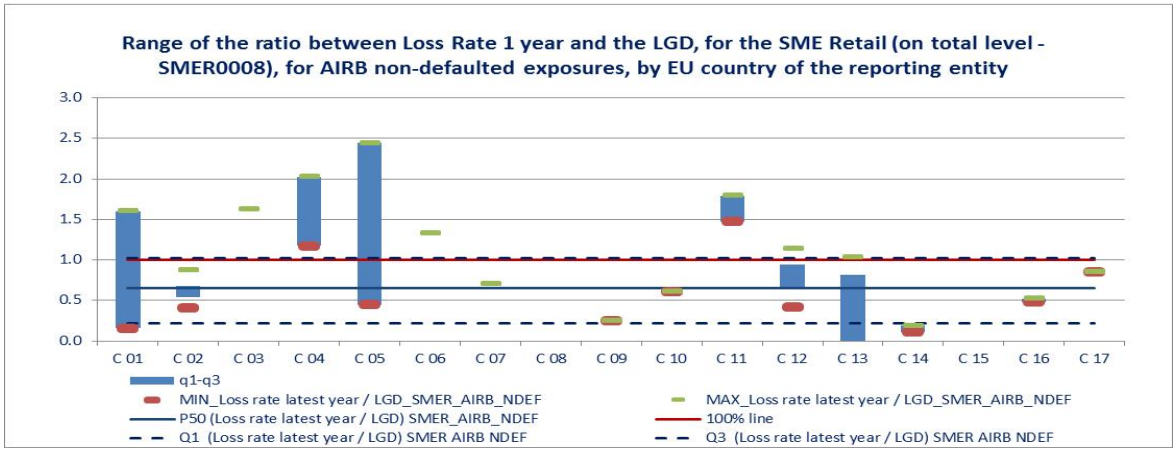


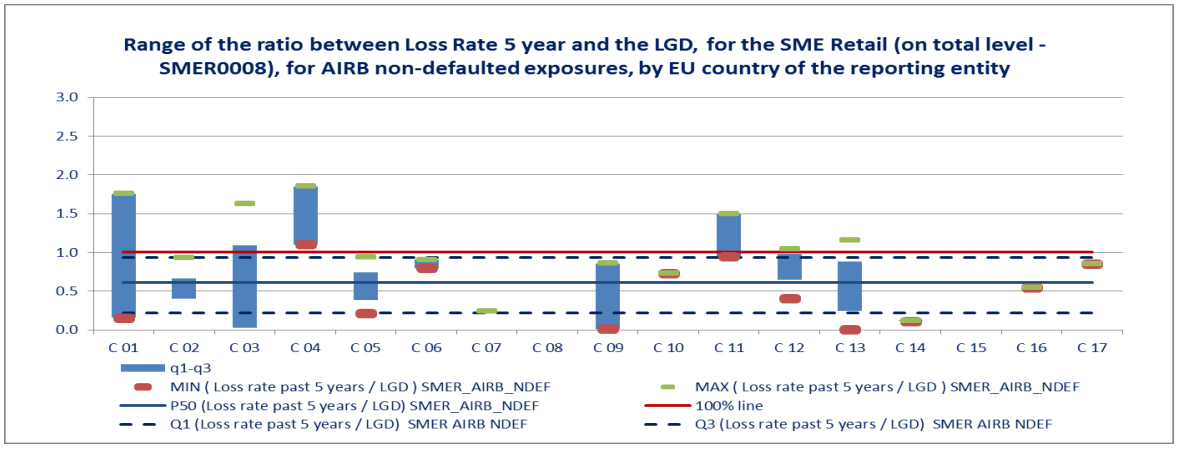
The backtesting approach shows that the medians of the ratios between the loss rate and the LGD, for both the latest year and the 5-year average, are below 1. That is to say that, in general, the outturn analysis does not raise concerns regarding the calibration of LGDs (based on the loss rates reported for the past 5 years) and the analysis is potentially conservative.

However, for situations where the ratio is above 1, it is also possible to identify some EU countries presenting systematically (for both the latest year and the 5-year average) minimum ratios above 1 (i.e. for those countries, for the institution with the minimum ratio, the ratio is always above 1 or even above 1.5). This indicated that, within those EU countries, all of the reporting institutions have experienced loss rates higher than the LGD estimates produced by their internal models (LGDs lower than the 1-year loss rate and the 5-year average), indicating the need for further investigation by the CA. It should be noted, however, that the LGDs reported by the institutions do not necessarily capture mitigation action imposed by the CA to address deficiencies previously identified in the models in scope. The comparison between LGDs and loss rates needs to consider the CRR requirement for LGDs to be reflective of downturn conditions.

Contrary to the evolution of the ratio between the default rates and the PDs, in which the variability decreased in the latest year, the LGD interquartile ranges for both the latest year and the average of the past 5 years show a similar degree of variability. This could be the result of a lag in the adjustment of the provisioning approach and assumptions as the economic conditions have improved, indicating the need for further investigation by the CA.

Figure 24: Comparison of the LGD and the loss rate (latest year and past 5 years), for the SME retail portfolio, for non-defaulted exposures, for the AIRB approach, by EU country of the bank



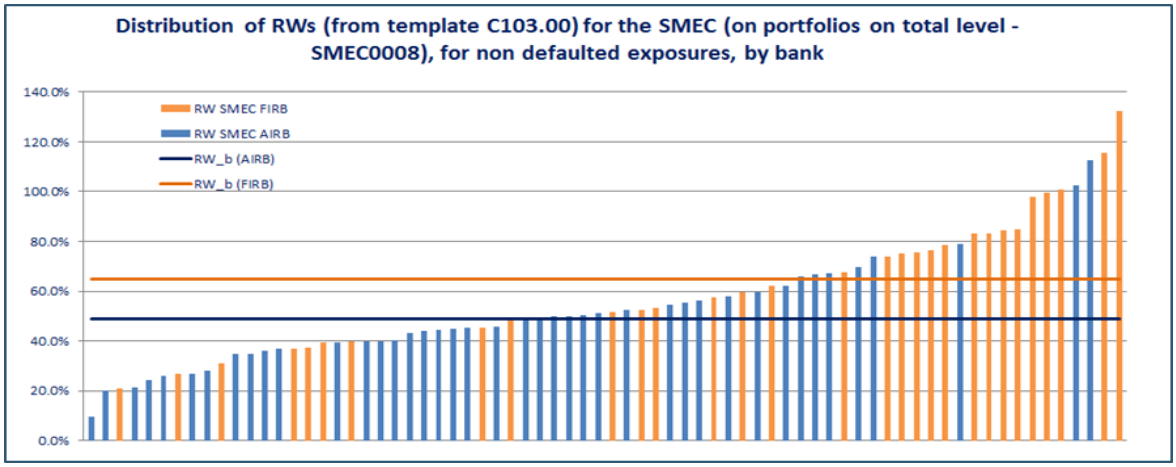


6.2 SME corporate

6.2.1 IRB risk weights

The RW deviations from the EU RW benchmark vary significantly at the bank level. There are no significant differences between the regulatory approaches (FIRB and AIRB), that is, there are banks with different approaches in both extremes of the distribution; however, the AIRB RWs are in general lower than the FIRB RWs.

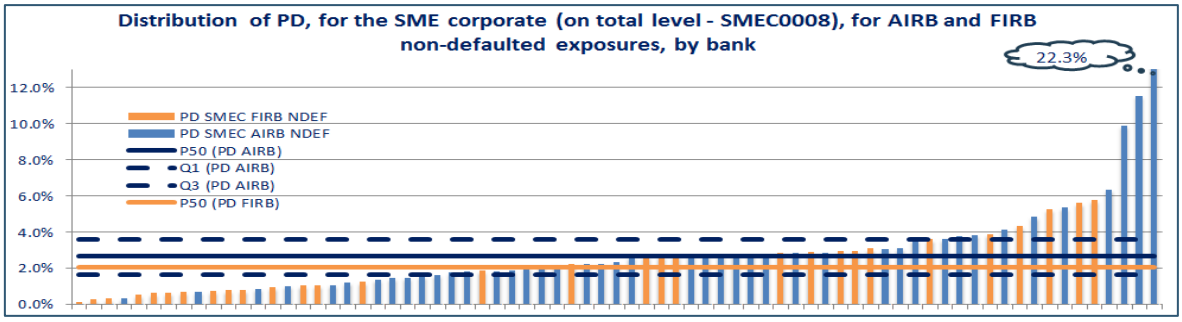
Figure 25: RWs (%) and the EU RW benchmarks, for the SME corporate portfolio, for IRB non-defaulted exposures, by bank



6.2.2 PD and default rate

The PD deviations (%) from the EU PD benchmark do not vary significantly at the bank level, with most of the PDs for the SME corporate portfolio around the EU PD benchmark. There are no significant differences between the regulatory approaches (FIRB and AIRB); however, contrary to the situation of the RWs and the different regulatory approaches, the median PD for the FIRB approach is slightly lower than the median PD for the AIRB approach. The size of the exposure, the turnover of the firm and, consequently, the size of the SME are normally considered drivers of the level of the PD (see, for instance, the 2013 HDP report showing such a relationship), i.e. in general, for smaller firms (and exposures), PDs are higher. The analysis of the data provided by the EU institutions for the benchmarking exercise indicates that the individual exposures under the FIRB approach are significantly smaller than the individual exposures under the AIRB approach (i.e. there is a lower median individual exposure size for FIRB portfolios than for AIRB portfolios when comparing the total exposure of the asset class and the number of obligors). As a result, in general, a higher PD would be expected in the FIRB sample than in the AIRB sample; however, this is not the case. Given that the RWs do not follow a similar pattern to the PDs (i.e. there is a higher median RW for the FIRB approach than for the AIRB approach), the analysis of the LGDs and CCFs may also provide additional information. If opposing results are found regarding LGDs and CCFs (i.e. they are lower for the AIRB approach than for the FIRB approach), this may be a signal of potential compensation effects from banks under the FIRB approach.

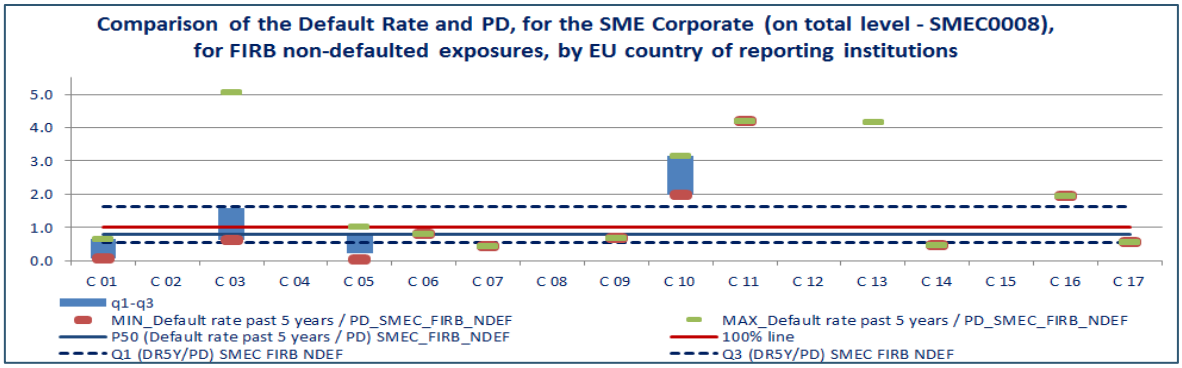
Figure 26: PDs (%) and the EU PD benchmark, for the SME corporate portfolio, for non-defaulted exposures, by regulatory approach (FIRB or AIRB), by bank

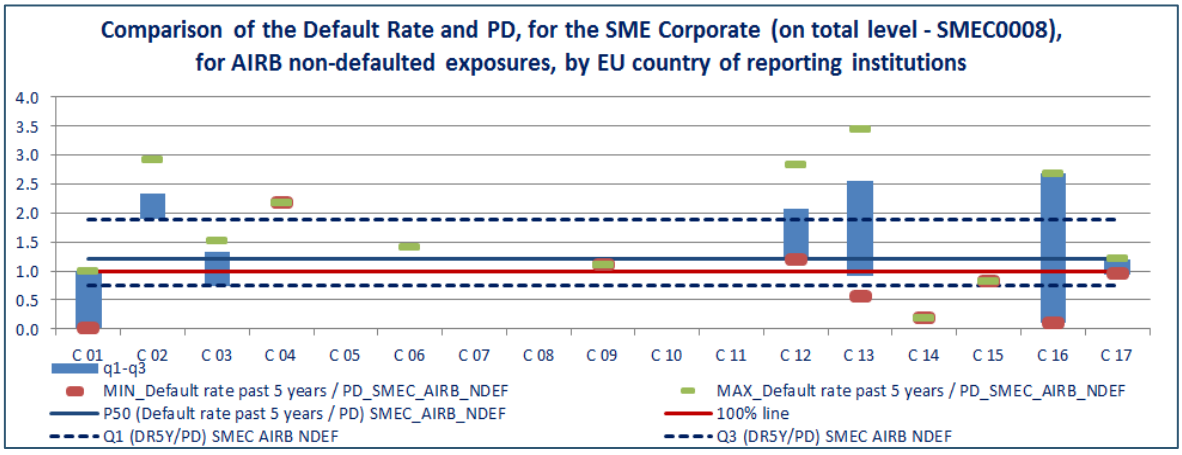


Moreover, it seems that some banks used group-wide models to estimate PDs and LGDs for exposures in jurisdictions in which they have smaller number of obligors, instead of developing country models (which was discussed during the interviews with banks). For retail exposures, the country location is an important driver, so the use of global IRB models may increase the possibility of misrepresentation of the risk estimations and increase RW variability. However, the country of the counterparty might be a driver within a model and, therefore, be taken into account. Moreover, if a bank has only few exposures to another country, it might not be possible to easily develop an own-country-specific model. The segmentation of the banks' risk parameter estimations at the country level showed misalignments when compared with the benchmarks of the country, with some exposures presenting a potential for systematic underestimations, i.e. both estimations being below the country benchmarks and also below observed values for the same bank. A possible persistent misalignment, despite being for a small number of obligors and with possible lower materiality, may be a signal of the inadequacy of a group-wide model when used for some jurisdictions. For instance, the same may applies when some models show persistent signals that are not adequate for being used for some sectors of activity, despite a good performance in general.

Regarding the different regulatory approaches, the comparison of the ratio between the default rate and the PD, for the average of the past 5 years, shows some differences. The participating banks under the AIRB approach, for the SME corporate portfolio, show less conservative figures, i.e. with a ratio above 1 and with much higher variability.

