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Methodology QIS 5.doc

Methodology for the aggregation of individual QIS 5 bank data

1 Introduction

The purpose of this note is to outline the calculation of minimum required capital (MRC) at the level of individual portfolios and to describe the weighting scheme for the aggregation of QIS 5 data that is applied for two types of analysis:

1. when considering the aggregation of changes in minimum required capital at a portfolio level across banks for a particular portfolio. “Portfolio” in this document refers to the different exposure classes set out in the CRD as well as to several other items with an impact on overall minimum required capital, such as capital requirements for market and operational risk and for the requirements arising from the partial use of the Standardised Approach under the IRB Approaches; and

2. when considering the aggregation of changes in minimum required capital for the whole banking system of individual countries. This includes in particular an assessment of how changes in the individual portfolios contribute to the total change for the banking system.

The formulae which are set out in this note were the basis for all portfolio and bank-specific results on changes in minimum required capital in this report. The methodology for bank-specific results is completely in line with the cross-country analysis carried out by the OC/QIS Working Group on the G10 and non-G10 level. The numbers in this report were extracted from an SQL database maintained in Frankfurt in which all QIS data of EU countries are stored. The analysis team of the Deutsche Bundesbank provided an Excel-based tool (QIS-Portfolioanalysis.xls) for supervisors to reproduce the numbers for the banks from their own countries.

The note is structured as follows: First the necessary notation is provided in Section 2. Then the formulae on the changes in minimum required capital and contribution on a portfolio level are set out (Section 3). An additional subsection of Section 3 describes how partial use exposures are treated in the analysis (3.2.1). Subsection 3.2.2 is devoted to the different risk categories of the trading book. Section 4 describes how aggregation across banks is carried out.

2 Notation

Throughout this note we rely on the following notation:

RWA_i, RWA_i^{Curr}	Risk-weighted assets (Risk-weighted exposures in the terminology of the CRD) of bank i according to the CRD and the current regime
$cRWA_i$, $cRWA_i^{Curr}$	Credit risk-weighted assets of bank i (i.e. risk-weighted assets without market risk and operational risk)

RWA_i^{PF} , $RWA_i^{PF,Curr}$	Risk-weighted assets according to the CRD for a specific portfolio PF of bank i
RWA_i^{PU} , $RWA_i^{PU,Curr}$	Risk-weighted assets of bank i treated under the partial use of the Standardised Approach and the risk-weighted assets for these exposures under the current regime
EL_i, EL_i^{PF}	Aggregated expected losses for the whole bank i and for a specific portfolio PF of bank i
D_i	Regulatory calculation difference, i.e. the difference between expected losses and loan loss provisions
Ded_i, Ded_i^{Curr}	Total deductions under the CRD and the current regime respectively, including deductions for securitisation, related entities, and other supervisory deductions as described below.
Ded_i^{Sec}, $Ded_i^{Sec,Curr}$	Deductions for the securitised portfolio under the CRD and the current regime, respectively
Ded_i^{RelEnt}, $Ded_i^{RelEnt,Curr}$	Deductions for the related entities under the CRD and the current regime, respectively
Ded_i^{other}, $Ded_i^{other,Curr}$	Other supervisory deductions under the CRD and the current regime, respectively. Note that these amounts do not include the deductions for securitisation and related entities, and deductions due to a possibly negative regulatory calculation difference.
$GP_i^{incl,Curr}$, GP_i^{incl}	General provisions included in capital under the current regime and under the Standardised Approach of the CRD
$GP_i^{incl,PU}$	General provisions which are eligible for Additional own funds under the Standardised Approach partial use
MRC_i, MRC_i^{PF}	Minimum required capital for a bank and for the claims of a specific portfolio PF of that bank under CRD
MRC_i^{Curr}, $MRC_i^{PF,Curr}{}_i$	Minimum required capital for a bank and for the claims of a specific portfolio PF of that bank under the current regime
ΔMRC_i , ΔMRC_i^{PF}	Absolute change in minimum required capital for bank i and portfolio PF for the CRD relative to the current regime, i.e. the differences $MRC_i - MRC_i^{Curr}$, $MRC_i^{PF} - MRC_i^{PF,Curr}$
$\%\Delta MRC_i$, $\%\Delta MRC_i^{PF}$	Percentage change in minimum required capital for bank i and portfolio PF for the CRD relative to the current regime, i.e. the expressions $\left(MRC_i - MRC_i^{Curr}\right) \Big/ MRC_i^{Curr}$, $\left(MRC_i^{PF} - MRC_i^{PF,Curr}\right) \Big/ MRC_i^{PF,Curr}$
$Size_i^{PF}$	Size of a portfolio PF in terms of the share of minimum required capital of the respective portfolio with respect to the current regime compared to the total minimum required capital of the bank with respect to the current regime

$Contr_i^{PF}$ Contribution of the portfolio PF to the change in the total minimum required capital

In the aggregation across all banks of a country we use PF as an index for the portfolios and i as an index for the banks.

