CEIOPS
Committee of European Insurance and Occupational Pensions Supervisors

CEIOPS-DOC-23/09

CEIOPS' Advice for Level 2 Implementing Measures on Solvency II:

SCR standard formula - Counterparty default risk module

(former Consultation Papers 28 and 51)

October 2009

CEIOPS e.V. – Westhafenplatz 1 - 60327 Frankfurt – Germany – Tel. + 49 69-951119-20
Fax. + 49 69-951119-19 email: secretariat@ceiops.eu; Website: www.ceiops.eu
© CEIOPS 2009

Table of content

© CEIOPS 2009

1. Introduction

1.1. In its letter of 19 July 2007, the European Commission requested CEIOPS to provide final, fully consulted advice on Level 2 implementing measures by October 2009 and recommended CEIOPS to develop Level 3 guidance on certain areas to foster supervisory convergence. On 12 June 2009 the European Commission sent a letter with further guidance regarding the Solvency II project, including the list of implementing measures and timetable until implementation.[1]

1.2. This consultation paper aims at providing advice with regard to the treatment of counterparty default risk in the standard formula for the Solvency Capital Requirement as requested in Article 111 Solvency II Level 1 text ("Level 1 text"). [2]

1.3. The objective of this paper is to give draft advice on the scope of the module and the calculation of the capital requirement for counterparty default risk.

[1] See http://www.ceiops.eu/content/view/5/5/
[2] Latest version from 19 October 2009 available at http://register.consilium.europa.eu/pdf/en/09/st03/st03643-re01.en09.pdf

© CEIOPS 2009

2. Extract from Level 1 Text

2.1 Legal basis for implementing measure

Article 111 - Implementing measures

1.*In order to ensure that the same treatment is applied to all insurance and reinsurance undertakings calculating the Solvency Capital Requirement on the basis of the standard formula, or to take account of market developments, the Commission shall adopt implementing measures laying down the following:*

> *(a) a standard formula in accordance with the provisions of Articles 101 and 103 to 109;*
>
> *(b) any sub-modules necessary or covering more precisely the risks which fall under the respective risk modules referred to in Article 104 as well as any subsequent updates;*
>
> *(c) the methods, assumptions and standard parameters to be used, when calculating each of the risk modules or sub-modules of the Basic Solvency Capital Requirement laid down in Articles 104 and, 105 and 304, the symmetric adjustment mechanism and the appropriate period of time, expressed in the number of months, as referred to in Article 106, and the appropriate approach for integrating the method referred to in Article 304 in the Solvency Capital Requirement as calculated in accordance with the standard formula;*
>
> *(d) where insurance and reinsurance undertakings use risk mitigation techniques, the methods and assumptions to be used to assess the changes in the risk profile of the undertaking concerned and adjust the calculation of the Solvency Capital Requirement;*

[…]

2.2 Other relevant articles for providing background to the advice

Article 13 - Definitions

For the purposes of this Directive, the following definitions shall apply:

[…]

> *(32) credit risk means the risk of loss, or of adverse change in the financial situation, resulting from fluctuations in the credit standing of issuers of securities, counterparties and any debtors to which insurance and reinsurance undertakings are exposed, in the form of counterparty default risk, or spread risk, or market risk concentrations;*
>
> *[…]*

Article 104 - Design of the Basic Solvency Capital Requirement

© CEIOPS 2009

1. *The Basic Solvency Capital Requirement shall comprise individual risk modules, which are aggregated in accordance with point 1 of Annex IV.*

   It shall consist of at least the following risk modules:

   (a) *non-life underwriting risk;*

   (b) *life underwriting risk;*

   (c) *health underwriting risk;*

   (d) *market risk,*

   (e) *counterparty default risk.*

[…]

Article 105 - Calculation of the Basic Solvency Capital Requirement

1. *The Basic Solvency Capital Requirement shall be calculated in accordance with paragraphs 2 to 6.*

[...]

6. *The counterparty default risk module shall reflect possible losses due to unexpected default, or deterioration in the credit standing, of the counterparties and debtors of insurance and reinsurance undertakings over the following 12 twelve months. The counterparty default risk module shall cover risk-mitigating contracts, such as reinsurance arrangements, securitisations and derivatives, and receivables from intermediaries, as well as any other credit exposures which are not covered in the spread risk sub-module.*

   For each counterparty, the counterparty default risk module shall take account of the overall counterparty risk exposure of the insurance or reinsurance undertaking concerned to that counterparty, irrespective of the legal form of its contractual obligations to that undertaking.

© CEIOPS 2009

3. Advice

3.1 Explanatory text

3.1.1 Scope of the module

3.1. According to Article 105, paragraph 6 of the Level 1 text the scope of application of the counterparty default risk module comprises credit exposures as follows:

- risk-mitigating contracts, such as reinsurance arrangements, securitisations and derivatives,
- receivables from intermediaries, and
- any other credit exposures which are not covered in the spread risk sub-module.

3.2. The extent of the residual class "any other credit exposures" may require further specification. The scope of this class depends on the definition of the spread risk sub-module of the market risk module. Article 105, paragraph 5 of the Level 1 text stipulates in very general terms that the spread risk module addresses "the sensitivity of the values of assets, liabilities and financial instruments to changes in the level or in the volatility of credit spreads over the risk-free interest rate term structure".

3.3. As any credit risk can be expressed in terms of credit spread, spread risk is not sharply defined in the Level 1 text. Consequently, there is – at least theoretically - some freedom in the definition of the scope of both modules.

3.4. In QIS4, a broad distinction was made: bonds, structured products (like asset-backed securities and collateralised debt obligations) and credit derivatives were subject to the spread risk sub-module while all other exposures were covered by the counterparty default risk module. In general, this approach seems to have been accepted by the stakeholders as alternative concepts were only proposed by few QIS4 participants. However, several participants asked for further clarification of the exact split between both kinds of exposures.

3.5. The QIS4 approach could be clarified as follows: The spread risk sub-module should cover the credit risk of

- investments as defined in the Insurance Accounting Directive (91/674/EEC) except for deposits with ceding undertakings,
- investments for the benefit of life-insurance policyholders who bear the investment risk, and

© CEIOPS 2009

- credit derivatives.

3.6. In relation to credit derivatives, only the credit risk which is transferred by the derivative should be covered in the spread risk sub-module. Article 105, paragraph 6 requires that the counterparty risk of the derivative agreement is covered in the counterparty default risk module.

3.7. The above definition ensures that the exposures in the scope of the spread risk sub-module share similar characteristics. Apart from credit derivatives, the exposures have a well defined duration and the overall portfolio can usually be expected to be diversified.

3.8. As a consequence of the definition of the scope of the spread risk sub-module, the counterparty default risk module should cover the credit risk of

- risk-mitigating contracts, such as reinsurance arrangements[3], securitisations and derivatives,
- receivables from intermediaries, and
- any other credit exposures which are not covered in the spread risk sub-module, in particular (list not exhaustive):
  - policyholder debtors,
  - cash at bank,
  - deposits with ceding institutions,
  - capital, initial funds, letters of credit as well as any other commitments received by the undertaking which have been called up but are unpaid, and
  - guarantees, letters of credit, letters of comfort which are provided by the undertaking as well as any other commitments which the undertaking has provided and which depend on the credit standing of a counterparty.

3.9. In relation to credit derivatives, the credit risk which is transferred by the derivative should not be covered in the counterparty default risk module. It is already covered in the spread risk sub-module.

3.10. If an undertaking holds bonds issued by an SPV securitisation, then the corresponding credit risk should be addressed in the spread risk sub-module and not in the counterparty default risk module, because the bonds are an investment and not a risk-mitigating contract.

3.11. Some insurance contracts (such as some index-linked and unit-linked policies) offer policyholders guarantees provided by third parties. If the insurance undertaking is held liable for these guarantees in case of default of the third party, the guarantees should be treated like derivatives in the calculation of the counterparty default risk module.

[3] Reinsurance includes intra-group reinsurance.

© CEIOPS 2009

3.12. Credit exposures in relation to a national government, or an institution covered by a guarantee of the national government, should be exempted from an application of the module. The exemption should be restricted to exposures in relation to governments and institutions of an OECD or EEA state in the currency of the government. These particular exposures can be considered to be free of credit risk. This exemption is consistent with the treatment of government exposures in QIS3 and QIS4.

3.13. The counterparty default risk module should not cover the underwriting risk of credit insurance. This risk will be addressed in the non-life underwriting risk module where the particular characteristics can be better taken into account.

3.14. As described above, the counterparty default risk module should consider the credit risk of guarantees[4], letters of credit, letters of comfort provided by the insurance or reinsurance undertaking as well as any other commitment which is provided by the undertaking and which depends on the credit standing of a counterparty. The current financial crisis has revealed that contingent liabilities of this kind can constitute a decisive risk for financial institutions. The risk connected to guarantees is not covered by the SCR standard formula as it was tested in QIS4. However, in view of the significance that these contingent liabilities can have for the protection of the policyholders and beneficiaries as well as for financial stability, their risk should be addressed in the standard formula.

3.15. Guarantees turn from a contingent liability into an existing liability in case the counterparty approaches default and thereby reduce the own funds of the undertaking which provided the guarantee. Therefore, and although guarantees are liabilities and not assets, they can fall under the scope of the counterparty default risk module. The second sentence of Article 105, paragraph 6 of the Level 1 text supports this interpretation stating that "the counterparty default risk module shall take account of the overall counterparty risk exposure of the insurance or reinsurance undertaking concerned to that counterparty, irrespective of the legal form of its contractual obligations to that undertaking."

3.16. Once a guarantee provided by the undertaking is activated, it turns into a liability of the undertaking which is not under credit risk anymore and is therefore not covered by the counterparty default risk module.

3.17. The proposed approach is consistent with the treatment of guarantees as credit exposures in the banking sector. Also the Swiss Solvency Test reflects their risk in the credit risk module of the standard model.

3.18. The treatment of guarantees *provided* by the undertaking as outlined above should not be confused with the treatment of guarantees *received* by the undertaking. As long as a guarantee received by the undertaking has not been activated, it is off the balance sheet of the undertaking and the default of the provider of the guarantee has no effect on the basic own funds of the undertaking. Therefore, the risk relating to the non-

[4] "Guarantee" shall mean an agreement or a declaration by which an entity assumes responsibility for paying another's debts or fulfilling another's responsibilities.

© CEIOPS 2009

activated received guarantee is not covered by the SCR (see also CEIOPS' Advice on supervisory Approval of ancillary own funds)[5]. If a guarantee received by the undertaking has been activated, it turns into an asset of the undertaking and the default risk relating to this asset is addressed in the counterparty default risk module as any other on-balance sheet exposure.

3.1.2 Modelling approaches

3.19. The calculation of the capital requirement for counterparty default risk in QIS4 was frequently commented by the participants. One of the complaints made was the reduced appropriateness of the QIS4 approach to some of the exposures, in particular in relation to intermediaries, policyholders and hospitals (cf. 9.5.1 of the CEIOPS QIS4 report). These counterparties are usually unrated. Under the QIS4 approach, a probability of default was assigned to unrated exposures which many participants considered not to reflect the credit risk of the exposure. Moreover, as several participants were in relation with a larger number of these counterparties, the practicability of a calculation which explicitly tries to measure the diversification between the portfolios was questioned.

3.20. On the other hand, the use of ratings and the explicit allowance for diversification which were criticised for these particular exposures seem to be appropriate approaches for other kind of exposures like reinsurance arrangements or derivatives. Therefore, a differentiation of two kinds of exposures, in the following denoted by type 1 and type 2 exposures, and a different treatment according to their characteristics appears to be suitable.

3.21. The class of type 1 exposures tries to cover the exposures which may not be diversified and where the counterparty is likely to be rated. The class should consist of exposures in relation to

- reinsurance arrangements,
- securitisations and derivatives,
- any other risk mitigating contracts,
- cash at bank,
- deposits with ceding institutions, if the number of independent counterparties does not exceed a certain threshold,
- capital, initial funds, letters of credit as well as any other commitments received by the undertaking which have been called up but are unpaid, if the number of independent counterparties does not exceed a certain threshold, and

[5] CEIOPS-DOC-24/09 (October 2009), see http://www.ceiops.eu//content/view/17/21/ (former CP29)

© CEIOPS 2009

- guarantees, letters of credit, letters of comfort which the undertaking has provided as well as any other commitments which the undertaking has provided and which depend on the credit standing of a counterparty.

3.22. The class of type 2 exposures attempts to cover the exposures which are usually diversified and where the counterparty is likely to be unrated. The class of type 2 exposure should consist of all exposures which are in the scope of the module and are not of type 1, in particular

- receivables from intermediaries,
- policyholder debtors,
- deposits with ceding institutions, if the number of independent counterparties exceeds a certain threshold, and
- capital, initial funds, letters of credit as well as any other commitments received by the undertaking which have been called up but are unpaid, if the number of independent counterparties exceeds a certain threshold.

3.23. The capital charges for type 1 and type 2 exposures should be calculated separately. A low diversification effect should be allowed in the aggregation of the requirements as follows:

$$SCR_{def} = \sqrt{SCR_{def,1}^2 + 1.5 \cdot SCR_{def,1} \cdot SCR_{def,2} + SCR_{def,2}^2},$$

where

SCR_{def} = Capital requirement for counterparty default risk

$SCR_{def,1}$ = Capital requirement for counterparty default risk of type 1 exposures

$SCR_{def,2}$ = Capital requirement for counterparty default risk of type 2 exposures

3.1.3 Calculation of capital requirement for type 1 exposures

3.24. In the counterparty default risk calculations of QIS4 a Vasicek-Herfindahl approach was used to determine the risk factors. The default loss distribution was assumed to follow a Vasicek distribution and the diversification between the counterparties was measured by means of the Herfindahl index (cf. TS.X.A of the QIS4 Technical Specifications).

3.25. Several participants of the QIS4 exercise reported significant inconsistencies in the determination of the risk factors. The inconsistencies related to the interplay between the diversification effect according to the Herfindahl indices and the Vasicek distribution. The

© CEIOPS 2009

participants presented examples of similar portfolios where the capital requirements derived with the QIS4 approach were not consistent.

