

**CEIOPS' Report
on its fourth
Quantitative Impact Study (QIS4)
for
Solvency II**

November 2008

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1 Executive summary

1.1 Background to the fourth quantitative impact study

In order to harmonize and strengthen the European supervisory framework, the European Commission has issued a Framework Directive Proposal for a modern risk-based supervisory framework for the supervision of European (re)insurance companies: Solvency II.

The Solvency II Framework Directive Proposal was published by the European Commission on 10 July 2007. Following the publication of the Framework Directive Proposal, a work plan has been agreed between the European Commission and the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS)¹ covering the development and adoption of Level 2 implementing measures and future work to be done on Solvency II. The negotiations on the Solvency II Proposal are ongoing in the Council and the European Parliament and should be concluded before March 2009, resulting in the adoption of the Level 1 Framework Directive. The framework will, following current plans, be implemented in 2012.

The most important feature of Solvency II is its risk-based character: capital requirements are related to the risk profile of an insurance entity. Higher risks will lead to a higher capital requirement. A second feature of the Solvency II framework is a greater focus on insurance groups (as opposed to separate legal entities). A third feature is the market consistent valuation for both assets and liabilities. Finally, Solvency II explicitly allows for the use of internal modeling for the calculation of capital requirements. In order not to impose a too heavy burden on small and medium undertakings, the principle of proportionality which applies throughout the Framework Directive Proposal allows for the use of simplifications under certain conditions.

As part of the Solvency II project, the Commission has requested CEIOPS to run a number of large scale field-testing exercises, so-called Quantitative Impact Studies (QIS), to assess the practicability, the implications and possible impact of the different alternatives considered. On 31 March 2008, after an eight-week public consultation run by the Commission with the technical support from CEIOPS, the Commission provided political guidance on specific issues, and published a Call for Advice asking CEIOPS to launch the fourth Quantitative

¹ Letter of the Commission to CEIOPS, 19 July 2007, and reply of CEIOPS to the Commission, 27 July 2007.

Impact Study (QIS4) on Solvency II. CEIOPS has run the QIS4 exercise from April to July 2008. This report summarizes the results of the QIS4 exercise.

One of the main objectives of QIS4 was to collect detailed information on the impact of the testing proposals on the balance sheet of the insurance industry, in order to help develop **Level 2** implementing measures in line with the Level 1 Framework Directive Proposal. Areas of particular relevance identified in the European Commission's Call for Advice are:

- The assessment of the quantitative impact of the solvency capital requirements on (re)insurance groups' balance sheets, including diversification effects and transferability of own funds;
- The inclusion of simplifications for the calculations of the solvency capital requirements and the technical provisions as well as the use of undertaking specific parameters;
- The design and calibration of the MCR;
- The comparability of the standard formula and (partial or full) internal models for the calculation of the solvency requirements.

At this stage, CEIOPS would already like to point out that despite the size and complexity of the exercise, the QIS4 exercise has been a success in many respects. Participation has shown that the industry is keen to contribute to the further development of the Solvency II framework. The basic architecture of Solvency II seems to be well received, and various improvements have been made on detailed technical aspects.

The following paragraphs relate in more detail the main findings of the exercise and areas where further work can be undertaken towards the development of Level 2 implementing measures.

1.2 Participation rate

In its Call for Advice, the European Commission has set out a target participation rate of 25% of solo undertakings and 60% of cross-border groups. Thanks to the close cooperation with European trade associations and long-time stakeholders and the efforts of national supervisors, the support for the Solvency II project has materialised in an **impressive participation** by (re)insurance undertakings and groups. The participation target has been largely met and all 30 EEA member countries are represented in the scope of this study.

- In total, 1,412 companies have participated in this study, compared to 1,027 in QIS3.

- From QIS3 to QIS4, the participation rate increased by 37%. It was especially notable that the number of small undertakings that took part in the study increased considerably, by 58%. The participation rate for medium size undertakings increased by 25%, for large undertakings by 18%. Also in absolute terms significantly more small undertakings participated in QIS4, with a total of 667 small undertakings, compared to 522 medium companies and 220 large undertakings.
- Participation rates in terms of market share are almost equal in life, non-life and health business. They amount to more than 60% in most participating countries and have globally increased compared to QIS3.
- In total, 111 groups from 16 EEA countries plus Switzerland participated in the group part of the QIS4 study. This figure includes more than 60% of cross-border groups and a significant number of mutual groups. This total more than doubles the number of groups in QIS3 (51 groups).
- Captives have been introduced as a separate category in QIS4.

1.3 Reliability of the results, operational issues and resource requirements

While participants were quite confident about the reliability of their submissions, supervisors in several countries expressed some concerns as to their quality. Concerns were voiced among others with regard to the treatment of deferred taxes, the inclusion of future premiums, calculations where sub-consolidation of data has been used and where IFRS accounting is not in force for solo entities. Furthermore, it should also be noted that the data for groups are in general surrounded with more caveats than the data at solo level.

Participating undertakings spent on average 3.2 person months to complete the QIS4 exercise.

1.4 Financial impact

Solvency II follows a total balance sheet approach, as it considers the whole asset and liability side.

Quantitative investment limits are replaced by internal limits set by the undertaking based on a prudent person approach and covered by an SCR capital charge on the assets the undertaking chooses to invest in.

Solvency II also introduces a common valuation principle based on the **market consistent valuation** of assets and liabilities, moving away from the general principle of prudent technical provisions and prudent valuation of assets. The hitherto implicit prudence included in the valuation of the technical provisions is made explicit and risks are explicitly charged in the SCR capital requirement.

For the purpose of analysis, an insurance company’s balance sheet can be presented in a stylised manner:

Figure 1: Stylised balance sheet

Assets	Liabilities
Reinsurance	Equity (net asset value)
Investments	Insurance liabilities - Technical provisions (best estimate) - Technical provisions (risk margin)
Unit-linked investments	Technical provisions for unit-linked business
Other assets	Other liabilities (including deferred taxes)
Total	Total

Based on this balance sheet, the Solvency II system defines two levels of capital requirements, representing two levels of intervention. A Solvency Capital Requirement (SCR) sets the required level of capital for a licensed entity, calibrated to cover at least a one in 200 year event occurring in the next twelve months (99.5% Value-at-Risk). A lower Minimum Capital Requirement (MCR) serves as the threshold for ultimate supervisory intervention, including winding-up, thus making the ease, robustness and reliability of calculation of the MCR important features.

The solvency assessment in this model is based on essentially three steps:

- All assets and liabilities follow a market consistent valuation (market value or mark-to-model value). The part of the insurance liabilities that cannot be valued using market prices (the non-hedgeable liabilities) is split into a best estimate and a risk margin.

The **best estimate** represents the discounted value of the current estimate of all future cash flows following from the insurance liabilities. The discount rate to be used is the risk free yield curve. The **risk margin** represents the costs of ensuring that the capital needed to support the (re)insurance obligations for subsequent years will be available (based on a cost-of-capital rate of 6%).

- Next, the **SCR** is calculated, based on the specific risks borne by an insurance undertaking in relation to both its assets and its liabilities. The SCR takes four main risk categories into account – underwriting risk,

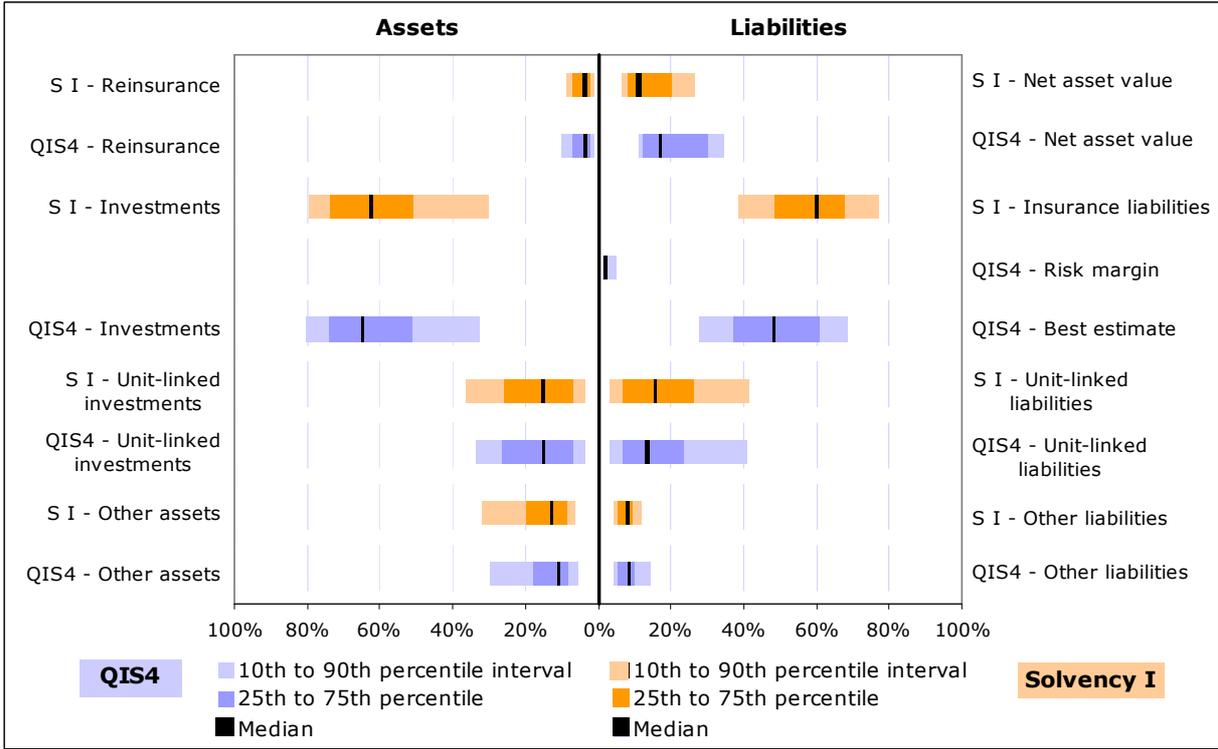
market risk, counterparty risk and operational risk – which are subdivided into several sub-risk classes. For every risk class, an assessment is made of the loss that may arise with a 0.5% probability over the next 12 months, as a result of the insurer bearing that risk. The amounts of these potential losses are then combined into a total capital requirement, taking into account the effect of diversification between risks.

- If the total value of eligible assets is less than the sum of the technical provisions, the SCR required for the following year and the value of the other liabilities, then the undertaking does not meet its solvency requirement. In the opposite situation, the undertaking is meeting its solvency requirement and the positive difference is called capital surplus.

1.4.1 Key indicators of the QIS4 financial impact

Under QIS4, the composition of the assets and liabilities does not change considerably (see figure 2), but is characterised by a relative decrease in the amount of insurance liabilities compared to an increase in eligible capital and capital requirements. This is inherent to the philosophy of Solvency II, which aims at removing implicit prudence in the valuation of the insurance liabilities and instead focuses on the risk management by undertakings by imposing explicit capital requirements for the risks incurred. Capital requirements will also rise as a result of this explicit risk assessment and an increase in the availability of capital has been noted. Nevertheless, the differences in the value of assets and liabilities between QIS4 and current balance sheet varied considerably between countries, with the main differences arising in those countries using a different method than market value (e.g. historic cost).

Figure 2: QIS4 impact on the balance sheet composition of insurance undertakings



With respect to solvency levels, the vast majority (98.8%) of undertakings will be able to meet the **MCR** as tested in QIS4. QIS4 showed that captives were most affected by the minimum capital requirements: approximately 7% of the participating captives do not meet the MCR.

Overall, almost 11% of the participants do not meet the **SCR** under QIS4, compared to 16% under QIS3. Large undertakings (13.2%) and non-life undertakings (11.2%) would be most affected by this. Also a significant number of captives (28.3%) would not meet the SCR tested in QIS4. Not meeting the SCR does not necessarily imply having to raise capital upon the introduction of Solvency II for a number of reasons. In particular, undertakings can anticipate the introduction of Solvency II or, for example in the case of entities forming part of a group, they can reallocate own funds between entities. In absolute amounts the aggregated capital surplus of participating undertakings remains fairly stable, with a reported aggregate decrease of 3%.

For the European insurance industry as a whole, no additional capital is needed. However, the redistribution process of capital between risks and undertakings is confirmed again by QIS4 results.

1.5 Suitability of the QIS4 specifications

Participants generally considered the architecture of the system to be **sound**, but indicated that more **guidance** on the calculation of technical provisions, the valuation of other liabilities and some assets, the calculation of the SCR, including the use of simplifications, and the assessment of eligible capital would be welcomed.

1.6 Valuation of assets and liabilities

There is broad support for the general design of the valuation approach, and the proposed valuation did **not create major difficulties** for most participants in countries already applying IFRS accounting principles. On particular areas however, some criticism was raised.

According to participants, Solvency II should be based on an **economic valuation** of both assets and liabilities, and there is a strong desire for the Solvency II valuation approach and the international accounting standards (IFRS phase II) to develop consistently. This is underlined by supervisors, who are concerned about the auditability of the solvency balance sheet if there is no clear link to accounting rules. In this context, further guidance was requested regarding the use of mark-to-market and mark-to-model approaches. The use of 'mark-to-model' seems to be predominant on the liability side, as no liquid or active market exists for insurance liabilities. Some undertakings mentioned that the application of IFRS valuation increases the volatility of values of assets and liabilities, which leads to volatility in the amount of own funds held by the insurer. This was said not to adequately reflect the long-term perspective of the life insurance business. Furthermore, the treatment of deferred taxes and intangibles remains an issue, with diverging views and responses among participants.

1.7 Technical provisions: support for the general framework

In general, undertakings **supported the design** of the proposed methods for the calculation of the technical provisions, including the simplifications and proxies. However, some questions have arisen as to the convergence and consistent application of the methods across countries.

1.7.1 Best estimate

In most countries, the calculation of the best estimate is a new exercise. As such, methods used vary considerably and as a consequence also the quality of the data diverges.

When valuing their insurance liabilities, the **segmentation** of data according to the categorisation proposed by QIS4 into lines of business and the **lack of available data** posed problems to undertakings. In particular, small and medium undertakings felt the lack of appropriate data to be an obstacle for stochastic valuation methods. Many undertakings also apply a more granular segmentation in their internal systems than the segmentation proposed in the QIS4 technical specifications.

Undertakings would also welcome clearer definitions and more guidance on the treatment of **future premiums**, the **valuation of options and guarantees**, the calculation of **future discretionary benefits**, the valuation of **future management actions**, the calculation of **net technical provisions** and the valuation of **future large claims**. Also the valuation of non-life premium provisions would benefit from additional guidance with regard to the treatment of acquisition costs. Undertakings and supervisors also raised specific concerns about the valuation of non-proportional reinsurance accepted and reinsurance recoverables, which requires detailed data on the risk mitigating effect on large single claims.

In addition, following the European Commission's guidance, QIS4 proposed the use of swap rates to derive the **discount rate** for the valuation of technical provisions. A number of undertakings expressed concerns about the methodology proposed by CEIOPS and used adapted curves. No conclusive view could be drawn from the exercise on the choice between swap rates or government bonds as a basis for deriving the risk free interest rate.

1.7.2 Risk margin

Almost all undertakings **support the cost-of-capital approach** for determining the value of the risk margin for non-hedgeable risks². However, many participants expressed concerns as to the complexity of the calculation method, especially in view of the impact of the risk margin. Many undertakings, including large ones, used the suggested simplification to calculate the risk margin. The cost-of-capital factor (6%) was questioned by various undertakings, while some undertakings and groups requested the recognition of diversification benefits between lines of business within the risk margin.

² There is no risk margin for hedgeable risks.

1.8 Use of simplifications and proxies: the proportionality principle put into practice

In order to implement the proportionality principle in concrete measures, QIS4 introduced simplifications and proxies for the valuation of technical provisions. This has greatly benefited the participation of small and medium undertakings in QIS4.

In general, undertakings support the design of the proxies and simplifications laid out in the QIS4 specifications. Undertakings (including large undertakings) mostly used the simplifications for the calculation of the risk margin and the interest rate risk module in the SCR computation. Results show that there is scope for revision of certain specific proxies or simplifications and for improvement of the consistent use of methods.

In addition, it turned out that the line between sound actuarial techniques, simplifications and proxies is not always clear-cut as some jurisdictions consider that methods suggested as proxies or simplifications could be recognised as sound actuarial methods. Guidance on the range of actuarial techniques available and more transparent application criteria for the use of simplified approaches and proxies, where there is a lack of data, would be needed in Level 2 implementing measures in order to ensure a proper application of the proportionality principle.

1.9 Own funds

Under Solvency II, an undertaking's eligible capital or own funds, corresponds to the financial resources which can serve as a buffer against risks and absorb losses where necessary. The amount of own funds is divided between basic own funds, which are items on the balance sheet and ancillary own funds, which are off-balance-sheet items. According to their loss absorbing capacity, these items are classified into three different tiers, depending on their nature and the extent to which they meet certain quality criteria. Tier 1 contains the highest quality instruments.

QIS4 reports an increase of total own funds across countries of 27% in comparison to the currently held own funds. This increase is mainly due to:

- 1) valuation adjustments following the move to market consistent valuation;
- 2) the reclassification of equalization provisions from technical provisions to own funds; and

- 3) the inclusion in full of hybrid capital instruments, subordinated liabilities and ancillary own funds, subject to the Solvency II limit structure, into own funds tier structure.

The impact of **deferred taxes** on the amount of own funds is **unclear**, given that participants have used different approaches. The majority of own funds have been classified by participants in **Tier 1** (95%; 4% Tier 2 and 1% Tier 3).

Undertakings **supported the general criteria for the classification of own funds**.

Consistent with the results of QIS3, the majority of own funds have been classified by undertakings in **Tier 1 basic own funds**. The improved guidance for classification in QIS4 has however increased the reliability of these results. The amount of **hybrid capital instruments and subordinated liabilities** reported by undertakings constitutes approximately 2% of total own funds across the EEA. Four countries account for approximately 85% of the total volume of hybrid capital instruments and subordinated liabilities. In general, undertakings and the majority of supervisors opposed the idea of splitting the classification of hybrid capital instruments and subordinated liabilities according to their debt and equity components.

Furthermore, QIS4 used the **issue date** as the point in time from which the maturity characteristics of own funds need to be assessed. Whilst the information received on the impact of the shift from issue date to reporting date is limited, this would lead to a significant number of instruments being classified in a lower tier.

Surplus funds represented a significant amount in three countries. Mutuals and mutual-type undertakings in one country reported the bulk of the surplus funds (69%). Undertakings reported a variety of **other reserves** with full or restricted loss absorbing capacity. QIS4 also collected information on the potential effects of transferability restrictions on own funds held within **ring-fenced funds**. Most ring-fenced funds were reported by life insurers that write with-profit business, but regulatory ring-fenced funds for pension contracts, funds in Protection and Indemnity Associations were also reported. The treatment of these funds may have a large impact for a small number of countries; and potentially for other countries depending on the definition. A clear definition of what is exactly considered to be ring-fenced is therefore important.