Throughout the rest of this note we rely on the following formulae for the minimum required capital according to the current regime

$$MRC_i^{Curr} = 8\% \cdot RWA_i^{Curr} + Ded_i^{Curr} - GP_i^{incl,Curr}, \quad (1)$$

on

$$MRC_i = 8\% \cdot RWA_i + \max\{D_i, -0.6\% \cdot cRWA_i\} + Ded_i - GP_i^{incl,PU} \quad (2)$$

for the minimum required capital under the IRB Approaches of CRD, and on

$$MRC_i = 8\% \cdot RWA_i + Ded_i - GP_i^{incl} \quad (3)$$

for the minimum required capital under the Standardised Approach of CRD.

These formulae take into account that the recognition of general provisions in Additional own funds is different under the Standardised and IRB Approaches and depends on national discretion. For example, there is no recognition of general provisions in CRD under the IRB Approaches. Under the Standardised Approach general provisions are eligible in Additional own funds up to 1.25% of risk-weighted assets.

3 Calculation of the change in minimum required capital on a portfolio level

3.1 Standardised Approach

The important factors for the change in minimum required capital are the risk-weighted assets both for the Standardised Approach and the current regime and the amount of general provisions which are eligible under the Standardised Approach and the current regime. We propose to allocate the general provisions to each of the specific portfolios according to the share of risk-weighted assets relative to the overall risk-weighted assets for the entire bank. Thus we obtain:

$$\%\Delta MRC_i^{PF} = \frac{8\% \cdot RWA_i^{PF} - \frac{RWA_i^{PF}}{cRWA_i} \cdot GP_i^{incl}}{8\% \cdot RWA_i^{PF,Curr} - \frac{RWA_i^{PF,Curr}}{cRWA_i^{Curr}} \cdot GP_i^{incl,Curr}} - 1. \quad (4)$$

3.2 IRB Approaches

Under the IRB Approaches, the switch to UL-based risk-weights in the CRD results in risk-weights which are fundamentally different from (EL+UL)-based risk-weights used prior to the

Madrid compromise. In the UL-based framework, a shortfall or excess in provisioning affects the numerator of the capital ratio, i.e. the capital figure. In order to take account of the fact that both numerator and denominator of the capital ratio changed and to ensure the comparability of the data, percentage changes in minimum required capital at the level of individual banks were calculated by

$$\%\Delta MRC_i = \frac{8\% \cdot RWA_i + \max\{D_i, -0.6\% \cdot cRWA_i\} + Ded_i - GP_i^{incl,PU}}{8\% \cdot RWA_i^{Curr} + Ded_i^{Curr} - GP_i^{incl,Curr}} - 1. \qquad (5)$$

3.3 Allocation of the regulatory calculation difference for the IRB Approaches

The problem we are facing now is that we need to allocate this difference to the portfolios of the bank such that the change in minimum required capital at the level of the entire bank can be computed as the sum of the contributions arising from the different portfolios. This is more difficult than in previous impact studies because some of the elements, e.g. general provisions appearing in formula (5), are available only at an aggregate level. This means that a method is needed to distribute these elements in some reasonable way across the different portfolios. We propose the following formula as a definition of the percentage change in minimum required capital for a single bank portfolio:

$$\%\Delta MRC_i^{PF} = \frac{8\% \cdot RWA_i^{PF} + \frac{EL_i^{PF}}{EL_i} \cdot \left(\max\{D_i, -0,6\% \cdot cRWA_i\}\right)}{8\% \cdot RWA_i^{PF,Curr} - \frac{RWA_i^{PF,Curr}}{cRWA_i^{Curr}} \cdot GP_i^{incl,Curr}} - 1. \qquad (6)$$

The denominator of formula (6) describes the minimum required capital at a portfolio level according to the current regime. Note that in the definition of the minimum required capital at a portfolio level a certain share of the general provisions which are currently eligible as Additional own funds are deducted from 8% of the risk-weighted assets for this particular portfolio. This share depends on the risk-weighted assets of the portfolio relative to the credit risk-weighted assets of the entire bank.