3.26. An example of such inconsistencies can be found in paragraph B.8 of Annex B where the capital requirements for different portfolios of equally rated counterparties are given. The relation between the diversification effect and the number of counterparties is not appropriate: when having more than one counterparty, the capital requirement increases with the number of counterparties for the high quality rating classes. This is unlikely to be an adequate reflection of the risk and it incentivises the concentration of counterparties.

3.27. Apart from these inconsistencies there is a conceptual reservation about the Vasicek-Herfindahl approach. The Vasicek distribution is based on the assumption of a high number of homogeneous exposures. However, this criterion is usually not met by the type 1 exposures of insurance undertakings.

3.28. Against this background, CEIOPS analysed alternative approaches to the risk factors for type 1 exposures. The approach that is presented below is deemed to be an improvement compared to the QIS4 calculation. In contrast with the Vasicek-Herfindahl approach, the model underlying the new approach emphasises the heterogeneous nature and the limited number of counterparties. Moreover, it is free of the anomalous behaviour as observed with the Vasicek-Herfindahl approach.

3.29. There are two core aspects in this new model. The first one assumes a latent stress or shock random variable that affects all counterparties related to type 1 exposure, mainly reinsurers and banks. This leads to an implicit correlation between the default probabilities of the counterparties. The existence of such dependence can be observed in the current crisis. The revaluation of certain assets (like subprime exposures) that started the current crisis can be seen as an example of the latent stress that is incorporated in the model. Another example would be a widespread natural catastrophe affecting many reinsurers.

3.30. The second core aspect of the model is the vulnerability of each counterparty to this latent stress variable. This vulnerability is modelled by expressing the specific default probability as a monotone increasing function of the stress variable. The mean value of this default probability, as a probability weighted average over the possible values for the stress variable, equals the observed default probability, as for example assigned by credit rating agencies (through-the-cycle rating)[6].

3.31. As mentioned above, all counterparties are exposed to the same stress variable and this induces positive correlation between the counterparties. This correlation is determined only by the mean default probabilities of the counterparties and two parameters, α and τ, that shape the randomness of the stress variable and the responsiveness of the default probability to this stress variable. The mean and variance of the

---

[6] The probability of default that will be assigned to the credit rating is usually based on a long time series of annual default rates of the rating class.

© CEIOPS 2009

reinsurance default risk for a given reinsurance bouquet can be easily evaluated as an expression of the various losses given default involved.

3.32. Annex A contains a mathematical outline of the model. A more detailed exposition of the new approach can be found in: P. TER BERG, *Portfolio Modelling of Counterparty Reinsurance Default Risk* (Life & Pensions, April 2008, pp. 29-33).

3.33. Given probabilities of default and losses-given-default (LGD) of the counterparties in the portfolio of type 1 exposures, the model provides an estimate V of the variance of the portfolio's loss distribution. This estimate can be used to calculate the capital requirement for type 1 exposures as follows:

$$SCR_{def,1} = \min\left(\sum_i LGD_i ;\quad q \cdot \sqrt{V}\right),$$

where the sum is taken over all independent counterparties with type 1 exposures and

LGD_i	=	Loss-given-default for type 1 exposure of counterparty i
q	=	Quantile factor
V	=	Variance of the loss distribution of the type 1 exposures

3.34. The loss distribution of the portfolio according to the model is too complex to determine the 99.5% quantile directly from it. Instead, the standard deviation of the distribution is multiplied with a fixed factor q in order to estimate the 99.5% quantile. The calibration of the factor still needs to be decided. (For example, if the lognormal distribution is considered to be an appropriate approximation of the loss distribution, then q could be fixed as 3, because for a certain interval of coefficients of variation this provides a good approximation of the 99.5% quantile of a normalised lognormal distribution.)

3.35. It may be necessary to cap the result of the quantile approximation with the sum of the losses-given default in order to avoid inconsistencies in the case of extreme variances.

3.36. For the calculation of the variance V of the loss distribution, the following summations of loss-given-default values are relevant.

3.37. For each rating class j, y_j and z_j denote the following figures:

$$y_j = \sum_i LGD_i \quad \text{and} \quad z_j = \sum_i (LGD_i)^2 ,$$

where sums run over all independent counterparties i in the rating class j.

3.38. The variance V of the loss distribution should be calculated as follows:

© CEIOPS 2009

$$V = \sum_j \sum_k u_{jk} \cdot y_j \cdot y_k + \sum_j v_j \cdot z_j - \left(\sum_j w_j \cdot y_j \right)^2,$$

where j and k in the sums run over all rating classes and u_{jk}, v_j and w_j are fixed parameters which only depend on the rating classes.

3.39. The rationale of the formulas and a definition of the parameters u_{jk}, v_j and w_j can be found in Annex A.

3.40. Annex B illustrates the model for counterparty default risk with a comparison of capital requirements according to the new approach and the Vasicek-Herfindahl approach used in QIS4.

3.41. According to Article 105(6), the counterparty default risk module should address losses due to both unexpected default and deterioration in the credit standing. Like the QIS4 approach, the proposed new model explicitly covers only the unexpected default. Nevertheless, the risk of a deterioration in the credit standing is implicitly captured in this approach, because a default is the most severe deterioration in credit standing.

3.1.4 Calculation of capital requirement for type 2 exposures

3.42. As described in section 3.1.2, type 2 exposures often relate to unrated counterparties and an undertaking's portfolio usually consists of a larger number of such exposures. Moreover, in most cases the default risk originating from these exposures is very small compared to the overall risk. Therefore, rather than attempting to address the individual risk characteristics of each exposure and their interdependencies a quantification of the level of the portfolio of type 2 exposures appears to be suitable. This can be done in a simple factor-based approach.

3.43. The capital requirement for counterparty default risk of type 2 exposures is calculated as follows:

$$SCR_{def,2} = x \cdot E + y \cdot E_{past-due},$$

where

x	=	Risk factor for type 2 exposures
E	=	Sum of the values of type 2 exposures, except for receivables from intermediaries which are due for more than T months.
y	=	Risk factor for past-due receivables from intermediaries
$E_{past\text{-}due}$	=	Sum of the values of receivables from intermediaries which are due for more than T months.

3.44. The risk factor x should be a fixed number. It should not depend on the probability of default of the counterparties nor on the size or number of

© CEIOPS 2009

exposures. However, its calibration should implicitly allow for the typical diversification between type 2 exposures.

3.45. The value of a type 2 exposure towards a counterparty is equal to the corresponding asset value according to Article 75 of the Level 1 text.

3.46. Supervisory experience shows that receivables from intermediaries which are due for a longer period of time have a much lower probability to be recovered in the future. Therefore, these exposures should be subject to a higher capital requirement. The calibration of the risk factor y for these past-due receivables should reflect this increased default probability.

3.1.5 Loss-given-default for risk mitigating contracts

3.47. The counterparty default risk module used in QIS4 required the calculation of the loss-given-default (LGD) in relation to each counterparty. The introduction of the LGD concept was considered to be an improvement compared to the vague notion of replacement costs in the previous QIS by many participants. However, the practicability of the calculation for risk mitigating contracts like reinsurance or derivatives was one of the main issues raised in QIS4 (cf. section 9.5 of the CEIOPS QIS4 report). The calculation turned out to be very difficult in many cases and was considered to be disproportionate in view of the low capital charges it produced. The criticism mainly related to non-life reinsurance where the number of counterparties was often high and the calculation of the LGD was especially complex.

3.48. The LGD of an exposure is conceptually defined to be the loss of basic own funds which the insurer would incur if the counterparty defaulted. Starting point for the determination of the loss is the current value of the exposure, namely the best estimate recoverables in the case of reinsurance and the market value in the case of derivatives.

3.49. As the size of the potential loss usually changes over time and a failure of the counterparty is more likely when the potential loss is high, the LGD should be determined for the case of a stressed situation. A straightforward approach to measure the additional loss owing to the stressed situation is the approximation of the risk mitigating effect of reinsurance arrangement or derivative in the SCR calculation. In particular, this approach ensures a consistent treatment of the transferred risk and the default risk of the mitigating contract. Consequently, in order to determine the LGD the value of the current exposure should be increased by the risk mitigating effect of the contract.

3.50. In case of default, typically a part of the exposure can still be collected. In order to allow for the potential recovery of the counterparty, the LGD is amended by a factor $(1 - RR)$ where RR denotes the recovery rate of the counterparty. The recovery rate may be different for reinsurance arrangements and securitisations on one hand and for derivatives on the other hand.

© CEIOPS 2009

3.51. For a reinsurance arrangements or securitisation i, the loss-given-default LGD_i should be calculated as follows:

$$LGD_i = \max((1\text{-}RR_{re})\cdot(Recoverables_i + RM_{re,i} - Collateral_i);\ 0),$$

where

RR_{re}	=	Recovery rate for reinsurance arrangements
$Recoverables_i$	=	Best estimate recoverables from the reinsurance contract (or SPV) i according to Article 80 of the Level 1 text plus any other debtors arising out of the reinsurance arrangement or SPV securitisation
$RM_{re,i}$	=	Risk mitigating effect on underwriting risk of the reinsurance arrangement or SPV securitisation i
$Collateral_i$	=	Risk-adjusted value of collateral in relation to the reinsurance arrangement or SPV securitisation i

3.52. The best estimate of the recoverables $Recoverables_i$ might be netted with liabilities towards the same legal entity to the extent they could be set off in case of the default of the legal entity. For this purpose, liabilities should be valued according to Article 75.

3.53. The risk mitigating effect $RM_{re,i}$ is an approximation of the difference between

- the (hypothetical) capital requirement for underwriting risk under the condition that the reinsurance arrangement or the SPV securitisation is not taken into account in its calculation

- and the capital requirement for underwriting risk (without any amendments).

3.54. Where an SPV also transfers market risk, the risk mitigating effect $RM_{re,i}$ should be given by the aggregation (assuming a correlation factor of 0.25, consistent with the SCR correlation factor for the underwriting and market risk modules) between the amount in 3.53 and the difference between:

- the (hypothetical) capital requirement for market risk under the condition that the risk mitigating effect of the SPV is not taken into account in its calculation

- and the capital requirement for market risk (without any amendments).

3.55. Thus, if we denote the amount in 3.53 as $RM_{re,i,u/w}$ and the difference referred in 3.54 as $RM_{re,i,mkt}$, the risk mitigating effect for such SPV would be given by:

© CEIOPS 2009

$$RM_{re,i} = \sqrt{RM_{re,i,u/w}^2 + RM_{re,i,mkt}^2 + 2 \cdot 0.25 \cdot RM_{re,i,u/w} \cdot RM_{re,i,mkt}} \ .$$

3.56. For a derivative i, the loss-given-default LGD_i should be calculated as follows:

$LGD_i = \max((1\text{-}RR_{fin})\cdot(MarketValue_i + RM_{fin,i} - Collateral_i);\ 0)$,

where

RR_{fin}	=	Recovery rate for derivatives
$MarketValue_i$	=	Value of the derivative *i* according to Article 75 of the Level 1 text
$RM_{fin,i}$	=	Risk mitigating effect on market risk of the derivative *i*
$Collateral_i$	=	Risk-adjusted value of collateral in relation to the derivative *i*

3.57. The risk mitigating effect $RM_{re,i}$ is an approximation of the difference between

- the (hypothetical) capital requirement for market risk under the condition that the risk mitigating effect of the derivative is not taken into account in its calculation
- and the capital requirement for market risk (without any amendments).

3.58. Two reasons for the practical problems in the calculation of the LGD which were observed in QIS4 can be identified:

- The calculation of the risk mitigating effect *RM* may require a reassessment of the affected SCR module. If the module formula is complex, this assessment may be demanding.
- In principle, the calculation needs to be made separately for each independent counterparty. If the number of counterparties is high, the overall calculation may be laborious.

For both problems simplifications can be provided.

<u>Sophisticated calculation of the risk mitigating effect</u>

3.59. The determination of the risk mitigating effects $RM_{re,i}$ and $RM_{fin,i}$ is based on the calculation of two capital requirements:

- The (hypothetical) capital requirement for underwriting and market risk under the condition that the risk mitigating effect of the reinsurance arrangement, SPV or derivative of a particular counterparty is not taken into account in its calculation. These

© CEIOPS 2009

values are only determined for the purpose of the counterparty default risk module. In the QIS4 calculations, they were referred to as capital requirements gross of the risk mitigating effect (SCR_{life}^{gross}, SCR_{nl}^{gross}, SCR_{mkt}^{gross}).

- The capital requirements for underwriting risk and market risk without any amendments are the requirements as defined in the Level 1 text for these modules. In the QIS4 counterparty default risk module, they were referred to as capital requirements net of the risk mitigating effect (SCR_{life}^{net}, SCR_{nl}^{net}, SCR_{mkt}^{net}). They are available as soon as the calculations of the particular modules have been made.

3.60. The gross capital requirements in relation to counterparty (i) are determined by a recalculation of the modules which are affected by the risk mitigating contracts with that counterparty. This should be done as follows <u>for life reinsurance and for derivatives</u>:

- If a module or sub-module is scenario-based, the scenario outcome should be reassessed assuming that the risk-mitigating contract with counterparty (i) will not provide any compensation for the losses incurred under the scenario.

- If the sub-module is factor-based, the volume measures which allow for the risk-mitigating effect of the contract need to be reassessed. In particular, the following changes need to be made in this respect:

  i. In the concentration sub-module of the market risk sub-module, the exposure measures *E* should be calculated without allowance for risk-mitigating effects of contracts with counterparty (i);

3.61. In particular, if a module of the SCR did not allow for the risk mitigating effect of the risk-mitigating contract with counterparty (i) in the calculation of the net capital requirement, the net and gross capital requirements coincide and $RM_{re,i}$ and $RM_{fin,i}$ are zero.