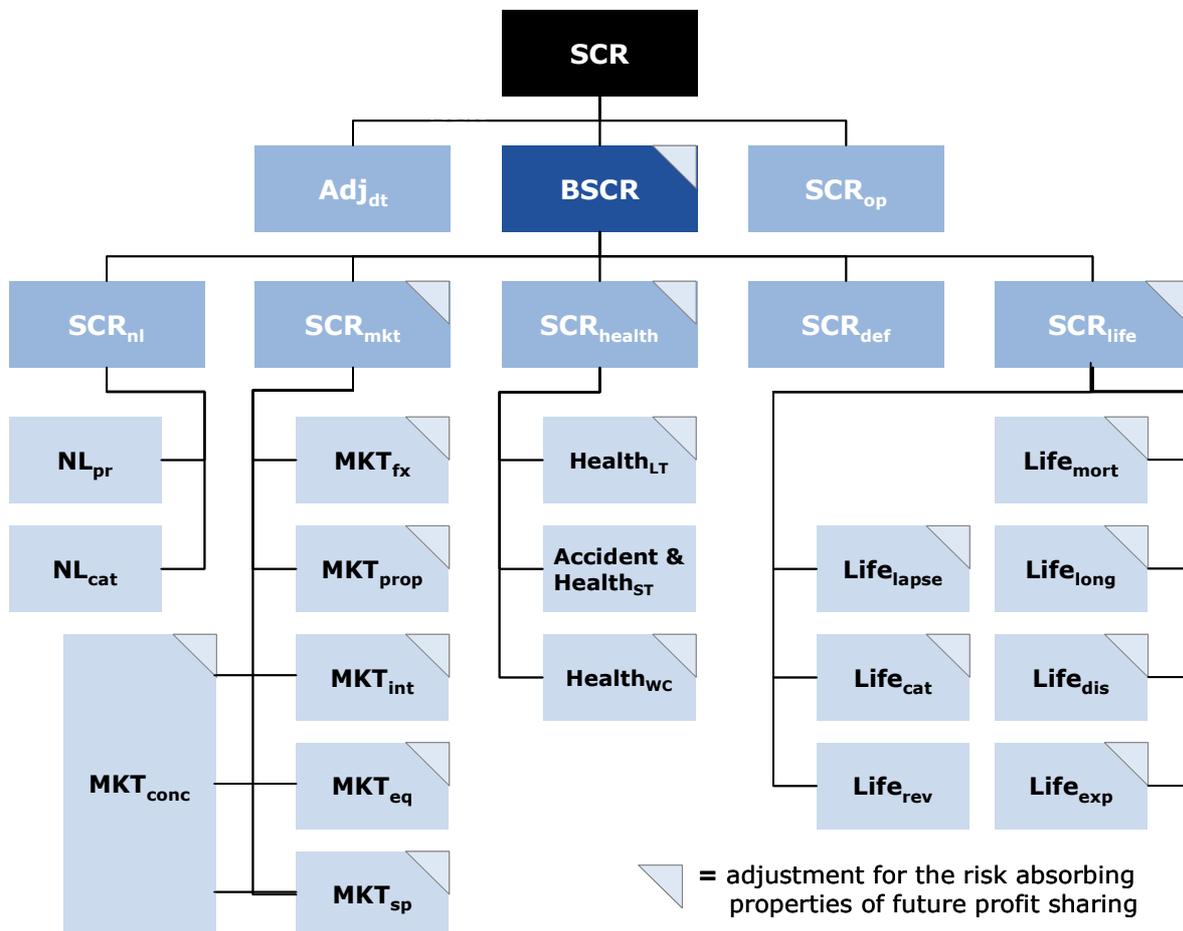
The 40-60 split of mutual supplementary members' calls tested in QIS4 did not raise any major concerns with undertakings.

A specific issue raised by participants concerns the need for rules for **grandfathering** when Solvency II will come into force.

1.10 Solvency capital requirement: standard formula approach

QIS4 has confirmed the support from industry and supervisors for the **modular structure** of the standard formula for the calculation of the capital requirements. This modular structure is composed of different risk modules and sub-modules, for each of which a capital requirement needs to be calculated (see Figure 3). These modules and sub-modules are then combined through correlation factors, through which diversification effects are taken into account. As diversification effects are difficult to calculate, the calibration of the correlation factors has been subject to many comments. Undertakings would also welcome more transparency on the calibration of the various (sub-) modules.

Figure 3: Modular approach of the SCR



1.10.1 Market risk

The market risk module accounts for the majority of capital requirements in life business and to a lesser extent in non-life business. For the equity risk module, many undertakings and supervisors stated that the **32% calibration** of the

equity stress was too low for a 99.5% calibration, and suggested that a figure of around 40% might be more appropriate.

QIS4 also introduced a so-called **duration dampener** as an option to be tested within equity risk. This dampener consists of two separate dampening functions: a dampener based on the duration of the liabilities and a dampener based on the position in the financial cycle. The duration element stresses that insurers hold equities for a long duration (equal to that of their liabilities) and makes the hypothesis that, on a longer run, equities recover, such that short-term shocks are of minor relevance for equities used to cover liabilities of a long duration and thus receive a lower SCR capital requirement.

The financial cycle element aims at dampening the effect of large upward or downward movements in equity prices, by imposing a higher capital charge in times of high equity values and a lower capital requirement in times of low equity values. This element of the dampener aims at preventing procyclical behaviour which would occur for example through fire sales of low valued equity in times of financial crisis.

This duration dampener resulted in a reduction of around 10% in equity risk capital based on the average of median results for all business segments, mainly due to the duration element. This element of the duration dampener approach was **opposed explicitly** by many supervisors and undertakings. Main reasons cited by supervisors were the lack of theoretical and empirical justification, inconsistency with the concept that the undertaking should have sufficient capital to ensure with 99.5% confidence that it would be able to establish a solvent balance sheet in 12 months time following a fall in the value of equities, and inappropriate incentives for risk management.

QIS4 also tested different approaches to the **treatment of participations** in the equity sub-risk-module. The differentiated equity stress for participations uses a lower shock for equities invested in participations due to the long term nature of these investments. The across-the-board stress does not discriminate between participations and other equity investments, and the look-through approach uses a sub-consolidation method, treating the participation as a subsidiary. Views regarding the suitability of the different approaches for the treatment of participations are mixed. Whereas some undertakings and supervisors favour the differentiated equity stress approach by nature of the participation, other parties criticise this approach and favour the across-the-board or look-through approach.

Further issues that were raised related to the interest rate risk (possibility to introduce **sensitivity to the changes in the shape of the yield curve** for the interest rate module; review of the **correlation** between equity risk and interest rate risk) and the burden to have to calculate the SCR before application of the risk mitigation **effect of future profit sharing**.

1.10.2 Counterparty default risk

The concept of the **loss-given-default** introduced in QIS4 was considered to be an **improvement** compared to the QIS3 exposure measure. However, its calculation was considered to be **too complex** by many undertakings, in particular with regard to non-life reinsurance counterparties. Further, the capital charge for the exposure to unrated counterparties was criticised as being prohibitively high and inconsistent with current practices (for instance, intermediaries are not always rated in all countries).

1.10.3 Life underwriting risk

The life underwriting risk combines through a correlation structure various sub-risks (i.e. mortality, longevity, sickness, lapses and expense inflation). Some participants have reported that **lapse risk** was considered to be too high. It should be pointed out however that the total lapse risk capital charge was considerably lower in QIS4 than in QIS3. Additionally, compared to QIS3, the life underwriting risk includes lapse catastrophe risk in QIS4. Further, the **allocation of contracts** between the life, non-life and health underwriting risk modules was not always clear for participants: in some cases it was possible to allocate a contract to e.g. either life or health.

1.10.4 Non-life underwriting risk

The main risk in the non-life underwriting risk is the premium and reserve risk. QIS4 has introduced the possibility to apply **geographical diversification** for non-life business across the globe. While this change is crucial for reinsurers and cross-border groups, it was seen by many participants as introducing unnecessary complexity at solo level, in view of the materiality of the reduction in capital requirement they could obtain from the calculation. Furthermore, QIS4 allowed for the use of **undertaking specific parameters** for parameters in the premium and reserve risk. Most undertakings welcome the possibility to use undertaking specific parameters. However few were able to test it in QIS4, mostly because the depth of the historic data necessary was not available. **Catastrophe risk** could be calculated on the basis of standard risk charges, geographical scenarios developed by supervisors or personalised catastrophe scenarios developed by the participants themselves. Participants welcomed these innovations and comments were mainly addressed at inciting CEIOPS to further develop and improve the approaches.

1.10.5 Health underwriting risk

Following criticism on the structure of the health module in QIS3, QIS4 has restructured the module and included the short-term health and accident insurance and workers' compensation in the health underwriting risk. This change was **welcomed** but some undertakings were still unsure about classifying particular types of insurance according to the sub-module structure provided.

1.10.6 Operational risk

The standard formula tested in QIS4 was similar to the QIS3 approach. Views diverged between respondents whether the operational risk charge in the standard formula is adequately designed. In general, non-life insurers and the smaller undertakings had a more positive opinion of the operational risk capital charge in QIS4 in comparison to life and larger undertakings and groups.

Many respondents noted that there are further improvements needed in the standard formula. Issues mentioned by those respondents are the correlation of 100% with other risks, a **lack of risk sensitivity**, the formula not reflecting the wide spectrum of operational risks that can materialise within an undertaking and the cap of 30% not being adequate, i.e. being too high. Some respondents noted that the objectives of the operational risk charge can only be properly tackled through internal models and Pillar 2 measures, as operational risk has a wide range of qualitative measures which cannot be taken into account reliably in the standard formula.

The responses to the qualitative questions indicated that there is a wide range of operational risk management systems in place, with some participants indicating that they have sophisticated techniques to quantify capital requirements for operational risk, while others have yet to start collecting and categorising operational risk losses.

1.10.7 Risk mitigation techniques

Participants support the approach taken in QIS4 which should allow for adequate recognition of risk mitigation techniques in reducing the relevant risk capital charges. However, the concrete application of the principles outlining this approach needs to be further fleshed out: it is not yet clear what risk mitigation techniques in practice are allowed and how the reduction would apply in practice.

1.10.8 Adjustment for loss absorbing capacity of technical provisions and deferred taxes

It was observed that the adjustment for loss absorbency through profit sharing appears to be one of the **key elements** in the calculation of the SCR for life and health insurers. There is an adjustment in about half of the countries, and its impact is material (reduction of more than 5% of the BSCR) in about a third of the countries, with a wide range of values (reduction of 5% to up to 75%). Undertakings are likely to need **further and more detailed guidance** on the approach and methodology that should be used to determine the effect of reductions in future profit sharing and how the **assumptions on future management actions** impact on the calculations. Developing some practical examples could be very helpful.

1.10.9 Supervisory intervention following a breach of the SCR

There was a **general welcome** from undertakings for the principle that the **overall risk situation**, reflecting the risks that the undertaking is facing and the overall economic background, should be taken into account when deciding on the nature of supervisory intervention in the event of a breach of the SCR.

Furthermore, the application of stress tests by undertakings and proactive review by supervisors is seen as important.

1.11 Internal models

An area of particular importance in QIS4 has been the collection of information on internal models. To this end, CEIOPS has asked participants to provide information on the current and future potential use of internal models. Approximately 50% of the solo participants provided some information on internal models. This is an improvement compared to the 13% of participants submitting information on internal models under QIS3. Only 10% of undertakings provided quantitative results for their internal model calculations.

A first finding is that many undertakings that answered the questionnaire consider that the standard formula works reasonably well, and therefore they would not consider developing an internal model at this stage (13% of the respondents, i.e. around 90 undertakings). Full and partial internal models are however a possible route for many undertakings and companies are in different stages of development, partial and internal models being both considered as a viable option (63% would consider using a partial or full internal model under

Solvency II, i.e. around 450 undertakings). The key drivers for the development of an internal model are better risk management and governance.

Undertakings were also asked to benchmark their internal model to the modular structure of the SCR standard formula in order to compare internal model outcomes with the QIS4 results. Overall, the internal model results for the solvency capital requirements seem to be lower, and half of the undertakings **expect a 20% decrease in their capital requirement**. Some risks seem to generate on average a **lower capital requirement** than under the standard formula (e.g. interest rate risk, longevity risk, lapse risk or premium and reserve risk). Other risks would require **higher capital charges** when calculated using an internal model (e.g. operational risk, equity risk or property risk).

With regard to **group internal models**, only seven groups provided complete data on a group SCR calculated with internal models. Therefore, no general trend at European level can be drawn due to size of the sample. For those groups, on average a **lower SCR** of 0.5% was calculated compared to the standard formula, but there was a **wide range of results** and a number of groups reported a higher group SCR when applying their internal model. General comments on the use of partial or full internal models and on the reasons for developing an internal model are the same for group and solo entities.

The above conclusions need to be read applying some important **caveats**. First of all, it needs to be pointed out that internal models vary among companies. Second, undertakings may structure their risks differently than what is foreseen in the standard formula. Third, internal models may apply different correlations between their risks than the ones prescribed in the standard formula. Fourth, internal models may tackle risks that are not considered in the standard formula, hence raising the capital requirements. The opposite also applies, where companies did not provide information on specific risks as they are not included in their internal model. Finally, it needs to be stressed that none of these internal models would currently be considered as fully 'Solvency II compliant'.

1.12 MCR: a workable proposal

Based on the feedback from QIS3 and the QIS4 consultation, the Commission and CEIOPS aimed resolving some of the previously identified problems with the MCR. The newly tested **combined approach** is based on percentages of technical provisions and other basic volume measures such as premiums and capital-at-risk (linear approach), and outcomes are limited by a cap and floor (20%-50%) calculated as a percentage of the SCR, hence ensuring a proper supervisory ladder of intervention. Most undertakings did not criticise the width of the corridor.

Overall, the QIS4 combined approach was **better received** by both undertakings and the majority of supervisors than the modular approach tested in QIS3. The feedback from QIS4 indicated that the calculation of the combined approach caused little or no practical difficulty for most undertakings. For non-life business, the underlying linear calculation broadly met the calibration target of the combined approach. For life business, the underlying linear approach would seem to benefit from some improvement, although results were more stable than in QIS3.

1.13 Groups

The QIS4 study is the first impact study on Solvency II in which the sample size is big enough to have a global view on the potential quantitative and qualitative impact of Solvency II on groups. However, it should also be noted that groups' data are in general surrounded with more caveats than the data at solo level.

By nature, **diversification effects vary considerably** from one group to another, mainly according to the diversity of their businesses. Consequently, an average diversification effect is a concept that should be used with care. The group diversification effect is **21% on average** where it is measured as the difference between the sum of solo SCRs and the group SCR, calculated using the standard formula and neutralising the capital charges related to intra-group transactions³. The results indicate that the diversification effects for larger groups are larger on average compared to smaller groups. Internationally active groups can account for a significant amount of diversification from non-EEA business. The same applies to groups that have with-profit business, i.e. the diversification of with-profit business has a major impact on the diversification effect.

When comparing the **group excess own funds under** Solvency I with the Solvency II results under the QIS4 assumptions **a slight increase** is found.

Supervisors and groups also consider that further work is needed on transferability of assets especially in relation to diversification effects, particularly with respect to elements stemming from third countries and the with-profits parts of insurance groups.

Only few groups from a small number of countries provided quantitative information in QIS4 on the amount of any '**group support**' that undertakings may use as part of own funds and how this relates to total own funds. Groups

³ The effect of the neutralising of double counting for the capital charge on intra-group transactions is on average 9%.

that answered classified the group support as Tier 2. The answers from groups indicate that there is broad support for the group support regime, in particular from the largest groups. Groups noted the importance of transferability issues in relation to group support.

1.14 Key lessons learned and challenges ahead

CEIOPS is committed to continue delivering advice to the European Commission on Level 2 measures and to produce Level 3 guidance for increasing the convergence of supervisory practices across the EU Member States.

QIS4 is a valuable source of information for the development of the further implementing measures of the Framework Directive Proposal. The advice on Level 2 implementing measures will be accompanied by a careful analysis of the impact of some of the key features of the Directive.

Furthermore, in continuing its work on Solvency II, CEIOPS will remain attentive to current developments in the market and in global standard setting.

In addition to the areas identified in the report where further guidance is needed or approaches need to be clarified or simplified, some challenges have arisen during the exercise, which will need to be tackled in the coming months and years when implementing Solvency II.

The challenges include:

1. The **validation** of the Solvency II balance sheet is a crucial element for the practical implementation of Solvency II. Some concerns arise with regard to the differences between Solvency II and IFRS and/or national GAAP valuation. CEIOPS participates in the ongoing discussions on how the current financial crisis will affect fair value measurement.
2. CEIOPS will carefully consider ways to ensure that the new regulation is appropriately risk sensitive, whilst taking into account the need to avoid **procyclical effects**, in particular in times of severe market stress.
3. Whilst QIS4 has already taken steps in improving the proposals taking into account the impact of **correlations** between risks, the treatment of structured products and the volatility of equities, further work on these issues will need to be carried out at Level 2.
4. Taking into account the possibility for including hybrid capital as eligible capital, careful consideration should be given to ways of reinforcing the highest **quality of capital** for covering the capital requirements.

2 Introduction

2.1 Disclaimer

This report sets out the results from the fourth Quantitative Impact Study (QIS4) conducted by CEIOPS on the basis of the European Commission's Call for Advice (MARKT/2504/08) in the framework of the Solvency II project. CEIOPS has drafted the QIS4 Technical Specifications under the political guidance of the European Commission⁴ and strictly following the framework set by the European Commission Directive Proposal COM(2008)119. This impact study was mainly designed to test the calibration and the main structure for groups. As such, QIS4 is a test and not a proposal for the final Solvency II framework.

Obviously, there remained scope for different interpretations, not least because Solvency II is a work in progress, eventually to the detriment of the comparability of the results. This may also explain some of the dispersion between country data, a phenomenon also found at country level between participants.

Whenever in this report a reference is made to a statement from a clear minority of national supervisors (e.g. a reference to 'one supervisor'), this is done because CEIOPS feels it is important to retain as much information from the individual country reports as possible. When for any issue only the view of a minority of supervisors is given, this means that the other supervisors did not give an explicit view on this issue.

Insurance groups were asked to voluntarily report to a centralised database, which has been set up for extracting necessary quantitative and qualitative answers from group submissions, starting from the individual group level. The analysis of the group results has been conducted at two different levels: (1) an analysis of insurance groups that directly submitted to the central database and (2) an analysis of the qualitative country reports as back up of the quantitative information retrieved from the database.

⁴ See the letter dated 29/2/2008 from Karel Van Hulle, Head of the Insurance and Pensions Unit in the DG Internal Market, to Thomas Steffen, CEIOPS chair with political guidance on ten issues and the letter dated 26/3/2008 from Jörgen Holmquist, DG Internal Market, to Thomas Steffen, CEIOPS Chair

2.2 Structure of the report

CEIOPS launched a first QIS (QIS1) in Autumn 2005, the results of which were received in February 2006. The exercise focused on testing the level of prudence in technical provisions under several hypotheses. In the summer of 2006 CEIOPS conducted a more comprehensive second impact study (QIS2), which covered both technical provisions and the calculation of the solvency capital requirement (SCR) and minimum capital requirement (MCR). QIS2 focused on the methodology of the solvency requirements; the testing of the calibration of the parameters was left for the third study (QIS3). Building on the findings of the previous QIS exercises, QIS3 was launched in April 2007. The results of QIS3 were reported in November 2007 and laid the basis for the current quantitative impact study (QIS4), the results of which are presented in this report.