Since the regulatory calculation difference depends on the expected losses, the most natural scheme for allocating it to individual bank portfolios is by relating it to the expected losses associated with the respective portfolios. Note that the contributions to the change in minimum required capital that result from the change in other supervisory deductions have not been incorporated at the portfolio level and will be reintroduced for analysis only at the level of the whole bank.

The portfolios equity, securitisation and related entities are not considered in the calculation of the regulatory difference D_i. In addition, deductions for securitisation and related entities have to be considered in the formulae. Thus, we have to define the minimum required capital of these portfolios separately, eg for securitisation and related entities by

$$MRC_i^{PF} = 8\% \cdot RWA_i^{PF} + Ded_i^{PF}, \quad PF \in \{Sec, RelEnt\},$$

and therefore a modification of formula (6) is necessary for these cases:

$$\%\Delta MRC_i^{Equity} = \frac{8\% \cdot RWA_i^{Equity} + EL^{Equity}}{8\% \cdot RWA_i^{Equity,Curr} - \frac{RWA_i^{Equity,Curr}}{cRWA_i^{Curr}} \cdot GP_i^{incl}} - 1 \qquad (7)$$

$$\%\Delta MRC_i^{Sec} = \frac{8\% \cdot RWA_i^{Sec} + Ded_i^{Sec}}{8\% \cdot RWA_i^{Sec,Curr} + Ded_i^{Sec,Curr} - \frac{RWA_i^{Sec,Curr}}{cRWA_i^{Curr}} \cdot GP_i^{incl,Curr}} - 1 \quad (8)$$

$$\%\Delta MRC_i^{RelEnt} = \frac{8\% \cdot RWA_i^{RelEnt} + Ded_i^{RelEnt}}{8\% \cdot RWA_i^{RelEnt,Curr} + Ded_i^{RelEnt,Curr}} - 1 \quad (9)$$

3.4 Portfolio size and contribution

We have to weight portfolios by their size in order to get the overall change in the minimum required capital of the bank from the changes of its portfolios. The size of the portfolio PF is expressed in terms of current minimum required capital:

$$Size_i^{PF} = \frac{MRC_i^{PF,Curr}}{MRC_i^{Curr}}. \quad (10)$$

Accounting for the size of the portfolio the contribution of the change in required minimum capital of the portfolio PF is defined as follows

$$Contr_i^{PF} = \%\Delta MRC_i^{PF} \cdot Size_i^{PF}. \quad (11)$$

Furthermore, we have to incorporate the contribution of the capital charge for operational risk. Since there is no capital charge for operational risk under the current regime, formula (2) cannot be applied to operational risk. However, since the contribution can be understood as the absolute change in minimum required capital compared to minimum required capital under the current regime, we define

$$Contr_i^{OpRisk} = \frac{8\% \cdot RWA_i^{OpRisk}}{MRC_i^{Curr}}.$$

Now, a simple calculation shows that

$$\sum_{PF} Contr_i^{PF} + Contr_i^{OpRisk} + \frac{Ded_i^{Other} - Ded_i^{Other,Curr}}{MRC_i^{Curr}} = \%\Delta MRC_i. \quad (12)$$

One advantage of this approach is its similarity to the approach taken in the analysis of QIS 3. Based on formulas (5), (6), (7) and (8) we can easily identify the portfolio of a bank that has the greatest influence on the overall result. In the QIS 5 exercise PF is an index running over the following portfolios: corporate, specialised lending, sovereign, interbank, residential mortgage, other retail, QRRE, purchased receivables, related entities, securitisation and the different risk categories of the trading book.

The implementation of the formulae described above is even more complex in the databases and in the portfolio analysis tool. In the Excel workbooks all risk-weighted asset amounts are scaled up by the factor 1/coverage, where coverage describes the amount of risk-weighted assets under the current regime a bank was able to include in the QIS survey divided by the total amount of risk-weighted assets under the current regime. Additional care is needed as in the allocation of the regulatory calculation difference the necessary information on the expected losses at a portfolio level needs to be scaled up by 1/coverage. The issue of scaling up is captured in more detail in Section 3.2.4 where exposure categories related to the trading book are considered.