3.62. <u>For non-life reinsurance</u>, the following method should be applied. If the reinsurance treaties with a counterparty affect only one non-life line of business, then the difference $SCR_{nl}^{gross} - SCR_{nl}^{net}$ should be approximated by the following term:

$$\sqrt{\begin{aligned}&\left(NL_{CAT}^{gross} - NL_{CAT}^{net}\right)^2 + \left(3 \cdot \sigma_{(prem,lob)} \cdot (P_{lob}^{gross} - P_{lob}^{net})\right)^2 + \left(3 \cdot \sigma_{(res,lob)} \cdot \text{recoverables}\right)^2 \\ &+ 9 \cdot \sigma_{(prem,lob)} \cdot (P_{lob}^{gross} - P_{lob}^{net}) \cdot \sigma_{(res,lob)} \cdot \text{recoverables}\end{aligned}}$$

where

$NL_{CAT}^{gross} - NL_{CAT}^{net}$ = Counterparty's share of CAT losses

© CEIOPS 2009

$P_{lob}^{gross} - P_{lob}^{net}$	=	Reinsurance premium of the counterparty in the affected line of business
recoverables	=	Reinsurance recoverables in relation to the counterparty in the affected line of business
$\sigma_{(prem,lob)}$	=	Standard deviation for premium risk in the affected line of business as used in the premium and reserve risk sub-module
$\sigma_{(res,lob)}$	=	Standard deviation for reserve risk in the affected line of business as used in the premium and reserve risk sub-module

3.63. If the reinsurance treaties with a counterparty affect more than one non-life line of business, the terms defined above for each line of business can be summed up to determine an approximation for $SCR_{nl}^{gross} - SCR_{nl}^{net}$.

3.64. The formula partly neglects the diversification effect between the lines of business. The diversification effect within the lines of business is approximated in a prudent way by means of the following formula:[7]

$$\sqrt{\left(SCR_1^{gross}\right)^2 + \left(SCR_2^{gross}\right)^2} - \sqrt{\left(SCR_1^{net}\right)^2 + \left(SCR_2^{net}\right)^2}$$
$$\leq \sqrt{(SCR_1^{gross} - SCR_1^{net})^2 + (SCR_2^{gross} - SCR_2^{net})^2}$$

Moreover, the usual linear approximation $\rho(\sigma) \approx 3 \cdot \sigma$ of the lognormal quantile formula has been applied to derive the simplification.

3.65. In QIS4, however, the practicability of the calculation for risk mitigating contracts like reinsurance or derivatives was one of the main issues raised by participants (cf. section 9.5 of the CEIOPS QIS4 report). The calculation turned out to be very difficult in many cases and was considered to be disproportionate in view of the low capital charges it produced. The criticism mainly related to non-life reinsurance where the number of counterparties was often high and the calculation of the loss-given-default was especially complex. Two reasons for the practical problems which were observed in QIS4 can be identified:

- The calculation of SCR^{gross} may require a reassessment of the affected SCR module. If the module formula is complex, this assessment may be demanding.
- In principle, the calculation needs to be made separately for each independent counterparty. If the number of counterparties is high, the overall calculation may be laborious.

[7] The aggregation of a vector of (sub-)module SCRs via correlation matrices defines a norm if the matrix is positive definite. In particular, the following consequence of the triangle equality holds:
Aggregation(SCR_1^A,…, SCR_n^A) − Aggregation(SCR_1^B,…, SCR_n^B)
≤ Aggregation($SCR_1^A - SCR_1^B$,…, $SCR_n^A - SCR_n^B$)

© CEIOPS 2009

3.66. Simplifications in these two areas are necessary. The following paragraphs present simplifications that address the problems that were raised in QIS4. In general, the appropriateness of the simplifications needs to be judged in relation to the materiality of the underlying risk. It should be noted that the low capital charges for counterparty default risk in QIS4 may not be a good indicator for the importance of this risk. Firstly, the counterparty default risk module may underwent relevant changes in order to address both the experience from QIS4 and the current financial crisis. Secondly, the amount of counterparty default risk that undertakings will be exposed to under Solvency II may change significantly. In particular, intra-group reinsurance and other intra-group relations may gain importance.

Simplified calculation for derivatives

3.67. In relation to financial instruments, the determination of the difference $SCR^{gross} - SCR^{net}$ was not in the focus of the complaints in QIS4. Obviously, the value SCR^{gross} is straightforward to determine for a market value scenario on sub-module level. However, if many counterparties need to be assessed, the calculation may still be demanding. A simplification as follows could be introduced to mitigate the problem:

3.68. If the financial instruments of counterparty (i) affect only one sub-module of the market risk module, then the difference $SCR_{mkt}^{gross} - SCR_{mkt}^{net}$ may be replaced by the difference $Mkt_{sub-risk}^{gross} - Mkt_{sub-risk}^{net}$ of the sub-module affected.

3.69. If the financial instruments of counterparty (i) affect more than one sub-module, the difference $SCR_{mkt}^{gross} - SCR_{mkt}^{net}$ may be replaced by the sum of the differences $Mkt_{sub-risk}^{gross} - Mkt_{sub-risk}^{net}$ of the sub-modules affected.

3.70. Example: Let the insurer have an equity portfolio with a market value of 100. There may be a hedge in place which restricts market value losses to 20%. Given that the SCR equity shock is 32% (QIS4 calibration), on a sub-module level the gross to net difference is as follows:

$$Mkt_{eq}^{gross} - Mkt_{eq}^{net} = 32 - 20 = 12$$

3.71. The determination of this difference should be no inappropriate burden to the insurer. In most cases, the determination of the difference will be a by-product of the original Mkt_{eq} calculation.

3.72. This simplification is conservative because it neglects the diversification effect between the sub-modules of the market risk module. It seems not possible to correct for this prudence in a simple way as the diversification depends on the composition of the investment portfolio and the hedging instruments in place. For example, a reduction factor for diversification could be introduced. But this factor would be difficult to calibrate and even if it was calibrated on an average level, it would distort the results in many cases.

© CEIOPS 2009

Simplified calculation for life reinsurance

3.73. Regarding life reinsurance the situation is similar to the problems outlined above for financial instruments. Hence, a similar simplification as follows can be provided.

3.74. If the reinsurance treaties with counterparty (i) affect only one sub-module of the life underwriting risk module, then the difference $SCR_{life}^{gross} - SCR_{life}^{net}$ may be replaced by the difference $Life_{sub-risk}^{gross} - Life_{sub-risk}^{net}$ of the sub-module affected.

3.75. If the reinsurance treaties with counterparty (i) affect more than one sub-module of the life underwriting risk module, the difference $SCR_{life}^{gross} - SCR_{life}^{net}$ may be replaced by the sum of the differences $Life_{sub-risk}^{gross} - Life_{sub-risk}^{net}$ of the sub-modules affected.

3.76. Example: Let the capital at risk of the insurer be 1,000,000. Further, let there be stop loss reinsurance in place which covers losses above 1,000. Then the SCR for life CAT risk is 1,000 because without reinsurance the loss would be 1.5‰·1,000,000 = 1,500 which exceeds the trigger point of the stop loss treaty.[8] In this case, the gross to net difference would be

$$Life_{CAT}^{gross} - Life_{CAT}^{net} = 1{,}500 - 1{,}000 = 500$$

If the stop loss treaty has been applied in other sub-modules, the sum of the differences would be used to determine LGD_i under this simplification. Again, the gross to net difference emerges in a natural way from the original SCR calculation.

3.77. For proportional life reinsurance a further simplification is possible. $SCR_{life}^{gross} - SCR_{life}^{net}$ could be determined by approximation of SCR_{life}^{gross} via the gross to net ratio of the best estimate provision:

$$SCR_{life}^{gross} - SCR_{life}^{net} \approx \left(\frac{BE^{gross}}{BE^{net}} - 1 \right) \cdot SCR_{life}^{net},$$

where BE^{net} is the best estimate provision for life insurance net of reinsurance, and BE^{gross} is the best estimate provision for life insurance net of reinsurance except reinsurance towards counterparty (i).

3.78. This simplification should not be applied to non-proportional reinsurance as the risk-mitigating effect of such reinsurance arrangements are not appropriately reflected in the gross to net ratio of the best estimate.

Simplified calculation for non-life reinsurance

3.79. Owing to the complex formulas for non-life underwriting risk module and the high number of counterparties, the treatment of non-life reinsurance

[8] The calculation is based on the QIS4 calibration of the life CAT sub-module.

© CEIOPS 2009

seems to have caused most problems in QIS4. The calculation can be simplified as follows:

- In a first step, calculate $SCR_{nl}^{gross} - SCR_{nl}^{net}$ for all reinsurance counterparties together.

- In a second step, approximate the share of a singe counterparty (i) as follows:

$$\left(SCR_{nl}^{gross} - SCR_{nl}^{net}\right)_i \approx \left(SCR_{nl}^{gross} - SCR_{nl}^{net}\right) \cdot \frac{Rec_i}{Rec_{total}},$$

where Rec_i are the reinsurance recoverables towards counterparty (i) and Rec_{total} the overall reinsurance recoverables.

3.80. Another simplification was used in QIS4 (cf. page 45 in the CEIOPS' QIS4 Questions and Answers Document). However, the underlying approximation is likely to underestimate the risk mitigating effect. A correction of this bias would add additional complexity to the approach. Moreover, the simplification only applies to the premium and reserve risk sub-module but not the CAT sub-module. Therefore, the above defined simplification seems to be more suitable.

<u>Implementation of the simplified calculations for derivatives and reinsurance</u>

3.81. Requirements for the use of the simplifications need to be defined. It appear to be appropriate if the simplifications are only use if the following conditions are met:

- There are no indications that the simplification significantly misestimates the risk mitigating effect.

- The capital requirement for counterparty default risk under the simplified calculation is less than 20% of the overall SCR before adjustment for the loss-absorbing capacity of technical provisions and deferred taxes. For this comparison the overall SCR can be calculated by means of the simplified calculation for the counterparty default risk capital requirement.

- The result of the sophisticated calculation is not easily available.

<u>Simplification in relation to the number of counterparties</u>

3.82. In principle, the calculation of the risk mitigating effect needs to be made separately for each independent counterparty. If the number of counterparties is high, the overall calculation may be laborious. In order to tackle the problem of too many calculation runs, the following simplification should be offered:

3.83. Instead of treating each counterparty (i) separately in the calculation of LGD_i and SCR_{def}, the set of counterparties is divided into disjoint subsets and the calculation is modified as follows:

© CEIOPS 2009

- In the determination of LGD_i each subset is treated as one counterparty.
- For the calculation of SCR_{def} it is necessary to assign a probability of default (or a rating) to the subset. This probability of default is the highest probability of default of the counterparties in the subset.

3.84. The simplification is always conservative. By treating several counterparties as one counterparty, the diversification effects between the counterparties are ignored. Moreover, the lowest quality counterparty determines the probability of default of the subset. The degree of conservatism depends on the granularity of the subsets used as well on their homogeneity. If the subsets are smaller and the counterparties in each subset of equal credit standing, then the deviation from the sophisticated calculation is also smaller.

3.85. Another probability of default could be assigned to the subset, for example an average of the counterparties' probability of default. This approach would be less conservative. However, such an average needs to be weighted to avoid significant distortions. For example, if a subset consists of a small exposure with a good rating and a large exposure with a bad rating an unweighted average would assign a medium rating to the overall exposure. However, it is unclear how such a rating can be defined and calculated without offsetting the simplification effect of the approach. Furthermore, the use of a weighted average default rate would increase the scope for cherry picking.

3.86. <u>Examples:</u> The simplification allows for a high degree in flexibility in the "reduction" of counterparties. For instance, insurers could opt for one of the following realisations of the simplification:

- All counterparties with the same rating are treated as one counterparty. This approach has already been used in QIS4;
- All counterparties with a small exposure are treated as one counterparty;
- All counterparties with a high quality rating are treated as one counterparty.

3.87. <u>Two concrete examples:</u>

- Let an insurer have 10 counterparties. Nine of them are rated AAA or AA while one counterparty is rated BB. If all exposures are of similar size, the BB exposure will drive the capital charge. Therefore, it could be sufficient to treat the nine high quality counterparties as one counterparty, because the diversification effect between the nine counterparties is small compared to the capital charge for the BB exposure. The number of necessary LGD calculations is reduced from ten to two in this way.
- Let an insurer have 10 counterparties, all of them rated AA. One counterparty dominates the overall exposure. The exposures of the remaining counterparties are not very relevant. In this case, all

© CEIOPS 2009

counterparties could be treated as one counterparty, because the diversification effect between the counterparties is small compared to the exposure of the dominating counterparty. The number of necessary LGD calculations is reduced from ten to one in this way. Alternatively, two subsets could be defined: the first subset contains only the dominating counterparty and the second subset all other counterparties. Two LGD calculations would be necessary, but a large part of the diversification effect should be captured in this way.

3.88. It should be possible to use this simplification without further requirements. Undertakings should be allowed to apply this simplification in combination with the sophisticated calculation or any of the simplifications described above.

3.1.6 Loss-given-default for type 1 exposures other than risk mitigating contracts

3.89. For type 1 exposures other than risk mitigating contracts the loss-given-default can be assumed not to vary significantly during the time horizon of the SCR. In this case a reference to the current asset value of the exposure can be made. An exception is the case of guarantees. Their liability value at the time of the SCR calculation may be negligible but in case of default there is a risk of a loss up to the nominal value of the guarantee.

3.90. For cash at bank, deposits with ceding institutions and unpaid but called up capital the loss-given-default should be the value of the corresponding asset according to Article 75 of the Level 1 text.

3.91. For guarantees, letters of credit, letters of comfort and other commitments which depend on the credit standing of a counterparty the loss-given-default should be the difference between their nominal value and their value according to Article 75 of the Level 1 text.

3.92. If in relation to a counterparty more than one type 1 exposure exists, then the loss-given-default for this counterparty should be the sum of the losses-given-default of the single exposures.

3.1.7 Independence of counterparties

3.93. The calculation of the capital requirements for type 1 exposures takes into account diversification effects between independent counterparties. An economic approach should be taken in order to decide whether counterparties are independent or not. For example, counterparties which belong to the same corporate group should usually not be considered to be independent for the purpose of the counterparty default risk module because a high dependence between the default of the counterparties is likely.