Figure 27: Comparison of the PD and the default rate (past 5 years), for the SME corporate portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank

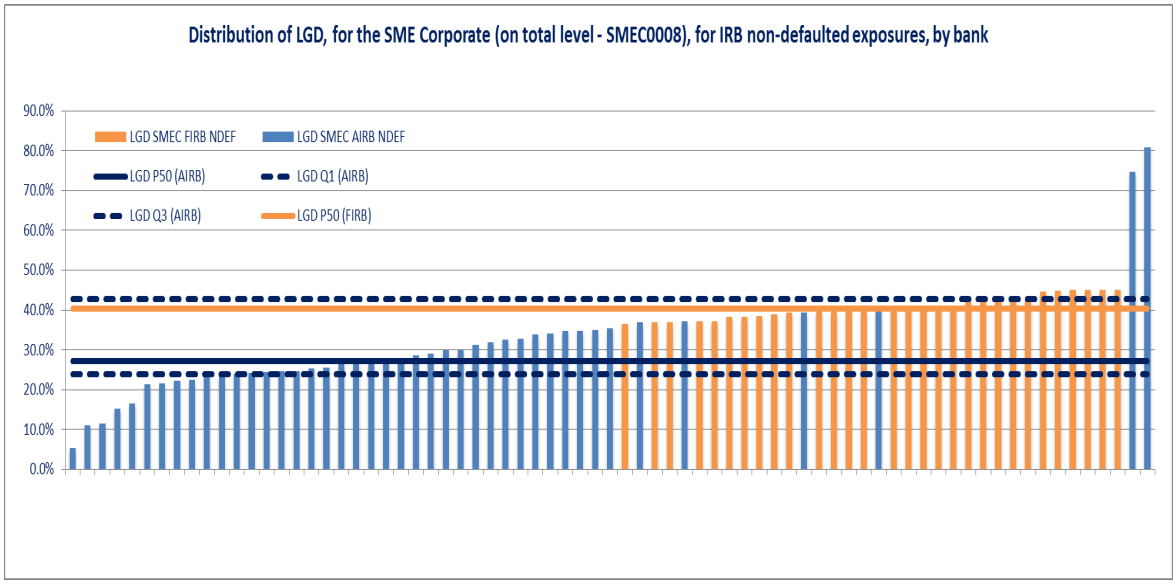




6.2.3 LGD and loss rate

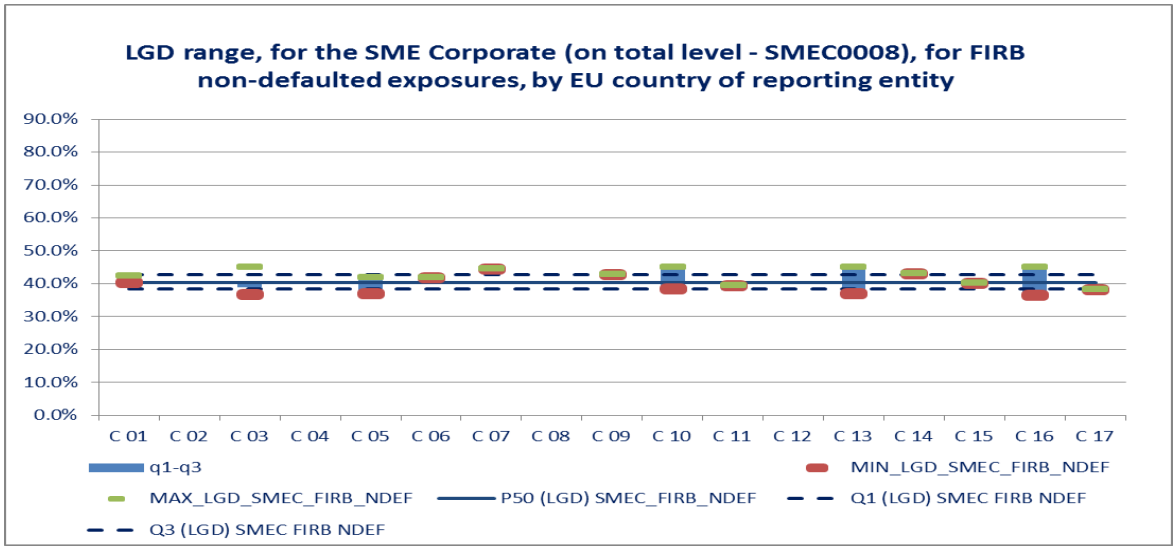
The LGD deviations (%) from the LGD benchmark vary at the bank level, ranging from 5% to 80%. Several banks show LGDs well below and above the interquartile extremes. There is a significant difference between the regulatory approaches (FIRB and AIRB), with a clear separation between the two approaches (the median LGD for the FIRB approach is 40% and the median LGD for the AIRB approach is 27%). The majority of AIRB banks have LGDs below the EU LGD benchmark (only six banks have LGDs higher than the lowest FIRB LGD). At the same time, the comparison of LGDs should take into account different levels of collateralisation.

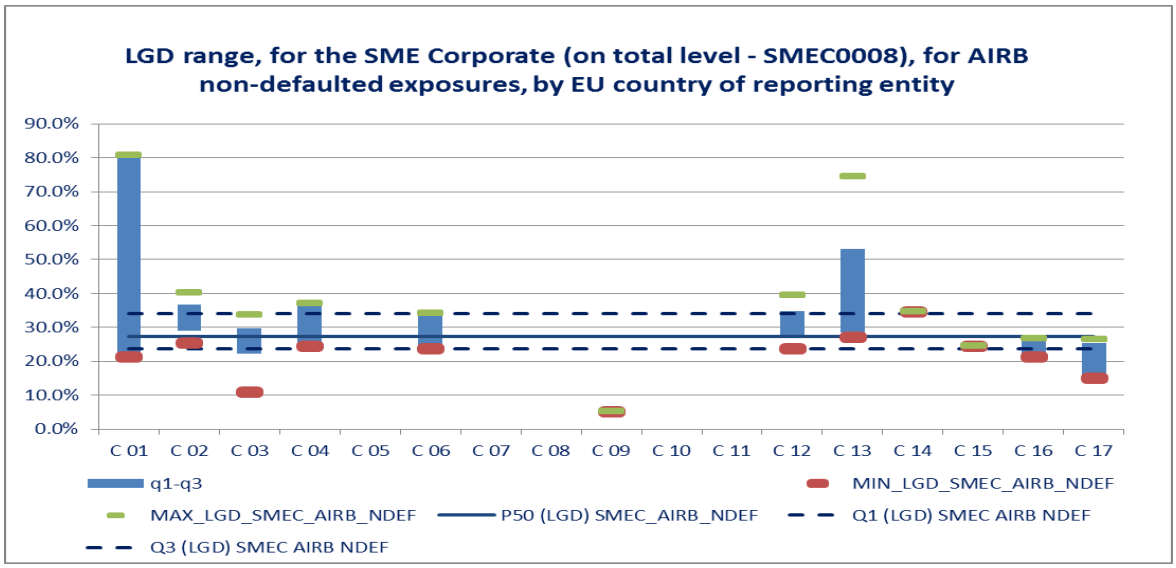
Figure 28: LGDs (%) and the EU LGD benchmark, for the SME corporate portfolio, for non-defaulted exposures, by regulatory approach (FIRB and AIRB), by bank



The LGD variability is much higher for AIRB banks than for FIRB banks. Despite such variability, the LGD interquartile range is around the EU LGD AIRB benchmark for most of the EU countries, with the minimums and maximums close to the 25th and 75th percentiles, respectively, i.e. the 25th and 75th percentiles of each EU country are close to the EU interquartile range.

Figure 29: LGD range, for the SME corporate portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank





In addition, the participating banks under the AIRB approach, for the SME corporate portfolio, for the ratio between the loss rate and the LGD for the average of the past 5 years, show conservative figures, i.e. with a ratio below 1[41], with some exceptions.

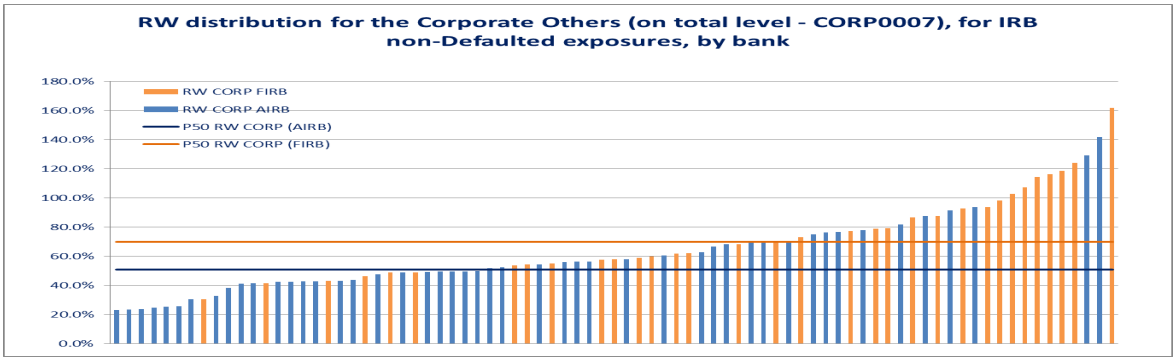
[41] See Annex 6 for additional charts.

6.3 Corporate-other

6.3.1 IRB risk weights

The RW deviations (%) from the EU RW benchmark vary significantly at the bank level. The corporate-other portfolio is the least homogeneous portfolio among the four exposure classes. On average, the number of obligors per bank in this portfolio is also smaller than in the other portfolios and, therefore, this may contribute to the variability. There is a significant difference between the regulatory approaches (FIRB and AIRB), with the median RW for the AIRB approach significantly below the median RW for the FIRB approach. The analysis of the risk parameters PD, LGD and CCF per regulatory approach allows an understanding to be gained of the possible reasons for such differences.

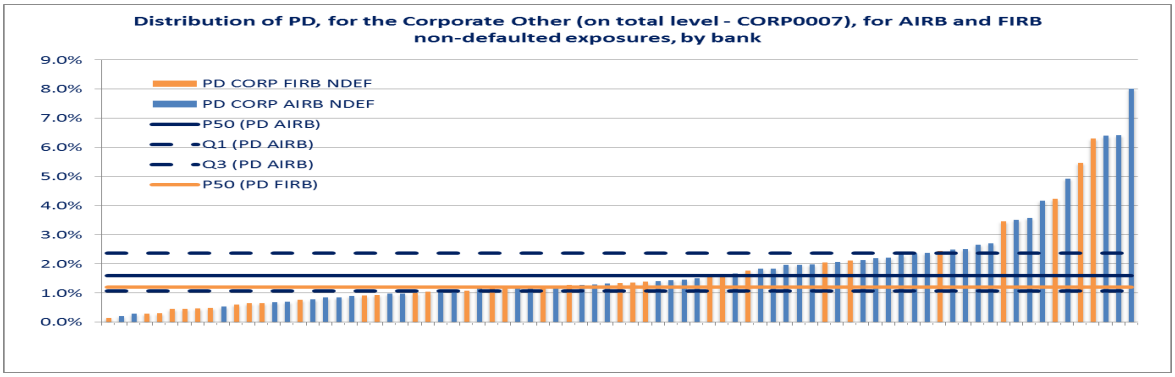
Figure 30: RWs (%) and the EU RW benchmarks, for the corporate-other portfolio, for IRB non-defaulted exposures, by bank



6.3.2 PD and default rate

The PD deviations (%) from the PD benchmark do not vary significantly at the bank level. There is a significant difference between the regulatory approaches (FIRB and AIRB), with the median PD for the AIRB approach above the median PD for the FIRB approach. That is, similarly to the SME-corporate portfolio, the PDs for the FIRB approach are lower than the PDs for the AIRB approach, although the difference is even higher than for the SME-corporate portfolio.

Figure 31: PDs (%) and the EU PD benchmarks, for the corporate-other portfolio, for non-defaulted exposures, by regulatory approach (FIRB and AIRB), by bank

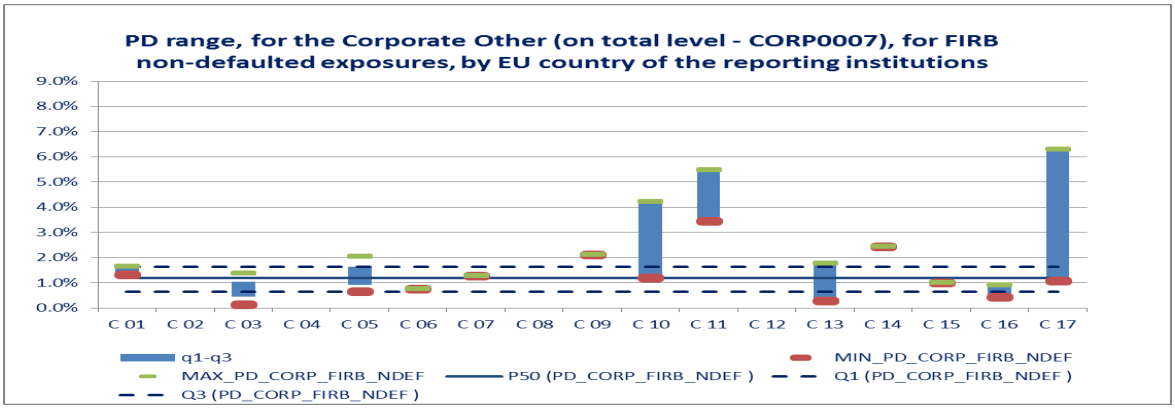


Again, the size of the exposure, the turnover of the firm and, consequently, the size of the firm are normally considered drivers of the level of the PD (see, for instance, the 2013 HDP report showing that, for smaller firms, and exposures, PDs are higher). Once more, it is expected that there will be a higher PD for a lower exposure size (based on the total exposure of the asset class and the number of obligors, and with a direct link to the size of the SME); however, this is not the case. Given that the RWs follow a different pattern from the PDs, the evolution of the LGDs and CCFs may also provide additional information of a possible compensation effect.

The interquartile ranges at the country level show that most of the EU countries lie within the 25th and 75th percentiles of the EU PD benchmark. The comparison of the regulatory approaches shows a higher variability for FIRB exposures than for AIRB exposures. In addition, for some countries, there are significant differences between the FIRB and AIRB exposures. Therefore, regarding PDs for the corporate-other portfolio, the possible compensation effects may be more significant for some EU countries.

Moreover, it seems that some banks have not developed country-specific models, using instead group-wide models to estimate PDs and LGDs for exposures in jurisdictions in which they have smaller number of obligors (information provided during the interviews with banks). The country location is an important driver, so the use of group-wide IRB models may increase the possibility of misrepresentation of the risk estimations and increase RW variability. The segmentation of the banks' estimations at the country level showed misalignments when compared with the benchmarks of the country, with some of them presenting systematic underestimations, i.e. both estimations being below the country benchmarks and also below observed values for the same bank. From a validation perspective, the estimations should maintain their uniformity and coherence, despite possible splits per country, sector, type of obligors, year of origination of the exposure, etc. The comparison with the benchmarks for the same country allows the coherence of such estimations to be assessed. A possible persistent misalignment, despite being for a small number of obligors, may be a signal of the inadequacy of a group-wide model for some jurisdictions. The same may happen within a country and a group sector-wide model that tries to cover very different types of sectors (agriculture, industry, tourism, etc.).

Figure 32: PD range, for the corporate-other portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank



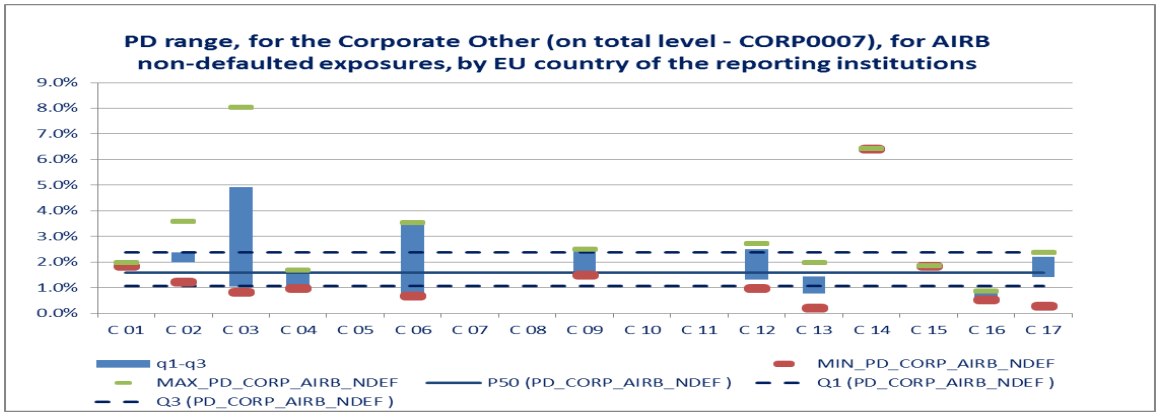
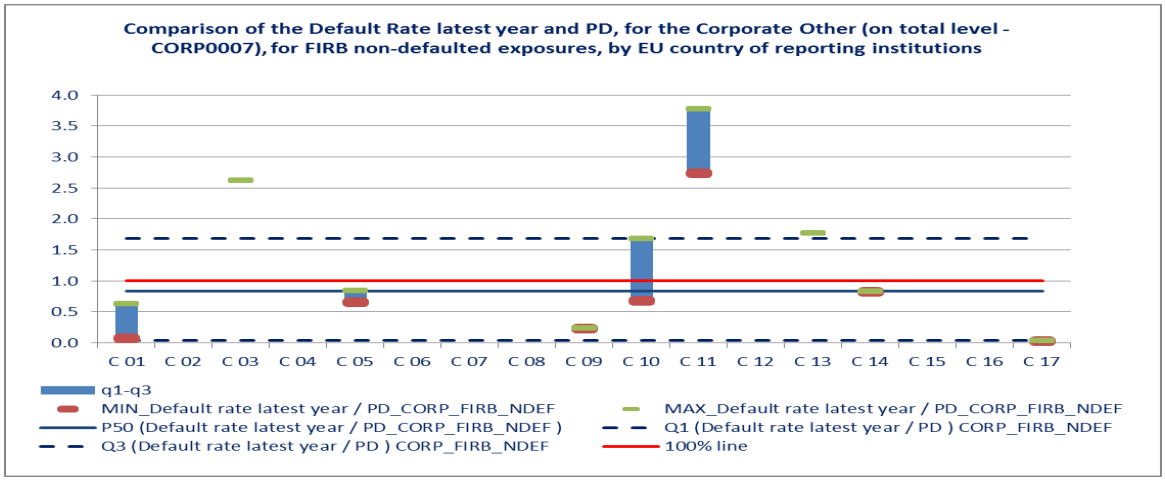
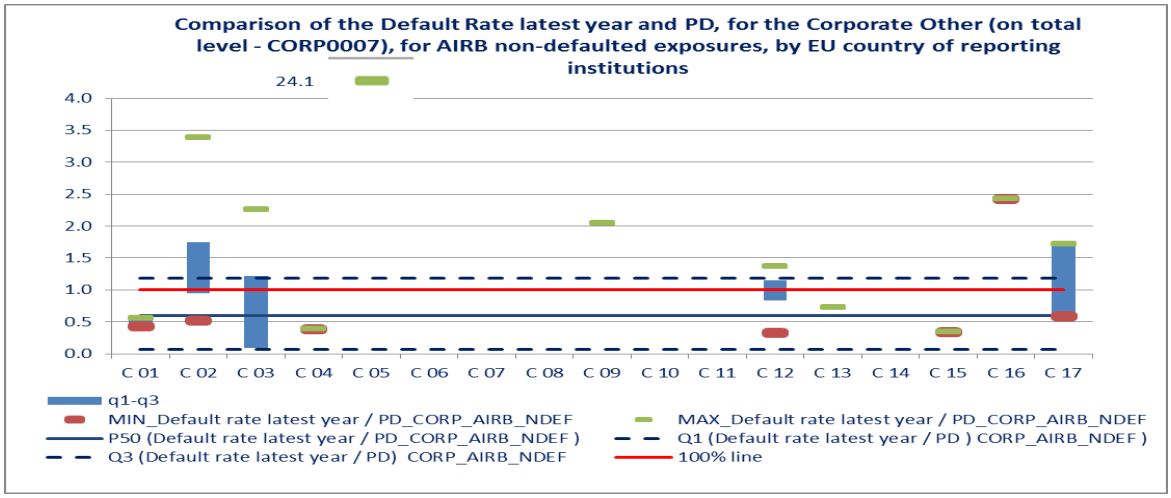