3.5 Treatment of partial use exposures

With the portfolio analysis we want to make sure that the overall change in minimum required capital at the bank level is obtained as the sum of the contributions of the specific portfolios. Therefore we also need a formula which captures the partial use of the Standardised Approach for banks adopting an IRB Approach. Clearly the risk-weighted assets arising from the rules of the Standardised Approach compared to those arising from the current regime need to be taken into account. Secondly, we need to consider that a certain sub-amount of the general provisions which were eligible elements of Additional own funds under the current regime can be still recognised as eligible Additional own funds under the CRD. Consequently, we obtain

$$\%\Delta MRC_i^{PU} = \frac{8\% \cdot RWA_i^{PU} - GP_i^{incl,\,PU}}{8\% \cdot RWA_i^{PU,Curr} - \frac{RWA_i^{PU,Curr}}{cRWA_i^{Curr}} \cdot GP_i^{incl,Curr}} - 1. \qquad (13)$$

This number has to be multiplied by $\frac{MRC^{PU,Curr}}{MRC_i^{Curr}}$ in order to compute the contribution of the partial use of the Standardised Approach to the overall bank change in minimum required capital.

3.6 Treatment of trading book and market risk

From a computational point of view trading book exposures receive a different treatment in the QIS 5 workbooks and in the Portfolio Analysis Tool to banking book exposures. The reason is not only that these positions are excluded from the allocation mechanism of the regulatory calculation difference but also that the "scaling-up mechanism"[1] and the scaling factor of 1.06 do not apply. The following table summarises the treatment of the categories counterparty credit risk, specific risk, general market risk, and large exposures. Note that the scaling mechanisms mentioned in columns 2 and 3 of the following table apply to the risk-weighted assets and should not be understood as factors to be applied to the exposure.

	Scaling mechanism to capture the coverage	**Scaling Factor of 1.06 (under IRB)**
Counterparty credit risk	Scaling	Multiplier
Specific risk	No scaling	No multiplier
General market risk + settlement risk + Annex V of Directive 93/6/EEC	No scaling	No multiplier
Large exposures	No scaling	No multiplier

The third row of the table includes the trading book exposures which are treated according to IRB rules (Annex V of Directive 93/6/EEC).

[1] Here, "scaling-up mechanism" refers to the procedure of multiplying risk-weighted assets by the factor 1/coverage, as the banks were allowed to consider the CRD risk-weights only for a certain subset of exposures. Coverage describes the percentage share of exposures which were included in the QIS 5 data collection exercise. According to the QIS instruction the banks had to achieve at least 80% coverage relative to their world-wide exposures.

4 Aggregation of results across banks

It is agreed that drivers of the overall results on portfolios should be identified and analysed. The question arises as to how the results of the individual banks should be weighted. Applying weights based on capital numbers may have the undesirable effect that a non-zero weight is applied to an empty portfolio.

Any proposed weighting scheme should satisfy the following two requirements:

1. equation (11) should hold for the same data aggregated over all banks, i.e. the product of the average size of a certain portfolio times the average change in minimum required capital should be equal to the average contribution of that particular portfolio to the change in minimum required capital for all Group 1 or Group 2 banks in the whole banking system; and

2. The contributions of all the portfolios of the banks plus the contributions arising from general provisions, deductions and operational risk should sum to the total change in minimum required capital (see equation (12)) also in the aggregated results.

The second condition is obviously satisfied by any arbitrary weighting specification, whereas the first requires more attention because the product of averages is not equal to the average of the product. (referring to the product of size and change in minimum required capital).

We have the choice of applying the bank-weights to either $\%\Delta MRC_i^{PF}$ or $Contr_i^{PF}$. Applying them to $\%\Delta MRC_i^{PF}$ is definitely not an appropriate definition because this might result in misleading averages in cases where selected banks do not have exposures in certain portfolios. In such cases we would apply non-zero weights to empty portfolios. The result is misleading because one could not know if the change in minimum required capital is due to the fact that the rules changed or because a bank has no exposure in this portfolio. This effect is avoided if the weights are applied to the contributions, because the contributions include the size of the portfolio as a factor. Consequently, empty or small portfolios do not have a big effect on the aggregate number.

Let us summarise this preliminary discussion:

4.1 Group 1 banks

In order to aggregate the results on a portfolio level as well as to obtain the total change in minimum required capital across the banks we suggest applying the following weight to each bank:

$$w_i = \frac{MRC_i^{Curr}}{\sum_i MRC_i^{Curr}}, \tag{14}$$

where the index i runs over all Group 1 banks. Applying these weights we would obtain

$$Contr_{avg}^{PF} = \sum_i w_i \cdot Contr_i^{PF} \tag{15}$$

as an average contribution to the change in minimum required capital for the portfolios and for operational risk.