The goals of QIS4 were fivefold. First, QIS4 aimed at collecting further information about the practicability and suitability of the calculations involved. Second, QIS4 aimed at receiving quantitative information about the possible impact on the balance sheets, and the amount of capital that might be needed, if the approach and the calibration set out in the QIS4 Technical Specifications were to be adopted as the Solvency II standard. Third, QIS4 aimed at obtaining information about the suitability of the suggested structure and calibration for the calculation of the SCR and MCR. Fourth, QIS4 studied the impact of these new proposals on insurance groups. A comparison between internal model results with the standard formula results formed the fifth important area of interest.

In addition to further improving the design and calibration of the standard formula, QIS4 included the assessment of eligible elements of capital.

Finally, the results of QIS4 are relevant for the adoption of the Solvency II Framework Directive Proposal by the European Parliament and the European Council and will be of particular importance in the design of any implementing measures to be drafted, based on this Framework Directive.

In principle, the structure of this report follows the structure of the country reports prepared by the national supervisors, complemented with information prepared on the basis of the aggregation of raw data received by the drafting team.

The report is also characterised by the integration of data collected in a centralised group submission database with the quantitative information received through the lead supervisors of the respective groups. Chapter 3 explores the scope of the exercise by presenting information on the participating undertakings and the number of undertakings able to give quantitative input on the various calculations asked for in QIS4. The subsequent chapter treats general comments on practicability and reliability of data and modules proposed in the Technical Specifications to QIS4. It also covers the cost incurred by undertakings for

participating in QIS4 and the reliability of data provided. Chapter 5 discusses the potential financial impact on each type of insurance undertaking; the following sections describe issues relating to the valuation principles applied, with chapter 7 dedicated to the assessment of technical provisions. Chapter 8 analyses the Own Funds issues, while chapter 9 is dedicated to the standard formula SCR calculation in its modules and submodules in detail. This assessment is followed by the findings regarding Internal Modals, as taken from the replies by participants, set out in chapter 10. Chapter 11 summarises the findings regarding the approaches to calculating the MCR, followed by a short reflection on the merits of simplifications and proxies, as set out for QIS4. Chapter 13 then treats the results on insurance groups and their treatment under QIS4. Finally, chapter 14 points out areas of further work based on the preceding information. The annexes provide a glossary of key terms used in the report, deeper information on captives, and the calculations behind the feedback analysis.

2.3 Methodology

2.3.1 Data aggregation

This Quantitative Impact Study is intended to provide the best possible overview of European insurance undertakings and their risk exposure under QIS4 testing proposals. The study also gives insight into supervisors' analysis of the national results. The presentation of these supervisory views is always flagged as such, in order to present a clear and balanced view.

Results have always been derived from submissions taking into consideration the necessary local information. Though data were sometimes aggregated centrally, the highest level of confidentiality and professional secrecy have been maintained, such that no participating entities' data can be recognised in the data presented.

At the request of the European Commission, the report contains references to countries where this would help understanding the results with regard to specific issues.

These issues include: the existence and treatment of ring-fenced funds, the impact of the equity dampener, the treatment of participations, results with regard to the revised health module, countries that reported the gross of hybrid capital, the publication of national guidance, the existence of surplus funds and the availability of supplementary members' calls.

For the analysis of quantitative data the following three-step approach was applied:

1. Assessment of individual entity results by the national supervisor. The submissions were checked for potential errors and misunderstandings before proceeding with the next step of analysis.
2. Building of ratios and basic statistics regarding the distribution of the sample (percentiles, weighted average, standard deviation and number of entities included).
3. Final assessment and aggregation into a European report by CEIOPS.

In a first step, supervisors analysed the participants' QIS4 submissions and checked them for potential errors and misunderstandings.

Then, an IT tool extracted structured information from the national databases, which in turn contain all data from the individual spreadsheet submissions. These databases served as the basis for the analytical tables which were generated for the country reports. Further, these databases were used to run complementary analyses on the data obtained: The methods used did not reveal any confidential information but produced only the aggregated results needed.

The national results, as provided by the respective supervisors, were finally compiled by CEIOPS and analysed for similarities, differences and potential anomalies. Together with the qualitative remarks by the participants the various aspects of the study were then combined to the present document.

Data presented as EEA aggregates are based either on the anonymised ratios of all participating undertakings or are derived from the aggregated values for each country. The first approach has been applied in order to avoid a distortion of the anonymised values by the weighting factors which have been applied in the country aggregation. Calculations based on the second method were taken into account, whenever anonymised values were not available or the before mentioned concerns did not apply (e.g. absolute amounts, simple averages). Hence the EEA aggregates calculated under the first approach do not feature the same informational depth as the aggregated country data. EEA aggregate values based on solo undertakings are provided for informational purposes only and the mentioned caveats apply when comparing these values with individual country aggregates.

For the group issues, the assessment was approached in a slightly different manner, but in principle using the same methodology: National reports remained the basis for the aggregation of qualitative results; however, groups were expected to submit their results to a central database, as their business was in most cases not confined to one single country and only a central assessment was providing for (1) more companies in the sample and therefore fewer confidentiality problems, (2) the possibility to compare similar groups from different jurisdictions and (3) facilitated assessment of inter-group commonalities and divergences.

It should be noted that CEIOPS has aimed at using the best available information for each analysis presented. Therefore some information in this report was based on anonymised individual company data (the percentile information given in the boxplots), while other information is derived indirectly from the country information, as provided in the country reports.

2.3.2 Graphical presentation

2.3.2.1 Bargraphs

The usual method used to present the QIS4 results is the bar graph. Note that a bar is a one-dimensional structure that can only inform you about the relative size of certain values. It makes a difference whether the depicted value represents the sample of participants with great accuracy as most of them have reported more or less the same figure, or whether there is a high dispersion in results.

2.3.2.2 Boxplots

Boxplots can be useful to display differences between samples without making any assumptions of the underlying statistical distribution. The spacings between the different parts of the box help indicate the degree of dispersion (spread) and skewness in the data.

In descriptive statistics, a five-number summary of a data set usually gives a good indication for the data to be presented.

It consists of:

- the minimum (smallest observation);
- the lower quartile (which cuts off the lowest 25% of the data);
- the median (middle value);
- the upper quartile (which cuts off the highest 25% of the data); and
- the maximum (largest observation).

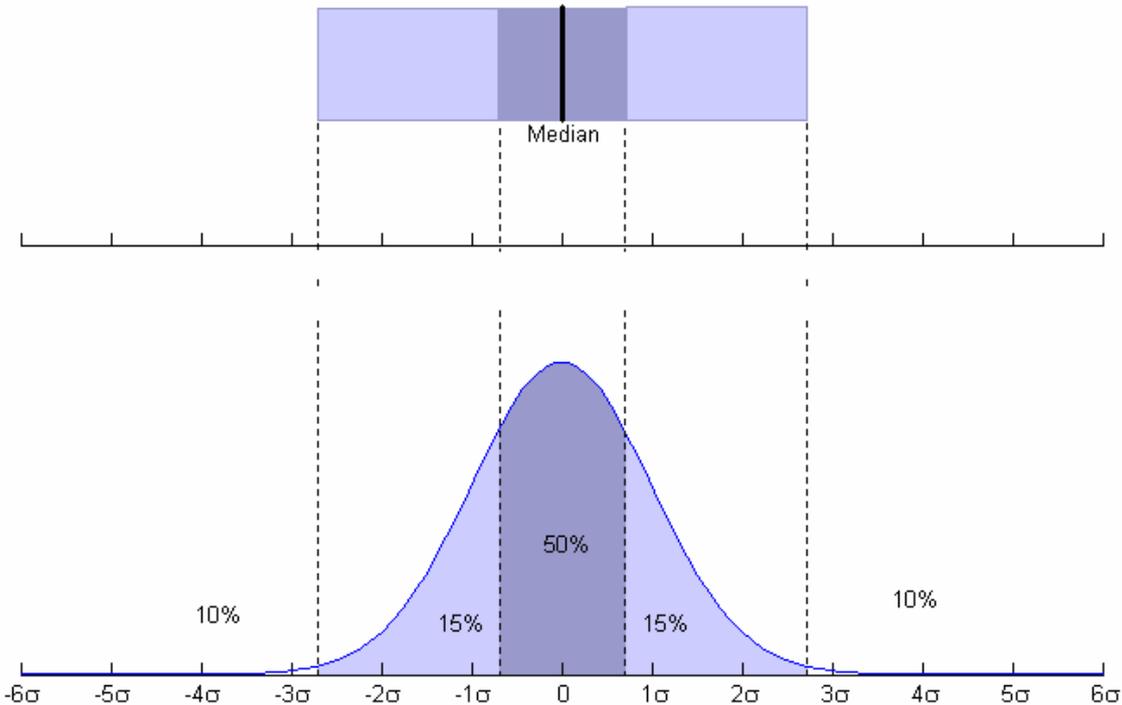
Minima and maxima often represent results of doubtful analytical quality. Hence, this report cuts off the lower and upper deciles (10%) for the purpose of graphical presentation. This means that the range of 80% of the sample is presented, while the remaining 20% are hidden, such that the presentation is clearer for the viewer.

In other words, the boxplots substitute a minimum and a maximum for the 10 to 90 percent range of results respectively. The dark blue box part of the box represents the 25th and 75th percentile (middle 50 percent of the data included). The median (middle value) is depicted using a line through the centre of the box.

The mean (which makes a difference if larger companies dominate a sample, as this is the weighted average) is drawn using a dot, where it is available. The lighter shaded areas display the range in which the upper and lower additional 30 percent of the sample fall. This way, the boxplot displays the overall range of 80 percent of the sample.

For presentational reasons and a better comprehensibility, the bars are capped in some cases so that extreme spans in the distribution are excluded from the presentation.⁵

Figure 4: Boxplots and underlying distributions



⁵ Note that e.g. negative ratios are possible if the calculated technical provisions substantially increase or decrease.

3 Participation and adequacy of (input) data, including data collection issues

3.1 QIS4 participation

In the QIS4 Call for Advice⁶, the European Commission set ambitious goals for industry participation in QIS4. Actual participation was higher than the objectives (34% of European undertakings compared to an objective of at least 25%, and 65% of cross-border groups compared to an objective of 60%). Both the number of insurers and the number of participating countries increased in comparison to the preceding QIS. In total, all 30 EEA member countries are represented in the scope of this study, including this time Romania and Liechtenstein.

The total number of solo company respondents is 1,412, i.e. an increase of 37% over QIS3, which had 1,027 respondents. Most countries reported a rising number of participants, whereas five countries observed a slight decrease. 351 undertakings are in the life sector and 686 in the non-life segment. 49 entities are classified as pure reinsurers. 227 are respondents that provide data for both life and non-life business (composites). Captives have been introduced as a separate category in QIS4, with 99 undertakings included. With 667 and 522 respectively there have been significantly more small than medium undertakings that responded to QIS4. There are 220 large undertakings that submitted their data. Three participants were not assigned to a size class. Among all respondents there are 304 mutual undertakings.

Classification by size was done according to the following table.

Table 1: Limits for size classification

size class	Non-life insurers	Life insurers
Large	> EUR 1,000 million gross written premiums	> EUR 10,000 million gross technical provisions
Medium	EUR 100 – 1,000 million gross written premiums	EUR 1,000 – 10,000 million gross technical provisions
Small	< EUR 100 million gross written premiums	< EUR 1,000 million gross technical provisions

Apart from non-life insurers and life insurers for which the classification above can be applied directly, there are reinsurers and composite direct insurers which

⁶ MARKT/2504/08 dated 31/3/2008

write both non-life business and life business. For those entities, the size class was assigned on a discretionary basis in line with the set classification of non-life insurers and life insurers described above. For instance,

- a composite insurer who conducts medium non-life business and small life business was classified at least medium;
- a composite insurer who conducts medium non-life business and medium life business was classified medium or large.

There have been significantly more small (667 undertakings which represents +58% compared to QIS3) and medium (522 undertakings, +25%) undertakings that responded to QIS4 compared to QIS3. 220 large undertakings also submitted their data (+18% compared to QIS3).

Table 2 below summarises the results and Table 3 shows the relative change in participants in comparison to QIS3 and with respect to size class.

Table 2: Number of respondents

Type of undertaking	Small	Medium	Large	Total ⁷
Life undertakings	127	139	84	351
Non-life undertakings	330	272	83	686
Composites	88	95	43	227
Pure reinsurers	24	15	10	49
Captives	98	1	0	99
All respondents	667	522	220	1,412
Mutuals thereof	177	103	24	304

Table 3: Relative growth in participation

Type of undertaking	Small	Medium	Large	Total
Life undertakings	9%	3%	6%	6%
Non-life undertakings	30%	40%	32%	34%
Composites	120%	20%	10%	44%
Pure reinsurers	100%	50%	67%	75%
Captives	n.a	n.a	n.a	n.a
All respondents	58%	25%	18%	37%
Mutuals thereof	50%	4%	-29%	21%

⁷ Three undertakings could not be classified according to their size class.

From QIS3 to QIS4, the number of small undertakings that took part in the study increased considerably, by 58 percent. In absolute numbers, this was an overall increase of 245 respondents. For medium-sized undertakings a 25 percent increase can be observed. In comparison to the other size classes the rise in the participation of large undertakings is rather modest. However, it has to be noted that in many EEA countries insurers of this size do not exist or already took part in QIS3.

In its Call for Advice, the EC set a participation target of 25% of the total number of European insurance and reinsurance undertakings. Based on national participation rate information CEIOPS reached this target: 33.6% of insurance and reinsurance undertakings under the scope of Solvency II submitted data for the QIS4 exercise. Among life undertakings the participation has been even higher (41.5%), non-life undertakings and composites had participation rates of 32.0% and 31.9% respectively. 27.1% of reinsurance undertakings and 19.2% of captives participated in the exercise.

France is the country with the highest number of participants and also the highest number of mutuals. The United Kingdom had the largest number of life undertakings and Germany the most non-life undertakings. France had the highest number of composites, Ireland the highest number of reinsurers and Luxembourg the most captives participating.

Table 4: Participation by country

Country	Life	Non-Life	Composite ⁸	Reinsurance	Captive	Total	Mutuals thereof	Total QIS3
Austria	4	7	15	0	0	26	4	27
Belgium	5	9	13	0	0	27	0	15
Bulgaria	2	3	0	0	0	5	0	6
Cyprus	4	3	0	0	0	7	0	5
Czech Republic	2	4	8	0	0	14	0	12
Denmark	19	40	0	1	0	60	16	69
Estonia	2	5	0	0	0	7	0	7
Finland	0	10	9	0	1	20	8	19
France	0	125	103	6	0	234	128	154
Germany	60	135	0	12	7	214	43	179
Greece	3	3	1	0	0	7	0	1
Hungary	4	3	8	0	0	15	1	13

⁸ The classification between Life/Composites is not always a strict one since life undertakings are allowed to do supplementary insurance (in particular, personal injury which is non-life business). As a consequence, two countries (Finland and France) have chosen to classify all life undertakings as composites.

Iceland	3	3	0	0	0	6	0	7
Ireland	23	19	0	13	10	65	0	39
Italy	36	36	16	0	0	88	3	73
Latvia	2	5	0	0	0	7	0	2
Liechtenstein	1	0	0	0	0	1	0	0
Lithuania	5	6	0	0	0	11	0	11
Luxembourg	10	15	0	3	65	93	2	16
Malta	2	8	1	2	3	16	0	5
Netherlands	29	69	0	4	0	102	19	58
Norway	4	9	0	0	7	20	6	19
Poland	11	14	0	0	0	25	2	24
Portugal	14	18	5	0	0	37	1	33
Romania	2	3	2	0	0	7	0	0
Slovakia	1	0	6	0	0	7	0	5
Slovenia	2	2	4	2	0	10	1	11
Spain	23	56	31	2	0	112	34	108
Sweden	16	17	1	0	6	40	14	27
United Kingdom	62	59	4	4	0	129	22	82
TOTAL	351	686	227	49	99	1,412	304	1,027

As shown in Table 5, a substantial market share – in terms of gross provisions for life and health and gross premiums for non-life – is covered in all three sectors. CEIOPS is pleased to note that these numbers in most cases constitutes an increase since QIS3. This reflects the particular interest of the industry in the quantitative impact studies and eventually Solvency II. Participation, with respect to market share, is almost equal in all three sectors, and for most countries exceeds 60 percent⁹. For the health business, the participation rate is particularly high, although it has to be borne in mind that only five countries were concerned¹⁰. The average coverage for all countries analysed increased in each business segment.

⁹ The unweighted average coverage is 75, 69, and 50 percent respectively. However, these numbers do not take into account the respective market concentration in each country.

¹⁰ Note that the health insurance business is not a separate sector in most European countries.

Table 5: Market share (%)

	Life	Non-Life	Health
Austria	76.7%	64.7%	100.0%
Belgium	88.1%	64.8%	78.2%
Bulgaria	42.6%	23.5%	0.0%
Cyprus	58.9%	16.5%	3.2%
Czech Republic	85.5%	94.0%	0.0%
Denmark	68.3%	94.2%	95.1%
Estonia	62.6%	74.7%	0.0%
Finland	99.6%	85.2%	94.3%
France	95.0%	79.4%	65.6%
Germany	89.7%	79.5%	77.8%
Greece	39.7%	11.8%	0.0%
Hungary	89.5%	94.2%	70.0%
Iceland	98.1%	57.0%	0.0%
Ireland	74.1%	64.4%	0.0%
Italy	83.3%	87.0%	92.1%
Latvia	97.2%	43.4%	92.4%
Liechtenstein	0.9%	0.0%	0.0%
Lithuania	48.2%	80.7%	90.7%
Luxembourg	52.8%	77.2%	0.0%
Malta	95.3%	53.2%	0.0%
Netherlands	93.5%	67.1%	93.0%
Norway	92.3%	67.2%	86.7%
Poland	85.7%	80.6%	0.0%
Portugal	97.0%	85.5%	95.3%
Romania	59.7%	51.4%	0.0%
Slovakia	81.3%	79.6%	75.6%
Slovenia	74.6%	87.1%	84.0%
Spain	69.4%	87.0%	69.5%
Sweden	62.6%	50.2%	80.3%
United Kingdom	75.8%	88.6%	0.0%

3.2 Data provided

Most respondents did not fill in all the tables and the qualitative questionnaires and even when they filled in a table or a questionnaire, they did not answer all the questions. About 500 undertakings provided only quantitative information and 31 undertakings only submitted a qualitative reply.

The tables below indicate the number of respondents that have filled in various parts of the QIS4 spreadsheet. Table 6 and Table 7 list the number of respondents providing data for the various calculations of the technical provisions, respectively for life and non-life business. Health (similar to life) was subsumed under the life business.