Figure 33: Comparison of the PD and the default rate (latest year), for the corporate-other portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank[42]



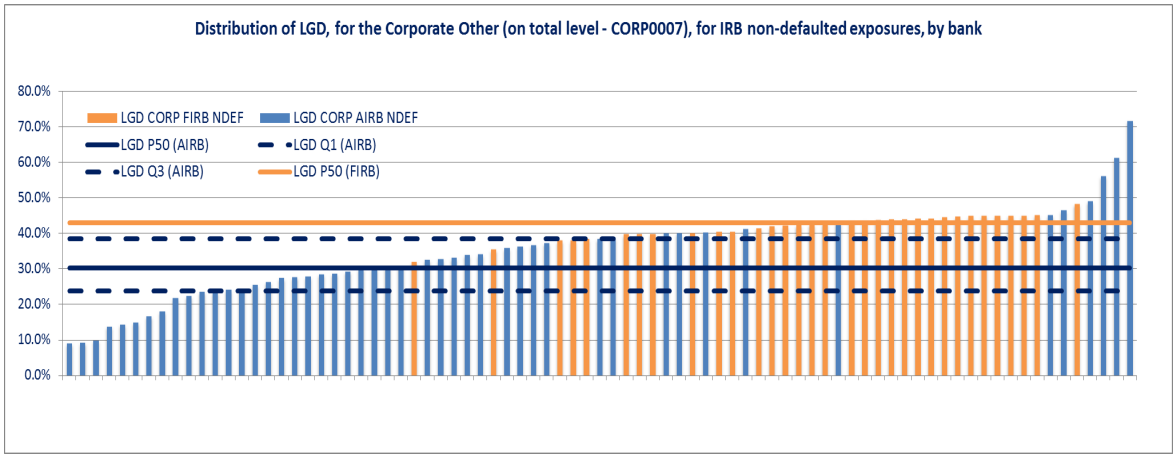


[42] The extreme outlier for C 06 is due to data quality issues when reporting the figures.

6.3.3 LGD and loss rate

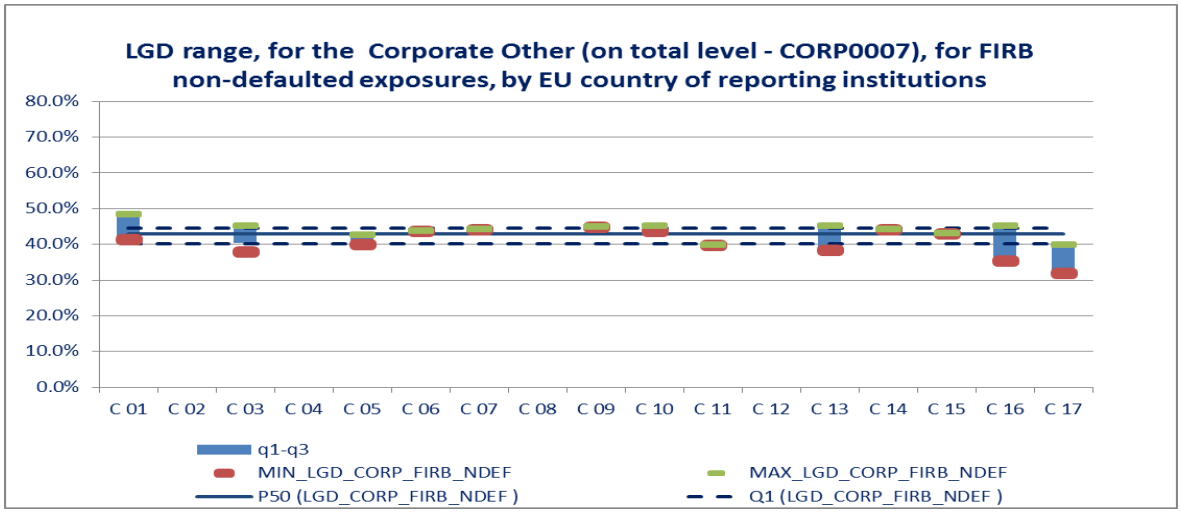
The LGD deviations (%) from the LGD benchmark vary at the bank level, ranging from 9% to 70%. Several banks show LGDs well below and above the 25th and 75th percentiles, respectively. LGDs are not concentrated around the median, but a high number of extreme values can be observed. A comparison of the regulatory approaches shows that there is a significant difference between the FIRB and AIRB approaches, with a clear separation between the two approaches. The majority of AIRB banks have LGDs below the EU FIRB LGD benchmark (e.g. the 75th percentile of the AIRB LGD is lower than the EU FIRB LGD benchmark).

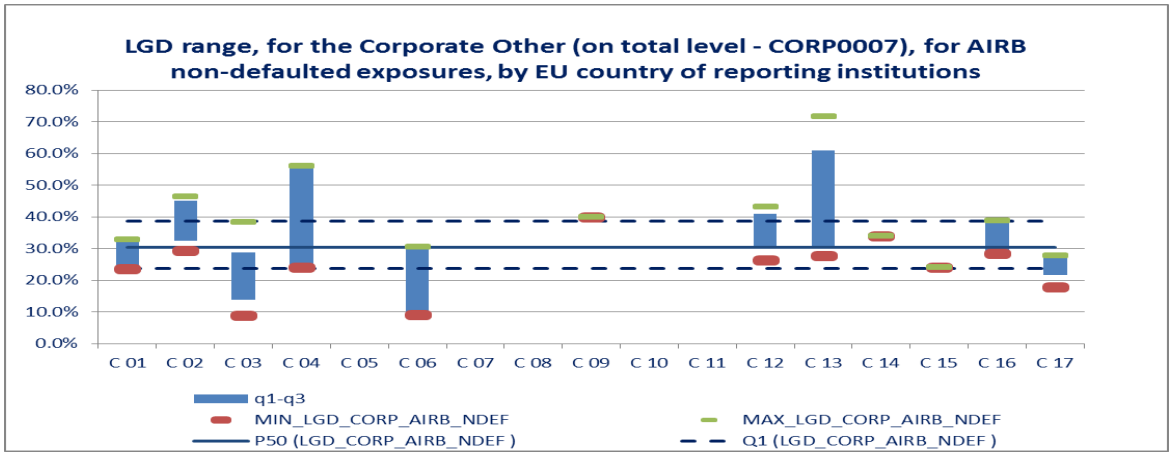
Figure 34: LGDs (%) and the EU LGD benchmarks, for the corporate-other portfolio, for non-defaulted exposures, by regulatory approach (FIRB and AIRB), by bank



As expected, LGD variability is much higher for banks under the AIRB approach than those under the FIRB approach. Despite such variability, the LGD interquartile range is around the EU LGD AIRB benchmark for most of the EU countries, with the minimums and maximums close to the 25th and 75th percentiles, respectively, i.e. the 25th and 75th percentiles of each EU country are close to the EU interquartile range.

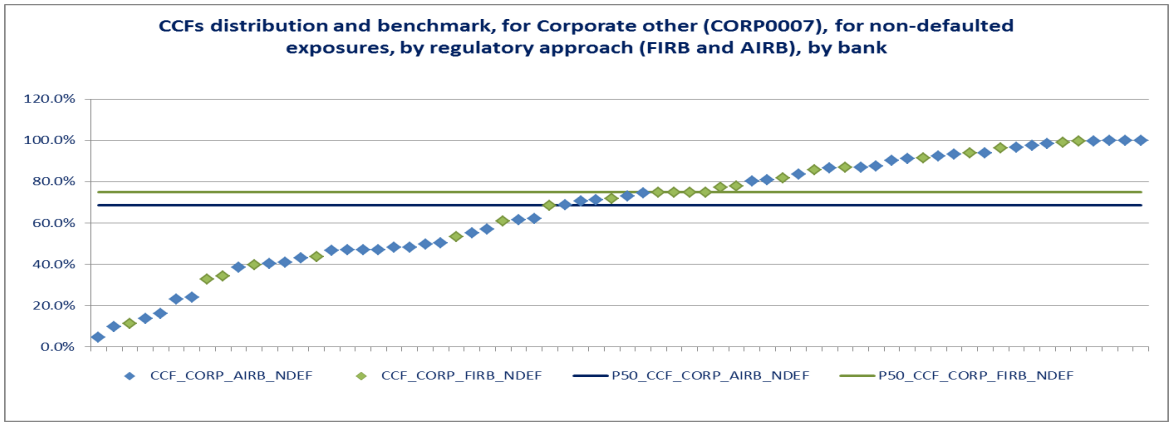
Figure 35: LGD range, for the corporate-other portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank





Regarding RWs, the differences between the regulatory approaches (FIRB and AIRB) seem substantial and are influenced by risk parameters. As expected, the median LGD is higher for the FIRB approach than for the AIRB approach, and is around the regulatory LGD of 45%. By contrast, the median PD is significantly lower for the FIRB approach than for the AIRB approach. Regarding the corporate-other portfolio, given the higher LGDs and CCFs for banks under the FIRB approach than for those under the AIRB approach, possible compensations on the estimation of PDs may be a reason for the significantly lower PDs for the FIRB approach than for the AIRB approach. The possible compensation seems unbalanced between the FIRB and AIRB approaches owing to the lower RWs for the AIRB approach than for the FIRB approach (although this was not the case for the SME corporate portfolio). That is, it seems that the lower PDs for the FIRB approach than for the AIRB approach do not compensate for the very low levels of LGDs for the AIRB approach. In addition, the CCFs also seem to play a role in such differences (in general, CCFs are higher for banks under the FIRB approach than for those under the AIRB approach)[43].

Figure 36: CCFs (%) and the EU CCF benchmark, for the corporate-other portfolio, for non-defaulted exposures, by regulatory approach (FIRB and AIRB), by bank



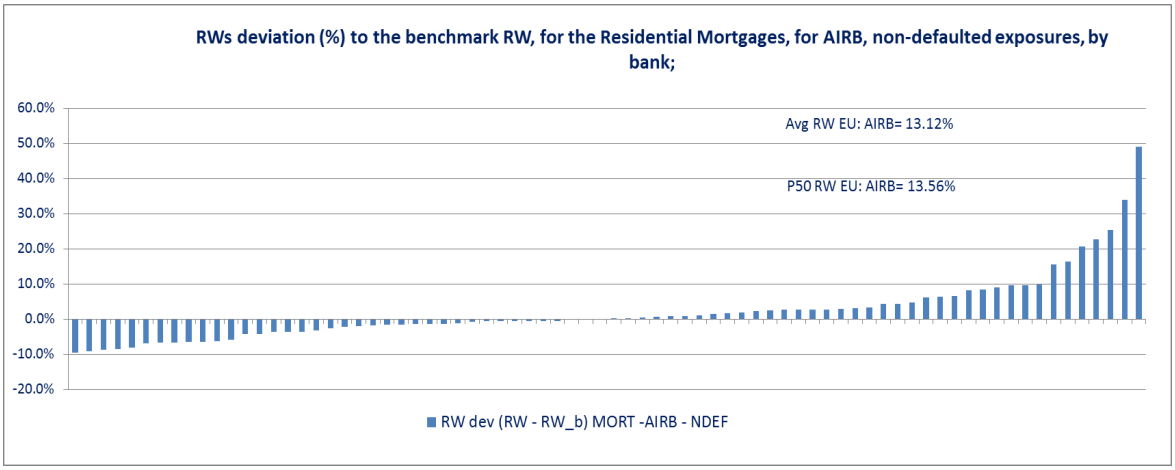
[43] See Annex 6 for additional charts.

6.4 Residential mortgage

6.4.1 IRB risk weights

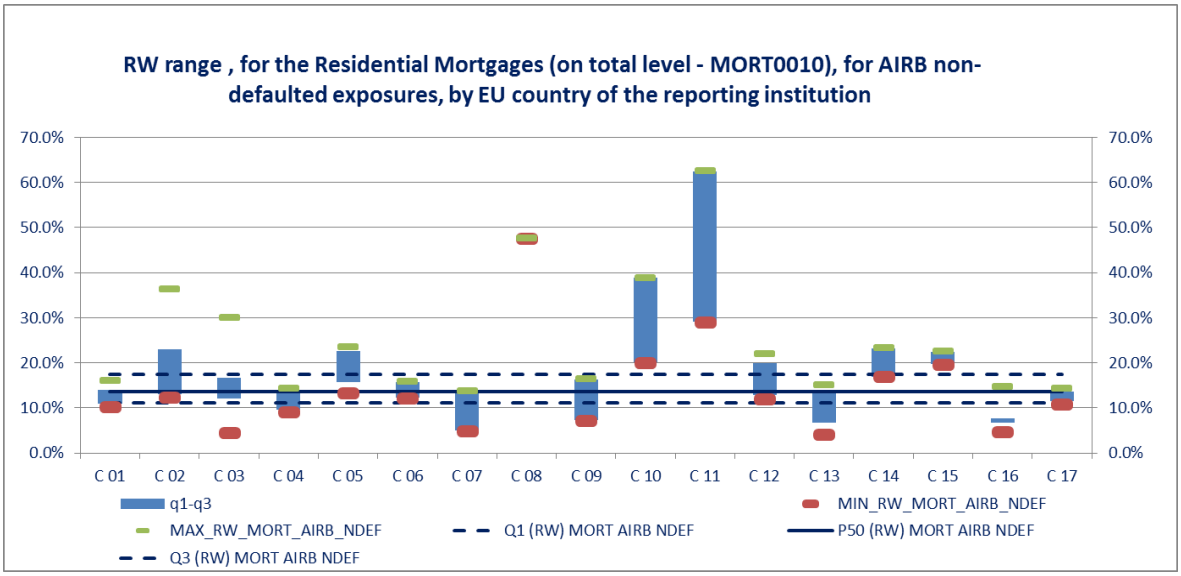
The RW deviations (%) from the EU RW benchmark vary significantly at the bank level, ranging from –10% to +50% (absolute values in comparison with the EU RW benchmark).

Figure 37: RW deviations (%) from the RW benchmark, for residential mortgages, for IRB non-defaulted exposures, by bank



The RW interquartile range of the majority of the EU countries is around the EU RW benchmark. The RW variability is low, not only across the EU countries but also within each EU country. The RW interquartile range is also significantly smaller than in other portfolios. The low variability may be driven by the fact that these type of portfolios are less geographically diverse than for the other portfolios.