© CEIOPS 2009

3.94. In particular, entities (regulated or not) which belong to the same group as defined in Article 212 of the Level 1 text[9] or to the same financial conglomerate as defined in Article 2(14) of the Financial Conglomerate Directive (2002/87/EC) should be treated as dependent counterparties. Consequently, the different legal entities of the group or financial conglomerate should be treated as one counterparty in the module calculations and no diversification effects between the entities are taken into account in the capital requirement. Cross-sectoral developments on the treatment of intra-group relations may be taken into account for further developing the notion of dependency.

3.1.8 Derivative clearing

3.95. If the issuer of a derivative is replaced by means of novation by a central counterparty[10], then the central counterparty should be taken into account in the calculation of the probability of default for the derivative exposure.

3.1.9 Probability of default for type 1 exposures

3.96. For the calculation of the capital requirement for type 1 exposures it is necessary to assign a probability of default or at least a rating class to each counterparty. In the past QIS this assignment was mainly based on credit rating agency estimates. In order to take best account of ongoing developments in the regulation of credit rating agencies this draft advice does not cover the assignment.

3.97. However, the draft advice presupposes that there are a finite number of rating classes (perhaps including a class for counterparties with unknown credit standing) such that

- an average probability of default can be assigned to the rating classes and
- one of the rating classes can be assigned to each counterparty with a type 1 exposure.

3.98. Later advice of CEIOPS will cover details of such or an equivalent assignment.

3.1.10 Treatment of risk mitigation techniques

3.99. The counterparty default risk module should take into account techniques to mitigate default risk like collaterals or netting of receivables with liabilities. Allowance should be made as follows:

[9] "Group" means a group of undertakings, which consists of a participating undertaking, its subsidiaries and the entities in which the participating undertaking or its subsidiaries hold a participation, as well as undertakings linked to each other by a relationship as set out in Article 12(1) of Directive 83/349/EEC.
[10] Cf. Article 2 of Directive 98/26/EC for a definition of central counterparty.

© CEIOPS 2009

Collaterals

3.100. If a collateral is posted in relation to the exposure, the custodian holding the collateral is independent from the counterparty and the requirements defined for collaterals in CEIOPS' Advice on financial risk mitigation techniques[11] are met, then the loss-given-default (in case of a type 1 exposure) or the value of the exposure (in case of a type 2 exposure) may be reduced by the risk-adjusted value of the collateral. The risk-adjusted value of the collateral should be calculated as follows:

$$Collateral = 80\% \cdot \left(MarketValue_{Collateral} - MktRisk_{Collateral}\right),$$

where

$MarketValue_{Collateral}$	=	Market value of the collateral assets
$MktRisk_{Collateral}$	=	Adjustment for market risk

3.101. The factor of 80% reflects the credit risk of the custodian. It is based on the assumption that the probability of default of the custodian is 0.25% and the custodian has a recovery rate of 10%. The factor reflects the loss on a 99.5 VaR level according to the model for type 1 exposures under these assumptions. Where the collateral assets are bancruptcy remote and no there is no credit risk present, the factor should equal 100%.

3.102. For the calculation of the adjustment for market risk, the reduction of the market value of the collateral according to the equity, property, credit spread and currency risk sub-module should be determined and aggregated according to the correlation matrix of the market risk module. For the calculation of the currency risk sub-module, the currency of the collateral is compared to the currency of the secured credit exposure. For reasons of practicability, interest rate risk and concentration risk are neglected. If the collateral assets are bank deposits which are not subject to the credit spread risk, the adjustment should be increased by the capital requirement for counterparty default risk of the deposits.

3.103. For example, let the market value of the collateral be 100, consistsing of 20 in equity of listed US companies and 80 in bonds denoted in euro with a AA credit rating and a maturity of 5 years. Let the currency of the secured credit exposure be euro. Then the equity risk of the collateral is 45%·20=9, the currency risk is 25%·20=5, and the credit spread risk is 7.1%·80=5.7. The adjustment for market risk is the aggregate of these risks (applying the correlation factors of the market risk module) and amounts to about 18.7.

3.104. If it is proportionate to the nature scale and complexity of the risks inherent in the collateral arrangement, a simplification as follows may be applied:

$$Collateral = 70\% \cdot MarketValue_{Collateral}$$

[11] See CEIOPS-DOC-26/09 (October 2009), see http://www.ceiops.eu//content/view/17/21/ (former CP31)

© CEIOPS 2009

Where the collateral assets are bancruptcy remote and no there is no credit risk present, a simplification as follows may be applied:

$$Collateral = 85\% \cdot MarketValue_{Collateral}$$

Segregated assets

3.105. Where, and to the extent that, the liabilities of the counterparty are covered by strictly segregated assets under arrangements which meet the requirements set out in CEIOPS' Advice on financial risk mitigation techniques, the segregated assets should be treated like collaterals in the calculation of the counterparty default risk module.

Letters of credit

3.106. If a letter of credit is provided to secure a credit exposure and the arrangement meets the requirement defined in CEIOPS' Advice on financial risk mitigation techniques, then the counterparty of the credit exposure may be replaced by the provider of the letter of credit in the calculation of the counterparty default risk module. This replacement affects the probability of default that is taken into account in the calculation as well as the assessment whether the counterparty is independent from other counterparties.

3.107. A letter of credit should not be taken into account in the calculation of the counterparty default risk module if is approved as ancillary own funds.

Netting

3.108. The loss-given-default (in case of a type 1 exposure) or the value of the exposure (in case of a type 2 exposure) may be netted with liabilities towards the same legal entity to the extent they could be set off in case of default of the legal entity. The general requirement defined in CEIOPS' Advice on financial risk mitigation techniques and CEIOPS' Advice on reinsurance risk mitigation techniques[12] should be met in relation to netting if it is taken into account in the calculation. In particular, if the legal situation in relation to netting is unclear, then no netting should be taken into account. No netting should be allowed for if the liabilities are expected to be met before the credit exposure is cleared.

3.1.11 Calibration

3.109. According to the above outset of the counterparty default risk module, the following parameters of the formula need to be specified:

- the recovery rates RR_{re} and RR_{fin},
- the parameters α and τ of the loss distribution for type 1 exposures,
- the quantile factor q which is applied to the standard deviation of the loss distribution to estimate the 99.5% quantile,

[12] CEIOPS-DOC-44/09 (October 2009), see http://www.ceiops.eu//content/view/17/21/ (former CP52)

© CEIOPS 2009

- the risk factors *x* and *y* for type 2 exposures as well as the number of months *T* which is used to define the past-due receivables of intermediaries,

- the thresholds to define when deposits with ceding institutions and called up but unpaid commitments are treated as type 1 or type 2 exposures.

3.110. CEIOPS points out that the calibration in this advice is being considered to be in line with 99.5% VaR and a one year time horizon, incorporating the experience from the current crisis. QIS5 will give an indication of the overall impact of the proposed calibrations, not limited to the SCR but including technical provisions and own funds.

<u>Recovery rates</u>

3.111. The recovery rates RR_{re} and RR_{fin} for reinsurance arrangements and derivatives should reflect a prudent estimate of the relative share of the stressed credit exposure that still can be collected in case of the default of the counterparty.

3.112. In QIS4, for both RR_{re} and RR_{fin} a value of 50% was used. This calibration was based on expert opinion because empirical data on recoverable rates of reinsurance arrangements and derivatives is rare.

3.113. There are indications that support this choice for reinsurance arrangements:

- Long-time studies of corporate bonds indicate that the QIS4 choice would reflect the recovery rate of corporate bonds.[13]

- For defaulted reinsurance counterparties, an assumed recovery rate in the range of 50% seems to reflect best practice.[14]

CEIOPS proposes to keep the recoverable rate for RR_{re} at 50%. However, if the counterparty has tied up an amount for collateralisation commitments (both on and off balance sheet, including commitments to other parties) greater than 60% of the assets on its balance sheet, the recovery rate is assumed to be 10% rather than 50%.

3.114. The current financial crisis has shown that banks and other issuers of derivatives can incur unprecedented losses which significantly diminish their ability to clear debt. In some cases, for example American Insurance Group Inc., the issuance of derivatives and their leverage effect was a main cause of the losses. The recovery rates observed for many banks

---

[13] Cf., for example, Moody's Investor Service »Moody's Global Credit Policy - Corporate Default and Recovery Rates, 1920-2008« February 2009, (http://v2.moodys.com/cust/content/content.ashx?source=StaticContent/Free%20Pages/Credit%20Policy%20Research/documents/current/2007400000578875.pdf)

[14] Cf., for example, Mark Flower et al. »Reinsurance counterparty credit risk – Practical suggestions for pricing, reserving and capital modelling«, July 2007, page 18, (http://www.actuaries.org.uk/__data/assets/pdf_file/0014/31307/BHPrize_Flower.pdf)

© CEIOPS 2009

which defaulted during the crisis are relevantly lower than 50%[15]. For instance, in 2008, Lehman Brothers had a recovery rate of 9.3%, and the three major Icelandic banks had recovery rates of 4.0% and less. For these reasons, the QIS4 calibration should be adapted. A value of 10% for the recovery rate of defaulted derivatives (RR_{fin}) appears to be justified.

3.115. These calibration proposals are based on expert opinion and should therefore be considered as preliminary. Any evidence about recovery rates evolving during the current crisis should be taken into account in the final calibration.

The parameters α and τ of the loss distribution for type 1 exposures

3.116. Above, a model for the loss distribution of type 1 exposures was proposed. The parameters α and τ influence the shape of this loss distribution. In order to determine the capital requirement from the loss distribution, only the variance of the distribution are used. This variance only depends on the ratio α/τ.

3.117. The meaning of the ratio can be illustrated by the relation between the baseline probability of default b, i.e. the minimum probability of default of a counterparty, for example in case of favourable economic situations, and the average default probability p:

$$p = \frac{\left(\frac{\alpha}{\tau} + 1\right) \cdot b}{\frac{\alpha}{\tau} \cdot b + 1}$$

The higher the ratio α/τ is, the more does the average probability default differ from the baseline probability of default. For example, if α/τ is 0.5, then $p \approx 1.5 \cdot b$ and if α/τ is 4, then $p \approx 5 \cdot b$.[16]

3.118. It can also be shown that the covariances between defaults of counterparties in the module increase with the ratio α/τ.

3.119. The current financial crisis has shown that

- the default probability of a counterparty can vary significantly over time, and
- there is a significant dependence between defaults.

3.120. Empirical data to assess the variance or covariance of reinsurance undertakings and issuers of derivatives is rare. Nevertheless, default statistics of corporate bonds indicate that volatility in market default rates

[15] See Moody's Investor Service »Moody's Global Credit Policy - Corporate Default and Recovery Rates, 1920-2008« February 2009, page 8.

[16] For these calculations, it was assumed that b is close to 0.

© CEIOPS 2009

is high[17]. The average default probability of this kind of debt seems to be a multiple of the baseline default probability.

3.121. On this basis it appears to be reasonable to set the ratio α/τ at 4. This calibration proposal is based on expert opinion and should therefore be considered as preliminary. Any evidence about the loss distribution evolving during the current crisis should be taken into account in the final calibration.

The quantile factor *q*

3.122. The model proposed above provides a loss distribution for the counterparty default risk of the portfolio of type 1 exposures. While the shape of the distribution may be complex, the mean and the variance of the distribution can easily be calculated. The 99.5% quantile is estimated by multiplying the standard deviation of the distribution with a quantile factor q.

3.123. The determination of the quantile factor is not a simple task. The shape of the distribution depends both on the probability of default of the counterparties in the portfolio as well as their number. However, if it is assumed that the portfolio is sufficiently diversified or the credit quality of the counterparties is high, it appears to be appropriate to base the factor on a skewed distribution like the lognormal distribution. In this case, the quantile factor should be set at $q = 3$.

3.124. If the portfolio is dominated by one or a small number of exposures with a high probability of default, the above mentioned assumption cannot be made as the resulting distribution is considerably more skewed than the lognormal distribution. In this case, a higher quantile factor should be chosen. If the standard deviation of the loss distribution exceeds 5% of the overall loss-given-default for type 1 exposures, the quantile factor should be set at $q = 5$. This higher quantile factor applies to portfolios with a credit quality of worse than BBB.

The risk factors for type 2 exposures

3.125. For type 2 exposures the capital requirement is calculated by multiplying the market value of the exposure with a fixed risk factor x.

3.126. In order to achieve consistency between the treatment of type 1 and type 2 exposures, the calibration of x could be determined by applying the approach for type 1 exposures to a model portfolio of type 2 exposures. Based on the assumptions that

- the probability of default of the type 2 counterparties is defined by a rating between BBB and BB,

[17] See Moody's Investor Service »Moody's Global Credit Policy - Corporate Default and Recovery Rates, 1920-2008« February 2009, or Standard & Poor's »Default, Transition, and Recovery: 2008 Annual Global Corporate Default Study And Rating Transitions«, April 2009 http://www2.standardandpoors.com/portal/site/sp/en/us/page.article/3,3,3,0,1204845478653.html

© CEIOPS 2009

- the portfolio of type 2 exposures is well diversified, and
- a third of the exposure can be collected in case of default

a risk factor of $x = 15\%$ can be derived.[18]

3.127. Above, a special treatment for past-due receivables towards intermediaries is proposed, in order to allow for the higher probability of default of these exposures. On a 99.5% quantile level, the collection of these receivables is very doubtful. Therefore, a risk factor of $y = 90\%$ appears to be appropriate. It should be applied to intermediary receivables which are past-due for more than $T = 3$ months.

The threshold to distinguish between type 1 and type 2 exposures

3.128. Te assignment of deposits with ceding institutions and called up but unpaid commitments to the classes of type 1 or type 2 exposures should depend on the number of independent counterparties. This decision was based on practicability considerations; if the number of counterparties is too large, the proposed approach for type 1 exposures becomes impracticable.

3.129. An appropriate choice for the threshold could be a number of 15 counterparties. In relation to this threshold, deposits with ceding institutions and called up but unpaid commitments should be assessed independently. For determining the number of independent counterparties, those counterparties that belong to one group should be treated as one independent counterparty.

3.130. The undertaking will still be allowed to classify these deposits with ceding institutions and called up but unpaid commitments as type 1 exposures. However, the undertaking must classify all such exposures as type 1 or as type 2.