Table 6: Completeness of life technical provisions calculations

Respondents with life business	Best estimate provisions		Cost-of-capital provisions		Internal model	
	No.	%	No.	%	No.	%
Total gross provisions	592	83.5%				
Total net of reinsurance provisions	241	83.3%	531	76.0%	47	21.2%

As Table 7 on non-life technical provisions shows, the results are quite similar but somewhat higher than those on life technical provisions.

Table 7: Completeness of non-life technical provisions calculations

Respondents with life business	Best estimate provisions		Cost-of-capital provisions		Internal model	
	No.	%	No.	%	No.	%
Total gross provisions	913	88.6%				
Total net of reinsurance provisions	910	89.6%	931	88.1%	23	12.8%

Table 8 summarises the completeness of calculations for the MCR and the SCR modules and various alternative options. As the tables indicate, none of the items listed here were provided by 100 percent of all respondents. This fact may have several causes: (1) the particular risk was non-existent, (2) the company did not agree with the methodology, or (3) the undertaking was unable to provide the relevant information. For these reasons, undertakings were asked to provide qualitative responses on the practicability and suitability of the methodology of the various modules in QIS4.

It is to be emphasised that due to the lack of more detailed information, the basis for comparison (the denominator) is always the number of all QIS4

participants. Thus, the difference between the exhibited actual share of respondents and the total of 100 percent includes both non-respondents and those that do not hold a particular risk (e.g. property risk if no real estate investments are held). Only a minority of supervisors calculated adapted percentages with varying denominators, i.e. taking account of the factual number of respondents that have an exposure to a particular risk.

Some of the country specific data are based on a small sample of insurance undertakings only and it does not take into account all participants of the considered market. It is therefore not necessarily advisable or useful to draw conclusions about the whole market based on the findings presented for the participating sub-sample.

Table 8: Completeness of MCR and SCR calculations

	Life	Non-Life	Composite ¹¹	Reinsurance	Captive
MCR calculation	98.7%	99.7%	98.7%	98.0%	99.0%
SCR calculation					
Operational risk	93.6%	99.2%	99.6%	98.0%	99.0%
Interest rate risk	97.3%	87.9%	96.5%	89.8%	79.8%
Equity risk	86.1%	71.6%	87.2%	59.2%	35.4%
Property risk	63.5%	61.8%	83.7%	34.7%	8.1%
Currency risk	57.1%	43.2%	45.4%	57.1%	35.4%
Spread risk	89.9%	84.6%	89.9%	85.7%	46.5%
Concentration risk	39.5%	52.3%	54.6%	51.0%	72.7%
Counterparty default risk	58.7%	70.7%	65.6%	81.6%	57.6%
Life revision risk	2.7%	6.0%	6.2%	2.0%	0.0%
Life mortality risk	82.1%	0.9%	81.9%	20.4%	3.0%
Life longevity risk	69.1%	5.1%	67.8%	12.2%	1.0%
Life disability risk	48.5%	1.5%	30.8%	16.3%	0.0%
Life lapse risk	72.5%	2.1%	60.8%	12.2%	2.0%
Life expense risk	85.3%	3.0%	81.9%	18.4%	2.0%

¹¹ The classification between Life/Composites is not always a strict one since life undertakings are allowed to do supplementary insurance (in particular, personal injury which is non-life business). As a consequence, two countries (Finland and France) have chosen to classify all life undertakings as composites.

Life CAT risk	67.7%	1.4%	64.8%	20.4%	4.0%
Health (long-term) risk	8.0%	1.4%	3.5%	2.0%	0.0%
Non-life health (short-term) risk	5.9%	71.9%	67.8%	49.0%	21.2%
Non-life workers' compensation risk	0.8%	19.6%	22.9%	12.2%	19.2%
Non-life premium/reserve risk	0.0%	84.4%	43.6%	89.8%	97.0%
Non-life CAT risk	0.3%	79.9%	41.4%	77.6%	88.9%
Non-life undertaking specific factors					
Premium risk	0.8%	14.7%	15.0%	8.2%	4.0%
Reserve risk	0.0%	3.6%	1.8%	4.1%	0.0%
Risk-absorbing effect of future profit sharing in SCR calculation	52.5%	2.7%	55.1%	4.1%	1.0%
Risk-absorbing effect of deferred taxes	33.1%	23.4%	27.8%	26.5%	0.0%
Alternative approaches					
Participations option 2	60.5%	51.5%	59.5%	42.9%	10.1%
Participations option 3	0.3%	0.0%	1.8%	0.0%	0.0%
Equity risk dampener	26.1%	19.9%	48.9%	18.4%	6.1%
Equivalent scenario	7.7%	3.6%	4.8%	0.0%	0.0%
Lower boundary for future profit sharing	41.9%	25.8%	50.2%	34.7%	8.1%
Simplified methods for calculation of SCR	6.9%	8.2%	5.3%	6.1%	2.0%
Geographical diversification non-life	1.1%	18.3%	7.5%	51.0%	50.5%

98.8% of undertakings reported data from 2007. The remaining undertakings reported 2006 data.

Large undertakings were usually in a position to provide more results for optional calculations which were less often performed by small undertakings. Among those calculations are undertaking-specific data for non-life underwriting business, the risk-absorbing effect of future profit sharing, option 2 for participations (see below), the equity risk dampener, and the equivalent scenario. Small undertakings in turn provided more results on simplified methods than large ones.

3.3 Reliability of input data

Participating undertakings usually considered their data input for the QIS4 as sufficiently reliable. It was mentioned that the data was mostly derived from IFRS figures and was also used for other purposes. Undertakings in some countries however pointed out that their data for life business might be of lower quality than data for non-life business. Undertakings in a few countries criticised the late release of the spreadsheet and the frequent updates which complicated the submission process and had a negative impact on the quality and completeness of the submissions.

Supervisors in several jurisdictions confirmed the general reliability of input data, though one supervisor questioned the reliability of data used by first-time participants. It was stressed by another supervisor that undertakings who had already participated in earlier rounds of QIS submitted more reliable data.

4 Reliability of results, operational issues and resource requirements

4.1 Suitability – a feedback analysis

Based on an analysis described further in Annex A, the following table presents the results of the survey included in the qualitative questionnaire on participants' views of the relative importance of different design aspects for the Solvency II framework.

Table 9: Priorities according to participants (all undertakings)

	Importance	Unanimity
Guidance for calculation of technical provisions	High (1)	High (2)
Guidance for calculation of SCR	High (2)	High (1)
Guidance for calculation for assessment of eligible capital	High (3)	High (4)
Simplification for methodology for calculation of SCR	High (4)	Medium (7)
Simplification for methodology for calculation of MCR	High (5)	Low(12)
Simplification for methodology for assessment of eligible capital	Medium (6)	Medium (8)
Guidance for calculation of MCR	Medium (7)	High (3)
Simplification for methodology for technical provisions	Medium (8)	Low (14)
Prescriptive rules for assessment of eligible capital	Medium (9)	Medium (10)
Prescriptive rules for calculation of MCR	Medium (10)	Medium (9)
Prescriptive rules Calculation of SCR	Low (11)	High (5)
Simplification for methodology for value of assets	Low (12)	Low (13)
Prescriptive rules for technical provisions	Low (13)	Low (11)
Guidance for calculation of value of assets	Low (14)	Medium (6)
Prescriptive rules for value of assets	Low (15)	Low (15)

From the feedback provided by the subset of participating undertakings that offered a view on their priorities, some conclusions can be drawn. Supervisors' views on the adequate prioritisation may, however, diverge.

- More guidance for the calculation of technical provisions, the calculation of the SCR, the assessment of eligible capital and seeking simplifications for the SCR seem to be non-controversial top priority items for the market participants that responded.
- Seeking simplified methodologies, or more prescriptive rules for the valuation of assets and more prescriptive rules for technical provisions seem to be non-controversial low priority items.
- Simplification for methodology for calculation of MCR appears in the upper part of the priority sorted list of expectations, but with a high diversity between countries.
- Simplification for methodology for assessment of eligible capital, prescriptive rules for assessment of eligible capital and for calculation of MCR are at the same time medium priority items, with medium diversity within country reports.
- Opinions expressed by small and large undertakings do not differ too much, however there are some variations worth mentioning. Small undertakings see the valuation of assets as a concern – both guidance for calculation and simplification for methodology are considered more desirable by this group of undertakings than by others. Large undertakings assign higher priorities to prescriptive rules for the valuation of technical provisions and to prescriptive rules for the assessment of eligible capital.

4.2 Level of confidence in key statistics in the report

While participants were quite confident about the quality of their submissions, supervisors in some countries expressed some concerns: One supervisor had reservations against the accuracy and reliability of the QIS4 balance sheet, further it was difficult to check the consistency with statutory data due to the use of IFRS accounting, sub-consolidation of subsidiaries or changes in the scope of the portfolio. Another supervisor mentioned that undertakings in some cases did not evaluate all risks inherent in their business. Finally, one supervisor considered both the own funds and the SCR overstated for some undertakings that did not include deferred tax adjustments.

4.3 Resource necessities

On average, it took undertakings 3.2 person months to complete the QIS4 exercise. The median is 2.0 months and 50% of the undertakings spent between

1.2 and 4.0 months. The detailed figures displayed in Table 10 do not add up to the overall figure in the first line due to smaller samples for which the detailed breakdown is available – these figures therefore show the relative amount of time needed for different parts of the QIS4 exercise.

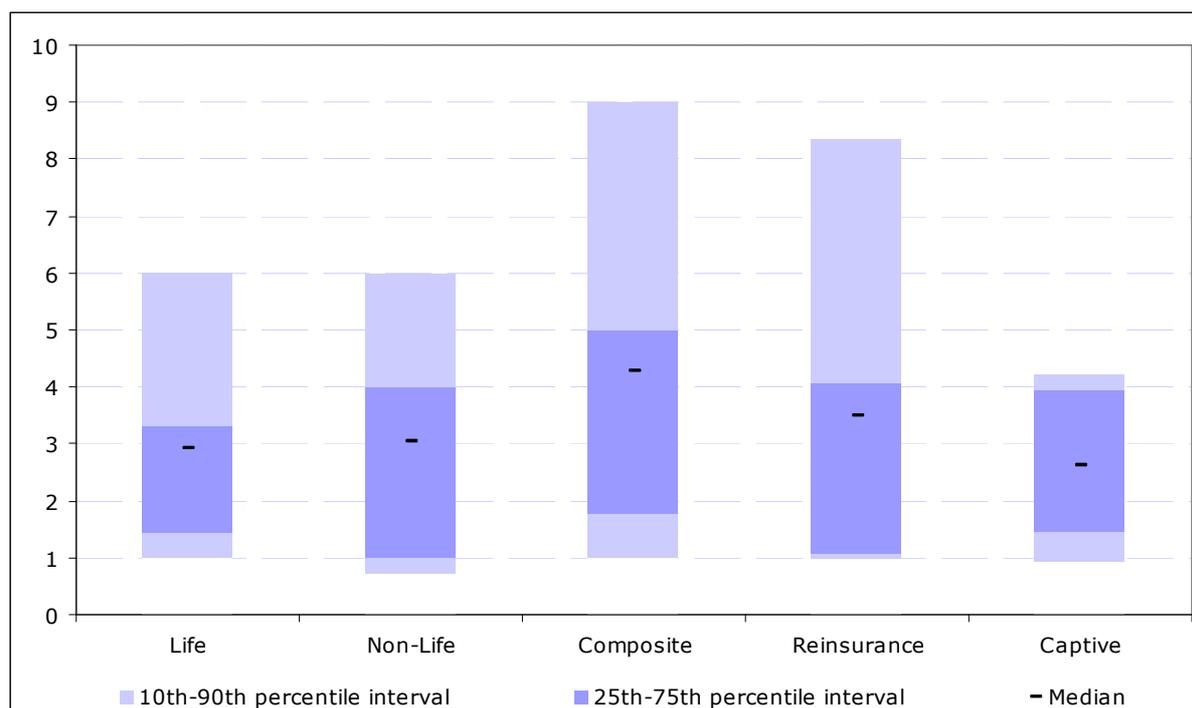
It appeared that before starting the actual calculations it took participants quite a long time to get acquainted with the Technical Specifications. Afterwards, the calculation of the SCR and the assessment of the best estimate provisions occupied most resources. When determining the SCR, the calculations for the market risk and the non-life underwriting risk were considered as most time-consuming.

Table 10: QIS4 resource necessities (average person months)

	All undertakings	Large undertakings	Small undertakings
Completing overall QIS4	3.2	4.4	2.6
Getting acquainted with the Technical Specifications	1.0	1.1	0.9
Assessment of best estimate provisions	0.9	1.1	0.8
Calculation of the risk margin	0.4	0.5	0.4
Valuation of assets and other non-insurance liabilities	0.5	0.6	0.4
Calculation of the MCR	0.4	0.5	0.4
Calculation of the SCR	1.0	1.6	0.8

Small undertakings were able to complete the exercise in a shorter time than large ones: On average, it took them about 2.6 months while large undertakings spent 4.4 months on QIS4.

Due to the wider scope of their business, composite undertakings took longest in completing the QIS4 exercise with an average of 4.3 months. Reinsurance undertakings spent 3.5 months on their calculations, non-life undertakings and life undertakings needed 3.0 and 2.9 months, respectively. For captives, the QIS4 exercise was least time-consuming (2.6 months).

Figure 5: QIS4 resource necessities by business segment (in months)

4.4 Feedback on the process

Undertakings in numerous countries stated that time was too scarce for the complex calculations required in this exercise. Further, the Technical Specifications were criticised as being unclear and too imprecise with respect to certain definitions (future discretionary benefits, health insurance, workers' compensation, deferred tax liabilities). Undertakings in some countries disapproved the late publication of documents needed for the exercise and the number of corrections and amendments. However, the Q&A procedure set up by CEIOPS, the helper tabs and other guidance was generally appreciated.

4.5 National guidance provided

Supervisors in a vast majority of countries (AT, BE, DE, EE, ES, FR, IE, IS, IT, LT, LU, MT, NL, NO, PL, PT) provided some additional guidance for undertakings participating in QIS4. Many supervisors (AT, BE, EE, ES, FR, IS, IT, LT, MT, NO, PT) prescribed one or more natural catastrophe scenarios, some (BE, FR, IT, NO, PL, PT) provided market development patterns for the application of proxies. For captives specific guidance was given by three supervisors (IE, LU, MT), also the treatment of deferred taxes was laid out in more detail by two supervisors (DE,

PT). Two supervisors (NL, UK) asked participating undertakings to test (on a voluntary basis) a higher equity shock.

Besides additional or more precise specifications, some supervisors also provided general support and guidance in the form of translations of the Technical Specifications (AT (partly), FR) or spreadsheet workshops (AT, HU, NL, PL).

5 Overall financial impact / capital surplus

This chapter discusses the high level conclusions to be drawn on the financial impact of the proposed methodology. It aims to find any general trends in the impact on specific types of insurers. The main findings can be summarised as follows:

- No major impact on balance sheet composition: The relative share of technical provisions (split in best estimate and risk margin) tends to decrease while the net asset value increases as a percentage of total assets;
- Capital requirements increase in QIS4 as compared to Solvency I;
- Available own funds increase as potential hidden reserves might be released;
- The solvency ratios do not develop uniformly: While usually rising for life undertakings, the solvency ratios decline for non-life undertakings. However, nearly 90% of undertakings are still in a position to meet the SCR. The MCR is not met by 1.2% of undertakings;
- While 21% of undertakings report a decrease of their capital surplus by more than half in comparison to Solvency I, 31% of undertakings observe an increase of more than 50%;
- In aggregate, capital surpluses in the sample of participating undertakings remain fairly stable and the overall surplus is reduced by roughly EUR 15 billion as compared to Solvency I. However, no general trend can be observed across countries: 17 countries reported an increase of the aggregated surplus while in 11 countries the aggregated surplus declined.

5.1 Balance sheet impact

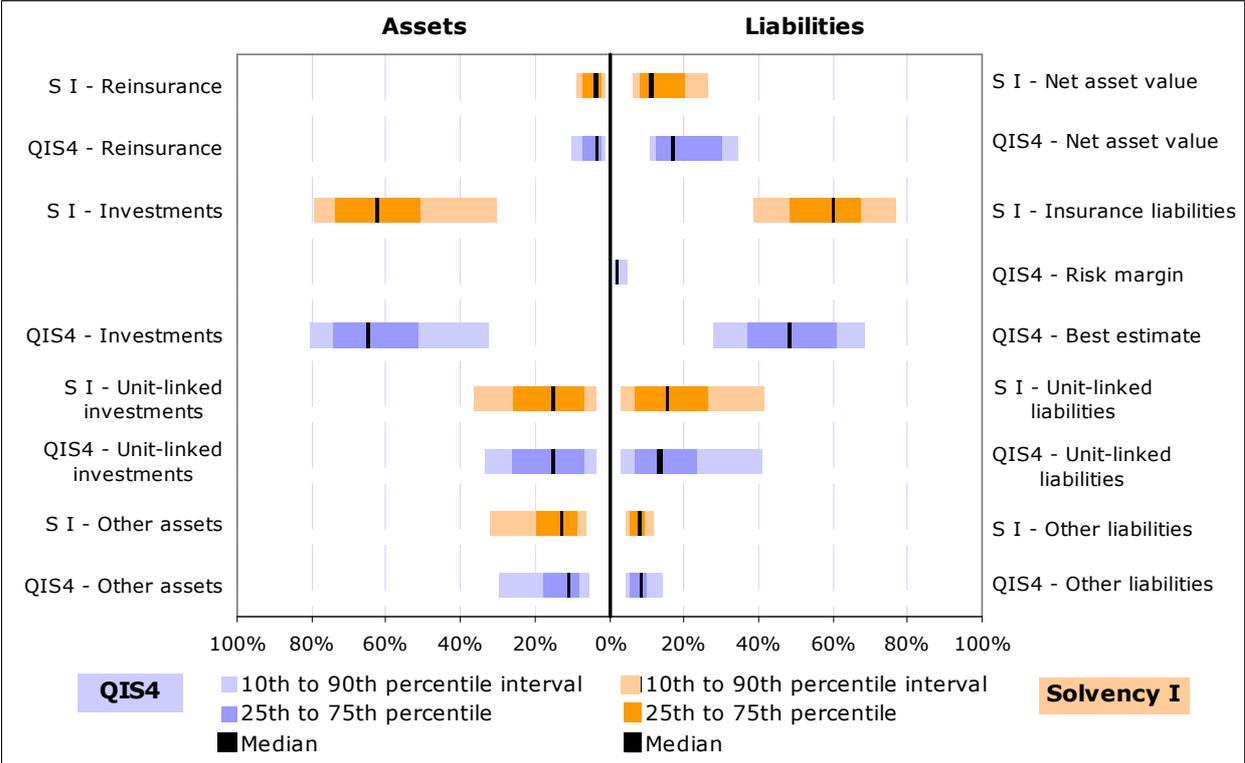
Solvency II follows the total balance sheet approach. Assets as well as liabilities may be affected by the technical provisions set out for QIS4. Solvency II principles therefore influence all items of an undertaking's balance sheet, which can be stylised in the following way:

Table 11: Stylised balance sheet

Assets	Liabilities
Reinsurance	Equity (net asset value)
Investments	Insurance liabilities - Technical provisions (best estimate) - Technical provisions (risk margin)
Unit-linked investments	Technical provisions for unit-linked business
Other assets	Other liabilities (including deferred taxes)
Total	Total

Figure 6 shows the composition of insurance balance sheets with respect to Solvency I and QIS4. The results are based on the weighted averages of each participating country. The biggest relative share by a wide margin is contributed by investments and insurance liabilities, the latter item being split under QIS4 into the best estimate and the risk margin.