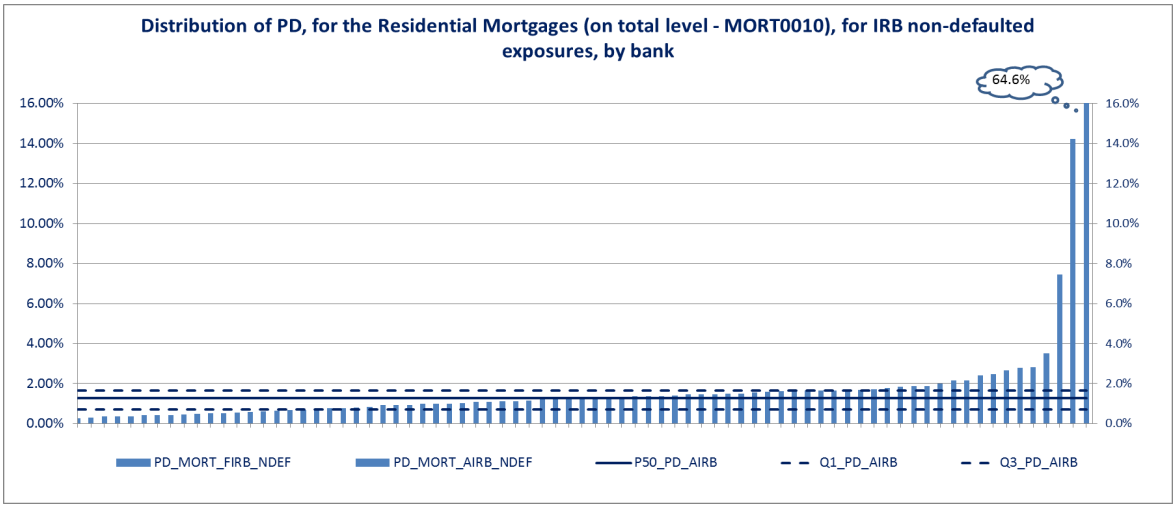
Figure 38: RW range, for residential mortgages, for IRB non-defaulted exposures, by EU country of the bank



6.4.2 PD and default rate

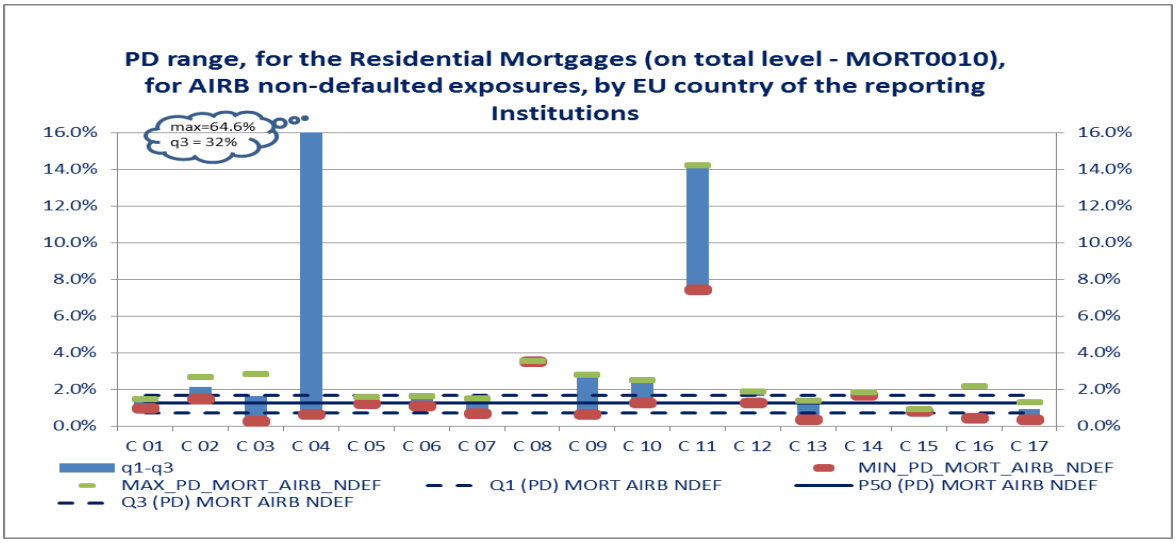
The PD deviations (%) from the PD benchmark do not vary substantially at the bank level (the PD of the majority of banks is around the EU PD benchmark, with PDs ranging from slightly higher than 0.3% to 65%). There are few banks with extreme values or with values well above the EU PD benchmark, reflecting the high level of non-performing loans for this type of portfolio.

Figure 39: PDs (%) and the EU PD benchmark, for residential mortgages, for non-defaulted exposures, by regulatory approach (FIRB and AIRB), by bank



There are no significant differences across EU countries (in particular, in comparison with other portfolios). Very few countries have high interquartile ranges, owing to macro-economic downturns, and the remaining countries have interquartile ranges smaller than 3%.

Figure 40: PD range, for residential mortgages, for IRB non-defaulted exposures, by EU country of the bank

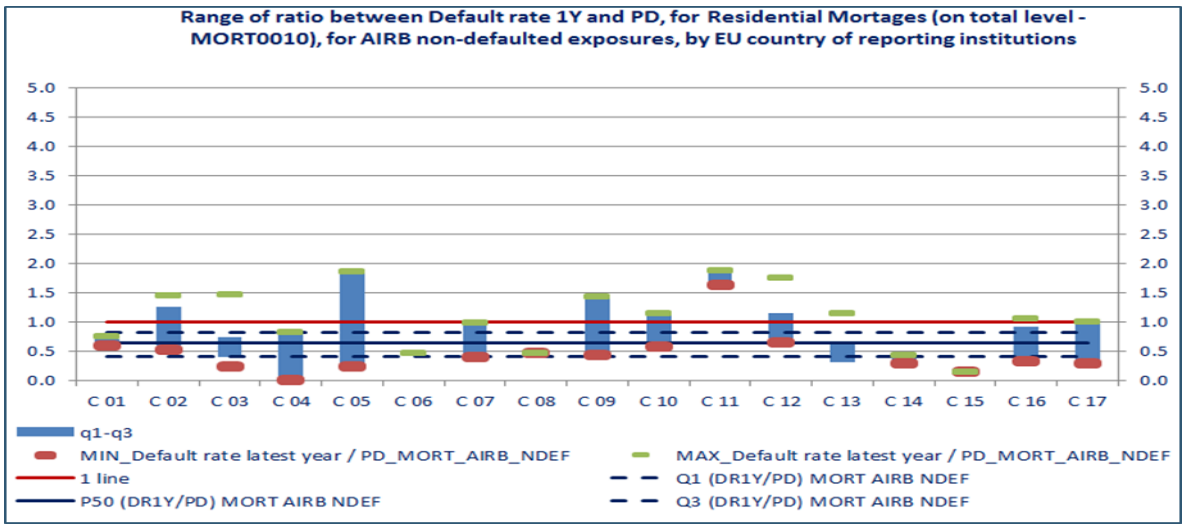


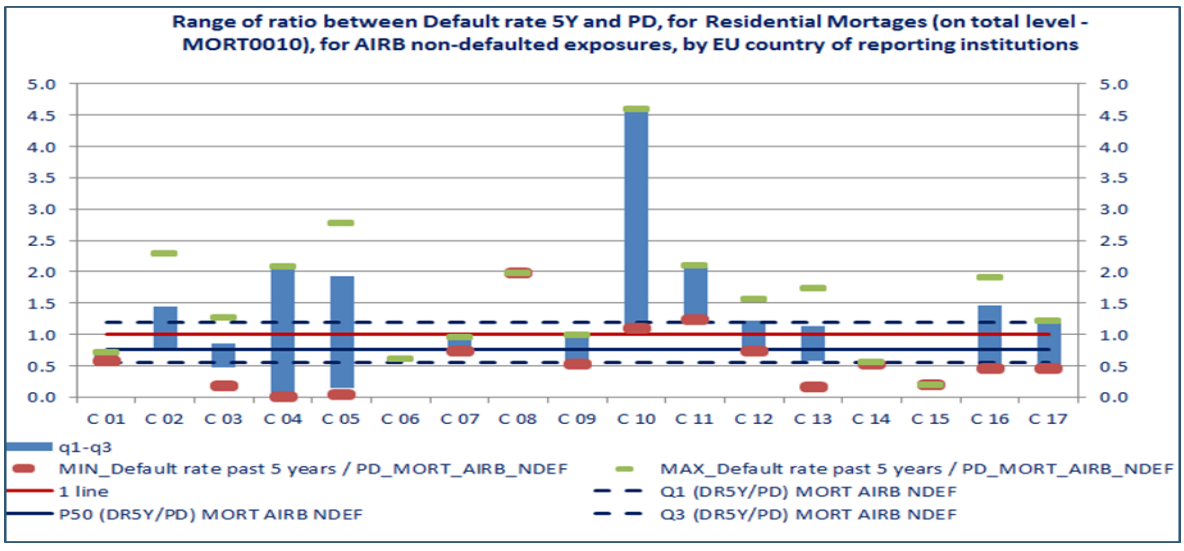
The outturns approach, i.e. the comparison of observed and estimated values (backtesting), shows that the medians of the ratios between the default rate and the PD (i.e. the ratio between observed and estimated values), for both the latest year and the 5-year average, are below 1 (i.e.

the numerator is lower than the denominator). That is, in general, the estimated values (PDs) are higher than the default rates observed over the past 5 years, in particular for the latest year (e.g. the 75th percentile also shows a ratio below 1).

The PD interquartile range of the ratio between the default rate and the PD is higher for the 5-year average than for the latest year. The consideration of a larger time span for the ratio seems to increase the difference between estimations and observed values. The past 5 years include economic downturns in many EU countries; therefore, the differences between PD estimations and default rates may have increased given the uncertainty and volatility of some exposures. The latest year seems to show more alignment between estimated and observed values (i.e. lower differences for the latest year than for the 5-year average). It should also be noted that the PDs reported by the institutions and used in the analysis do not necessarily capture the impact of mitigation actions imposed by the CA to address deficiencies identified in the models in scope.

Figure 41: Comparison of the PD and the default rate (latest year and past 5 years), for residential mortgages, for IRB non-defaulted exposures, by EU country of the bank

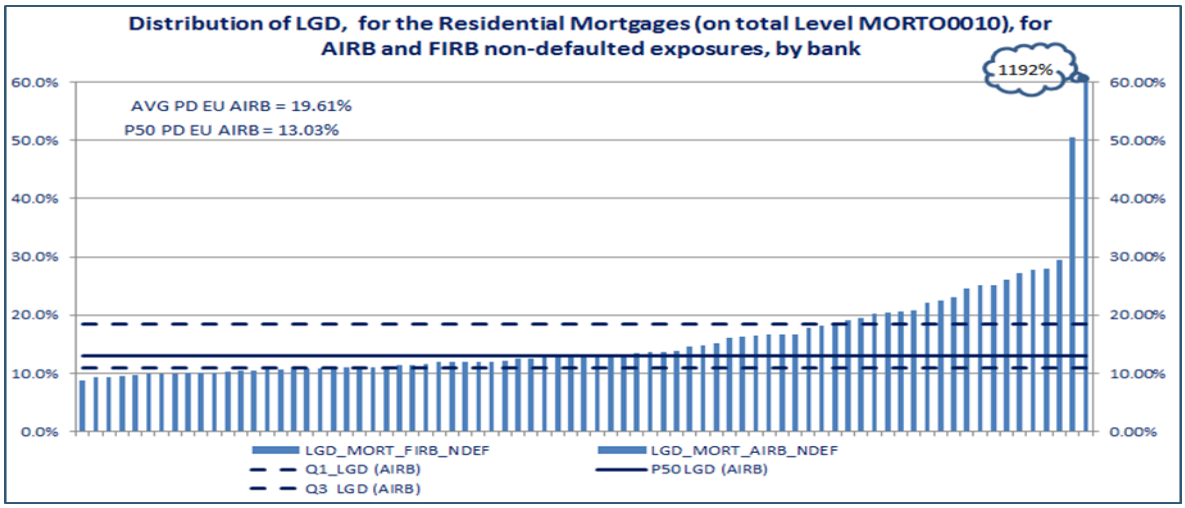




6.4.3 LGD and loss rate

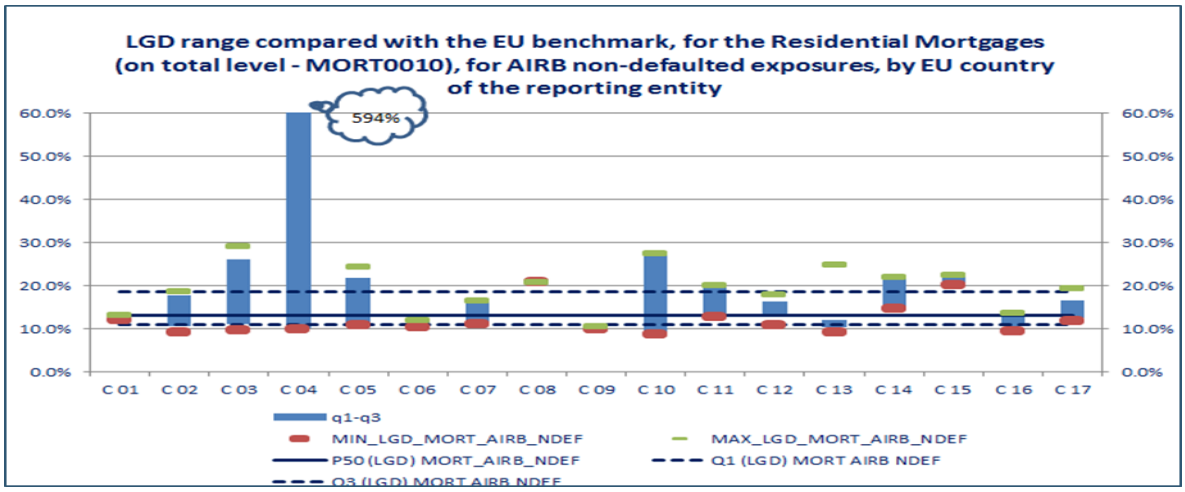
The LGD deviations (%) from the LGD benchmark vary at the bank level. Few banks show LGDs below the 25th percentile, whereas many banks show LGDs well above the 75th percentile. However, the 75th percentile is also very low (19%).

Figure 42: LGDs (%) and the EU LGD benchmark, for residential mortgages, for non-defaulted exposures, for the AIRB approach, by bank



The low interquartile range of the LGDs is visible at the EU country level, with lower LGD variability and fewer differences not only per country but also within some EU countries (in comparison with other portfolios). Similarly to PDs, the participating banks have LGDs around the EU LGD benchmark for most of the EU countries (i.e. with the 25th and 75th percentiles, respectively, below and above the EU LGD benchmark).

Figure 43: LGD range, for residential mortgages, for IRB non-defaulted exposures, by EU country of the bank

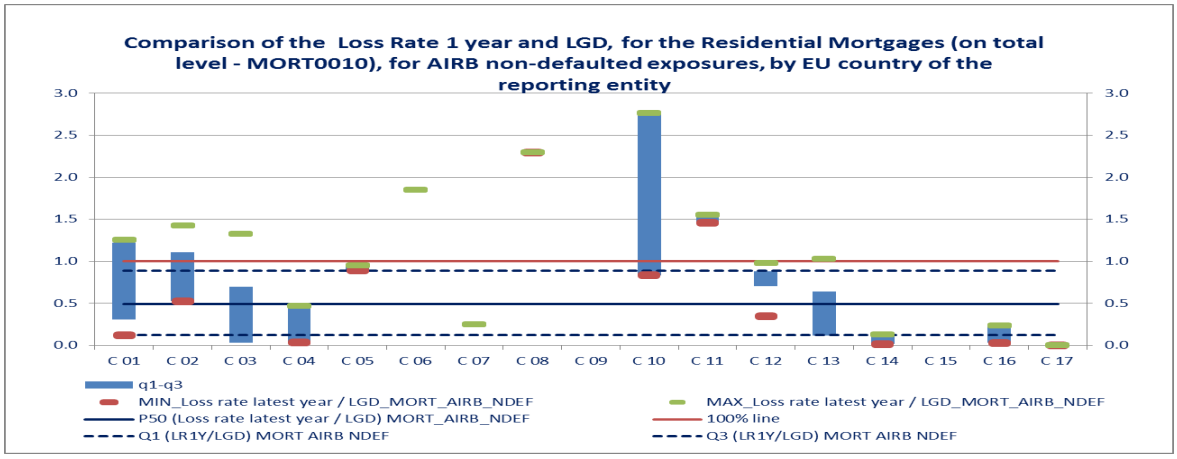


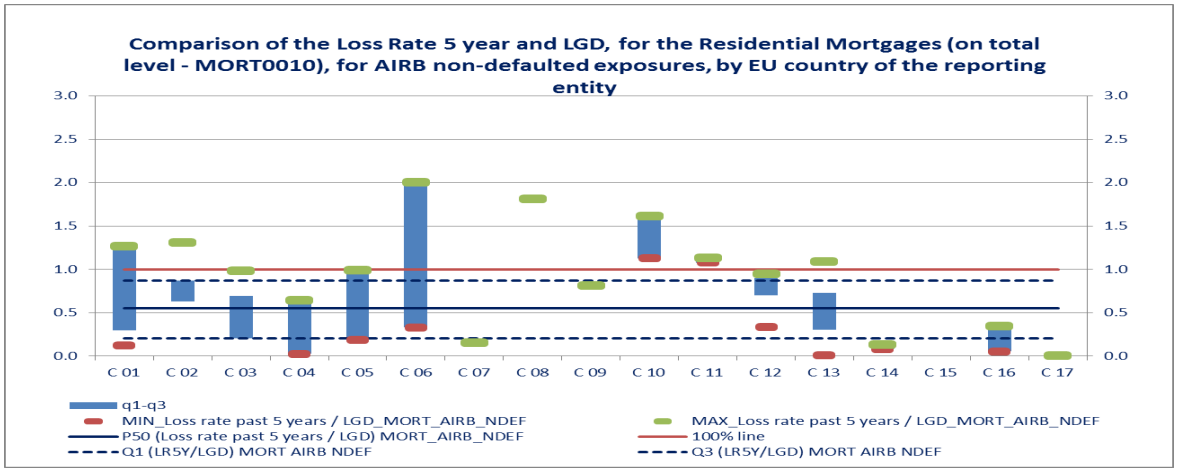
The outturns approach, i.e. the comparison of observed and estimated values (backtesting), shows that the medians of the ratios between the loss rate and the LGD (i.e.

observed/estimated), for both the latest year and the 5-year average, are very similar and well below 1 (i.e. the numerator is lower than the denominator). In general, the estimated values (LGDs) are higher than the loss rates reported in recent years. This is consistent with the fact that the CRR requires LGDs to be reflective of downturn conditions.