3.1.12 Probability of default for type 1 exposures

3.131. For the calculation of the capital requirement for type 1 exposures it is necessary to assign a probability of default to each counterparty. The model underlying the proposed approach for type 1 exposures recognizes that the probability of default of a particular counterparty may change over time. The probability of default that is required as input data for the calculation is a long-term average of this random variable like it is determined, for example, by credit rating agencies in their through-the-cycle assessment. By abuse of terminology in the following mainly the term "probability of default" will be used instead of "long-term average probability of default" to ensure readability of the text.

Determination of the probability of default via credit rating agency assessments

[18] See paragraph B.8 in Annex A.

© CEIOPS 2009

3.132. In the past QIS the probability of default was mainly based on the assessment provided by credit rating agencies (CRA). An assignment of probabilities of default to external ratings was provided as part of the Technical Specifications. If a counterparty was rated the probability of default corresponding to its rating was used in the calculation of the capital requirement for counterparty default risk.

3.133. CEIOPS is aware that the use of CRA assessments has many drawbacks. CRAs operate in an oligopolistic market. Doubts have been raised whether the independence of CRA from the rated counterparties may in certain cases be impaired by conflicts of interest. The rating methodology may be inadequate and not sufficiently transparent. Changes in the credit standing of a counterparty may be declared by CRAs with delay.[19]

3.134. According to the Proposal for a Regulation on Credit Rating Agencies of the European Commission, "*it is commonly agreed that credit rating agencies contributed significantly to recent market turmoil by underestimating the credit risk of structured credit products. The great majority of subprime products were given the highest ratings, thereby clearly underestimating the major risks inherent in those instruments. Furthermore, when market conditions worsened, the agencies failed to adapt the ratings promptly.*"[20]

3.135. Despite these deficiencies, for the time being and within the scope of the standard formula, there does not seem to be an alternative way to assign a probability of default to most of the relevant counterparties than by means of credit ratings provided by CRAs.

3.136. In order to make use of credit ratings for the determination of the probability of default, two elements need to be specified:

- A recognition of the CRAs whose credit ratings can be used in the standard formula.

- For each recognised CRA, an assignment of probabilities of default to the rating classes used by the CRA. This assignment should distinguish between different kind of rated instruments and counterparties.

3.137. The credit ratings used in the standard formula should meet highest standards. Only credit ratings of CRAs which are registered according to the Regulation on Credit Rating Agencies and which meet the requirements specified in this Regulation should be recognised. Moreover, they should meet requirements which are consistent with those for external credit assessment institutions included in the Capital Requirements Directive 2006/48/EC[21].

3.138. The assignment of probabilities of default to rating classes should meet the requirements specified in Directive 2006/48/EC.

[19] see for example, United States Securities and Exchange Commission: "Summary Report of Issues Identified in the Commission Staff's Examinations of Select Credit Rating Agencies", July 2008
[20] See COD/2008/0217, page 2.
[21] Articles 81-83 and Annex VI, parts 2 and 3 of Directive 2006/48/EC

© CEIOPS 2009

3.139. As in Directive 2006/48/EC, in cases where more than one rating is available for a counterparty, the second-highest rating should be used.

3.140. The assignment described in the CRD directive is based on observed default rates. One of the consequences of the current financial crisis is that the default experience may be significantly distorted by state intervention. Many counterparties in and outside of the financial sectors were saved from default by receiving capital, guarantees or other support from governments. If these counterparties were counted as not defaulted in the default statistics then the statistics would not reflect the full credit risk of these counterparties and thereby overestimate the credit quality of the credit classes they belong to. Indeed, according to such a distorted statistics the financial crisis did basically not take place and most of the past credit ratings which are criticised for having been overly optimistic were justified.

3.141. Basing the solvency assessment on a statistic with this flaw would imply that supervisors anticipate in their assessment state intervention during the next crisis. Such a conclusion should be avoided. Therefore, it is important to ensure that the counterparties which would have defaulted without state intervention during the current crisis are considered as defaulted for the estimation of the default probability of a rating class.

<u>Treatment of unrated counterparties</u>

3.142. If a counterparty is not rated by a recognised CRA, an alternative assignment of the probability of default is necessary. In QIS4, four approaches were tested in that respect:

- A look through approach for intra-group reinsurance;
- The derivation of a probability of default from the solvency ratio of the counterparty;
- The assignment of a fixed probability of default (corresponding to a BBB rating) to unrated insurance and reinsurance undertakings which are subject to Solvency II supervision;
- The assignment of a fixed probability (corresponding to a CCC rating) of default to all counterparties where non of the above approaches applied.

Look through approach

3.143. Under the look through approach the probability of default of a group-internal reinsurance counterparty is replaced by the probability of default of an external undertaking for the share of the recoverable that is retroceded to the external undertaking. In particular, in case of a 100% retrocession it is not necessary to determine the probability of default of the intra-group counterparty.

3.144. The look through approach is based on the idea that capital flows freely within the group so that the only risk relating to the retroceded business

© CEIOPS 2009

is the default of the external undertaking. A default of the internal reinsurance counterparty is considered risk-free in this respect because payments of the external undertaking to the internal reinsurance counterparty are considered as payments to the whole group. This approach is not in line with economic reality. Capital flow between group members may be restricted, in particular in times of crisis.

Solvency ratio rating

3.145. An analysis of SCR and own funds appears to be a straightforward way to derive a probability of default. However, this approach has several shortcomings:

- The derivation of the default probability from the solvency ratio requires a general assumption about the loss distribution of insurance undertaking. This assumption includes a significant model error.

- As the SCR allows for one-time risk mitigating effects in the adjustment to the Basic SCR, the solvency ratio can be a bad indicator of the probability of default. If the solvency ratio of undertaking A is lower than the ratio of undertaking B then this does not imply that the probabilities of default have the same order.

- The current solvency ratio is likely to correspond to a point-in-time assessment of the undertaking's credit standing. For the counterparty default risk module, a through-the-cycle estimate is more appropriate. In particular, under benign economic conditions a default probability estimate based on the solvency ratio may underestimate the long-term average default probability.

- The solvency ratio of a counterparty may not be known or only with delay. In case of a circular counterparty relation (for example, A is a credit counterparty of B, B is a credit counterparty of C and C is a credit counterparty of A) it may be very difficult to determine the capital requirements and solvency ratios.

3.146. Because of these shortcomings, the solvency ratio rating should only be applied with several safeguards. In particular, the derivation should take into account the significant estimation error of this approach.

3.147. According to the MCR definition in Article 129 of the Level 1 text, counterparties which do not meet the MCR have a default probability of more than 15%. To these counterparties a default probability of 30% should be assigned under the solvency ratio rating approach.[22] Under the proposed model, this probability produces a risk factor of 100% for the stand-alone exposure of the counterparty.

[22] An undertaking that does not meet the MCR has a probability of default between 15% and 100%. 30% is chosen as an average value.

© CEIOPS 2009

3.148. If a counterparty meets the MCR, a default probability depending on the SCR and the eligible own funds to meet the SCR (OF) could be defined as follows:

OF/SCR	Probability of default
> 200%	0.025%
> 175%	0.050%
> 150%	0.1%
> 125%	0.2%
> 100%	0.5%
> 90%	1%
> 80%	2%
≤ 80%	10%

3.149. A derivation of this table can be found in Annex C.

3.150. The solvency ratio rating should be based on the last publicly reported figures for SCR, MCR and the eligible own funds to meet these requirements. Usually, these will be figures which are one year old. If more recent information is available to the undertaking, then they should be used. If there are indications that the current figures significantly and adversely deviate from the most recent known figures then the requirements of the solvency ratio rating are not met and it should not be applied. If the counterparty and the undertaking that has to assess the counterparty's default probability belong to the same group, the current figures or, if that is not possible, the last calculated figures should be used. If the last calculated figures are not available, then the requirements of the solvency ratio rating are not met and it should not be applied.

Undertakings subject to Solvency II supervision

3.151. QIS4 included the assignment of a probability of default (corresponding to a BBB rating) to unrated insurance and reinsurance undertakings which are subject to Solvency II supervision. After the implementation of Solvency II such a rule is not necessary anymore. As undertakings under Solvency II supervision have to publish their SCR and eligible own funds, the solvency ratio rating can be derived for them. Moreover, the QIS4 approach is not appropriate for supervised counterparties which do not meet the SCR.

Treatment of counterparties without a solvency ratio rating

3.152. As in QIS4 it will be necessary to define a treatment of those counterparties for which no default probability can be assigned by one of the appropriate approaches specified above. These counterparties are defined as follows: they are not rated by a recognised CRA and no solvency ratio rating can be assigned to them, either because they are

© CEIOPS 2009

not under Solvency II supervision or they do not meet the requirement of the solvency ratio rating.

3.153. To these counterparties, a probability of default of 10% should be assigned. This corresponds to a credit rating between B and CCC according to the S&P classification.

Counterparties which belong to the same group

3.154. If an undertaking has more than several counterparty which are not independent (for example because they belong to the same group) then it is necessary to assign a probability of default to the whole set of dependent counterparties. This overall probability of default should be average probability of the counterparties weighted with the corresponding losses-given-default.

Equivalent supervision

3.155. Unrated counterparties under supervision equivalent to Solvency II which meet the local capital requirements that is equivalent to the SCR can be treated as if having a BBB rating.

Banks

3.156. Unrated banks compliant with the Capital Requirements Directive (2006/48/EC) shall be treated as if having a BBB rating.

Ceiling to probabilities of default

3.157. The proposed model for type 1 exposures may produce risk factors above 100% for high default probabilities (corresponding to B and CCC rated counterparties). In order to avoid this inconsistency, the probabilities of default that feed into the model should be limited. Under the proposed calibration of the model, a ceiling of 4.175% should apply. (This probability leads to a risk factor of 100%.)

3.1.13 Pools

Background

3.158. During the stakeholder consultation, undertakings specifically asked for advice in respect of the treatment of pool arrangements under the counterparty risk module.

3.159. The treatment of the pool arrangements has generated a lot of questions by QIS4 participants. A CEIOPS questionnaire was produced and completed by member states with the help of the industry, to understand and identify existing pools, their organisation and tasks.

3.160. In particular CEIOPS wanted to know how such arrangements work and how reinsurance arrangements in a pool may be affected for calculating capital charges for counterparty default risk related to pool arrangements.

© CEIOPS 2009

Organisation

3.161. Pools may be organised and managed in a variety of ways.

3.162. There may exist a central pool undertaking, which can be an insurance undertaking owned by the pool members or by a jointly established organisation.

3.163. A pool arrangement could also mean a mere agreement according to which the claims are shared among the pool members. In such a case there usually exists a pool organisation of which the pool members share the costs, i.e. a pool with no central undertaking.

No central pool undertaking

3.164. Where there is no central pool undertaking, CEIOPS has identified the following possible default options that could occur within such arrangement and also presents how this would be dealt within the counterparty default module:

3.165. Default of a member of the pool:

Circumstances affecting the undertaking	**Treatment under the Standard formula**
Where there is a right of offset, payments due to the counterparty can be set against amounts due from the counterparty. This applies even when the counterparty is insolvent. For most pools the claims by each pool member against the pool will roughly balance the claims against the pool member.	In such cases, only exceptionally would there be material exposure to other pool members. The desired effect on the SCR is that the exposure to the counterparty should be the net liability from the counterparty (that is amounts due from counterparty less amounts due to counterparty) where there are rights of offset. Please refer to the advice on Netting provided in this advice.
Where there are letters of credit securing designated reserves held by a Trust under the control of a Trustee. These security arrangements materially mitigate this risk if the bank providing the letter of credit has a good credit rating (BBB or better).	This should be treated as a guarantee as per the counterparty default risk module, enabling the undertaking to replace exposure to the other pool member(s) with exposure to the provider of the letter of credit.
Where there are legally binding arrangements relating to a segregated cell company that acts as security. These prevent the assets in the cell of another	The desired effect is that assets in other pool members' cells should be treated as collateral. Refer to CEIOPS' Advice on financial risk mitigation techniques, CEIOPS-DOC-26/09, in particular the

© CEIOPS 2009

member being distributed to the detriment of the undertaking. The assets in the cell act as collateral for the obligations of the "owner" of the cell.	section on segregated assets.
Where no security arrangements are in place. The exposure to another pool member is similar to exposure for any other reinsurer.	No special treatment is required.
Where the pool agreement includes the commitment that if a pool member defaults, the remaining pool members share the losses caused by the default. Here, the direct exposure of the undertaking to another pool member is reduced by the loss that is borne by other members but there is indirect exposure because the undertaking is bearing part of the losses experienced by those other members.	Subject to materiality and practicality (i.e. the principle of proportionality), the exposure should be adjusted for the effect of this pooling of losses. Where undertakings have contractual arrangements with more than five other undertakings to share their reinsurance default exposure to a counterparty (i.e. forming a pool), they may use reasonable approximations to estimate their exposure, as modified by these pooling arrangements, to the counterparty for the purpose of their SCR calculation, provided that the approximations are proportionate to the nature, scale and complexity of the risks and unlikely to underestimate the SCR.

3.166.Default of segregated cell company, acting legally as retrocessionnaire:

Circumstances affecting the undertaking	**Treatment under the Standard formula**
Where a segregated cell company to which obligations to other pool members are ceded, acts as security in relation of those obligations, from an economic perspective they are not retrocession but merely a way of providing security to other pool members.	Treatment should be based on economic substance over legal form as per CEIOPS' Advice on reinsurance mitigation techniques CEIOPS-DOC-44/09.

3.167.Default of an external reinsurer:

Circumstances affecting the undertaking	**Treatment under the Standard formula**

© CEIOPS 2009

Where losses are not shared with other pool members. The pool does not affect this.	No special treatment is required.
Where each pool member would be required to share the losses. The direct exposure of the undertaking to the reinsurer is reduced by the loss that is borne by other members but there is indirect exposure because the undertaking is bearing part of the losses experienced by those other members.	Subject to materiality and practicality (i.e. the principle of proportionality), the exposure should be adjusted for the effect of this pooling of losses. Where undertakings have contractual arrangements with more than five other undertakings to share their reinsurance default exposure to a counterparty (i.e. forming a pool), they may use reasonable approximations to estimate their exposure, as modified by these pooling arrangements, to the counterparty for the purpose of their SCR calculation, provided that the approximations are proportionate to the nature, scale and complexity of the risks and unlikely to underestimate the SCR.