Figure 6: Comparison of Solvency I and QIS4 balance sheet (all undertakings)



Results show that the QIS4 composition does not considerably deviate from the Solvency I composition: The relative weight of insurance liabilities decreases in all but two countries; in turn, the equity component (net asset value) increases, both on average for the complete EEA sample and in nearly all national sub-

samples. For the average life undertaking the net asset value rises by 72% in comparison to Solvency I, for non-life undertakings the figure is 74%.

On the asset side there are no material changes. For a more detailed breakdown of valuation changes for specific balance sheet items refer to chapter 6.

5.2 Impact on solvency ratios and capital surplus

5.2.1 Broad description

When comparing solvency ratios across undertakings and countries, some supervisors expressed some caution. Only limited conclusions should be drawn from this analysis since solvency ratios cannot be transposed into ruin probabilities. In particular, if undertaking A has a higher solvency ratio than undertaking B, this does not imply that A has a lower ruin probability than B. Furthermore, cross-country comparisons might be hampered by different positions of the countries in the underwriting cycle.

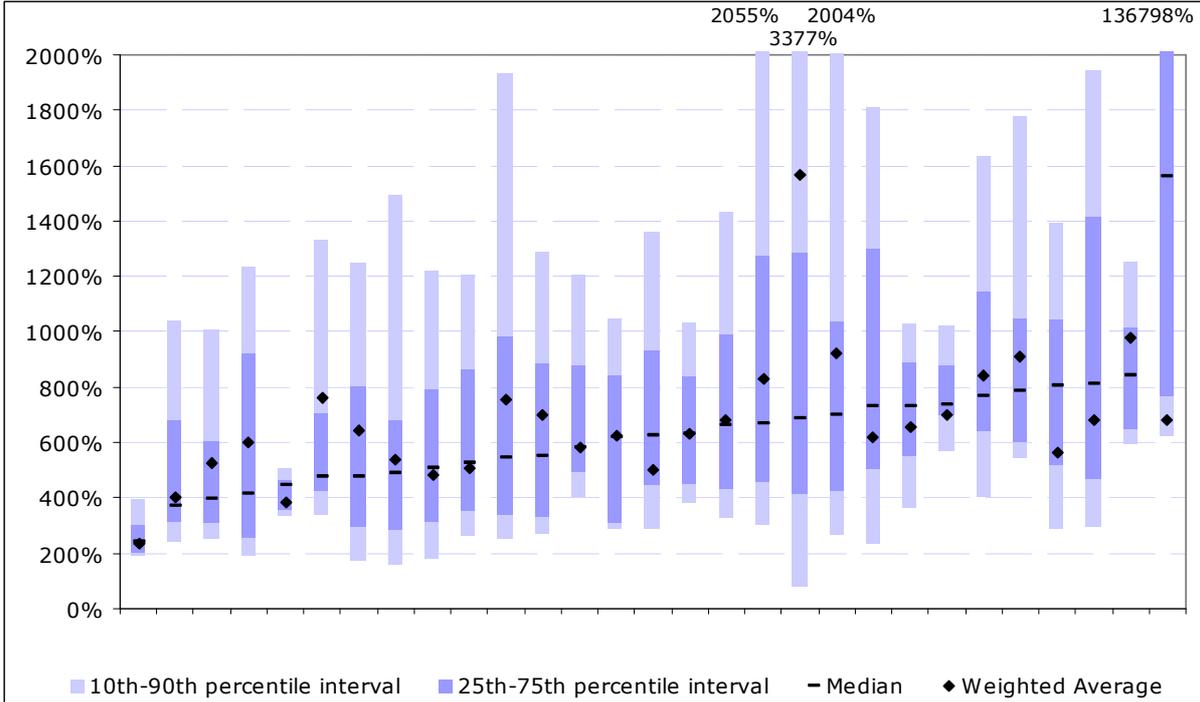
Solvency ratios have risen for life undertakings compared to Solvency I: In QIS4 the median undertaking records a solvency ratio of 230% which is an increase by 30 percentage points. Contrary, the solvency ratio of the median non-life undertaking has decreased from 277% to 193%. The declines are even greater for reinsurance undertakings and captives.

Table 12: Comparison of solvency ratios across business segments (all undertakings, EU median)

Median solvency ratio	Solvency I	QIS4
Life	200%	230%
Non-Life	277%	193%
Composite	267%	230%
Reinsurance	366%	221%
Captive	331%	167%

Tier 1 and Tier 2 Basic Own Funds usually exceed the MCR by a wide margin. The median EU undertaking covers the MCR 6.4 times. In most countries more than 90% of undertakings have MCR coverage ratios of at least 200%.

Figure 7: Tier 1 + Tier 2 Basic Own Funds to MCR (all undertakings)



In absolute amounts, the aggregated capital surplus of participating undertakings decreases from nearly EUR 430 billion to about EUR 410 billion which is a fairly stable development.¹²

The capital surplus increases in 17 jurisdictions while decreasing in 11 jurisdictions. Relative changes across countries vary largely between +300% and -51% without any clear trends emerging.

¹² Absolute figures in general should be interpreted with care as any conclusions based on them are limited to the analysed sample. Specifically the sample for the capital surplus is slightly smaller than the overall sample of 1,412 undertakings.

Figure 8: Absolute change in capital surplus from Solvency I to QIS4 (EUR million, all undertakings)

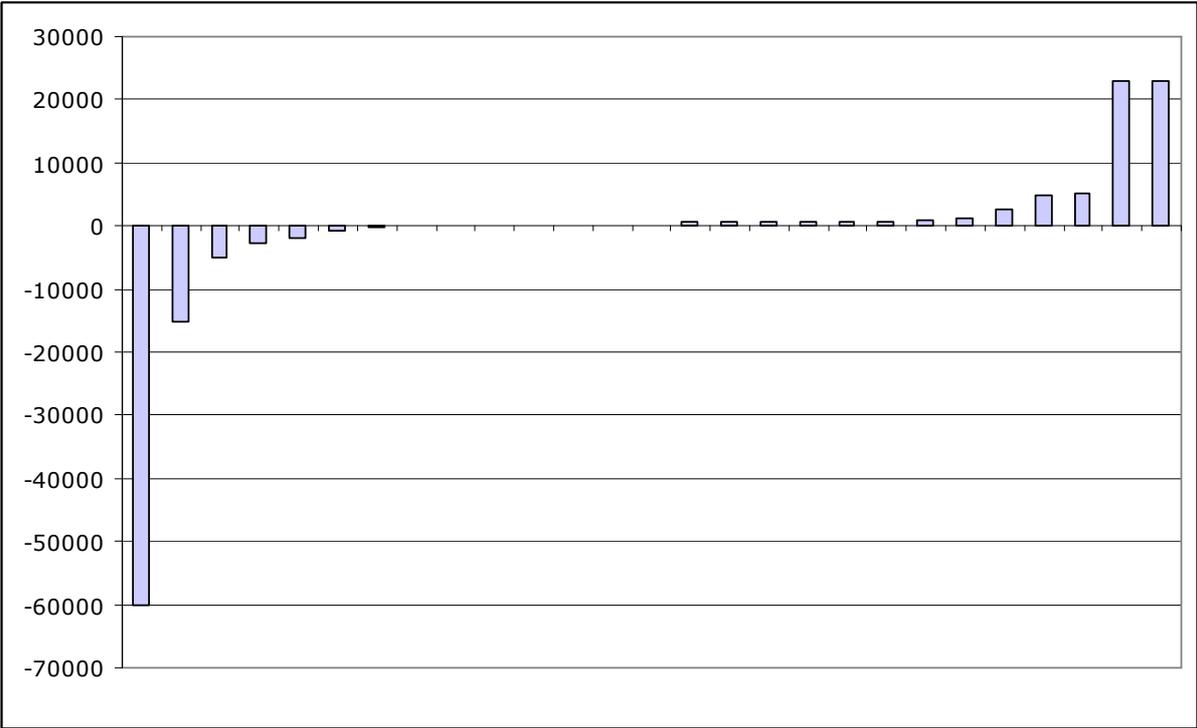
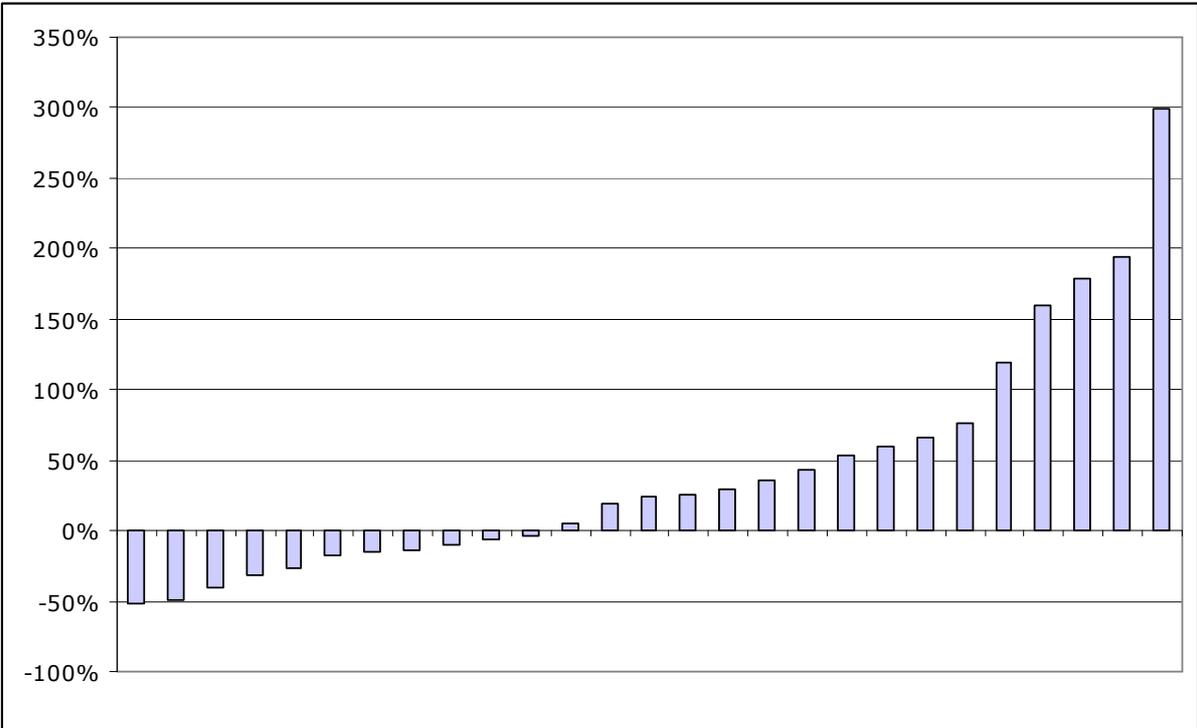


Figure 9: Relative change in capital surplus from Solvency I to QIS4 (all undertakings)



5.2.2 Life

For life insurance undertakings a couple of countries reported relatively stable or slightly increasing solvency ratios as compared to the Solvency I regime. One supervisor mentioned that the reduction for future profit sharing might reduce the SCR significantly for some life undertakings which, in combination with broadly unchanged available own funds, would boost the solvency ratio. Decreasing solvency ratios have been reported by supervisors in three countries.

When comparing capital requirements between Solvency I and QIS4 it is useful to take into account any valuation adjustments on the asset and liabilities side of the balance sheet. Usually the comparison of unadjusted figures would produce a larger change.

Figure 10: Capital requirement QIS4 to capital requirement Solvency I (life undertakings)

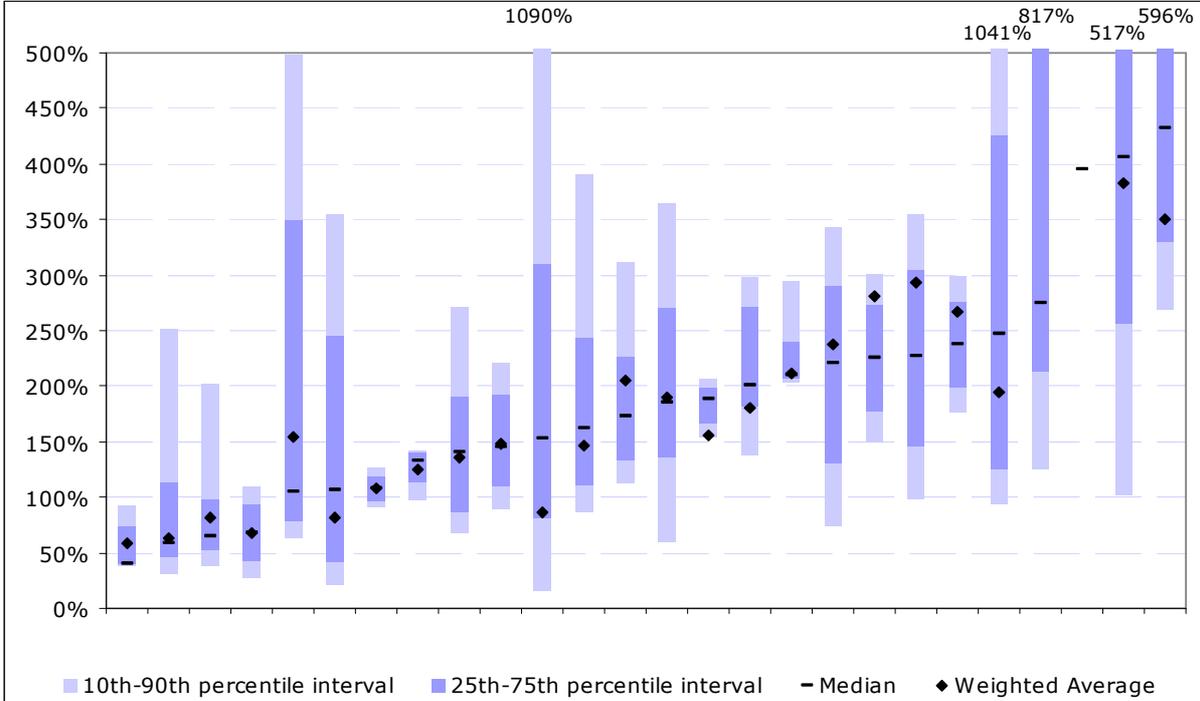
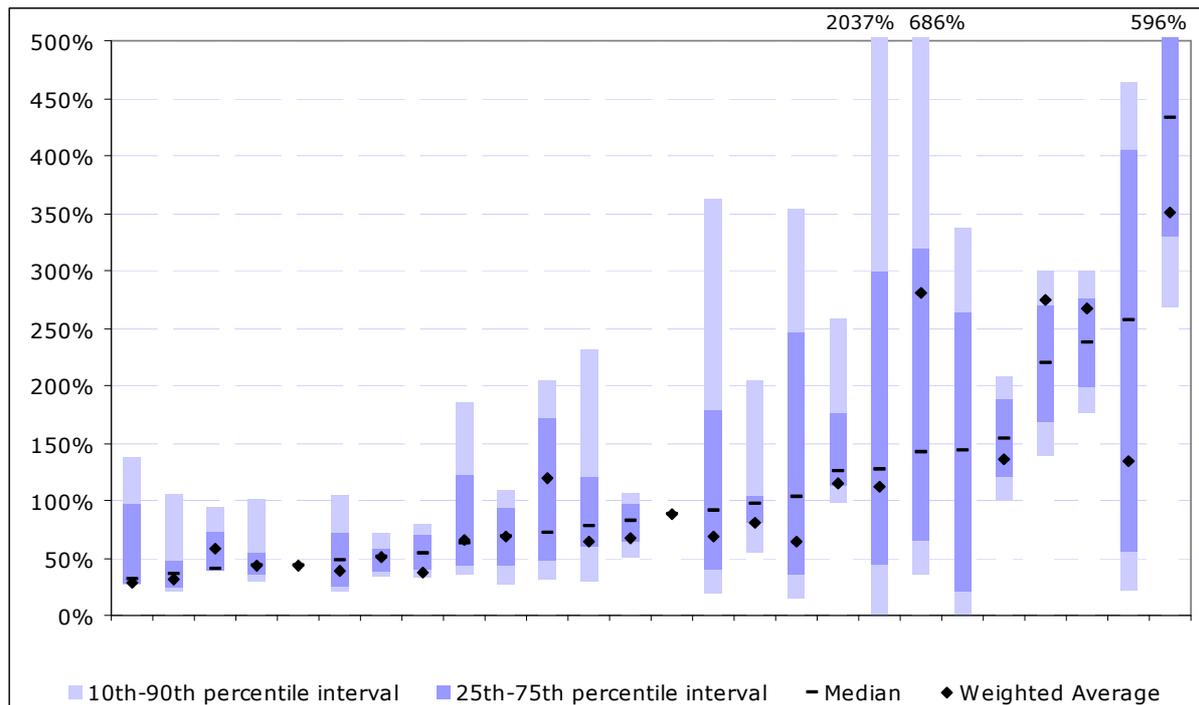


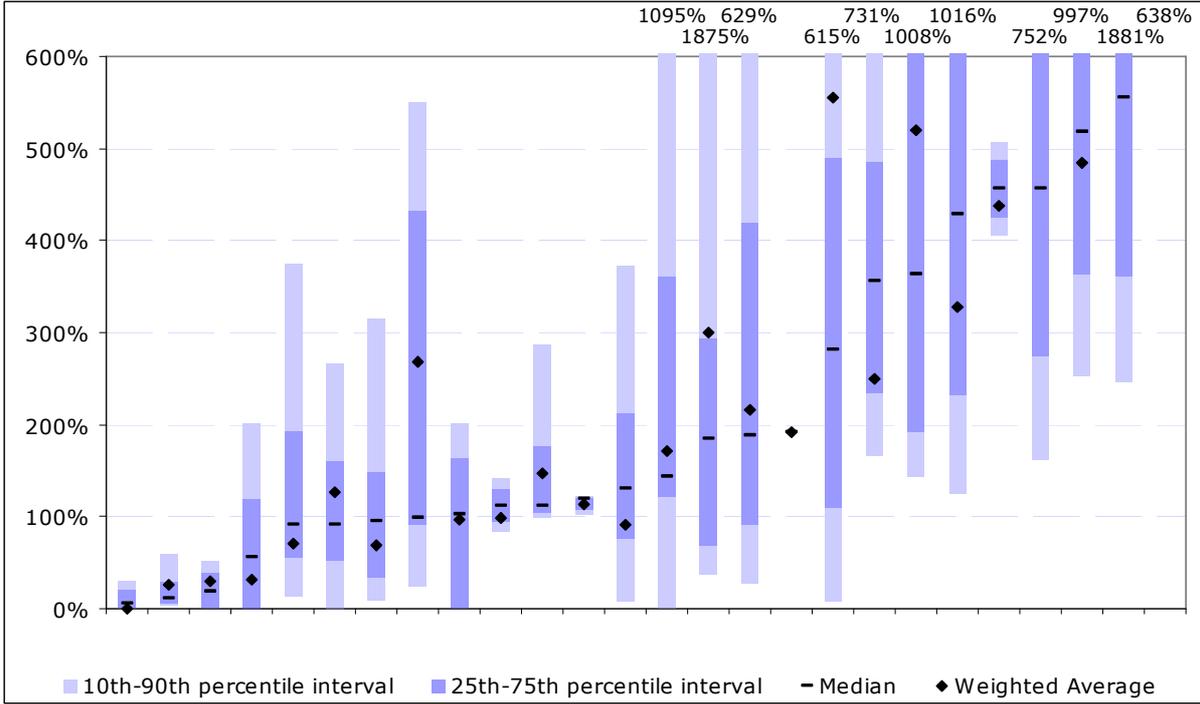
Figure 11: Capital requirement QIS4 to “effective” capital requirement Solvency I (life undertakings)



When comparing the capital surplus (in absolute numbers), even more supervisors observed rising figures. In a few countries a decrease of the capital surplus could be observed for nearly all life undertakings. The variation of results being quite large, however, no definite conclusion can be drawn for some countries.