Contrary to the evolution of the ratio between default rates and PDs, in which the variability decreased in the latest year, the LGD interquartile range for both the latest year and the average of the past 5 years shows similar variability.

Figure 44: Comparison of the LGD and the loss rate (latest year and past 5 years), for residential mortgages, for IRB non-defaulted exposures, by EU country of the bank





7. Impact analysis using the CET1 ratio

This chapter describes the outcome of a specific impact analysis on the CET1 ratio that is based on alternative higher RWA quantities (RWA* and RWA**) reported by the institutions, in particular by using the outturns for PDs.

This impact analysis is based on a specific definition of alternative risk parameters and, thus, only negative variations (i.e. reduction of the CET1 ratios) are considered; therefore, possible positive variations and consequent compensation effects are not included (e.g. for a specific portfolio and specific rating grades, a possible underestimation of the PD and use of a higher PD to recalculate the RW, with a resulting decrease in the CET1 ratio, is not offset by a possible overestimation of the PD in another portfolio).

This impact analysis does not try to reflect regulatory measures or corrective actions in place that are having an impact on institutions' capital requirements, nor does it consider institutions' different risk management practices or different levels of collateralisation. Instead, it aims to provide an estimate of the potential magnitude of RWA changes under a specific scenario influenced by observed parameters. Providing such a reference point should help the reader to understand the potential scale of RW differences. Extrapolations to the total IRB credit risk portfolio cannot be made, because of the specific nature of HDP exposures. The data should, however, be interpreted with caution, given the one-sided conservative view of the analysis and some data quality constraints. The data collection was based on new definitions and parameters to be systematically calculated by all institutions and may require some improvements. Ultimately, this hampered the ability to draw definite conclusions about the impact explained by this dimension (see also Annex 3 for more information regarding possible limitations in relation to data availability and data quality constraints).

Methodology

The methodology applied compares the actual CET1 ratios with those re-computed using the RWA* and RWA** reported by the participating bank. The differences between the RWA and both the RWA* and the RWA** provide the impact of the observed default rate of, respectively, the latest year and the average of the past 5 years (based on a binomial test assumption for the internal credit risk models) for the UL. If the PD used to estimate the RWA shows an extreme negative deviation from the observed default rate, higher PDs are used (PD* and PD**) to recalculate the RWA (i.e. RWA* and RWA**), where, however, PD* and PD** are still well below the observed default rate (at the lower boundary of the 97.5% confidence interval) and are thus not designed as a measure of conservatism. Therefore, the re-calculation of the CET1 ratio, per bank and main portfolio (residential mortgage, SME retail, SME corporate or corporate-other), based on both the RWA* and the RWA**, can provide an example of the possible impact on capital requirements influenced by estimated PDs and observed default rates[44].

[44] PD* and PD**, calculated by the participating banks, are the smallest PD estimates for which the one-sided binomial test (based on a normal approximation of the binomial distribution with a confidence level of 97.5%) would be passed (see, for details, Commission Implementing Regulation (EU) 2016/2070, OJ L 328, 2.12.2016 (Annex IV, Results

The example below provides practical information regarding the calculations of the impact on CET1 for a specific bank with a current CET1 ratio of 8%, for a specific portfolio, namely residential mortgages, taking into account the RWA* provided by the bank.

Example for Bank Y

COREP data:

CET1 = 8 (monetary unit, i.e. m.u.)
Total RWA = 100 m.u.
CET1 ratio = 8 / 100 = 8%

Residential mortgage (ITS – supervisory benchmarking data):

RWA residential mortgage = 25 m.u.
RWA* residential mortgage = 40 m.u.

Impact on CET1 ratio derived from residential mortgage:

CET1 ratio* = 8 / (100 – 25 + 40) = 6.96%
Impact (bps) = 6.96% – 8% = – 1.04% = – 104 bps

The necessary increase of CET1 capital to maintain the same CET1 ratios as before the estimated impact would be 1.04% * (100 – 25 + 40) = 1.2 m.u.

The simple aggregation of participating banks allows the aggregate impact on the CET1 ratio derived from residential mortgage or, more generally, from the main portfolios to be presented.

Results

The exposure-weighted average CET1 capital ratio in the sample as of December 2015 is 13.23%.[45] The impact of the use of the RWA* and RWA** on the CET1 capital ratio is, respectively, –9 bps and –17 bps, bringing the CET1 ratio across the sample from 13.23% to, respectively, 13.15% and 13.06%. In addition, the negative variations are not concentrated in banks with lower CET1 ratios, but dispersed throughout banks with different levels of CET1 ratios (namely the difference between the original CET1 ratio and both the CET1* and the CET1** ratios).

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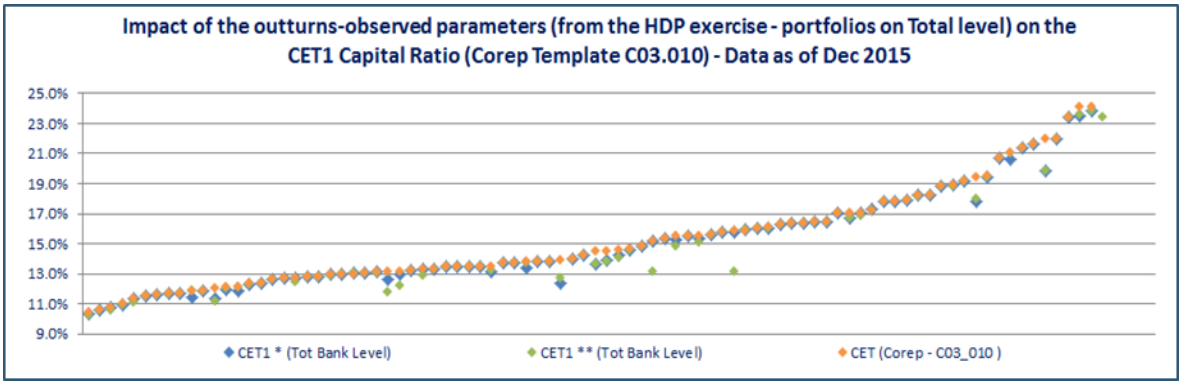
[45] Pooling all of the banks' figures together as if they were one large bank and using COREP figures from C 01.020 and C 02.010 to compute the ratio.

Figure 45: Impact on the CET1 ratio using both the RWA* and the RWA**, on the total level, for all portfolios, for defaulted and non-defaulted exposures, by bank



The impacts on the CET1 ratio from institutions' real RWAs and the associated change to both the RWA* and the RWA**, for each main portfolio, show that, on average, the variations are not significant. The SME retail portfolio presents the smallest impact on the CET1 ratio using both the RWA* and the RWA**, without any significant change at the bank level for most of the banks (with a concentration of the CET1** delta around the 75th percentile, which is around –0.34 bps, and an interquartile range of only 8 bps).

Figure 46: Impact on the CET1 ratio using both the RWA* and the RWA** for defaulted and non-defaulted exposures, by portfolio

	CET1** (CORP - Delta bps)	CET1** (SMER - Delta bps)	CET1** (SMEC - Delta bps)	CET1** (MORT - Delta bps)
P50	- 4.03	- 1.63	- 2.51	- 6.19
Q1	- 12.40	- 7.91	- 15.38	- 30.06
Q3	- 0.45	- 0.34	- 0.51	- 0.72
Q3 - Q1	12	8	15	29

The highest impacts on CET1 are shown in the residential mortgage portfolio, with the median around –6 bps and the 25th percentile around –30 bps. For all the portfolios, the dispersion and interquartile ranges are higher for the RWA based on the average of the past 5 years (RWA**) than that based on the latest year (RWA*). The regulatory approach may be also relevant; however, the CET1 ratio impacts were not calculated.[46]

From the interviews with some banks, it was observed that, in the case of model reviews as a result of deficiencies and the consequent need for conservative bank and regulatory actions to improve the outputs, a margin of conservatism (e.g. add-ons) is often applied by banks to their RWA until the issues have been addressed. The impact on those margins of conservatism, or other regulatory imposed add-ons, have not been captured in the analysis. In future exercises, the collection of additional data regarding the use of margins of conservatism, possible links to compensation effects and the different add-ons' impacts on the RWA estimates would need to be considered.

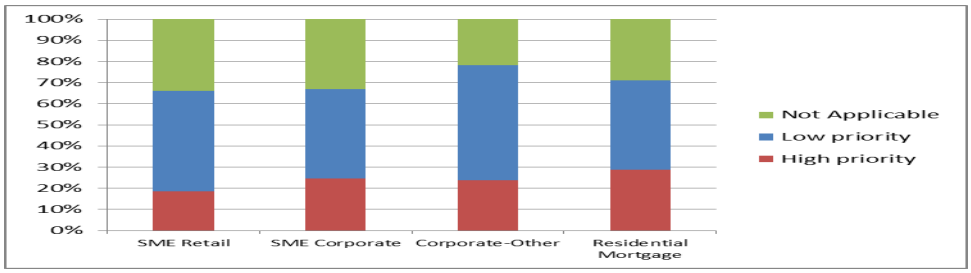
[46] Even if using only the effect from the observed defaults and PDs for the RWA* and RWA**, there may be differences to take into account between the FIRB PD and AIRB PD, and the same is true for LGDs (i.e. the FIRB LGD* and the AIRB LGD*, as well as the FIRB LGD** and the AIRB LGD**, and the influence on the RWA* and the RWA**).

8. Competent Authorities' assessments

As part of the HDP 2016 exercise, the CAs provided individual assessments for each participating institution about any potential underestimation of the capital requirement as required by Article 78(4) of Directive 2013/36/EU, and Articles 8 and 9 of the draft RTS on supervisory benchmarking. This chapter highlights some of the key information derived from these assessments.

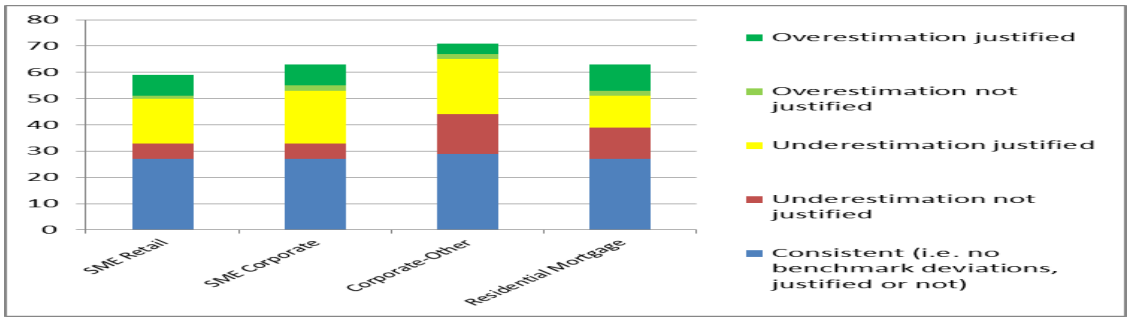
Regarding the level of priority for the assessments, most of the CAs considered the residential mortgage portfolio to be the most important portfolio. Among other reasons, CAs referred the to the materiality of the exposures in terms of EAD, the possible underestimation of own funds requirements for the defaulted assets (e.g. doubts regarding the calculation of the LGD for defaulted exposures – the so called LGD in-default – and the best estimate of EL (ELBE) models) and the number of situations (risk parameters and other indicators) in which a bank is an outlier when compared with peers.

Figure 47: Level of priority for the assessments



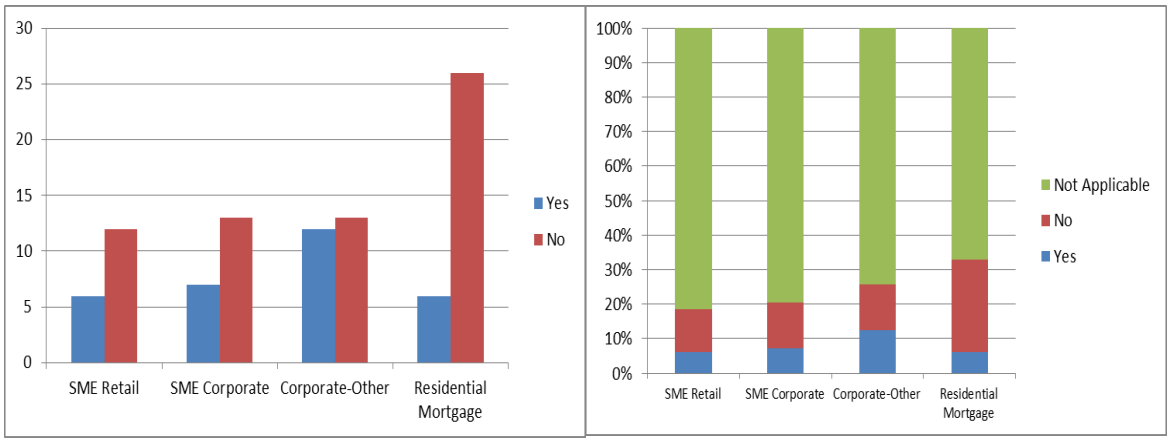
The CAs' own overall assessments of the level of own funds requirements, taking into account benchmark deviations, show that the corporate-other and residential mortgage portfolios present the highest numbers of potential underestimations that are not justified, with additional information required to determine the possible reasons for this. In addition, the corporate-other portfolio shows a higher number of banks with potential underestimations that are justified, according to the CAs. As an example, a CA notes that, since the exercise was conducted, the models related to possible underestimations that are not justified were re-developed/recalibrated in 2016 and thus it is expected that the gap will be closed once these improved and more cautious models are validated in 2017.

Figure 48: Number of responses in CAs' own overall assessments of the level of own funds requirements, taking into account benchmark deviations, per portfolio, per type of answer



The banks' internal validation processes are also an important element to consider. According to the CAs, for most of the situations, banks' internal validations have not identified possible unjustified underestimations of the internal models. This is particularly evident for the residential mortgage portfolio, and more details need to be collected in future assessments.

Figure 49: Number of responses to the question 'Have the banks' internal validations identified possible underestimations of the internal models that are not justified?', per portfolio, per type of answer



Regarding the CAs' monitoring activities, most of the CAs noted that the ongoing or on-site monitoring of the internal models identified possible underestimations that are not justified, in particular for both the corporate-other and SME corporate portfolios. For instance, one CA noted that weaknesses in the rating process and in the related credit processes had been identified in past on-site inspections. Supervisors will need to conduct further investigations to understand the details.

Figure 50: Number of responses to the question 'Have the CA monitoring activities (ongoing or on-site) of the internal models identified the possible underestimations that are not justified?', per portfolio, per type of answer

Conclusion

This report presents the results of the supervisory benchmarking exercise for residential mortgage, SME retail, SME corporate and corporate-other portfolios (collectively referred to as HDPs), conducted pursuant to Article 78 of the CRD and the related technical standards on the internal approaches for credit risk.[47] The 2016 HDP benchmarking exercise involved, for the first time, the entire population of banks that are authorised to use internal models for the calculation of regulatory capital in the context of HDPs. However, the analysis is carried out on only the highest level of consolidation. This study includes 114 institutions,[48] which participated in the exercise across 17 EU countries. The reference date for the data of this report is 31 December 2015

The benchmarking results should, however, be interpreted with caution given some data quality constraints, which hamper the ability to draw definite conclusions. The data collection was based on new technical standards with new definitions and parameters; therefore, the findings should be interpreted with caution, given some data quality constraints. Additional qualitative information on specific aspects – such as banks' modelling methodologies and assumptions, data sources, lengths of time series, default definitions, number and scope of models – as well as on the downturn approach for LGDs has been collected through interviews with a sample of 10 banks.