Central pool undertaking

3.168. Where there is a central pool undertaking, CEIOPS has identified the following possible default options that could occur within such arrangement and also presents how this would be dealt within the counterparty default module:

3.169. Default of the pool undertaking:

Circumstances affecting the undertaking	**Treatment under the Standard formula**
There is a central pool undertaking and the pool member can incur a loss in case of the default of the central pool undertaking.	This risk is measured like with any other reinsurer by means of the exposure to the central pool undertaking and its probability of default.

© CEIOPS 2009

3.170. Default of a member from the pool

Circumstances affecting the undertaking	Treatment under the Standard formula
The pool agreement does not include a legally binding commitment that in the event of a member defaulting, the remaining pool members have to cover losses which are caused by the default of a pool member.	The risk is not captured in the counterparty default risk module because the loss needs to be covered by the pool undertaking. However, to the extent an undertaking has an equity holding in the pool undertaking the risk is implicitly captured in the equity sub-module or by special treatment of participations.

3.171. Default of an external reinsurer

Circumstances affecting the undertaking	Treatment under the Standard formula
The pool agreement does not include a legally binding commitment that in the event of a member defaulting, the remaining pool members have to cover losses which are caused by the default of a pool member. External reinsurer protects pool rather than each pool member. On failure of reinsurer, the loss falls solely on the pool	The risk is not captured in the counterparty default risk module because the loss needs to be covered by the pool undertaking. However, to the extent an undertaking has an equity holding in the pool undertaking the risk is implicitly captured in the equity sub-module or by special treatment of participations.

© CEIOPS 2009

3.2 CEIOPS' advice

3.2.1 Scope of the counterparty default risk module

3.172. The counterparty default risk module should reflect possible losses due to unexpected default, or deterioration in the credit standing, of the counterparties and debtors of insurance and reinsurance undertakings over the forthcoming twelve months. The counterparty default risk module should cover risk-mitigating contracts, such as reinsurance arrangements, securitisations and derivatives, and receivables from intermediaries, as well as any other credit exposures which are not covered in the spread risk sub-module.

3.173. For the purpose of the counterparty default risk module, reinsurance should include financial reinsurance.

3.174. In relation to credit derivatives, the credit risk which is transferred by the derivative should not be covered in the counterparty default risk module, but in the credit spread risk sub-module of the market risk module.

3.175. The aforementioned "other credit exposures" should include, inter alia,

- policyholder debtors,
- cash at bank,
- deposits with ceding institutions, and
- capital, initial funds, letters of credit as well as any other commitments received by the undertaking which have been called up but are unpaid.

3.176. "Other credit exposures" should also include guarantees, letters of credit, letters of comfort provided by the insurance or reinsurance undertaking as well as any other commitment which is provided by undertaking and which depends on the credit standing of a counterparty.

3.177. Credit exposures in relation to a national government, or an institution covered by a guarantee of the national government, should be exempted from an application of the module. The exemption should be restricted to exposures in relation to governments and institutions of an OECD or EEA state in the currency of the government.

3.178. The counterparty default risk module should not cover the underwriting risk of credit insurance.

© CEIOPS 2009

3.2.2 Calculation of the capital requirement for counterparty default risk

3.179. The calculation of the capital requirement for counterparty default risk should distinguish between two types of exposures. Type 1 exposures are exposures in relation to

- reinsurance arrangements,
- securitisations and derivatives,
- any other risk mitigating contracts,
- cash at bank,
- deposits with ceding institutions, if the number of independent counterparties does not exceed a certain threshold,
- capital, initial funds, letters of credit as well as any other commitments received by the undertaking which have been called up but are unpaid, if the number of independent counterparties does not exceed a certain threshold, and
- guarantees, letters of credit, letters of comfort provided by the undertaking and other commitment which is provided by the undertaking and which depends on the credit standing of a counterparty.

3.180. Type 2 exposures are all other exposures which are in the scope of the module, in particular

- receivables from intermediaries,
- policyholder debtors,
- deposits with ceding institutions, if the number of independent counterparties exceeds a certain threshold, and
- capital, initial funds, letters of credit as well as any other commitments received by the undertaking which have been called up but are unpaid, if the number of independent counterparties exceeds a certain threshold.

3.181. The output of the module should be calculated as follows:

$$SCR_{def} = \sqrt{SCR_{def,1}^2 + 1.5 \cdot SCR_{def,1} \cdot SCR_{def,2} + SCR_{def,2}^2},$$

where

SCR_{def} = Capital requirement for counterparty default risk

© CEIOPS 2009

$SCR_{def,1}$	=	Capital requirement for counterparty default risk of type 1 exposures
$SCR_{def,2}$	=	Capital requirement for counterparty default risk of type 2 exposures

3.2.3 Calculation of the capital requirement for type 1 exposures

3.182. The capital requirement for counterparty default risk of type 1 exposures should be calculated as follows:

$$SCR_{def,1} = \min\left(\sum_i LGD_i ;\quad q \cdot \sqrt{V}\right),$$

where the sum is taken over all independent counterparties with type 1 exposures and

LGD_i	=	Loss-given-default for type 1 exposure of counterparty i
q	=	Quantile factor
V	=	Variance of the loss distribution of the type 1 exposures

3.2.4 Calculation of the loss-given default of risk mitigating instruments

3.183. The loss-given-default for type 1 exposure of counterparty depends on the kind of exposure.

3.184. For a reinsurance arrangement or a securitisation, the loss-given-default LGD_i should be calculated as follows:

$$LGD_i = \max((1-RR_{re})\cdot(Recoverables_i + RM_{re,i} - Collateral_i);\ 0),$$

where

RR_{re}	=	Recovery rate for reinsurance arrangements
$Recoverables_i$	=	Best estimate recoverables from the reinsurance contract (or SPV) i according to Article 80 of the Level 1 text plus any other debtors arising out of the reinsurance arrangement or SPV securitisation
$RM_{re,i}$	=	Risk mitigating effect on underwriting risk of the reinsurance arrangement or SPV securitisation i
$Collateral_i$	=	Market value of collateral in relation to the reinsurance arrangement or SPV securitisation i

3.185. The risk mitigating effect $RM_{re,i}$ is an approximation of the difference

© CEIOPS 2009

between

- the (hypothetical) capital requirement for underwriting risk under the condition that the reinsurance arrangement or the SPV securitisation is not taken into account in its calculation

- and the capital requirement for underwriting risk (without any amendments).[23]

3.186. Where an SPV also transfers market risk, the risk mitigating effect $RM_{re,i}$ should be given by the aggregation (assuming a correlation factor of 0.25, consistent with the SCR correlation factor for the underwriting and market risk modules) between the amount in 3.53 and the difference between:

- the (hypothetical) capital requirement for market risk under the condition that the risk mitigating effect of the SPV is not taken into account in its calculation

- and the capital requirement for market risk (without any amendments).

3.187. Thus, if we denote the amount in 3.53 as $RM_{re,i,u/w}$ and the difference referred in 3.54 as $RM_{re,i,mkt}$, the risk mitigating effect for such SPV would be given by:

$$RM_{re,i} = \sqrt{RM_{re,i,u/w}^2 + RM_{re,i,mkt}^2 + 2 \cdot 0.25 \cdot RM_{re,i,u/w} \cdot RM_{re,i,mkt}}$$

3.188. For a derivative, the loss-given-default LGD_i should be calculated as follows:

$$LGD_i = \max((1-RR_{fin}) \cdot (MarketValue_i + RM_{fin,i} - Collateral_i); 0),$$

where

RR_{fin}	=	Recovery rate for derivatives
$MarketValue_i$	=	Value of the derivative *i* according to Article 75 of the Level 1 text
$RM_{fin,i}$	=	Risk mitigating effect on market risk of the derivative *i*
$Collateral_i$	=	Market value of collateral in relation to the derivative *i*

3.189. The risk mitigating effect $RM_{re,i}$ is an approximation of the difference between

- the (hypothetical) capital requirement for market risk under the condition that the risk mitigating effect of the derivative is not taken into account in its calculation

- and the capital requirement for market risk (without any amendments).[24]

© CEIOPS 2009

Sophisticated calculation of the risk mitigating effect

3.190. The determination of the risk mitigating effects $RM_{re,i}$ for reinsurance arrangements and SPV and $RM_{fin,i}$ for derivatives should be based on the calculation of two capital requirements:

- The (hypothetical) capital requirement for underwriting and market risk under the condition that the risk mitigating effect of the reinsurance arrangement, SPV or derivative of a particular counterparty is not taken into account in its calculation (SCR_{life}^{gross}, SCR_{nl}^{gross}, SCR_{mkt}^{gross}).

- The capital requirements for underwriting risk and market risk without any amendments are the requirements as defined in the Level 1 text for these modules (SCR_{life}^{net}, SCR_{nl}^{net}, SCR_{mkt}^{net}).

3.191. The gross capital requirements in relation to counterparty (i) should be determined by a recalculation of the modules which are affected by the risk mitigating contracts with that counterparty. This should be done as follows for life reinsurance and for derivatives:

- If a module or sub-module is scenario-based, the scenario outcome should be reassessed assuming that the risk-mitigating contract with counterparty (i) will not provide any compensation for the losses incurred under the scenario.

- If the sub-module is factor-based, the volume measures which allow for the risk-mitigating effect of the contract need to be reassessed. In particular, the following changes need to be made in this respect:

  i. In the concentration sub-module of the market risk sub-module, the exposure measures *E* should be calculated without allowance for risk-mitigating effects of contracts with counterparty (i).

3.192. In particular, if a module of the SCR did not allow for the risk mitigating effect of the risk-mitigating contract with counterparty (i) in the calculation of the net capital requirement, the net and gross capital requirements coincide and $RM_{re,i}$ and $RM_{fin,i}$ are zero.

3.193. For non-life reinsurance, the following method should be applied. If the reinsurance treaties with a counterparty affect only one non-life line of business, then the difference $SCR_{nl}^{gross} - SCR_{nl}^{net}$ should be approximated by the following term:

$$\sqrt{\begin{aligned}&\left(NL_{CAT}^{gross} - NL_{CAT}^{net}\right)^2 + \left(3 \cdot \sigma_{(prem,lob)} \cdot (P_{lob}^{gross} - P_{lob}^{net})\right)^2 + \left(3 \cdot \sigma_{(res,lob)} \cdot \text{recoverables}\right)^2 \\ &+ 9 \cdot \sigma_{(prem,lob)} \cdot (P_{lob}^{gross} - P_{lob}^{net}) \cdot \sigma_{(res,lob)} \cdot \text{recoverables}\end{aligned}}$$

© CEIOPS 2009

where

$NL_{CAT}^{gross} - NL_{CAT}^{net}$	=	Counterparty's share of CAT losses
$P_{lob}^{gross} - P_{lob}^{net}$	=	Reinsurance premium of the counterparty in the affected line of business
recoverables	=	Reinsurance recoverables in relation to the counterparty in the affected line of business
$\sigma_{(prem,lob)}$	=	Standard deviation for premium risk in the affected line of business as used in the premium and reserve risk sub-module
$\sigma_{(res,lob)}$	=	Standard deviation for reserve risk in the affected line of business as used in the premium and reserve risk sub-module

3.194. If the reinsurance treaties with a counterparty affect more than one non-life line of business, the terms defined above for each line of business can be summed up to determine an approximation for $SCR_{nl}^{gross} - SCR_{nl}^{net}$.

3.195. The formula partly neglects the diversification effect between the lines of business. The diversification effect within the lines of business is approximated in a prudent way by means of the following formula:[25]

$$\sqrt{\left(SCR_1^{gross}\right)^2 + \left(SCR_2^{gross}\right)^2} - \sqrt{\left(SCR_1^{net}\right)^2 + \left(SCR_2^{net}\right)^2}$$
$$\leq \sqrt{(SCR_1^{gross} - SCR_1^{net})^2 + (SCR_2^{gross} - SCR_2^{net})^2}$$

Moreover, the usual linear approximation $\rho(\sigma) \approx 3 \cdot \sigma$ of the lognormal quantile formula has been applied to derive the simplification.

Simplified calculation for derivatives

3.196. The calculation of the risk mitigating effect for life reinsurance can be simplified as follows:

3.197. If the financial instruments of counterparty (i) affect only one sub-module of the market risk module, then the difference $SCR_{mkt}^{gross} - SCR_{mkt}^{net}$ may be replaced by the difference $Mkt_{sub-risk}^{gross} - Mkt_{sub-risk}^{net}$ of the sub-module affected.

3.198. If the financial instruments of counterparty (i) affect more than one sub-module, the difference $SCR_{mkt}^{gross} - SCR_{mkt}^{net}$ may be replaced by the sum of the differences $Mkt_{sub-risk}^{gross} - Mkt_{sub-risk}^{net}$ of the sub-modules affected.

Simplified calculation for life reinsurance

© CEIOPS 2009

3.199. The calculation of the risk mitigating effect for life reinsurance can be simplified as follows:

3.200. If the reinsurance treaties with counterparty (i) affect only one sub-module of the life underwriting risk module, then the difference $SCR_{life}^{gross} - SCR_{life}^{net}$ may be replaced by the difference $Life_{sub-risk}^{gross} - Life_{sub-risk}^{net}$ of the sub-module affected.

3.201. If the reinsurance treaties with counterparty (i) affect more than one sub-module of the life underwriting risk module, the difference $SCR_{life}^{gross} - SCR_{life}^{net}$ may be replaced by the sum of the differences $Life_{sub-risk}^{gross} - Life_{sub-risk}^{net}$ of the sub-modules affected.

3.202. For proportional life reinsurance a further simplification is possible:

$$SCR_{life}^{gross} - SCR_{life}^{net} \approx \left(\frac{BE^{gross}}{BE^{net}} - 1 \right) \cdot SCR_{life}^{net},$$

where BE^{net} is the best estimate provision for life insurance net of reinsurance, and BE^{gross} is the best estimate provision for life insurance net of reinsurance except reinsurance towards counterparty (i).