The aggregate figure for the capital surplus of life undertakings in the sample of participating undertakings decreases by about EUR 40-50 billion (Solvency I: nearly 170 billion – QIS4: roughly 125 billion).

Figure 12: Capital surplus QIS4 to capital surplus Solvency I (life undertakings)



5.2.3 Non-life

While for many life undertakings solvency ratios are rising, the opposite is true for non-life undertakings. Several supervisors reported decreasing solvency ratios, some also observed declining capital surpluses. In another market, both solvency ratios and capital surplus increased.

The aggregated capital surplus of non-life undertakings in the sample of participating undertakings increases by about EUR 10 billion (Solvency I: about 140 billion – QIS4: roughly 150 billion).

Figure 13: Capital requirement QIS4 to “effective” capital requirement Solvency I (non-life undertakings)

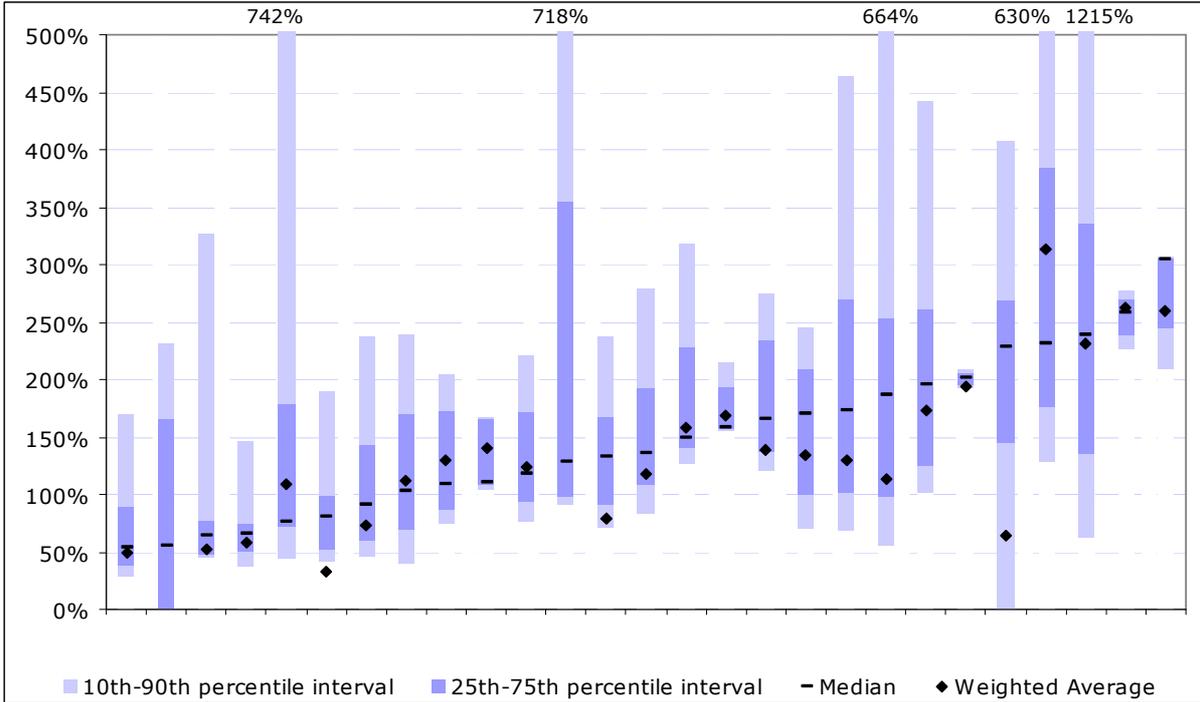
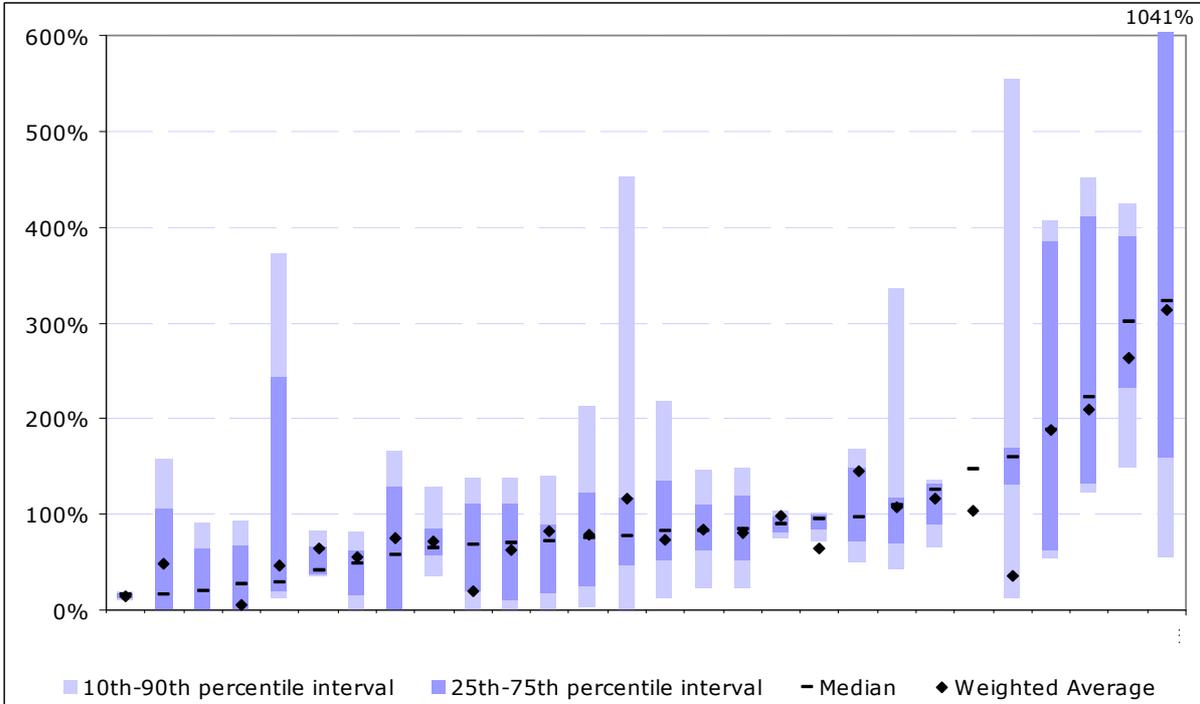


Figure 14: Capital surplus QIS4 to capital surplus Solvency I (non-life undertakings)



5.2.4 Health

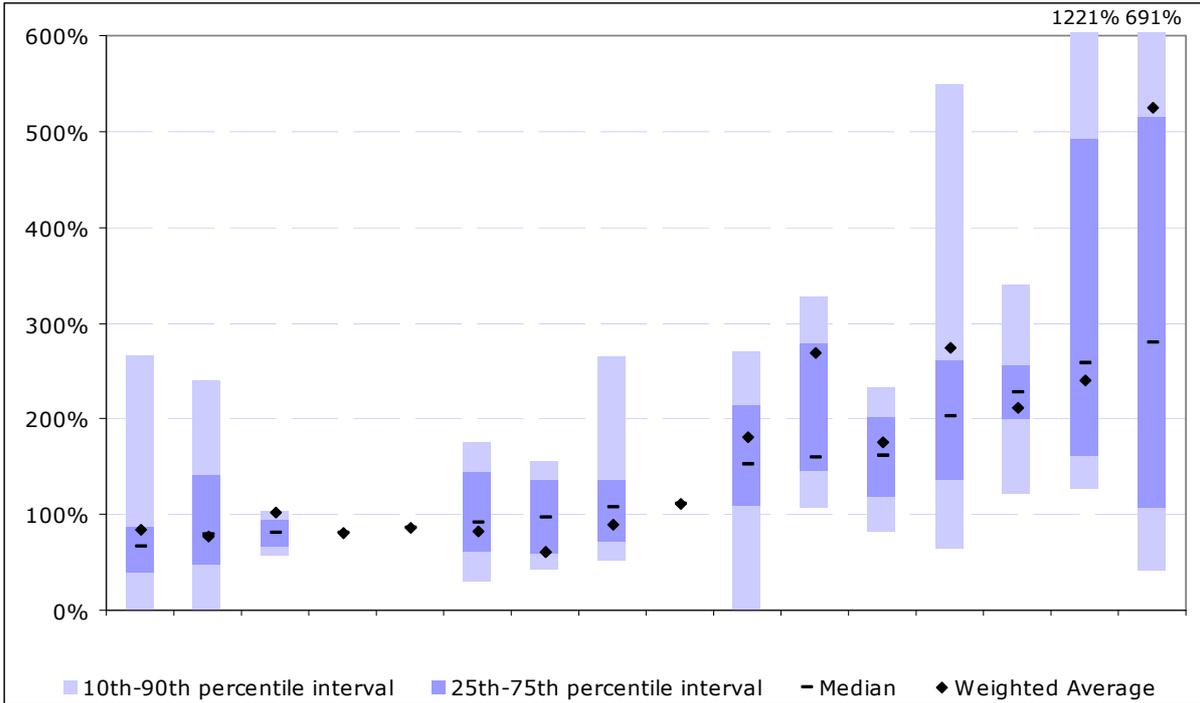
Due to the variety of health insurance schemes, no general conclusions can be drawn. While one supervisor (DE) reported large increases in capital surpluses for health insurance undertakings, in another jurisdiction (NL) a significant number of undertakings would not be able to meet the SCR.

One supervisor (AT) mentioned that the reduction for future profit sharing might reduce the SCR significantly for some health undertakings which offer long-term health insurance.

5.2.5 Composites

With rising solvency ratios for many life undertakings and falling ratios for a number of non-life undertakings, the results for composites are not straightforward to analyse as no clear trend emerges. One supervisor mentioned declining solvency ratios and absolute capital surpluses for composite insurers. Another supervisor observed an increase in both figures.

Figure 15: Capital surplus QIS4 to capital surplus Solvency I (composites)



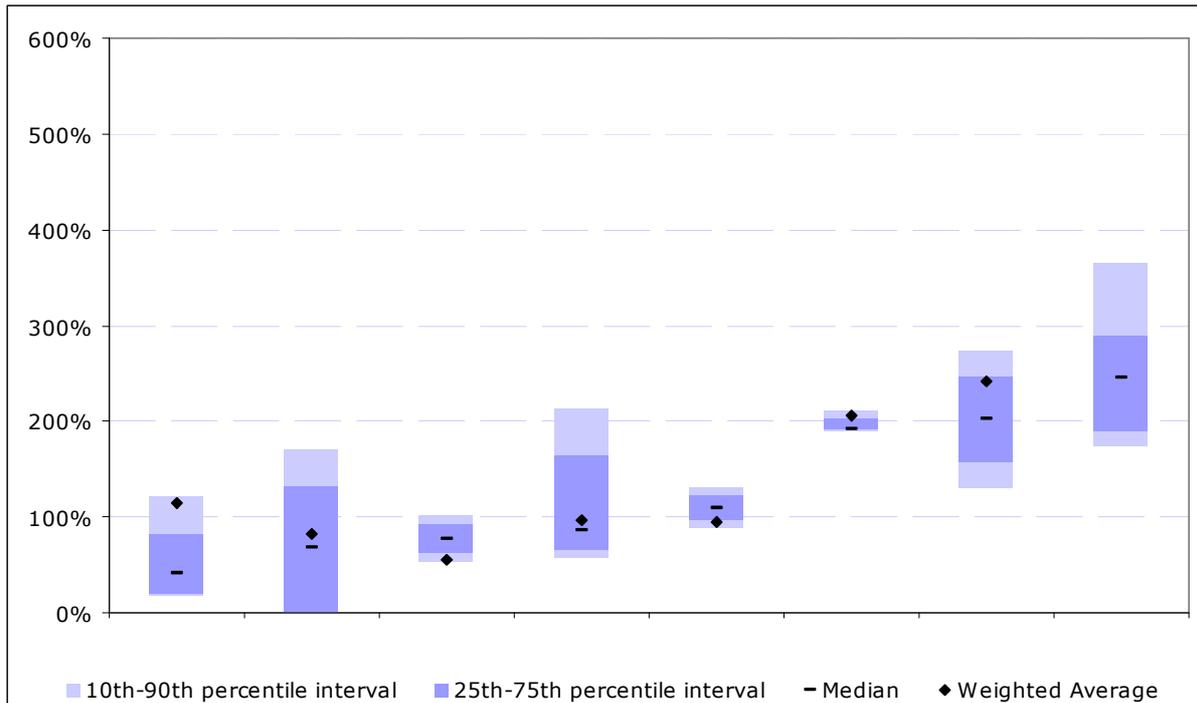
5.2.6 Reinsurers

No general conclusion can be drawn on the overall financial impact of QIS4 on reinsurance undertakings. In one country, the supervisor observed a significant

increase in the capital requirements for reinsurance undertakings. Another supervisor reports both rising solvency ratios.

On average, capital surpluses are increasing or decreasing in comparison to Solvency I in four countries each. Variations in the ratios within and across countries are comparable to those of non-life undertakings.

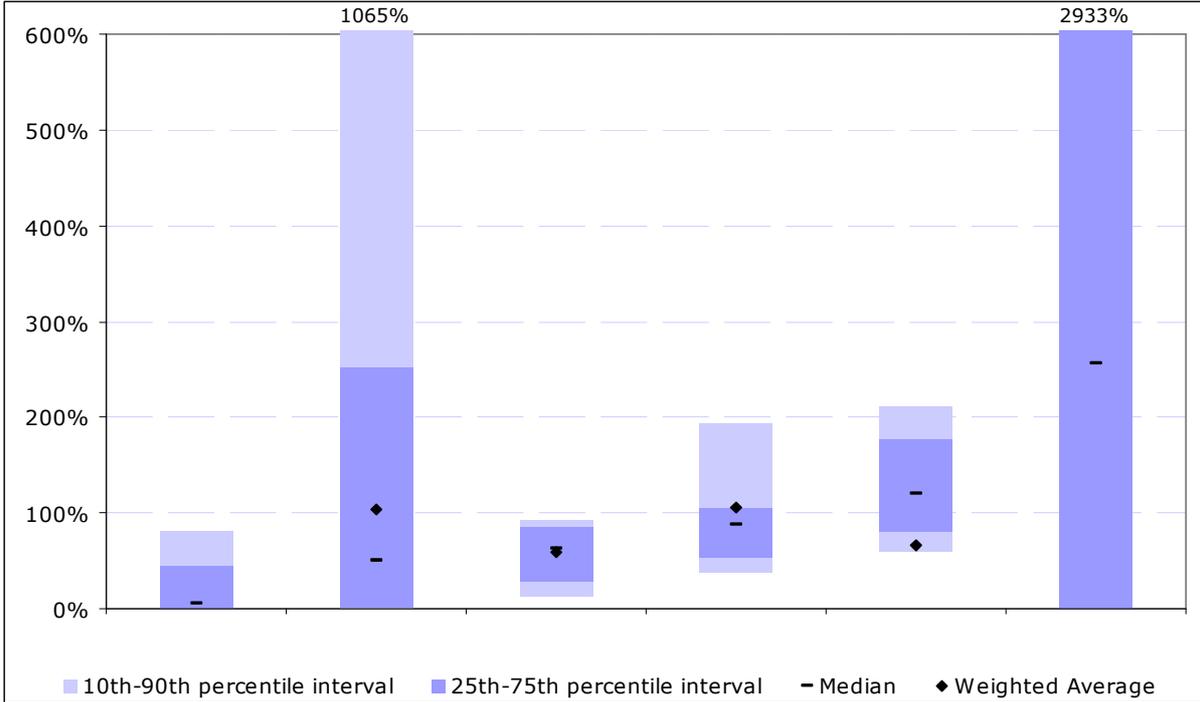
Figure 16: Capital surplus QIS4 to capital surplus Solvency I (reinsurance undertakings)



5.2.7 Captives

In general, solvency ratios are decreasing for captives. According to one supervisor most captives would have sufficient funds if equalisation provisions were considered.

Figure 17: Capital surplus QIS4 to capital surplus Solvency I (captives)



5.3 Impact by category of undertaking

5.3.1 Impact by size

Three supervisors reported that deteriorating solvency ratios could be observed more often for small undertakings than for medium or large ones. One supervisor mentioned a larger decrease in the absolute amount of surpluses for small undertakings; another supervisor reported higher increases in capital surplus for small and medium undertakings than for large undertakings.

5.3.2 Impact by legal structure

Supervisors in three countries reported higher solvency ratios for mutual undertakings than for proprietary undertakings. One of these supervisors however commented that the difference is smaller than in QIS3.

5.3.3 Impact by specialisation

There was little feedback on the overall financial impact of QIS4 on undertakings which are specialised in certain lines of business. According to one supervisor life undertakings writing annuities business were mostly affected by decreasing

solvency ratios. The same was reported by the same supervisor for non-life undertakings writing motor business and for P&I clubs.

5.4 Summary

The tables below summarise the financial impact of the QIS4 specifications on the participating undertakings, presenting the percentages of undertakings which would have to raise additional capital to meet their minimum or solvency capital requirement.

Meeting the MCR is no problem for the vast majority of insurance undertakings. The coverage ratios Tier 1 + Tier 2 Basic Own Funds to the MCR are well above 500% for the median undertaking, irrespective of the business segment; for life undertakings, the ratio tends to be higher than for non-life undertakings (712% and 549% respectively).

Only 1.2% of the undertakings, residing in eight countries, would not meet the MCR, compared to 2% and 3% for the two MCR alternatives in QIS3 – the percentage among life undertakings was observed to be slightly higher. Also small non-life undertakings had a higher chance than large undertakings not to meet the MCR. Most striking, however, is the result for captives: On average, 7.1% would not meet the MCR though results vary significantly in different countries.