Main findings

Most of the results from the 2016 HDP exercise are broadly in line with those of previous studies on HDPs. The GC[49] varies at the total portfolio level, and for a larger sample than in the 2013 HDP report, from 8% to 293%, with a simple average of 75%. In the 2013 HDP report, the range was between 14% and 174%,with a simple average of 67%.[50] Similarly, the average RW per institution varies from 7% to 129%, with a simple average of 37%. This compares to a range between 11% and 71% and a simple average of 32% reported in the 2013 HDP report.

A key finding is that 82% of the observed GC variability across participating institutions' portfolios can be explained by only a few factors, namely the proportion of defaulted assets, the proportion

[47] This is the first exercise that is based on the new technical standards on supervisory benchmarking pursuant to Article 78 of the CRD. The technical standards are applied for the calculation of RWAs on the internal approaches across the EU. They were published by the EBA in January 2015 and adopted by the EU Commission in September 2016.

[48] EBA list of institutions for the purpose of supervisory benchmarking (June 2016), i.e. HDPs and LDPs. https://www.eba.europa.eu/documents/10180/15926/EBA+list+of+institutions+for+the+purpose+of+supervisory+benchmarking+%28June+2016%29.pdf/2b0b55f7-f745-49e2-ace5-f7249205db8d (see, for details, Chapter 3 on the dataset and assessment methodology).

[49] GC, for IRB exposures, is computed as (12.5 * EL + RWA) / EAD. The RW, computed at different levels of aggregation, enables the effect of all the IRB parameters (namely PD, LGD, CCF and maturity, but also the asset correlation) to be synthesised in one indicator. The pitfall with the RW is that it refers only to the UL. Indeed, under the IRB approach, a bank is asked to cover with provisions or capital the estimated total losses, i.e. EL and UL.

[50] EBA report 'Third interim report on the consistency of risk-weighted assets: SME and residential mortgages'. https://www.eba.europa.eu/documents/10180/15947/20131217+Third+interim+report+on+the+consistency+of+risk-weighted+assets+-+SME+and+residential+mortgages.pdf

of non-EU exposures and the portfolio-mix. The level of GC variability that can be explained increased slightly in comparison with the 2013 HDP report (from 78%), and the main determinants are almost the same, after the number of participating banks increased significantly.

The cross-sectional (distribution analysis) approach and the outturn ('backtesting') approach focused on EU countries (country of the participating institution), for non-defaulted exposures, for each of the main portfolios (residential mortgage, SME retail, SME corporate and corporate-other portfolios). The distribution analysis represents a peer comparison of the estimates of the risk parameters at the portfolio level, whereas the outturn ('backtesting') analysis produces a peer comparison between observed values and estimated values for the same comparable risk parameters.

Considering the cross-sectional approach, for EU non-defaulted exposures, the RW interquartile ranges present significant variation, in particular for both the SME corporate and corporate-other portfolios. Regarding the outturn ('backtesting') approach and the comparisons between observed values and estimated values, in general, the estimated values for PDs and LGDs are above the observed values for default rates and loss rates. It is important to note, however, that the comparisons and possible differences between estimated and observed values should consider that the CRR requires the PD to reflect the long run experience and to include some conservatism for data and model errors, whereas the LGD needs to reflect downturn conditions.

However, the comparison of the ratio between the default rate and the PD, for the average of the past 5 years, shows some differences per regulatory approach. The participating banks under the AIRB approach, for the SME corporate portfolio, show less conservative figures, i.e. with a ratio above 1 and with much higher variability. This again might be compensated for by more conservative PD estimates. As in previous reports, this approach also shows that there may be differences across jurisdictions in the level of conservatism. Some EU countries show systematically (i.e. for the latest year and the average of the past 5 years) ratios above 1 (i.e. observed values above the estimate values) for different risk parameters.

CAs provided individual assessments for each participating bank, as required by Article 78(4) of the CRD.[51] For the majority of the banks' assessments, the RW deviations (both negative and positive) from EU benchmarks were assessed by the CAs as justified and not significant. Regarding the level of priority for the assessments, most of the CAs considered residential mortgages to be one of the most important portfolios to follow, given the details provided by the supervisory benchmarking exercise.

The supervisory benchmarking exercise highlighted several areas in which supervisors should develop further investigations, such as the practices regarding defaulted exposures, the definition of default, the use of group-wide models and the interaction with country specificities for exposures with counterparties from different jurisdictions, unjustified differences between regulatory approaches and possible compensation effects between risk parameters, and systematic differences between observed and estimated values for some banks, among other

[51] CAs should, at least annually, make an assessment of the quality of the IRB approaches and, in accordance with Article 78(4) of the CRD, pay particular attention to significant differences in own funds requirements for the same type of exposures, and also to significant and systematic underestimation of own funds requirements.

issues. For those reasons, supervisory actions are expected to address the issues that have the potential to provoke underestimations in the calculation of the regulatory capital.

Future work

The results of the supervisory exercises are taken into account for the work the EBA is conducting in parallel on the validation of internal models, which is contributing to harmonising supervisory and banks' practices and to enhancing consistency. This work includes using existing EBA Guidelines, where appropriate, to enhance convergence in the computation of RWAs, and to improve Pillar 3 disclosures, as well as the validation and ongoing monitoring of internal models. In 2016, the EBA set out a roadmap specifying the general principles and timelines for the implementation of the regulatory review of the internal models for credit risk. Among several measures, it introduced changes aimed at harmonising definitions and supervisory practices in the definition of default, the estimation of risk parameters and treatment of defaulted assets, credit risk mitigation techniques and disclosure in four phases.[52] These changes should be supplemented by amendments to the underlying framework – beyond what is currently allowed in European legislation – to reduce undue variability in the implementation of the IRB models.

The use of a new complementary methodology, namely the outturn (backtesting) approach, allowed the results from previous analyses to be confirmed based on other approaches and more details to be determined regarding risk parameters, in particular the variability and possible systematic differences across the EU and within each EU country.

The report tracks the progress in the repair of internal models and contributes to the identification of areas in which supervisory action is still necessary. In general, the CAs will need to continue to ensure that their decisions on the appropriateness of corrective actions comply with the principle that such actions must maintain the objectives of an internal approach and, therefore, do not lead to standardisation or preferred methods, create wrong incentives or cause herd behaviour. The policy implications of the analyses carried out so far, as well as possible regulatory measures for improving the functioning of internal models, were summarised in the 'Discussion Paper on the future of the IRB Approach', published by the EBA in March 2015.[53]

Regarding future work, this study provides an initial starting point for the analysis of HDPs, allowing future evolution to be monitored and highlighting potential areas for further investigation, such as the comparisons between regulatory approaches, in particular between FIRB, AIRB and standardised approaches; the possible influence of the collateral status and assumptions on the internal LGD estimates; the importance of data sources, the length of the time series of the data and data quality issues (aspects mentioned during the interviews with banks); the influence of cross-border exposures in the quality of the internal models; and the evolution of risk parameters and interquartile figures at the country level in comparison with the EU benchmarks.

Data quality constraints from some participating institutions also deserve attention from CAs, given the possible data limitations and the need for improvements in their internal general data

[52] EBA model validation. https://www.eba.europa.eu/regulation-and-policy/model-validation

[53] 'Discussion Paper on the future of the IRB Approach'. https://www.eba.europa.eu/regulation-and-policy/credit-risk/discussion-paper-on-the-future-of-the-irb-approach

collection systems, IT infrastructures and database level. Moreover, the ITS on supervisory benchmarking needs further developments to allow a common understanding to be gained of the reporting requirements. In addition, more guidance might be provided to the CAs on the EBA benchmark and the assessment of the benchmarking results.

Annex 1: List of participating institutions in supervisory benchmarking exercises

The EBA collected information related to the institutions that met the criteria of this exercise.[54]

The EBA has requested that the CAs transmit institutions' data for supervisory benchmarking purposes, leveraging on the usual data collection procedures and formats of regular supervisory reporting, by the 30 June 2016.

EBA list of institutions for supervisory benchmarking as of June 2016

LEI Code	BankName	Country	Submits Credit Risk?	Submits Market Risk?
5299004SNO5GECIBWJ18	Promontoria Sacher Holding N.V.	Austria	Yes	Yes
529900JP9C734S1LE008	Raiffeisen-Landesbanken-Holding GmbH	Austria	Yes	Yes
PQOH26KWDF7CG10L6792	Erste Group Bank AG	Austria	Yes	Yes
529900IQMS1E10HN8V33	Volkskredit Verwaltungsgenossenschaft reg.Gen.m.b.H.	Austria	Yes	No
213800X3Q9LSAKRUWY91	KBC Group NV	Belgium	Yes	Yes
A5GWLFH3KM7YV2SFQL84	Belgiumlfius Banque SA	Belgium	Yes	Yes
5493008QOCP58OLEN998	Investar	Belgium	Yes	No
D3K6HXMBBB6SK9OXH394	Dexia NV	Belgium	Yes	No
LSGM84136ACA92XCN876	AXA Bank Europe SA	Belgium	Yes	No
549300DYPOFMXOR7XM56	Crelan	Belgium	Yes	No
3M5E1GQGKL17HI6CPN30	Jyske Bank A/S	Denmark	Yes	Yes
LIU16F6VZJSD6UKHD557	Nykredit Realkredit A/S	Denmark	Yes	Yes
MAES062Z21O4RZ2U7M96	Danske Bank A/S	Denmark	Yes	Yes
GP5DT10VX1QRQUKVBK64	Sydbank A/S	Denmark	Yes	Yes
213800UYAHIRLZ4NSN67	Lån og Spar Bank A/S	Denmark	Yes	No
7437003B5WFBOIEFY714	OP-Pohjola Group	Finland	Yes	No
7437006WYM821IJ3MN73	Ålandsbanken Plc	Finland	Yes	No
743700GC62JLHFBUND16	Aktia Bank	Finland	Yes	No
	Groupe BPCE	France	Yes	Yes
	Groupe Credit Agricole	France	Yes	Yes
O2RNE8IBXP4R0TD8PU41	Société Générale SA	France	Yes	Yes
R0MUWSFPU8MPRO8K5P83	BNP Paribas SA	France	Yes	Yes
549300HFEHJOXGE4ZE63	SFIL (Société de Financement Local)	France	Yes	No
96950001WI712W7PQG45	RCI banque (Renault Crédit Industriel)	France	Yes	No
9695000CG7B84NLR5984	Crédit Mutuel Group	France	Yes	No
9695004ON2K947Z21B87	Banque PSA Finance	France	Yes	No
969500E07BR6468F5910	BANQUE ACCORD	France	Yes	No
969500GVS02SJYG95632	CARREFOUR BANQUE	France	Yes	No
ZSLF02UC3X1JFV1UX676	GOLDMAN SACHS PARIS INC ET CIE	France	Yes	No
391200EEGLNXBBCVKC73	Erwerbsgesellschaft der S-Finanzgruppe mbH & Co. KG	Germany	Yes	Yes
529900HNOAA1KXQJUQ27	Deutsche Zentral-Genossenschaftsbank AG	Germany	Yes	Yes
7LTWFZYICNSX8D621K86	Deutsche Bank AG	Germany	Yes	Yes
851WYGNLUQLFZBSYGB56	Commerzbank AG	Germany	Yes	Yes
B81CK4ESI35472RHJ606	Landesbank Baden-WürttemBelgiumrg	Germany	Yes	Yes
DIZES5CFO5K3I5R58746	Landesbank Hessen-Thüringen Girozentrale	Germany	Yes	Yes
DSNHHQ2B9X5N6OUJ1236	NORD/LB Norddeutsche Landesbank Girozentrale	Germany	Yes	Yes
EFHQAFG69S4HKHLIZA14	Westdeutsche Genossenschafts-Zentralbank AG	Germany	Yes	Yes
0W2PZJM8XOY22M4GG883	DekaBank Deutsche Girozentrale	Germany	Yes	No
5299007S3UH5RKUYDA52	Deutsche Apotheker- und Ärztebank eG	Germany	Yes	No
529900GM944JT8YIRL63	Münchener Hypothekenbank eG	Germany	Yes	No
DZZ47B9A52ZJ6LT6VV95	Deutsche Pfandbriefbank AG	Germany	Yes	No
EZKODONU5TYHW4PP1R34	Aareal Bank AG	Germany	Yes	No
TUKDD90GPC79G1KOE162	HSH Nordbank AG	Germany	Yes	No
VDYMYTQGZZ6DU0912C88	Bayerische Landesbank	Germany	Yes	No
529900XLAZ15LYK8XK27	BHF Bank	Germany	No	Yes
391200UEWWKBDK12KP84	LBS Bayerische Landesbausparkasse	Germany	Yes	No
529900505U0S4QQ4Z793	Landesbank Saar	Germany	Yes	No
5299008I0TO44SUINZ71	Oldenburgische Landesbank AG	Germany	Yes	No
529900CLVK38HUKPKF71	Süd-West-Kreditbank Finanzierung GmbH	Germany	Yes	No
529900EM0ZU25V87GD50	ALTE LEIPZIGER Bauspar AG	Germany	Yes	No
529900J55ZSQTHBPLR53	KfW IPEX-Belgiumteiligungsholding GmbH	Germany	Yes	No
529900S1KHKOEQL5CK20	Wüstenrot Bausparkasse AG	Germany	Yes	No
529900TP68LKVLHKNE55	TOYOTA Kreditbank GmbH	Germany	Yes	No
529900VFIFTUZZZT3C10	BSQ Bauspar AG	Germany	Yes	No
D2OIGPB6E66YOBJ9GT20	BMW Bank GmbH	Germany	Yes	No
MRFNHBHO7AUDKS46SC62	Degussa Bank	Germany	Yes	No
QS0KV71ZZFYPT6POX557	Wüstenrot Bank AG Pfandbriefbank	Germany	Yes	No
5299009N55YRQC69CN08	Alpha Bank AE	Greece	No	Yes
5UMCZOEYKCVFAW8ZLO05	National Bank of Greece SA	Greece	Yes	Yes
JEUVK5RWVJEN8W0C9M24	Eurobank	Greece	Yes	Yes
2594004MC7VOKSK7Z633	Group of Magyar Takarékszövetkezeti Bank Zrt.	Hungary	Yes	No
3U8WV1YX2VMUHH7Z1Q21	Allied Irish Banks, Plc	Ireland	Yes	No
635400DTNHVYGZODKQ93	Permanent TSB Group Holdings Plc	Ireland	Yes	No
Q2GQA2KF6XJ24W42G291	Bank of Ireland	Ireland	Yes	No
2W8N8UU78PMDQKZENC08	Intesa Sanpaolo SpA	Italy	Yes	Yes
5493006P8PDBI8LC0O96	Banco Popolare Società Cooperativa	Italy	Yes	Yes
549300TRUWO2CD2G5692	UniCredit SpA	Italy	Yes	Yes
8156009BC82130E7FC43	Banca Popolare di Milano Scarl	Italy	Yes	Yes
815600AD83B2B6317788	Credito Emiliano Holding SpA	Italy	Yes	No
81560097964CBDAED282	Unione di Banche Italiane SCpA	Italy	Yes	No
J4CP7MHCXR8DAQMKIL78	Banca Monte dei Paschi di Siena SpA	Italy	Yes	No
549300AUUQG072ATL746	Precision Capital S.A.	Luxembourg	Yes	No
549300IVXKQHV6O7PY61	RBC Investor Services Bank S.A.	Luxembourg	Yes	No
R7CQUF1DQM73HUTV1078	Banque et Caisse d'Epargne de l'Etat, Luxembourg	Luxembourg	Yes	No

[54] The list of institutions is available on the EBA website at the following link: https://www.eba.europa.eu/-/eba-publishes-decision-on-data-for-supervisory-benchmarking