Simplified calculation for non-life reinsurance

3.203. The calculation of the risk mitigating effect for non-life reinsurance can be simplified as follows:

- In a first step, calculate $SCR_{nl}^{gross} - SCR_{nl}^{net}$ for all reinsurance counterparties together.
- In a second step, approximate the share of a single counterparty (i) as follows:

$$\left(SCR_{nl}^{gross} - SCR_{nl}^{net} \right)_i \approx \left(SCR_{nl}^{gross} - SCR_{nl}^{net} \right) \cdot \frac{Rec_i}{Rec_{total}},$$

where Rec_i are the reinsurance recoverables towards counterparty (i) and Rec_{total} the overall reinsurance recoverables.

Implementation of the simplified calculations for derivatives and reinsurance

3.204. The simplifications should only be used if the following conditions are met:

- There are no indications that the simplification significantly misestimates the risk mitigating effect.
- The capital requirement for counterparty default risk under the simplified calculation is less than 20% of the overall SCR before

© CEIOPS 2009

and deferred taxes. For this comparison the overall SCR can be calculated by means of the simplified calculation for the counterparty default risk capital requirement.

- The result of the sophisticated calculation is not easily available.

Simplification in relation to the number of counterparties

3.205. In order to reduce the number of calculations of risk mitigating effects, the following simplification should be offered:

3.206. Instead of treating each counterparty (i) separately in the calculation of LGD_i and SCR_{def}, the set of counterparties is divided into disjoint subsets and the calculation is modified as follows:

- In the determination of LGD_i each subset is treated as one counterparty.
- For the calculation of SCR_{def} it is necessary to assign a probability of default (or a rating) to the subset. This probability of default is the highest probability of default of the counterparties in the subset.

3.207. It should be possible to use this simplification without further requirements. Undertakings should be allowed to apply this simplification in combination with the sophisticated calculation or any of the above simplifications described in the above paragraphs.

3.2.5 Calculation of the loss-given-default for other type 1 exposures

3.208. For cash at bank, deposits with ceding institutions and unpaid but called up capital the loss-given-default should be the value of the corresponding asset according to Article 75 of the Level 1 text.

3.209. For guarantees, letters of credit, letters of comfort and other commitment which depend on the credit standing of a counterparty the loss-given-default should be the difference between their nominal value and their value according to Article 75 of the Level 1 text.

3.210. If in relation to a counterparty more than one type 1 exposures exist, then the loss-given-default for this counterparty should be the sum of the losses-given-default of the single exposures.

3.2.6 Independence of counterparties

3.211. An economic approach should be taken in order to decide whether counterparties are independent or not.

3.212. Counterparties which belong to the same group as defined in Article 212 of the Level 1 text or to the same financial conglomerate as defined in Article 2(14) of the Financial Conglomerate Directive (2002/87/EC) should not be treated as independent counterparties. The legal entities of the group or

© CEIOPS 2009

of the capital requirement.

3.2.7 Calculation of the variance of the loss distribution of the type 1 exposures

3.213. For the calculation of the variance of the loss distribution, the following summations of loss-given-default values are relevant.

3.214. For each rating class *j*, y_i and z_i denote the following figures:

$$y_j = \sum_i LGD_i \quad \text{and} \quad z_j = \sum_i (LGD_i)^2 ,$$

where sums run over all independent counterparties *i* in the rating class *j*.

3.215. The variance *V* of the loss distribution should be calculated as follows:

$$V = \sum_j \sum_k u_{jk} \cdot y_j \cdot y_k + \sum_j v_j \cdot z_j - \left(\sum_j w_j \cdot y_j \right)^2 ,$$

where *j* and *k* in the sums run over all rating classes and u_{jk}, v_i and w_i are fixed parameters which only depend on the rating classes.

3.2.8 Calculation of the capital requirement for type 2 exposures

3.216. The capital requirement for counterparty default risk of type 2 exposures should be calculated as follows:

$$SCR_{def,2} = x \cdot E + y \cdot E_{past-due} ,$$

where

x	=	Risk factor for type 2 exposures
E	=	Sum of the values of type 2 exposures, except for receivables from intermediaries which are due for more than *T* months.
y	=	Risk factor for past-due receivables from intermediaries
$E_{past-due}$	=	Sum of the values of receivables from intermediaries which are due for more than *T* months.

3.217. The risk factor *x* should be a fixed number. It should not depend on the probability of default of the counterparties nor on the size or number of exposures. However, its calibration should implicitly allow for the typical diversification between type 2 exposures.

© CEIOPS 2009

3.218. The value of a type 2 exposure towards a counterparty is equal to the corresponding asset value according to Article 75 of the Level 1 text.

3.2.9 Treatment of risk mitigation techniques

3.219. The counterparty default risk module should take into account techniques to mitigate default risk like collaterals or netting of receivables with liabilities. Allowance should be made as follows:

<u>Collaterals</u>

3.220. If a collateral is posted in relation to the exposure, the custodian holding the collateral is independent from the counterparty and the requirements defined for collaterals in CEIOPS' Advice on financial risk mitigation techniques (CEIOPS-DOC-29/09) are met, then the loss-given-default (in case of a type 1 exposure) or the value of the exposure (in case of a type 2 exposure) may be reduced by the risk-adjusted value of the collateral. The risk-adjusted value of the collateral should be calculated as follows:

$$Collateral = 80\% \cdot \left(MarketValue_{Collateral} - MktRisk_{Collateral}\right),$$

Where

$MarketValue_{Collateral}$	=	Market value of the collateral assets
$MktRisk_{Collateral}$	=	Adjustment for market risk

Where the collateral assets are bancruptcy remote and no there is no credit risk present, the factor of 80% should be replaced by a factor of 100%.

3.221. For the calculation of the adjustment for market risk, the reduction of the market value of the collateral according to the equity, property, credit spread and currency risk sub-module should be determined and aggregated according to the correlation matrix of the market risk module. For the calculation of the currency risk sub-module, the currency of the collateral is compared to the currency of the secured credit exposure. If the collateral assets are bank deposits which are not subject to the credit spread risk, the adjustment should be increased by the capital requirement for counterparty default risk of the deposits.

3.222. If it is proportionate to the nature scale and complexity of the risks inherent in the collateral arrangement, a simplification as follows may be applied:

$$Collateral = 70\% \cdot MarketValue_{Collateral}$$

Where the collateral assets are bancruptcy remote and no there is no credit risk present, a simplification as follows may be applied:

$$Collateral = 85\% \cdot MarketValue_{Collateral}$$

© CEIOPS 2009

Segregated assets

3.223. Where, and to the extent that, the liabilities of the counterparty are covered by strictly segregated assets under arrangements which meet the requirements set out in CEIOPS' Advice on financial risk mitigation techniques, the segregated assets should be treated like collaterals in the calculation of the counterparty default risk module.

Letters of credit

3.224. If a letter of credit is provided to secure a credit exposure and the arrangement meets the requirement defined in CEIOPS' Advice on financial risk mitigation techniques, then the counterparty of the credit exposure may be replaced by the provider of the letter of credit in the calculation of the counterparty default risk module. This replacement affects the probability of default that is taken into account in the calculation as well as the assessment whether the counterparty is independent from other counterparties.

3.225. A letter of credit should not be taken into account in the calculation of the counterparty default risk module if is approved as ancillary own funds.

Netting

3.226. The loss-given-default (in case of a type 1 exposure) or the value of the exposure (in case of a type 2 exposure) may be netted with liabilities towards the same legal entity to the extent they could be set off in case of default of the legal entity. The general requirement defined in CEIOPS' Advice on financial risk mitigation techniques and CEIOPS' Advice on reinsurance risk mitigation techniques (CEIOPS-DOC-44/09) should be met in relation to netting if it is taken into account in the calculation. In particular, if the legal situation in relation to netting is unclear, then no netting should be taken into account. No netting should be allowed for if the liabilities are expected to be met before the credit exposure is cleared.

3.2.10 Calibration

3.227. Based on the assumptions contained in the explanatory text, CEIOPS has calibrated the sub-module according to 99.5% VaR and a one year time horizon.

Recovery rate

3.228. The recovery rates RR_{re} and RR_{fin} for reinsurance arrangements and derivatives should reflect a prudent estimate of the relative share of the stressed credit exposure that still can be collected in case of the default of the counterparty.

3.229. They should be set at RR_{re} = 50% and RR_{fin} = 10%. However, if a reinsurance counterparty has tied up an amount for collateralisation commitments (both on and off balance sheet, including commitments to

© CEIOPS 2009

recovery rate is assumed to be 10% rather than 50%.

The parameters α and τ of the loss distribution for type 1 exposures

3.230. The ratio α/τ should properly reflect the volatility in the probability of default of reinsurers and issuers of derivatives as well as the dependence between the defaults of such counterparties.

3.231. The ratio should be set at $\alpha/\tau = 4$.

The quantile factor q

3.232. The quantile factor should be set as follows:

$$q = \begin{cases} 3 & if \quad \sqrt{V} \leq 5\% \cdot \sum_i LGD_i \\ 5 & else \end{cases}$$

The risk factors for type 2 exposures

3.233. The risk factors for type 2 exposures should be chosen consistently with the model for type 1 exposures.

3.234. The risk factor for intermediary receivable which are past-due for more than $T = 3$ months should be set at $y = 90\%$. For all other type 2 exposures a risk factor $x = 15\%$ should be chosen.

The threshold to distinguish between type 1 and type 2 exposures

3.235. If the number of independent counterparties in relation to deposits with ceding institutions does not exceed 15, these exposures should be treated as type 1 exposures. The same should apply to called up but unpaid commitments. For determining the number of independent counterparties, those counterparties that belong to one group should be treated as one independent counterparty.

3.236. The undertaking will still be allowed to classify these deposits with ceding institutions and called up but unpaid commitments as type 1 exposures. However, the undertaking must classify all such exposures as type 1 or as type 2.

3.2.11 Probability of default for type 1 exposures

3.237. The assignment of a probability of default should follow three steps as follows:

- If the counterparty is rated by a credit rating agency (CRA) which meets certain quality requirements, the credit rating should be used to derive a probability of default.
- Otherwise, if the counterparty is an insurance or reinsurance undertaking that is subject to Solvency II supervision and up-to-date

© CEIOPS 2009

available, then the probability of default should be derived by means of a solvency ratio rating.

- Otherwise the probability of default should be a fixed figure.

Counterparties rated by CRA

3.238. In order to make use of credit ratings for the determination of the probability of default two elements should to be specified:

- Recognition of the CRAs whose credit ratings can be used in the standard formula.

- For each recognised CRA, an assignment of probabilities of default to the rating classes used by the CRA. This assignment should distinguish between different kind of rated instruments and counterparties.

3.239. The credit ratings used in the standard formula should meet highest standards. Only credit ratings of CRAs which are registered according to the Regulation on Credit Rating Agencies and which meet the requirements specified in this Regulation should be recognised. Moreover, they should meet requirements which are consistent with those for external credit assessment institutions included in the Capital Requirements Directive 2006/48/EC.

3.240. The assignment of probabilities of default to rating classes should meet the requirements specified in Directive 2006/48/EC.

3.241. As in Directive 2006/48/EC, in cases where more than one rating is available for a counterparty, the second-highest rating should be used.

3.242. In order to avoid a distortion of the default experience underlying this assessment, counterparties which would have defaulted without state intervention during the current crisis should be considered as defaulted for the estimation of the default probability of a rating class.

Solvency ratio rating

3.243. If the counterparty is an insurance or reinsurance undertaking that is subject to Solvency II supervision and not rated by a recognised CRA, then the probability of default of the counterparty should be derived by means of a solvency ratio rating as follows.

3.244. To counterparties which do not meet the MCR, a default probability of 30% should be assigned.

3.245. If a counterparty meets the MCR, a default probability depending on the SCR and the eligible own funds to meet the SCR (OF) could be defined as follows:

OF/SCR	Probability of default
> 200%	0.025%

© CEIOPS 2009

> 175%	0.050%
> 150%	0.1%
> 125%	0.2%
> 100%	0.5%
> 90%	1%
> 80%	2%
≤ 80%	10%

3.246. The solvency ratio rating should be based on the last publicly reported figures for SCR, MCR and the eligible own funds to meet these requirements. Usually, these will be figures which are one year old. If more recent information is available to the undertaking, then they should be used. If there are indications that the current figures significantly and adversely deviate from the most recent known figures, then the solvency ratio rating should not be applied. If the counterparty and the undertaking that has to assess the counterparty's default probability belong to the same group, the current figures or, if that is not possible, the last calculated figures should be used. If the last calculates figures are not available, the solvency ratio rating should not be applied.

Counterparties without a CRA credit rating and a solvency ratio rating

3.247. A probability of default of 10% should be assigned to counterparties which are not rated by a recognised CRA and no solvency ratio rating can be assigned to them, either because they are not under Solvency II supervision or they do not meet the requirements of the solvency ratio rating. The latter is the case when the last calculated figures are not available or if there are indications that the ratio significantly and adversely deviates from the most recent known figures, the solvency ratio rating should not be applied.

Counterparties which belong to the same group

3.248. If an undertaking has more than several counterparty which are not independent (for example because they belong to one group) then it is necessary to assign a probability of default to the whole set of dependent counterparties. This overall probability of default should be average probability of the counterparties weighted with the corresponding losses-given-default.

Equivalent supervision

3.249. Unrated counterparties under supervision equivalent to Solvency II which meet the local capital requirements that is equivalent to the SCR can be treated as if having a BBB rating.

Banks

3.250. Unrated banks compliant with the Capital Requirements Directive (2006/48/EC) shall be treated as if having a BBB rating.

© CEIOPS 2009

Ceiling to probabilities of default

3.251. In order to limit the risk factors under the proposed model to 100%, a ceiling to the probabilities of default of 4.175% should apply.