Table 13: Percentage of undertakings not meeting the MCR

	Large	Medium	Small	Total
Life insurer	2.4%	0.0%	1.6%	1.1%
Non-Life insurer	0.0%	0.7%	1.2%	0.9%
Composite insurer	0.0%	0.0%	0.0%	0.0%
Reinsurance	0.0%	0.0%	0.0%	0.0%
Captive	n.a.	0.0%	7.1%	7.1%
Total	0.9%	0.4%	1.9%	1.2%

10.9% of undertakings experienced a negative SCR surplus under QIS4 (QIS3: 16%). Non-life undertakings (11.2%) are slightly more prone to having additional capital needs than life undertakings (9.7%). Large undertakings (13.2%) on average showed a higher probability to be in need of additional capital, composite undertakings being an exception. Again, a significant number of captives showed a deficit: 28.3% did not meet the solvency capital requirement.

Table 14: Percentage of undertakings not meeting the SCR

	Large	Medium	Small	Total
Life insurer	16.7%	7.2%	7.9%	9.7%
Non-Life insurer	14.5%	10.3%	11.2%	11.2%
Composite insurer	4.7%	6.3%	5.7%	5.7%
Reinsurance	10.0%	6.7%	0.0%	4.1%
Captive	n.a.	0.0%	28.6%	28.3%
Total	13.2%	8.6%	12.0%	10.9%

About one fifth of participating undertakings saw their surplus decrease by more than 50%; the opposite was true for nearly one third of the undertakings. The remaining 50% of undertakings reported an available surplus which did not deviate more than 50% from their Solvency I surplus. Especially in the life business, significantly higher surpluses were observed in nearly every other undertaking: 43% reported a surplus which is more than 50% higher than under Solvency I while it decreased by the same amount only in 20% of the participating companies. There is a strong variation of outcomes between the markets with respect to these figures: While in 17 countries the number of those undertakings with a more-than-50% increase outweighs the number of undertakings with the opposite effect, 11 countries report more decreases than increases.

Table 15: Percentage of undertakings whose available surplus decreased by more than 50%

	Large	Medium	Small	Total
Life insurer	33.3%	18.0%	14.2%	20.2%
Non-Life insurer	31.3%	26.1%	21.5%	24.5%
Composite insurer	16.3%	10.5%	12.5%	12.3%
Reinsurance	0.0%	0.0%	12.5%	6.1%
Captive	n.a.	100.0%	30.6%	31.3%
Total	27.7%	20.5%	19.9%	21.3%

Table 16: Percentage of undertakings whose available surplus increased by more than 50%

	Large	Medium	Small	Total
Life insurer	32.1%	47.5%	45.7%	43.0%
Non-Life insurer	20.5%	30.1%	18.8%	23.5%
Composite insurer	51.2%	42.1%	22.7%	36.1%
Reinsurance	0.0%	33.3%	25.0%	22.4%
Captive	n.a.	0.0%	31.6%	31.3%
Total	30.0%	37.0%	26.5%	30.9%

6 Valuation of assets and liabilities (other than provisions)

In QIS3 assets and liabilities other than technical provisions were generally required to be valued at “market value” (using in some cases IFRS as a proxy) but only limited guidance was provided to undertakings on how to undertake an economic valuation of their balance sheet items.

QIS4 is based on the EC Solvency II Framework Directive Proposal. Only one article in this Proposal deals explicitly and exclusively with valuation standards, which, because of its importance, is reproduced in full:

Article 74 - Valuation of assets and liabilities

1. Member States shall ensure that, unless otherwise stated, insurance and reinsurance undertakings value assets and liabilities as follows:

(a) assets shall be valued at the amount for which they could be exchanged between knowledgeable willing parties in an arm's length transaction;

(b) liabilities shall be valued at the amount for which they could be transferred, or settled, between knowledgeable willing parties in an arm's length transaction.

When valuing liabilities, no adjustment to take account of the own credit standing of the insurance or reinsurance undertaking shall be made.

2. The Commission shall adopt implementing measures to set out the methods and assumptions to be used in the valuation of assets and liabilities as laid down in paragraph 1. Those measures designed to amend non-essential elements of this Directive, by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 304(3).

Given the postponement of IFRS work on insurance contracts, and the decision of the EC not to postpone Solvency II, the EC has chosen to include the principle of fair value in the Directive Proposal, without however using the term itself, but instead repeating exactly the definition by the IASB. In the explanatory memorandum, the EC states that Article 74 “introduces valuation standards for all assets and liabilities, based upon the current IFRS definition of fair value.”

In Recitals 11, 27 and 28, the EC further explains its approach. Recital 11 stresses the importance of following an economic risk-based approach, with harmonisation through further specific measures; Recital 27 (latest compromise)¹³ states that “solvency requirements should be based on an

¹³ See <http://register.consilium.europa.eu/pdf/en/08/st13/st13370.en08.pdf>

economic valuation of assets and liabilities (economic solvency balance-sheet)” and Recital 28 notes that “Valuation standards for supervisory purposes should be compatible with international accounting developments, to the extent possible”.

CEIOPS has endeavoured to provide more guidance after having received requests for more information on the valuation principles used and on the differences between accounting figures and solvency figures, where relevant.

6.1 Main findings

- **Broad support** for the general design and the methodologies of the proposed approach (market consistent valuation already used for a number of other purposes – i.e. internal model, European Embedded Value, risk management).
- **IFRS** are deemed to be a suitable approximation of the economic valuation and respondents stated a clear need for the Solvency II valuation approach and the international accounting standards (IFRS on Insurance Contracts - Phase II) to develop consistently.
- A large number of undertakings stated that they did **not perceive a major difficulty in the application of the economic valuation principles**. This is especially true for undertakings that either use IFRS or local GAAPs which are based on an economic approach and for medium-large undertakings. Some valuation difficulties were expressed with respect to e.g. deferred taxes, participations, reinsurance recoverables and intra-group transactions. However, a number of undertakings just provided their accounting balance sheets as a proxy for an economic balance sheet hence greater appreciation should be given to the analysis required to produce an economic balance sheet.
- **Quantitative impact:** the differences in the value of assets and liabilities between QIS4 and current balance sheets varied considerably between countries. For those countries currently using approaches other than market values, e.g. historical cost, some significant increases were observed in the balance sheet (especially on the asset side). This increase was partly offset by increases on the liability side (e.g. deferred taxes).
- **Deferred taxes:** their treatment would need to be clarified, as different approaches were applied and IFRS could not be automatically used as a proxy. This has led to an inconsistent treatment of deferred taxes across participants. A clearer framework should be sought in the future to avoid inconsistent treatment between undertakings and Member States.

Moreover, participants encountered practical problems in the valuation of deferred taxes in some markets.

- Undertakings gave mixed views on whether **intangibles** should be taken into account at nil or at their economic value under Solvency II. Most supervisors are of the opinion that intangibles should be valued at nil.
- Need for **further guidance** as regards
 - the methodologies to be applied for some specific balance sheet items (i.e. deferred taxes and reinsurance recoverables);
 - the use of IFRS values and local accounting values as or instead of market values;
 - the different use of mark to market and mark to model approaches.

6.2 Suitability of the design and methodology

Many undertakings expressed their **support for the general design of the valuation approach**. However, the following criticisms were provided:

- some undertakings hold the view that loans and mortgages should be classified as investments;
- some comments concerned the valuation of reinsurance recoverable for which the current value has been used as default;
- it was unclear to some undertakings whether bonds need to be valued using the specified risk-free rates;
- it was noted that some European insurance undertakings are openly criticising these days the IFRS rules and even more the requirement to account for the market value of assets.

Like undertakings, most of the supervisors expressed their **support for the methodologies** and to the general approach proposed in QIS4, namely that Solvency II should be based on an economic valuation of assets and liabilities.

Moreover, **IFRS** are deemed to be a suitable approximation of the economic valuation by many countries, with the main exception of the corridor¹⁴ in IAS 19, openly criticised by one supervisor, who implies that a potentially significant part

¹⁴ IAS 19 permits entities to recognise some changes in the value of plan assets and in the defined benefit obligation in periods after the period in which they occur. Specifically, it permits entities “to leave unrecognised actuarial gains and losses within a ‘corridor’ (the greater of 10 per cent of plan assets and 10 per cent of plan liabilities)”.

of the debt is not presented in the balance sheet. Another supervisor questioned the suitability with regard to the valuation of deferred taxes.

Nevertheless, some supervisors feel that the use of **IFRS as a proxy needs further guidance** (to be accomplished by implementing measures) as regards the methodologies to be applied to specific balance sheet items. In addition, one supervisor felt the need to have a better differentiation between mark to model and mark to market valuation together with guidance on how to apply these principles: this would be very useful especially considering that application might have been different amongst undertakings.

Finally, a number of undertakings as well as some supervisors stressed the need for the **Solvency II** valuation approach and the international accounting developments (**IFRS to develop consistently**).

6.3 Practicability

Regarding practicability of the proposed valuation methodologies, the majority of undertakings reported **no major difficulties in the valuation** of assets and other non-insurance liabilities under the economic valuation principles. This is especially true for undertakings that either use IFRS or local GAAPs which are based on an economic approach; in those cases, undertakings used accounting figures as a proxy: figures were directly taken from the accounting balance sheet, with adjustments in some cases - e.g. for deferred taxes.

Some undertakings reported that they **used accounting figures instead of economic values** (mainly for a few groups of assets and for non-significant amounts). According to some others, the valuation of assets and liabilities was not an easy task to accomplish because local GAAPs are very different from an economic valuation or due to the lack of market data.

In some cases, **where market data were not available** and where accounting figures were deemed not able to reflect the economic value, undertakings used their own **internal model** valuations to derive calculations while in other cases they were obtained from counterparties (i.e. the pricing of structured products and of derivatives).

The following **main difficulties** regarding practicability were underlined:

- Some countries held the view that the **"look-through" approach** was difficult to implement for mutual funds, especially due to the very different kind of instruments held in the fund.
- Some undertakings have raised the issue of using market values when there is **no liquid market** or when the date of the last transaction is not consistent with the date of the valuation.

- Some undertakings commented on the **valuation of non-insurance liabilities using the risk-free rate and not taking into account own credit standing**.¹⁵ The main concern amongst undertakings was that the use of the risk-free rate to value non-insurance liabilities does not reflect the market value of the instrument and is not a market consistent approach. A number of undertakings commented that they disagree with this approach since it generates an arbitrary charge to the undertaking which has no realistic justification. One undertaking believes that a more appropriate method would be to take into account the undertaking's own credit standing on initial valuation in line with current market practice. Other undertakings expressed the view that the use of accounting proxies for the valuation of non-insurance liabilities seems a feasible solution. Other undertakings commented that it is cumbersome to exclude own credit standing from the available market valuation in order to comply with Article 74 of the Directive Proposal.

Some undertakings commented on the valuation of the following **specific balance sheet items**¹⁶:

- **Participations (non-listed assets)**: some undertakings and supervisors considered the valuation of participations as an issue. Some undertakings could not derive a market value for their participations so other methods were used (i.e. cost, equity method). On the contrary, few other undertakings deem the fair value treatment under IAS 39 to be suitable and appropriate for participations. As expected, in many undertakings the economic value of participations heavily exceeds the book value. The question might be whether these values are realistic. In one country, a number of undertakings valued participations by applying a look-through approach to assess the net value of assets less liabilities held by the participation.
- **Reinsurance**: reinsurance recoverables were not always valued at market value. Some undertakings did not know how to value the item and so used the current value or market to model values.

¹⁵ According to the Framework Directive Proposal (Article 74) undertakings are required to evaluate non-insurance liabilities excluding own credit risk. When an undertaking issues a liability, the rate of return associated to this liability includes own credit standing (generally in the form of a spread over the risk-free rate). To require undertakings to exclude it and therefore to use a risk-free rate (which is lower than the rate associated to the liability) means that just after it is issued, the liability gets a higher value (because the undertaking discounts cash-flows at a lower rate) and this penalizes immediately the undertaking.

¹⁶ Regarding Deferred Taxes and Intangibles refer to chapter 6.5.

- **Intra-group transactions:** only very few answers were given concerning intra-group transactions. Undertakings in one country stated that the valuation of intra-group transactions should be at an arms-length basis, but can also be avoided by using the look-through approach as laid out in Option 3 in Annex 1 to the Technical Specifications.
- **Options and investment funds:** some undertakings reported that the valuation of options and investment funds was felt to be rather time consuming.

Even though most companies did not report major difficulties for the valuation of assets and other liabilities, some **supervisors** feel that this topic needs **further guidance**.

Amongst the comments received, in addition to what is already reported above for specific items, some underlined the following areas for further work:

- Further **specification on the use of IFRS values and local accounting values** as or instead of market values should be given. In few countries, indeed, many undertakings did not care about the valuation of other liabilities according to the required criteria but just kept the figures from the national accounts which lead to less comparable results. Moreover, according to some supervisors, it's worth highlighting that while large undertakings had less difficulty in applying the methodologies proposed as they already use a sort of economic valuation for accounting purposes (under IFRSs) as well as for other internal/external reasons, small companies (especially those not belonging to a group) had some difficulties in the application of IFRS and hence a **fully market-consistent valuation was not an easy task to accomplish**.
- A better differentiation between **mark to model** and **mark to market** together with guidance on how to apply these principles is deemed to be very useful as undertakings interpreted these rules very differently.
- To what degree the valuation of assets and other liabilities needs to be **consistent to the risk-free interest rate term structure** used in the calculation of technical provisions; this issue should be clarified.

6.4 Quantitative impact

The following observations have been made by some supervisors:

- on the assets side the valuation of '**Investments**', especially '**Lands and buildings**', is substantially higher as well as the revaluation of '**Common equity capital**' on the liability side. Differences arise, in some cases, regarding intangibles and deferred taxes. For the latter, differences were

significant in many countries but average figures could not be seen as representative given the high variability of the data. According to many supervisors, it seems that '**Reinsurance**' items in the balance sheet were among the most affected by the new valuation approach.

- The **differences** in the value of assets and liabilities between QIS4 and current balance sheet **varied considerably between countries**, depending on the accounting approach that is currently adopted in each country. Indeed, some supervisors affirmed that valuations in the two regimes are virtually identical as most assets and non-insurance liabilities are already marked to market, while for those countries currently using approaches other than market values, e.g. historical cost, some significant increases were observed in the balance sheet (especially on the asset side, i.e. Investments).

6.4.1 Comparison of QIS4 balance sheet figures to current balance sheet – assessment of quantitative results

It is important to emphasise that quantitative results must be analysed carefully, as sometimes significant changes in value of some items of the balance sheet are not the result of a real change in the value of that item, but instead result from its **reclassification** in the QIS4 balance sheet. Moreover, for specific balance sheet items the weighted average of the ratio may not be meaningful due to the high variability of the data. One supervisor added that it was sometimes difficult to do a consistency check because of the use of IFRS accounting, sub-consolidation of subsidiaries or a change in the scope of the portfolio.

The assessment of the result proves that the proposed methods for the valuation of assets and other liabilities have a considerable impact for some categories of assets and for some liabilities. The impact seems to be particularly high for some jurisdictions and low for others depending on the valuation principles used under the current balance sheet/Solvency I regime, as already reported.

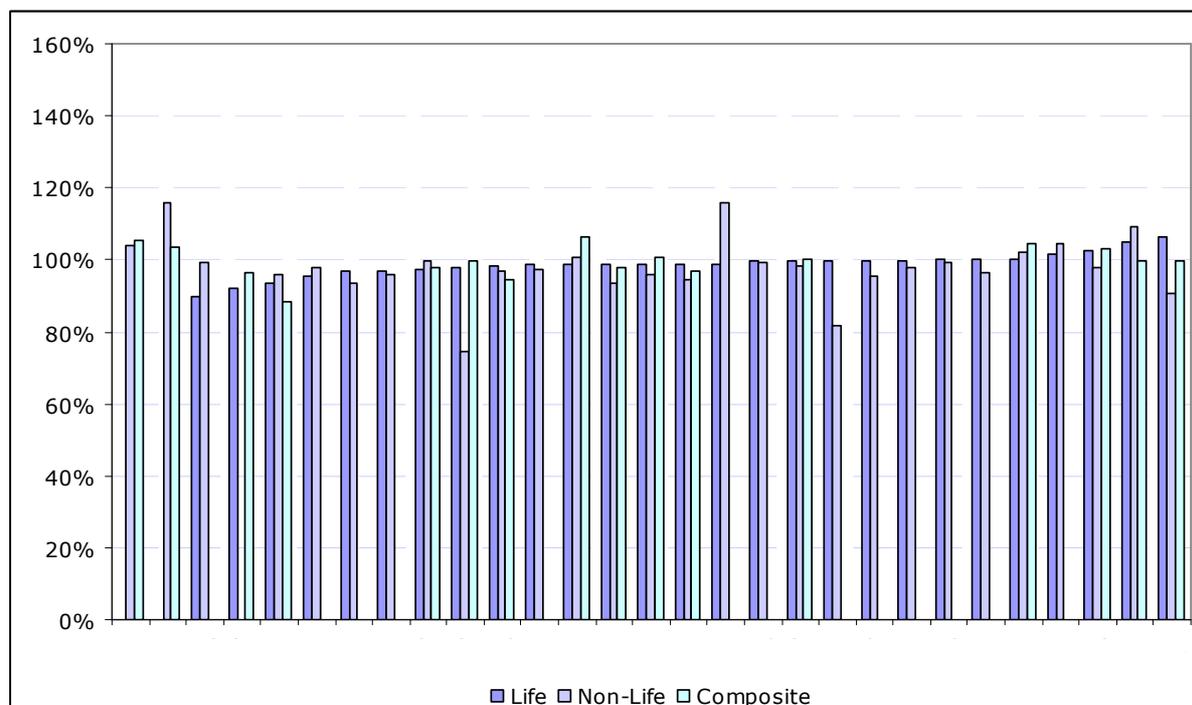
On average, the valuation of **QIS4 balance sheet total assets slightly increased compared to the current valuation**¹⁷ in 10 countries (the ratio ranges from 100% to 105%); these countries represent the majority (more than 1,000) of the undertakings. In one country the ratio is around 120%. Moreover, for the majority of the countries (representing only 25% of the undertakings) the ratio is below 100%.

Conversely, the ratio of **Solvency I balance sheet assets to current valuation** is below 100% for most of the countries (21 out of 27) representing

¹⁷ Ratio: (value of QIS4 balance sheet assets) divided by (value of Current balance sheet assets).

the majority of undertakings, even though the assessment of the results shows that, except for some countries and for Intangibles (completely deducted from the available solvency margin under Solvency I), Solvency I rules had less impact on the current balance sheet than the QIS4 valuation principles.