LEI Code	BankName	Country	Submits Credit Risk?	Submits Market Risk?
549300NYKK9MWM7GGW15	ING Groep N.V.	Netherlands	Yes	Yes
DG3RU1DBUFHT4ZF9WN62	Coöperatieve Rabobank U.A.	Netherlands	Yes	Yes
724500VLXQUMMD5BJB61	SNS Holding B.V.	Netherlands	Yes	No
724500DWE10NNL1AXZ52	ABN AMRO Groep N.V.	Netherlands	Yes	No
7245006WQ4T1GV2W4C98	NIBC Holding N.V.	Netherlands	No	Yes
724500SLLRS6HBWA3277	Global Mobility Holding B.V.	Netherlands	Yes	No
724500ZM85SCL0RS8L71	Van Lanschot N.V.	Netherlands	Yes	No
IDDOOAK3G8HWKHD18968	TD Bank N.V.	Netherlands	Yes	No
L35YSDFOIH056VDJ2557	GarantiBank International N.V.	Netherlands	Yes	No
549300GKFG0RYRRQ1414	DNB BANK ASA	Norway	Yes	No
549300Q3OIWRHQUQM052	SR-bank	Norway	Yes	No
213800M7T3CYVZ3ZRT12	Sparebanken Vest SPA	Norway	Yes	No
549300SXM92LQ05OJQ76	Sparebank 1 Nord-Norge SPA	Norway	Yes	No
549300VRM6G42M8OWN49	Sparebanken Hedmark SPA	Norway	Yes	No
5967007LIEEXZX5I4888	Bank 1 Oslo Akershus AS	Norway	Yes	No
5967007LIEEXZX5PU005	Sparebanken Møre SPA	Norway	Yes	No
7V6Z97IO7R1SEAO84Q32	Sparebank 1 SMN SPA	Norway	Yes	No
JU1U6S0DG9YLT7N8ZV32	Banco Comercial Português SA	Portugal	Yes	Yes
5493009W2E2YDCXY6S81	Novo Banco	Portugal	Yes	No
5493006QMFDDMYWIAM13	Banco Santander SA	Spain	Yes	Yes
549300TJUHHEE8YXKI59	BFA Tenedora De Acciones, S.A.	Spain	Yes	Yes
959800DQQUAMV0K08004	Criteria Caixa Holding, S.A	Spain	Yes	Yes
K8MS7FD7N5Z2WQ51AZ71	Banco Bilbao Vizcaya Argentaria, SA	Spain	Yes	Yes
80H66LPTVDLM0P28XF25	Banco Popular Español SA	Spain	Yes	No
SI5RG2M0WQQLZCXKRM20	Banco de Sabadell, SA	Spain	Yes	No
VWMYAEQSTOPNV0SUGU82	Bankinter SA	Spain	Yes	No
6SCPQ280AIY8EP3XFW53	Nordea Bank - group	Sweden	Yes	Yes
F3JS33DEI6XQ4ZBPTN86	Skandinaviska Enskilda Banken - group	Sweden	Yes	Yes
M312WZV08Y7LYUC71685	Swedbank - group	Sweden	Yes	Yes
1FOLRR5RWTWWI397R131	AB Svensk Exportkredit - group	Sweden	Yes	No
H0YX5LBGKDVOWCXBZ594	SBAB Bank AB - group	Sweden	Yes	No
NHBDILHZTYCNBV5UYZ31	Svenska Handelsbanken - group	Sweden	Yes	No
5493004WUGGU2BQI7F14	Landshypotek Bank AB (publ)	Sweden	Yes	No
549300C6TUMDXNOVXS82	Länförsäkringar Bank AB (publ)	Sweden	Yes	No
549300ZEF3QWM810M319	Volvofinans Bank AB (publ)	Sweden	Yes	No
2138005O9XJIJN4JPN90	The Royal Bank of Scotland Group Public Limited Company	United Kingdom	Yes	Yes
5493004FUULDQTMX0W20	Citigroup Global Markets Europe Limited	United Kingdom	Yes	Yes
5493004I1J5XW2WFNE95	Merrill Lynch UK Holdings Ltd	United Kingdom	Yes	Yes
549300FK5LWVMQ9QY386	Credit Suisse Investments (UK)	United Kingdom	Yes	Yes
549300IU15NXFPV2FC82	Nomura Europe Holdings PLC	United Kingdom	Yes	Yes
549300PPXHEU2JF0AM85	Lloyds Banking Group Plc	United Kingdom	Yes	Yes
549300RQT6K4WXZL3083	Goldman Sachs Group UK Limited	United Kingdom	Yes	Yes
E58DKGMJYYYJLN8C3868	Credit Suisse International	United Kingdom	Yes	Yes
G5GSEF7VJP5I7OUK5573	Barclays Plc	United Kingdom	Yes	Yes
LSMWH68Y2RHEDP8W5261	Morgan Stanley International Ltd	United Kingdom	Yes	Yes
MLU0ZO3ML4LN2LL2TL39	HSBC Holdings Plc	United Kingdom	Yes	Yes
U4LOSYZ7YG4W3S5F2G91	Standard Chartered Plc	United Kingdom	Yes	Yes
U7M81AY481YLIOR75625	Mitsubishi UFJ Securities International PLC	United Kingdom	Yes	Yes
2138004G59FXEAZ6IO10	Coventry Building Society	United Kingdom	Yes	No
213800TLZ6PCLYPSR448	The Co-operative Bank Plc	United Kingdom	Yes	No
549300XFX12G42QIKN82	Nationwide Building Society	United Kingdom	Yes	No
213800TAU9ZX2WZNCO64	Virgin Money Plc	United Kingdom	Yes	No
F01VVKN4DRF2NWKGQ283	ICBC Standard Bank Plc (was Standard Bank Plc)	United Kingdom	No	Yes
2138003CSNVJEPFZ3U52	Principality Building Society	United Kingdom	Yes	No
2138003QTHQUES5MZX76	Toronto Dominion Investments B.V.	United Kingdom	Yes	No
213800KWCGLFG9WZDX35	TSB Banking Group PLC	United Kingdom	Yes	No
NT7C58H5HPZYKZDPOO64	Sumitomo Mitsui Banking Corporation Europe Limited	United Kingdom	Yes	No

Annex 2: Source of data

Annex II of the ITS, Template C 103.00 – This template gives the definitions of the different HDPs and segments as follows:

- ***Portfolio ID*** (identified by the EBA with a unique ID). It represents **the most granular portfolios** (**portfolio ID** per country of the counterparty for the EU).

- ***Portfolio name*** (**four types of exposure classes** have been broken down in different 'portfolio names': nine portfolio names for corporate-other (CORP), nine portfolio names for corporate SME (SMEC), nine portfolio names for retail SME (SMER) and 10 portfolio names for residential mortgage (MORT)).

    - **For firms (corporate and SME), there are three exposure classes**, based on the size of the counterparty:
        - **corporate-other** (size of the counterparty: >EUR 50 million, ≤EUR 200 million);
        - **corporate SME** (size of the counterparty: >EUR 1 million, ≤EUR 50 million);
        - **retail SME**:
            - For retail SME, in the template, there are three exposure classes: retail (secured by real estate) SME, retail (other) SME and retail (secured by real estate SME/other) SME. However, these three exposures classes can be classified from a practical and methodological point of view as just one group, namely retail SME;
    - **For mortgages, there is only one exposure class** ('retail-secured by real estate non-SME');[55]

    - For the four exposure classes, it is possible to distinguish between **defaulted** (only one portfolio name for each exposure class, that is, without further breakdown)[56] and **non-defaulted** (eight portfolio names for each corporate, corporate SME and retail SME, and nine portfolio names for mortgages).

[55] In Article 4(75) of the CRR there is a definition of residential property but no definition of commercial property. For the purposes of the CRR, 'commercial immovable property' encompasses any immovable property (including offices and other commercial premises) that is not a 'residential property' within the meaning of Article 4(1) and (75) of the CRR.

[56] Article 178 of the CRR. The obligor is past due more than 90 days on any material credit obligation to the institution, the parent undertaking or any of its subsidiaries. **Competent authorities may replace the 90 days with 180 days for exposures secured by residential or SME commercial real estate in the retail exposure class**, as well as exposures to public sector entities). The 180 days shall not apply for the purposes of Article 127 of the CRR.

Firms (corporate and SME) – portfolios for the three exposure classes (CORP, SMEC or SMER)

Portfolio name	Portfolio name	Portfolio name
020	020	020
CORP Non-defaulted Secured Construction	SMEC Non-defaulted Secured Construction	SMER Non-defaulted Secured Construction
CORP Non-defaulted Secured Other	SMEC Non-defaulted Secured Other	SMER Non-defaulted Secured Other
CORP Non-defaulted Secured	SMEC Non-defaulted Secured	SMER Non-defaulted Secured
CORP Defaulted	SMEC Defaulted	SMER Defaulted
CORP Non-defaulted Unsecured Construction	SMEC Non-defaulted Unsecured Construction	SMER Non-defaulted Unsecured Construction
CORP Non-defaulted Unsecured Other	SMEC Non-defaulted Unsecured Other	SMER Non-defaulted Unsecured Other
CORP Non-Defaulted	SMEC Non-defaulted Unsecured	SMER Non-defaulted Unsecured
CORP Non-defaulted Secured	SMEC Non-Defaulted	SMER Non-Defaulted
CORP Non-defaulted Unsecured	SMEC Non-defaulted Secured	SMER Non-defaulted Secured

- **For firms (corporate and SME) non-defaulted**, it is possible to distinguish the **construction sector** from the remaining sectors ('construction' or 'other sectors') and between two forms of **collateral status** (with credit protection (secured) or without credit protection (unsecured)).[57]

- **For mortgages** (one exposure class: 'retail-secured by real estate non-SME'), it is possible to make distinctions according to both the six indexed loan to value (current loan amount to the current value of the property) portfolio names and the two forms of collateral status (funded CRM or unfunded CRM).

Mortgage – portfolios for the exposure class

Portfolio name
020
020-Portfolio name
Mortgages Defaulted
Mortgages Non-defaulted funded CRM
Mortgages Non-defaulted ILTV <=25%
Mortgages Non-defaulted ILTV >100%,<=125%
Mortgages Non-defaulted ILTV >125%
Mortgages Non-defaulted ILTV >25%,<=50%
Mortgages Non-defaulted ILTV >50%,<=75%
Mortgages Non-defaulted ILTV >75%,<=100%
Mortgages Non-defaulted
Mortgages Non-defaulted Unfunded CRM

For all the portfolio names mentioned above, it is possible to also have a breakdown by the country of the bank for the EU (i.e. there are 29 portfolio IDs for each of the portfolios mentioned above).

Several potential **breakdowns are not available**, namely breakdowns by:

- ***geographical area*** *(country of the counterparty for non-EU counterparties);*
- ***rating*** *(internal rating assigned from the lowest risk to the highest risk, with a maximum of 30 grades);*
- ***type of facility****;*
- ***NACE code*** *(apart from 'construction').*

[57] Article 4 of the CRR. Definitions: Article 4(58), **Funded** credit protection means CRM 'where the reduction of the credit risk on the exposure (…) derives from the right (…) in the event of the default of the counterparty (…) **to liquidate, or to obtain transfer o appropriation of, or to retain certain assets or amounts** (…).' Article 4(59), **Unfunded** credit protection means CRM 'where the reduction of the credit risk on the exposure derives from the **obligation of a third party to pay an amount** in the event of a default (…).'

Annex 3: Data availability and data quality constraints

The source of the data is mainly Template C 103.00 (HDP), with the reference date 31 December 2015. The initial dataset is formed from the most recent data submissions from the institutions that arrived at the EBA up the 14 November 2016. Another source has been COREP data (Templates C 01 (020), C02 (010) and C03 (010)), with the reference date 31 December 2015 (no data cleaning on these figures has been conducted).[58]

Data cleaning

The initial dataset, before the data cleaning, was contributed to by 114 institutions (if the bank submitted at least one record with an EAD>0). From July to mid-September 2016, the EBA liaised with the national CAs to improve the data quality of the submissions, exchanging with them files containing feedback on the validation rules and additional quality checks. After the first step, other requests of data resubmissions were considered. In mid-September 2016, a cleaned dataset had been selected following these rules (at record level):

i. Portfolio IDs in the list of Annex I, C 103.00 (i.e. with figures at the total level and not only sub-portfolios levels);
ii. EAD: not missing and >0 (i.e. with EAD figures in order to compute the weighted figures based on EADs);
iii. PD: missing or between (excluded) 0 and (≤)100%;
iv. LGD: missing or ≥0;
v. Number of obligors: missing or >0;
vi. Default rate for 1Y (latest year): missing or ≥0;
vii. Default rate for 5Y (average of past 5 years): missing or ≥0;
viii. Loss rate for 1Y: missing or ≥0;
ix. Loss rate for 5Y: missing or ≥0;
x. Where C 103.00 c070 (i.e. default status) presented different values from the ones expected and laid down in Annex I:
    a. The information reported by institutions was replaced (C 103.00 c170, Annex III) by the equivalent (and accurate) information presented in Annex I for that particular portfolio;
    b. The records with 'Not applicable (default status)' were excluded.
xi. Regulatory Approach C103.00 c030 Annex III:
    a. only not null and values (representing AIRB and FIRB and excluding slotting criteria) were considered;
    b. The records with 'Not applicable (approach)' were excluded;
xii. For the institutions that submitted portfolios related to countries outside the scope of this exercise, the observations were excluded;
xiii. Some analyses have been performed at only the total level;
xiv. For the analysis in this report, no filters on the low number of obligors or low amounts of EAD have been considered.

[58] In this exercise, there are 77 832 potential data points for each bank and 807 521 data points were submitted in total.

After the implementation of the data cleaning rules (in particular rules (i) and (ii)), 99 banks remained in the clean dataset. This clean dataset was used to compute some statistics[59] and the EU benchmarks. These statistics, computed at the portfolio and regulatory approach levels, were provided in mid-September, in an Excel file to the national CAs through the TFSB (Task Force on Supervisory Benchmarking) for their assessments of the internal models.

Examples of data quality constraints:

- different interpretations of the data requirements by banks (i.e. of the description in the ITS, e.g. loss rates, secured/unsecured portfolios, provisions of non-performing exposures);
- some instances of low number of obligors, which might bias the values reported by banks and the benchmark (in particular for the country-specific portfolios);
- partly low number of banks contributing to the benchmark of certain portfolios, which might bias the benchmark;
- time constraints in implementing the reporting of the supervisory benchmark (associated with the ITS, potential aggregation problems, technical problems, etc.).

[59] Q1, Q3, P50, AVG (weighted average of the EAD), mean (simple average), minimum, maximum, *n* (count of the observations) and STD (standard deviation).

Annex 4: Outturns (backtesting) approach

The majority of portfolio IDs present the data at the level of the country (of the counterparty) per bank, i.e. for each bank with a specific portfolio ID, there are (potentially) 29 EU countries (i.e. sub-portfolio names can split the portfolio names by 29 potential countries). As an example, a specific bank ('A') provides the ratio between the default rate for latest year and the PD for the country 'BE' in the SME corporate portfolio in the category non-defaulted, secured construction. Therefore, it is possible to have information on variables at the country level (e.g. for each EU country of the bank, an average of the ratio between the default rate for the latest year and the PD from several banks).

C 103.00 – Definition of High Default Portfolios

Example

Portfolio ID	Portfolio name	Geographical area	Exposure class
010	020	030	040
010–Portfolio ID	020–Portfolio name	030–Geographical area	040–Exposure class
bank "A" – BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates – SME
bank "B" – BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates – SME
bank "C" – BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates – SME
bank "D" – BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates – SME
bank "E" – BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates – SME
(...)	(...)		(...)