© CEIOPS 2009

Annex A

Outline of the model underlying the calculation of capital requirements for type 1 exposures

A.1. A core assumption of the model is a latent variable for a common shock S which follows a probability distribution:

$$\Pr(S \leq s) = s^{\alpha} \qquad 0 < s < 1$$

This distribution is described by a single shape parameter α. (For the illustrative calculations in Appendix B the parameter has been fixed at α = 0.1.)

A.2. The default probability $p(S)$ is driven by the latent common shock size S. Its formula reads:

$$p(S) = b + (1 - b)S^{\tau / b}$$

with b a baseline default probability and τ a shape parameter.

A.3. The idea behind this specification is that counterparties with low base level default probabilities are rather immune for shocks as long as these remain non-extreme. Large base levels increase the sensitivity for shocks even if these are of modest size.

A.4. The common shock size generates correlation between the counterparties. This built-in correlation is driven by the two mentioned shape parameters α and τ as well as the baseline default probabilities.

A.5. The exposure portfolio consists of a list of k counterparties indexed $i = 1, \cdots, k$. For notational simplicity the assigned default probability is denoted by p_i and the loss given default by y_i.

A.6. The default probability p, as assigned to the counterparty, corresponds with the mathematical expectation of $p(S)$. Its formula boils down to:

$$p = \frac{(\tau + \alpha)b}{\tau + \alpha b}$$

A.7. This equation serves to determine the baseline default probability b from the input p:

$$b = \frac{p\tau}{\alpha(1 - p) + \tau}$$

© CEIOPS 2009

A.8. The covariances between the k counterparties are elements of a matrix $\Omega = (\omega_{ij})$ given by:

$$\omega_{ii} = p_i(1 - p_i) \qquad i = 1,\cdots,k$$

$$\omega_{ij} = \frac{\alpha(1 - b_i)(1 - b_j)}{\alpha + \tau b_i^{-1} + \tau b_j^{-1}} - (p_i - b_i)(p_j - b_j) \qquad i, j = 1,\cdots,k \quad i \neq j$$

A.9. Counterparty default risk will follow a probability distribution with a firm probability mass attached to zero. The mean and variance follow as:

$$mean: \quad \sum_{i=1}^{k} p_i y_i$$

$$variance: \; V = \sum_{i=1}^{k}\sum_{j=1}^{k} \omega_{ij} y_i y_j$$

Only the variance plays a role in the determination of the capital requirement for counterparty default risk.

A.10. The capital charge for counterparty default risk is the product of a quantile factor q and the square root of the variance, whereby the results is subject to a ceiling by the sum of the loss given default:

$$SCR_{def} = \min\left(\sum_{i=1}^{k} y_i ; q \cdot \sqrt{V}\right)$$

A.11. For large k, an economy in storage and computation can be realised if there are only a limited number of default probability values p which are assigned to the counterparties, for example if counterparties are grouped in rating classes. Let N be the number of these classes. (In QIS4, N was equal to 7.)

A.12. In this case the covariance matrix Ω allows a "compressed" form which can be written as an additive combination of three matrices: a diagonal one, a rank-1 outer product one as well as full-rank one. For this we need an $N \times N$ symmetric matrix **U** and two vectors **v** and **w** defined by:

$$\mathbf{U} = \begin{bmatrix} u_{11} & \cdots & u_{1N} \\ \vdots & \ddots & \vdots \\ u_{N1} & \cdots & u_{NN} \end{bmatrix} \qquad where \; u_{ij} = \frac{\alpha(1 - b_i)(1 - b_j)}{\alpha + \tau b_i^{-1} + \tau b_j^{-1}} \qquad i, j = 1,\cdots,N$$

$$\mathbf{v} = \begin{bmatrix} p_1(1 - p_1) + (p_1 - b_1)^2 - \dfrac{\alpha(1 - b_1)^2}{\alpha + 2\tau b_1^{-1}} \\ \vdots \\ p_N(1 - p_N) + (p_N - b_N)^2 - \dfrac{\alpha(1 - b_N)^2}{\alpha + 2\tau b_N^{-1}} \end{bmatrix} \qquad \mathbf{w} = \begin{bmatrix} p_1 - b_1 \\ \vdots \\ p_N - b_N \end{bmatrix}$$

© CEIOPS 2009

where earlier symbols are reused with an obvious rating class interpretation.

A.13. The compressed Ω results as:

$$\Omega = \mathbf{U} + \mathbf{v}_{\Delta} - \mathbf{ww}'$$

Besides the compressed form for **y** we need a compressed form for the sum of the squared losses-given-default by rating class. We denote this vector as **z**.

A.14. The mean and variance follow as:

$$\textit{mean}: \quad \mathbf{p}'\mathbf{y} = \sum_{i=1}^{N} p_i y_i$$

$$\textit{variance}: \; V = \mathbf{y}'\mathbf{Uy} + \mathbf{v}'\mathbf{z} - (\mathbf{w}'\mathbf{y})^2 = \sum_{i=1}^{N}\sum_{j=1}^{N} u_{ij} y_i y_j + \sum_{i=1}^{N} v_i z_i - \left(\sum_{i=1}^{N} w_i y_i\right)^2$$

In this way a significant simplification of the calculation is achieved. The calculation can easily be implemented in a spreadsheet.

© CEIOPS 2009

Annex B

Comparison of risk factors according to the proposed approach and the QIS4 approach

Introduction

B.1. The following tables display the capital requirements of exemplary type 1 exposures according to the approach proposed in this consultation paper and the QIS4 approach.

B.2. In the tables, the capital requirements are standardised with the sum of losses-given-defaults (LGD), i.e. shown are the ratios of capital requirements and the sum of LGDs.

B.3. The probabilities of default of the exposures are denoted with the rating classes used in QIS4 Technical Specifications (cf. TS.X.A.9). This is not meant to be part of CEIOPS' advice on the assignment of default probabilities to counterparties. Rather, this approach was chosen to make the results of the proposed approach comparable to the results of the QIS4 approach.

B.4. As can be seen below, compared to QIS4 the proposed approach leads to a significant increase of the risk factors for counterparties rated AAA or AA. This stems, inter alia, from the fact that the model underlying the calculation recognizes that probability of defaults are not constant over time but increase in times of systemic stress. This feature of the model is in line with best practice of credit risk modelling. A justification for this approach as well its quantitative outcome can also be found in the observations made during the current financial crisis where several banks with a high rating defaulted or had to be bailed out by governments.

The case of a single counterparty

B.5. In this case all type 1 exposures relate to one counterparty. Depending on the rating class of the counterparty requirements as follows can be derived:

	Proposed approach SCR in % of LGD	QIS4 approach SCR in % of LGD
AAA	1.3%	0.2%
AA	3.0%	1.0%
A	6.7%	5.0%
BBB	14.7%	24.0%
BB	54.5%	100.0%
B	100.0%	100.0%

© CEIOPS 2009

CCC	100.0%	100.0%

B.6. Remarks on the table:

- The QIS4 approach does not apply the Vasicek-Herfindahl calculus to the case of a single exposure. Instead, the risk factor is just equal to min(100%; 100 · Probability of default).
- Under the proposed approach, the capital requirement for the CCC rating is capped.

The case of two counterparties

B.7. In this case the type 1 exposures relate to two independent counterparties. The losses-given-default of both counterparties are assumed to be equal. Depending on the rating class of the two counterparties, capital requirements (in % of the sum of LGDs) can be derived:

Proposed approach							
	AAA	AA	A	BBB	BB	B	CCC
AAA	1.1%						
AA	1.8%	2.5%					
A	3.5%	4.1%	5.6%				
BBB	7.4%	7.7%	8.9%	12.3%			
BB	27.3%	27.5%	28.6%	33.0%	45.5%		
B	50.04%	50.2%	50.8%	53.5%	64.3%	83.4.%	
CCC	50.04%	50.2%	50.8%	53.5%	64.3%	83.4.%	83.4%

QIS4 approach							
	AAA	AA	A	BBB	BB	B	CCC
AAA	0.01%						
AA	0.1%	0.1%					
A	0.9%	0.9%	1.7%				
BBB	6.0%	6.0%	6.8%	11.9%			
BB	24.0%	24.0%	24.8%	29.9%	47.9%		
B	45.6%	45.7%	46.5%	51.6%	69.6%	91.3%	
CCC	50.0%	50.1%	50.8%	55.9%	73.9%	95.6%	100.0%

Diversification within a rating class

B.8. In this case the type 1 exposure relates to counterparties which all belong to the same rating class. The losses-given-default of all these counterparties are assumed to be equal. Depending on the number and rating class of the counterparties, capital requirements (in % of the sum of LGDs) can be derived:

Proposed approach							
	AAA	AA	A	BBB	BB	B	CCC

© CEIOPS 2009

1	1.3%	3.0%	6.7%	14.7%	54.5%	100.0%	100.0%
2	1.1%	2.5%	5.6%	12.3%	45.5%	83.4%	83.4%
3	1.0%	2.3%	5.2%	11.4%	42.2%	77.0%	77.0%
4	1.0%	2.2%	5.0%	10.9%	40.3%	73.7%	73.7%
5	1.0%	2.2%	4.8%	10.6%	39.2%	71.5%	71.5%
6	0.9%	2.1%	4.7%	10.4%	38.3%	70.1%	70.1%
…							
10	0.9%	2.0%	4.5%	10.0%	36.8%	67.1%	67.1%
..							
100	0.9%	1.9%	4.3%	9.3%	34.5%	62.9%	62.9%

QIS4 approach							
	AAA	AA	A	BBB	BB	B	CCC
1	0.200%	1.00%	5.0%	24.0%	100.0%	100.0%	100.0%
2	0.009%	0.15%	1.7%	11.9%	47.9%	91.3%	100.0%
3	0.026%	0.26%	2.0%	10.7%	39.5%	83.0%	99.7%
4	0.036%	0.30%	2.0%	10.0%	35.9%	78.6%	99.4%
5	0.042%	0.32%	2.0%	9.6%	33.9%	75.9%	99.0%
6	0.046%	0.33%	2.0%	9.3%	32.8%	74.0%	98.8%
…							
10	0.053%	0.35%	2.0%	8.7%	30.3%	70.4%	98.1%
..							
100	0.061%	0.36%	1.9%	8.0%	27.2%	65.4%	96.9%

B.9. Under the proposed approach the diversification effect between counterparties in the same rating class is defined in terms of a simple formula as follows:

B.10. Within the same rating class a reinsurance bouquet with Herfindahl index[26] denoted as *H* and equicorrelation between reinsurers as ρ, implies a reduction factor of the standard deviation as compared to a fully concentrated bouquet given by $\sqrt{H+(1-H)\rho}$. This ratio declines from the value 1 for *H*=1 to $\sqrt{\rho}$ for *H*=0.

B.11. The equicorrelation is given by $\rho = \dfrac{\alpha(1-p)}{\alpha(2-p)+2\tau} = \dfrac{2-2p}{5-2p}$

© CEIOPS 2009

Annex C

Derivation of a solvency ratio rating

C.1. For the purpose of the solvency ratio rating for undertakings that meet the MCR, the probability of default (PD) of an undertaking can be defined as the probability that eligible own funds to meet the SCR become negative during the following year. Hence,

$$PD = P(OF - X \leq 0),$$

where *OF* are the current eligible own funds and *X* is the random variable describing the reduction of basic own funds during the following year.

C.2. Because of

$SCR = VaR_{0.995}(X)$ and $OF = VaR_{1-PD}(X)$,

a relation between PD and the solvency ratio *OF/SCR* can be established as follows:

$$\frac{OF}{SCR} = \frac{VaR_{1-PD}(X)}{VaR_{0.995}(X)}$$

C.3. In order to properly allow for risk mitigation effects which are limited and do not linearly increase with the risk (like the mitigating effects of discretionary benefits or deferred taxes), the solvency ratio should be adjusted as follows: instead of applying the ratio OF/SCR a modified solvency ratio

$SR^{*} = \dfrac{OF + 50\% \cdot SCR}{SCR + 50\% \cdot SCR}$ could be used.

This modification corresponds to the assumption that a third of the risk is mitigated by effects which do not increase linearly with the risk. Without the mitigating effect the risk is 50% higher. The mitigating effects are taken into account in the numerator to reflect their limited ability to reduce risk. (They resemble own funds in the characteristics that they are used up once they have absorbed losses.) The modification should only be applied to solvency ratios above 100%. The effect of this adjustment can be seen in the table in paragraph C.6.

C.4. It is necessary to make assumptions on the distribution of *X* in order to evaluate this relation. Owing to the homogeneity of VaR, the distribution needs only to be known up to a scaling factor. Moreover, only the tail of the distribution is relevant.

© CEIOPS 2009

C.5. A usual assumption about reinsured business is that the tail of its distribution follows a Pareto distribution. For the compound distribution function $F(x) = 1 - x^{-a}$, $x \geq 1$, the following relation can be derived:

$$PD = \left(SR^*\right)^{-a} \cdot 0.5\% \,.$$

C.6. The following table shows the default probabilities depending on the solvency ratio for different choices of the parameter *a* of the Pareto distribution.

OF/SCR	SR*	PD a = 5	PD a = 6	PD a = 7
200%	167%	0.039%	0.023%	0.014%
190%	160%	0.048%	0.030%	0.019%
180%	153%	0.059%	0.038%	0.025%
170%	147%	0.074%	0.050%	0.034%
160%	140%	0.093%	0.066%	0.047%
150%	133%	0.119%	0.089%	0.067%
140%	127%	0.153%	0.121%	0.096%
130%	120%	0.201%	0.167%	0.140%
120%	113%	0.267%	0.236%	0.208%
110%	107%	0.362%	0.339%	0.318%
100%	100%	0.500%	0.500%	0.500%
90%	90%	0.847%	0.941%	1.045%
80%	80%	1.526%	1.907%	2.384%
70%	70%	2.975%	4.250%	6.071%
60%	60%	6.430%	10.717%	17.861%
50%	50%	16.000%	32.000%	64.000%

C.7. If the parameter *a* = 6 is chosen, a solvency ratio rating could be defined as follows:

OF/SCR	Probability of default
> 200%	0.025%
> 175%	0.050%
> 150%	0.1%
> 125%	0.2%
> 100%	0.5%
> 90%	1%
> 80%	2%
≤ 80%	10%

© CEIOPS 2009