As described above applying the weights w_i to determine the average $\%\Delta MRC_{avg}^{PF}$ analogously would be misleading because of the empty or small portfolios of certain banks. However, there is another possibility for determining $\%\Delta MRC_{avg}^{PF}$. Taking into account that $Contr_i^{PF}$ was defined as a product which includes the size of the portfolio as a factor (see formula (12)), expression (15) can be reinterpreted in the following way - the right side of (11) could be understood as a weighting of the $\%\Delta MRC_i^{PF}$, where the index i runs over all Group 1 or Group 2 banks of a certain country. The weights are given by $\left(w_i \cdot Size_i^{PF}\right) \Big/ \sum_i w_i \cdot Size_i^{PF}$.[2] Consequently we obtain:

$$\%\Delta MRC_{avg}^{PF} = \frac{\sum_i w_i \cdot Size_i^{PF} \cdot \%\Delta MRC_i^{PF}}{\sum_i w_i \cdot Size_i^{PF}} . \qquad (16)$$

For analysis purposes (16) will be very useful to analyse effects on portfolio level. However, it should be noticed that the weights used in (16) are different for each portfolio.

4.2 Group 2 banks

Consistent aggregation across banks requires a weighting scheme which reflects the differences in the relative contributions of individual banks to the changes in minimum required capital for the whole banking system. In choosing a weighting scheme, it is necessary to distinguish between Group 1 and Group 2 banks. The reason is that the majority of Group 1 banks participate in the QIS exercise and, therefore, the data collected for these banks is broadly representative for the Group 1 banks of an entire country. This is not the case for Group 2 banks. Since relatively few of the smaller Group 2 banks are participating in QIS 5, they would be underrepresented in the analysis if the same weighting scheme is applied as for Group 1 banks. Therefore, a different weighting scheme should be used for Group 2 banks:

$$w_i = 1 / (\text{number of Group 2 banks})$$

The same formulae as in Section 4.1 can be used for the averages of the changes in total minimum required capital, the contributions at a the portfolio level and the changes in minimum required capital on a portfolio level for Group 2 banks. The even weighting of banks without regard to their risk-weighted assets could be considered to be disadvantageous, however it should be reiterated that the sample of Group 2 banks will not be representative for all Group 2 banks in the banking system. This becomes clear when one considers that a QIS 5 Group 2 bank with €10 million in Original own funds may represent a large number of banks of similar size not participating in the study. QIS Group 2 banks with €1 billion Original own funds are representative of significantly fewer Group 2 banks in the total banking system. Applying the same weighting scheme as proposed for the Group 1 banks would have the undesirable effect that data coming from small banks would have little impact on the overall results.

Example:

Let us consider the residential mortgage portfolios of three Group 2 banks, or for three Group 1 banks having the same minimum required capital relative to the current regime, i.e. the same weights.

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[2] We have to include the expression $\sum_i w_i \cdot Size_i^{PF}$ in the denominator of each weight to make sure that the weights sum up to 1.

	Bank 1	**Bank 2**	**Bank 3**
$\%\Delta MRC_i^{Res.Mortg.}$	-40%	-60%	no exposures
$Size_i^{Res.Mortg.}$	20%	40%	0%
$Contr_i^{Res.Mortg.}$	-8%	–24%	0%
Weights	1/3	1/3	1/3

The contribution to the overall change would be 1/3 (-8% – 24%) = -10.7%, which should be interpreted as follows: If the minimum required capital for all the other portfolios of this bank remains unchanged, the rules of the CRD would, on average, result in a change in minimum required capital of -10.7%. Now we compute $\%\Delta MRC_{avg}^{Res.Mortg.}$. Note that the simple average would be 1/3 (-40% – 60%) = -33.3%, which is misleading since Bank 3 has no residential mortgage exposures and the average should lie somewhere between -40% and -60%, which are the values of those two banks having residential mortgage exposures. In contrast, formula (11) yields a plausible result. We have

$$\frac{1/3\cdot\left(20\%\cdot\left(-40\%\right)\right)+1/3\cdot\left(40\%\cdot\left(-60\%\right)\right)+1/3\cdot\left(0\%\right)}{1/3\cdot\left(20\%+40\%+0\%\right)}=-53\%$$

according to (15). The -53% is closer to the -60% of Bank 2 than to the -40% of Bank 1 because the residential mortgage portfolio is more important for Bank 2 than Bank 1 in terms of size.