These portfolio IDs and the descriptive for each ratio between the observed value and the estimated value (for comparable parameters) could be presented for each EU country of the bank as follows:

Outturn approach

Macro Exposure (non present in the annex)	040-Exposure class	080-Collateralisation status	020-Portfolio name	090-NACE code	150-Indexed Loan to value range	120-Collateral type	050-Default status	050-Default status
							Defaulted	Non-defaulted
Corporates	Corporates - Other	Exposures with credit protection	CORP Non-defaulted Secured			Non Real estate funded collateral		29
						Other eligible collateral: Real estate		29
			CORP Non-defaulted Secured Construction	060 F Construction				29
			CORP Non-defaulted Secured Other	YY Y Other non financial no construction				29
		Exposures without credit protection	CORP Non-defaulted Unsecured					29
			CORP Non-defaulted Unsecured Construction	060 F Construction				29
			CORP Non-defaulted Unsecured Other	YY Y Other non financial no construction				29
			CORP Defaulted				29	
			CORP Non-Defaulted					29
	Corporates - SME	Exposures with credit protection	SMEC Non-defaulted Secured			Non Real estate funded collateral		29
						Other eligible collateral: Real estate		29
			SMEC Non-defaulted Secured Construction	060 F Construction				29
			SMEC Non-defaulted Secured Other	YY Y Other non financial no construction				29
		Exposures without credit protection	SMEC Non-defaulted Unsecured					29
			SMEC Non-defaulted Unsecured Construction	060 F Construction				29
			SMEC Non-defaulted Unsecured Other	YY Y Other non financial no construction				29
			SMEC Defaulted				29	
			SMEC Non-Defaulted					29
Retail - Mortages	Retail - Secured by real estate non-SME		Mortgages Non-defaulted funded CRM			Real estate collateral, other funded CRM and/or personal guarantees		29
			Mortgages Non-defaulted Unfunded CRM			Real estate collateral and other unfunded CRM		29
			Mortgages Non-defaulted ILTV <=25%		<=25%			29
			Mortgages Non-defaulted ILTV >100%,<=125%		>100% <= 125%			29
			Mortgages Non-defaulted ILTV >125%		>125%			29
			Mortgages Non-defaulted ILTV >25%,<=50%		>25% <=50%			29
			Mortgages Non-defaulted ILTV >50%,<=75%		>50% <=75%			29
			Mortgages Non-defaulted ILTV >75%,<=100%		>75% <=100%			29
			Mortgages Defaulted				29	
			Mortgages Non-defaulted					29
Retail - SME	Retail - Secured by real estate SME	Exposures with credit protection	SMER Non-defaulted Secured			Other eligible collateral: Real estate		29
	Retail - Other SME	Exposures with credit protection	SMER Non-defaulted Secured			Non Real estate funded collateral		29
			SMER Non-defaulted Unsecured					29
		Exposures without credit protection	SMER Non-defaulted Unsecured Construction	060 F Construction				29
			SMER Non-defaulted Unsecured Other	YY Y Other non financial no construction				29
	Retail - Secured by real estate SME ; Retail - Other SME	Exposures with credit protection	SMER Non-defaulted Secured Construction	060 F Construction				29
			SMER Non-defaulted Secured Other	YY Y Other non financial no construction				29
			SMER Defaulted				29	
			SMER Non-Defaulted					29

Outturn approach

EAD	Default rate (latest year) / PD								Default rate (past 5 years) / PD	(...)
110	190/060	190/060	190/060	190/060	190/060	190/060	190/060	190/060	200/060	(...)
	Banks N	Simple Average	St Dev	Min	25th Percentile	Median	75th Percentile	Max	Banks N	(...)

Annex 5: Cross-sectional (distribution analysis) approach

For the extreme values (Article 3(a)) of the technical standards, the analysis should **at least focus on**:

- Very low **RWs for the defaulted assets**
  - *e.g. Portfolio name 'CORP defaulted' and total exposure versus RWA for each bank.*

For the descriptive analyses, and for each regulatory approach (i.e. IRB, FIRB and AIRB), the following statistics should be calculated:

- **Mean, median, quartile 1 and quartile 3 for each exposure class and portfolio ID**: PD, LGD, CCF and maturity (in days).
- **Standard deviation for each exposure class and portfolio ID**: PD and RW, LGD and CCF. This aims to understand the difference between PD and RW compared with peers, or the difference between LGD and CCF.

The majority of portfolio IDs present the data at the level of the country (of the counterparty) per bank. The following portfolio IDs and the descriptive for each variable (in addition to the variables already available from the templates, the ratio between RWA and EAD is also computed and presented) could be presented for each EU country of the bank as follows:

Cross-sectional approach
Distribution Analysis

Macro Exposure (non present in the annex)	040-Exposure class	080-Collateralisation status	020-Portfolio name	090-NACE code	150-Indexed Loan to value range	120-Collateral type	050-Default status	050-Default status	PD									LGD	(...)	RWA /EAD
							Defaulted	Non-defaulted	060	060	060	060	060	060	060	060	060	130	(...)	170 /110
									Banks N	Simple Average	EAD Weighted Average	St Dev	Min	25th Percentile	Median	75th Percentile	Max	Banks N	(...)	(...)
Corporates	Corporates - Other	Exposures with credit protection	CORP Non-defaulted Secured			Non Real estate funded collateral		29												
						Other eligible collateral: Real estate		29												
			CORP Non-defaulted Secured Construction	060 F Construction				29												
			CORP Non-defaulted Secured Other	YY Y Other non financial no construction				29												
		Exposures without credit protection	CORP Non-defaulted Unsecured					29												
			CORP Non-defaulted Unsecured Construction	060 F Construction				29												
			CORP Non-defaulted Unsecured Other	YY Y Other non financial no construction				29												
			CORP Defaulted				29													
			CORP Non-Defaulted					29												
	Corporates - SME	Exposures with credit protection	SMEC Non-defaulted Secured			Non Real estate funded collateral		29												
						Other eligible collateral: Real estate		29												
			SMEC Non-defaulted Secured Construction	060 F Construction				29												
			SMEC Non-defaulted Secured Other	YY Y Other non financial no construction				29												
		Exposures without credit protection	SMEC Non-defaulted Unsecured					29												
			SMEC Non-defaulted Unsecured Construction	060 F Construction				29												
			SMEC Non-defaulted Unsecured Other	YY Y Other non financial no construction				29												
			SMEC Defaulted				29													
			SMEC Non-Defaulted					29												
Retail - Mortages	Retail - Secured by real estate non-SME		Mortgages Non-defaulted funded CRM			Real estate collateral, other funded CRM and/or personal guarantees		29												
			Mortgages Non-defaulted Unfunded CRM			Real estate collateral and other unfunded CRM		29												
			Mortgages Non-defaulted ILTV <=25%		<=25%			29												
			Mortgages Non-defaulted ILTV >100% <=125%		>100% <= 125%			29												
			Mortgages Non-defaulted ILTV >125%		>125%			29												
			Mortgages Non-defaulted ILTV >25% <=50%		>25% <=50%			29												
			Mortgages Non-defaulted ILTV >50% <=75%		>50% <=75%			29												
			Mortgages Non-defaulted ILTV >75% <=100%		>75% <=100%			29												
			Mortgages Defaulted				29													
			Mortgages Non-defaulted					29												
Retail - SME	Retail - Secured by real estate SME	Exposures with credit protection	SMER Non-defaulted Secured			Other eligible collateral: Real estate		29												
	Retail - Other SME	Exposures with credit protection	SMER Non-defaulted Secured			Non Real estate funded collateral		29												
			SMER Non-defaulted Unsecured					29												
		Exposures without credit protection	SMER Non-defaulted Unsecured Construction	060 F Construction				29												
			SMER Non-defaulted Unsecured Other	YY Y Other non financial no construction				29												
	Retail - Secured by real estate SME ; Retail - Other SME	Exposures with credit protection	SMER Non-defaulted Secured Construction	060 F Construction				29												
			SMER Non-defaulted Secured Other	YY Y Other non financial no construction				29												
			SMER Defaulted				29													
			SMER Non-Defaulted					29												

The same analysis can be developed for each regulatory approach (FIRB, AIRB and IRB). For the FIRB approach, the variables to consider are the following: PD, default rate for the latest year and default rate for the past 5 years.

C 103.00 - Definition of High Default Portfolios										
Example				(ITS-Annex IV, template 103)						
Portfolio ID	Portfolio name	Geographical area	Exposure class	Regulatory Approach	EAD	PD	CCF	LGD	(...)	Loss rate past 5 years
010	020	030	040	030	110	060	100	130	(...)	220
010-Portfolio ID	020-Portfolio name	030-Geographical area	040-Exposure class							
bank "A" - BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates - SME	FIRB		1.50%				
bank "B" - BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates - SME	FIRB		4.50%				
bank "C" - BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates - SME	FIRB		5.05%				
bank "D" - BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates - SME	FIRB		2.30%				
bank "E" - BESMEC0001	SMEC Non-defaulted Secured Construction	BE	Corporates - SME	(...)	(...)	(...)	(...)	(...)	(...)	(...)
(...)	(...)		(...)			Simple Average	Simple Average	Simple Average	Simple Average	Simple Average
						EAD Weighted Average	EAD Weighted Average	EAD Weighted Average	EAD Weighted Average	EAD Weighted Average

It is also possible to develop descriptives of the model ID; however, clear mapping with portfolio IDs and variables (e.g. EAD per model for portfolio IDs) is necessary to provide suitable analysis (Annex IV, Template C 105.02).

Annex 6: Additional charts on RW and risk parameter deviations

Figure 51: RW range, for the SME corporate portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank

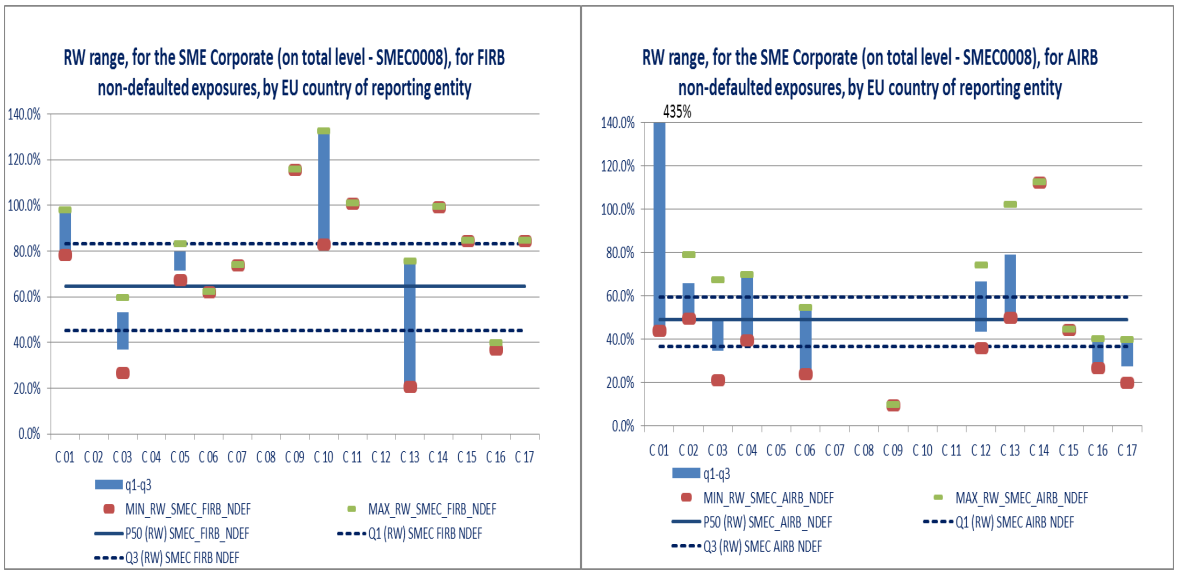


Figure 52: PD range, for the SME corporate portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank

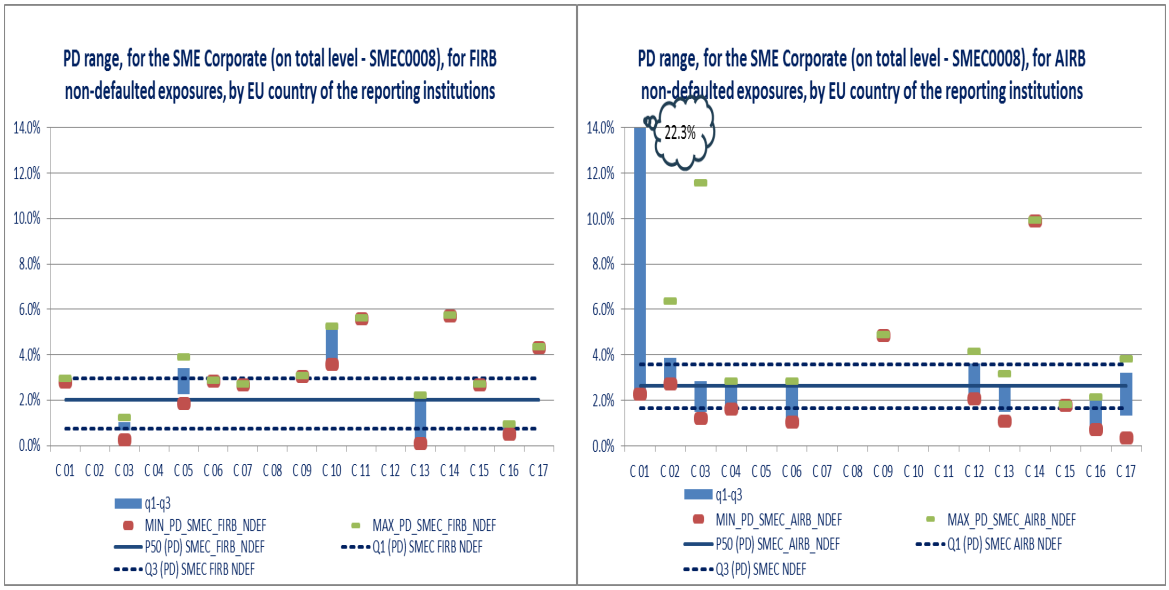


Figure 53: Comparison of the LGD and the loss rate (latest year and past 5 years), for the SME corporate portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank[60]

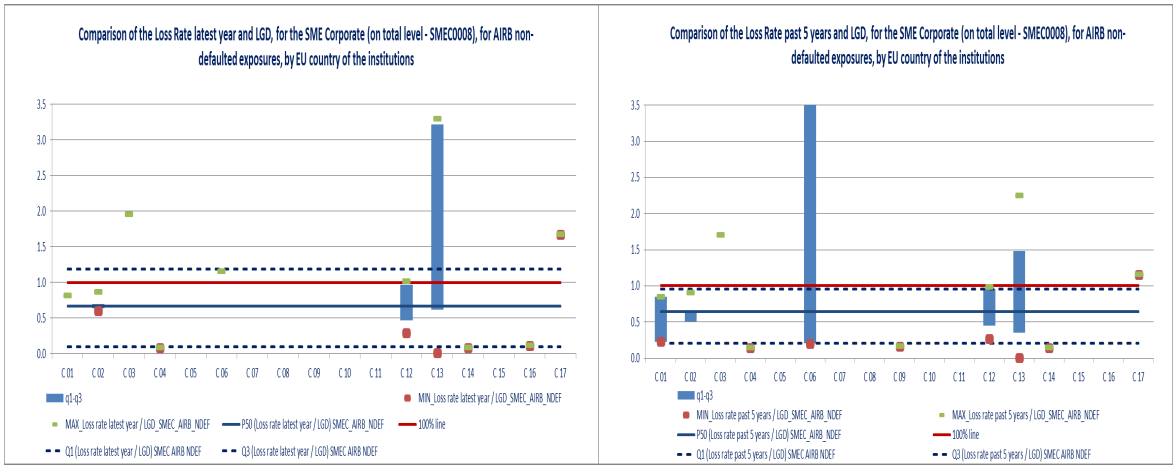
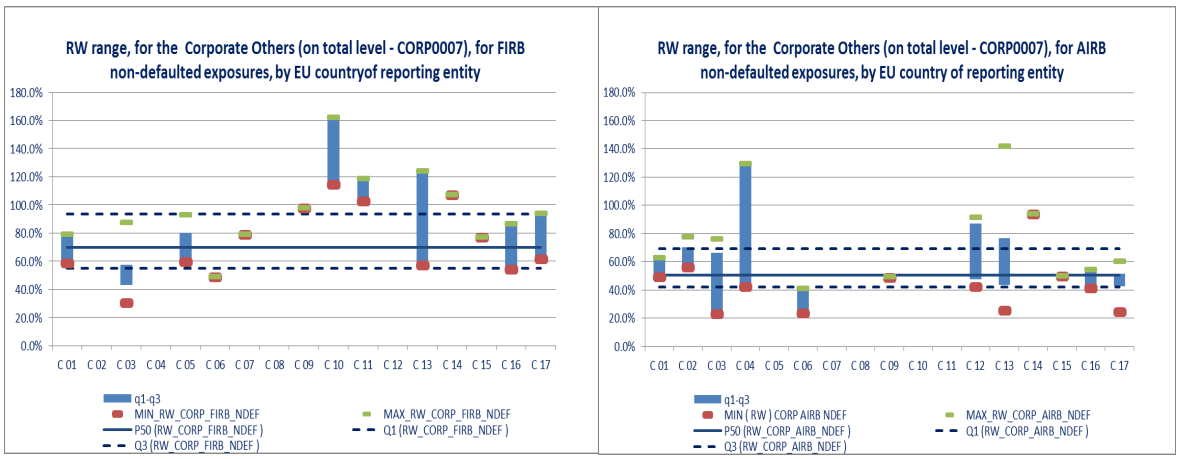


Figure 54: RW range, for the corporate-other portfolio, for IRB (FIRB and AIRB) non-defaulted exposures, by EU country of the bank



[60] The extreme outlier for C 06 is due to data quality issues when reporting the figures.

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