Figure 18: Total assets - Ratio of QIS4 balance sheet to current valuation



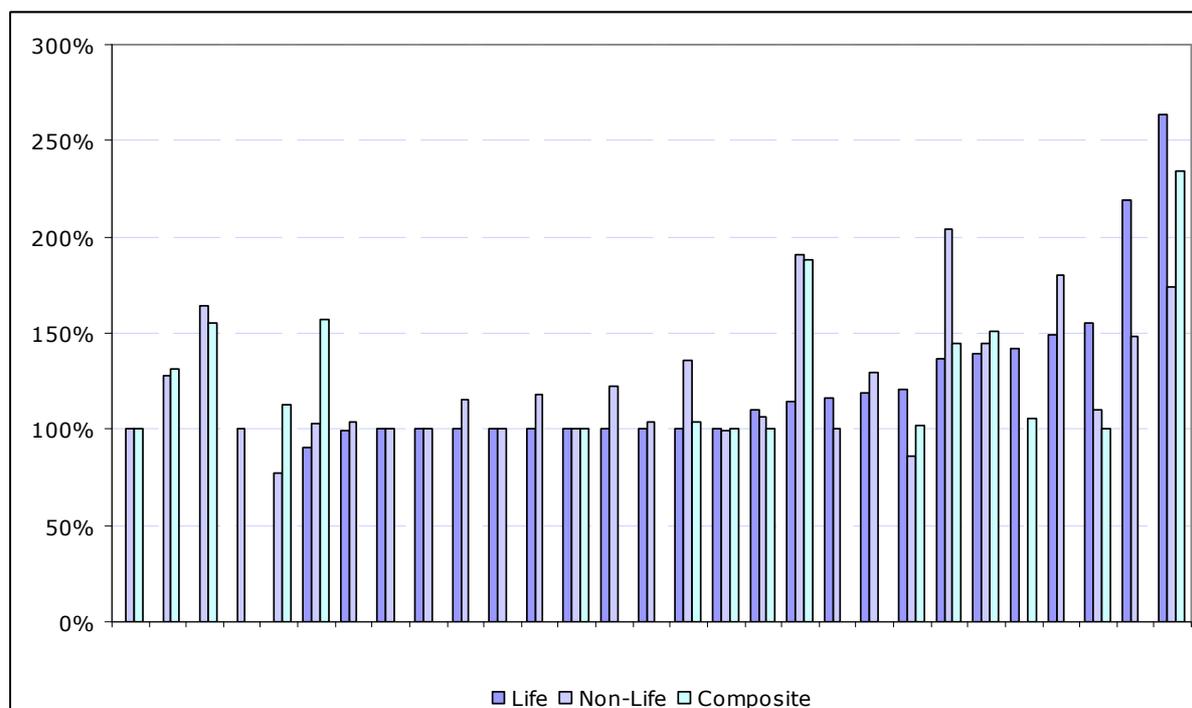
a) Assets that show an average **increase** in value:

Investments – around 85% of the undertakings with available data (18 out of 27 countries) show an increase in the ratio; the range is from 100% to 138% (the related variability seems to be at an adequate level in order to consider results to be meaningful). In line with the expectations, one of the reasons of this outcome might be that in many countries Investments are currently accounted for at their book value whereas they were valued according to their economic value under QIS4. Regarding the different components of this item, Lands and buildings recorded an increase in almost all undertakings' balance sheets (in 22 out of 24 countries, representing 99% of the respondents, with an average ratio ranging from 100.4% to 166%). The same outcome applies to Equities (on average, the ratio ranges from 100% to 146.5%) and to Bonds (on average, the ratio ranges from 100.6% to 107.9%).

Deferred tax assets – due to the high variability of the results, it is difficult to value precisely what the real impact of deferred tax is on the balance sheet. Results show a large increase for some countries and a large decrease for others. These highly variable outcomes are in line with comments received by

undertakings and supervisors, which highlight the existing differences amongst the approaches and methods used by undertakings to value this item (see chapter 6.5.2).

Figure 19: Lands and buildings – Ratio of QIS4 balance sheet to current valuation



*b) Assets that either remain broadly **unchanged** in value or that show **variable results among undertakings**:*

Deposits related to reinsurance – for 16 countries out of 28 the value of this item remains broadly the same; it increases in 3 countries and decreases in 4 (the remaining countries reported a zero value)

Unit linked investments - the ratio ranges from 93.6% to 100%

Cash and bank deposits - the ratio ranges from 97.8% to 116.2%, with two outliers: 138% and 75.2%

Intra group transactions - the ratio ranges from 98% to 100% for almost all countries. There are some major exceptions: a strong decrease in one country (by 98%) and an increase in other three countries.

Investments in affiliated and participating interests - this item decreases in value for the majority of countries (13 out of 24) considering all business segments. Taking into account the undertakings represented by these countries, results might look the opposite, so that a clear picture cannot be drawn for this balance sheet item.

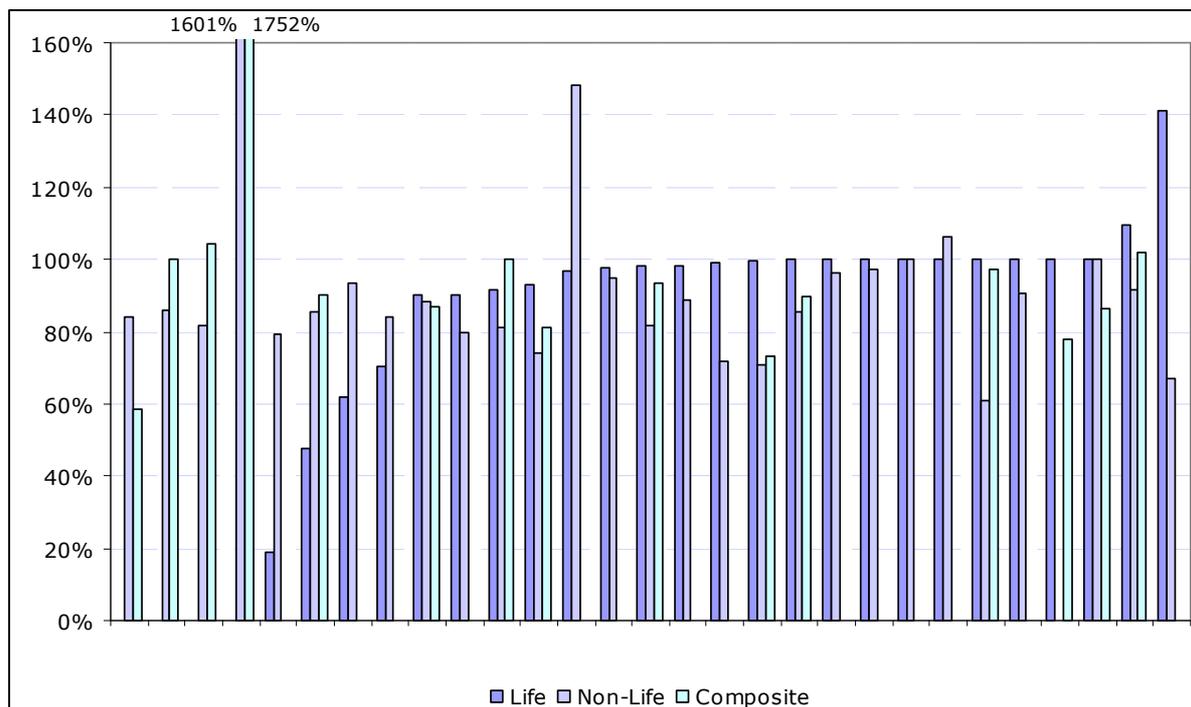
Loans and mortgages - for 21 countries out of 28 the value of this item is more or less unchanged; a sharp increase (linked to a high level of variability) has been recorded by two countries.

Called up but unpaid common equity capital: only 8 out of 29 countries have this item in their balance sheet, for 5 of them (representing 25 undertakings) the asset remains the same in value (on average), 2 of them recorded a decrease (45 respondents) and for only one of them (2 respondents) there has been an increase.

*c) Assets that show an average **decrease** in value:*

Mutual funds (as part of the Investment category): taking into account all business segments, this item shows a decrease under QIS4 valuation in countries representing 61% of the sample.

Reinsurance – overall, considering all countries, for the vast majority of undertakings (25 countries representing around 1,000 undertakings) the QIS4 balance sheet reinsurance decreases compared to current valuation. The weighted average ranges from 47.3% to 97.8% with very high variability among the results. The drop is more significant in Non-Life business. High level of variability is especially true for countries which recorded an increase in value (only three out of 27). For one of them, which recorded a sharp increase of more than 5,000%, the rationale is that reinsurance is not generally recognised as an asset under current accounting rules (it is mostly netted against related technical provisions).

Figure 20: Reinsurance recoverables – Ratio of QIS4 balance sheet to current valuation

Regarding the **liability side**, the largest increase in value was recorded for the items Called up or paid up common equity capital and reserves and for Deferred tax liabilities. The ratios considerably increase in almost all countries.

a) *Liabilities that show an average **increase** in value:*

Called up or paid up common equity capital and reserves (the ratio ranges from 103% to 408% - only in one country the ratio is 93.4%);

Deferred tax liabilities, for which the ratio increases considerably for almost all countries except for three (it is worth underlining that standard deviations are significant as well).

b) *Liabilities that either remain broadly **unchanged** in value or that show **variable results among undertakings***

Subordinated liabilities/hybrid capital are mainly unaffected by the new valuation rules except for two countries (limits of the weighted average values are 16.7% and 148.9%). One of the reasons for this might be that the Solvency II approach, whereby no adjustment is made for own credit standing, has not been followed in the vast number of cases.

Other liabilities (e.g. loan stock): in 16 countries out of 24 the value is almost unchanged; in the remaining countries the ratio is highly variable, 37.3% being the lower limit and 182% the upper one.

Deposits from reinsurers: this item remains broadly the same in value with the exception of 4 countries which show a large decrease.

Intra group transactions are unchanged; countries that show either a significant increase or decrease also have high standard deviation.

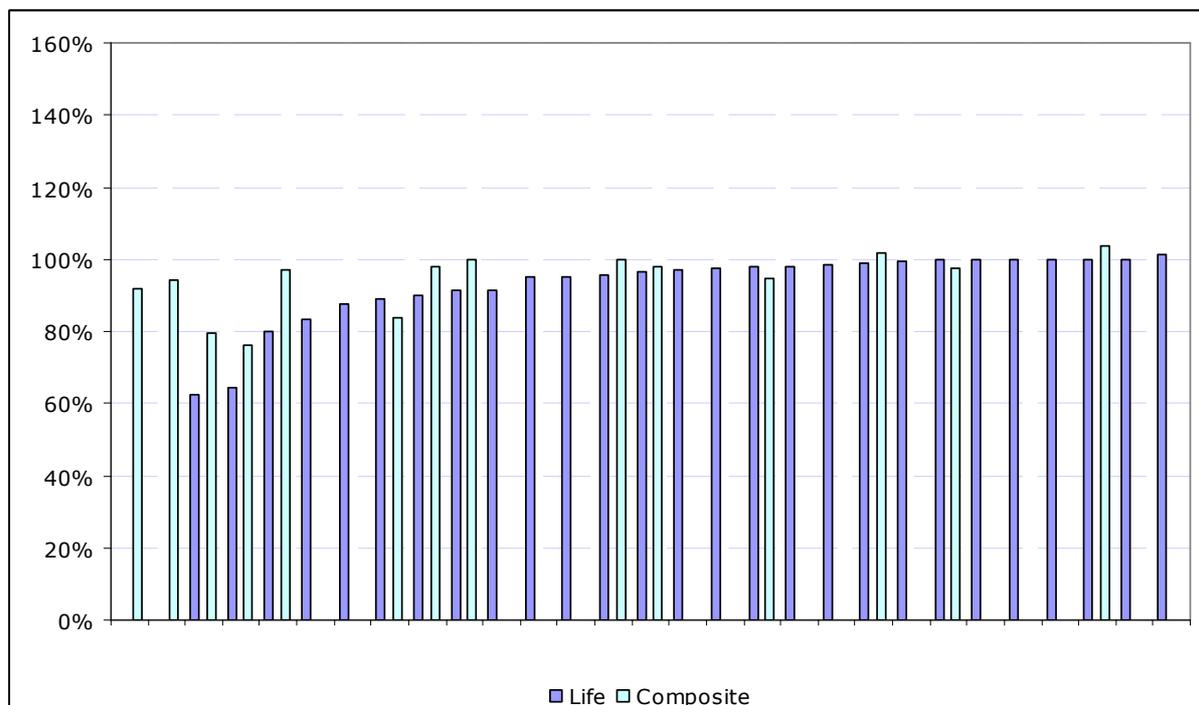
Employee benefits: out of 27 respondents, in 10 countries the ratio increases (ranging from 102 to 216%), while in 9 countries it falls (lower and upper limits are: 39.3% and 99.7%)

Other liabilities seem less affected with the exception of 5 countries whose results show high variability as well.

*c) Liabilities that show an average **decrease** in value:*

Unit linked liabilities show a fall in almost all countries (22 out of 29 ranging from 64.4% to 99.6%)

Figure 21: Unit-linked liabilities – Ratio of QIS4 balance sheet to current valuation



6.5 Highlighted issues: Intangibles and deferred taxes

6.5.1 Intangibles

Many undertakings did not provide any feedback on intangible assets or simply stated that they valued intangibles at nil.

Amongst respondents, some reported goodwill on acquisition and other specific software. Only in a few cases did they clearly explain how these figures were derived: mainly IFRS valuation (cost model) for goodwill on acquisition and IFRS or accounting values for software and IT development cost were mentioned.

Views on how to treat intangible assets are mixed: a certain number of countries (some undertakings, in some cases supported by the supervisor) believes that intangibles should be taken into account at their economic value, different from zero. On this topic, some countries asked for more clarifications on certain types of investments (e.g. intangible assets such as computer software).

It is important to note that **quantitative analysis** on Intangibles only refers to undertakings which assigned them an economic value. From the quantitative figures provided by the undertakings, it is difficult to draw clear conclusions.

Goodwill related to participations: few data were provided by respondents on this balance sheet item; the ratio of QIS4 balance sheet value to current balance sheet is below 1, except for one country whose ratio shows a sharp increase.

Goodwill related to business: the same conclusions are valid for this item; moreover, among undertakings that provided data there is a high variability of results.

Other: most of the data related to intangibles fall under this category; along the lines of the previous categories, ratios are generally below zero and standard deviations are particularly high.

6.5.2 Deferred taxes

Both QIS4 undertakings and supervisors share the view that the **valuation of deferred taxes was one of the main issues** for many participants. The definition of deferred taxes in the Technical Specifications and how to calculate the related effects were considered to be unclear. Hence they asked for more clarifications as well as for precise and consistent specifications.

Indeed, many supervisors (and some undertakings as well) expressed their concerns on the **lack of the harmonisation**: actually, deferred taxation effects may have a different as well as significant impact depending on the suggested approach to be followed to treat them. Therefore, they stress that a clearer

framework should be sought in the future to **avoid inconsistent treatment between undertakings and countries**.

Moreover, in reviewing the QIS4 spreadsheet submissions there seemed to be a **wide range of views** that had been reflected in the variety of approaches used for the accounting of deferred tax in one country: many undertakings used a full economic approach, namely they took into account the effects of deferred taxation on both the asset and liability side.

Others valued the deferred tax effect only on the asset side. Some supervisors (without expressing their views) underline that those two different approaches to taxation led to data which are not entirely comparable: some undertakings calculated deferred tax effects only on the asset side, others on both sides; some of them used a pre-tax approach while others included non-adjusted accounting figures. Consequently, supervisors expressed their concern that the results might not be completely consistent and comparable.

Some undertakings reported that they were not able to determine the value of deferred taxes although it is likely to be a material item in their balance sheet and respondents who did calculate them differently stated:

- A lot of undertakings valued their deferred taxes on the balance sheet to an amount equivalent to the tax rate multiplied by their SCR (just what could be absorbed through the risk mitigating impacts);
- As a proxy, some undertakings used a simplification based on the tax rate applied to the difference in the balance sheet between current valuation and QIS4 valuation;
- Others used cash-flow projections to assess the mean likely discounted value of their taxes out-flows or EEV calculations;
- Some undertakings affirmed that they had applied a total balance sheet approach;
- Other undertakings used IFRS as a proxy or did not take into account the taxation adjustments at all.

6.6 Source of QIS4 figures and their use for other purposes

Not very detailed comments were received on this issue. However, several respondents mentioned that they had either fully or mostly used numbers derived from general purpose accounting - **IFRS or local GAAP (market value based)** - as a proxy for their solvency balance sheet for the QIS4 submission with minor adjustments.

Regarding the use of **accounting figures not regarded as economic values** many undertakings were silent on this question or provided only few comments. Few countries mentioned the use of pure accounting figures in the absence of economic values.

In general, it seems a common practice that respondents used **economic valuation for most assets and liabilities**. Nevertheless, when accounting principles are based on IFRS these were used for some balance sheet items as an acceptable proxy, in line with the guidance in TS.III.A-B. Other undertakings used accounting figures deemed to be close to market values or adjusted accounting figures in accordance with IFRS rules/economic values where differences were relevant.

Regarding the **adjustments made by undertakings to the accounting figures**, most of the undertakings did not provide feedback on this issue. Other countries report only immaterial or even no adjustments at all made by undertakings to the accounting figures.

A small number of undertakings explicitly mentioned the use of the same valuation as for local general accounting purposes for some items (e.g. **deposits** of reinsurance (account payables), '**other liabilities**') or the need to adjust **deferred taxes** for the purpose of QIS4. As no further information was provided on the difference between the economic value and the accounting figure this impact cannot be quantified.

Only a few undertakings stated explicitly that the differences between accounting figures and economic values are very significant; others underlined that demonstrating that the difference between the accounting values and the economic values is not significant was a complicated task.

Regarding specific items, it seemed **difficult to set a pure economic value for items like reinsurance assets, short-term receivables and payables and inter company loans**.

A source of concern might exist with those undertakings which did not review the value of other liabilities (but just kept the figures from national accounts, which in some cases cannot be regarded as economic value), some of them due to the lack of internal models able to assess the differences between accounting values and economic values where market data are not available.

More guidance is probably needed for those (mostly smaller) undertakings also to ensure that they undertake economic valuation of assets and liabilities as far as possible. Difficulties emerged on the use of IFRS values and local accounting values as or instead of market values, hence further specification should be given on this topic.

In the light of the answers received, in order to derive QIS4 figures, besides accounting figures, the **following methods** were mentioned:

- Internal or vendor model/software were used in order to perform scenario calculations as well as the use of replicating portfolios for some assets
- Some mentioned the use of external expert opinion or experience.

Many undertakings from various countries reported that the same figures are also used for **other purposes** such as:

- Internal model calculations
- European Embedded Value (MCEV/EC)
- Risk management (and ALM)
- Notes to the annual account/report
- Pricing and product developments
- Other valuation bases.

Undertakings in some countries also gave examples of figures differing from those used for general purpose accounting (i.e. adjustments for employee benefit, deferred taxes).

Many supervisors expressed no views on this issue. Among the few comments received, it is worth highlighting the following:

- According to one supervisor when QIS4 figures stem from the accounting figures or when they are also used for other internal/external purposes this improves the reliability as well as the accuracy of the data.
- Another supervisor expressed the view that reporting in QIS4 is more transparent than in general purpose accounting due to the grossing up concept, as applied to the compulsory health insurance.

6.7 Mark to market vs. mark to model valuation

The answers concerning the **nature of assets and liabilities** were widely diversified. Some give details down to each balance sheet item, others show aggregations on a high level only. Hence, according to the answers received, there is no strict dividing line to draw between items that were mainly marked to market and items that were mainly marked to model.

The answers indicate that the use of 'mark to market' or 'mark to model' strongly depends on the existence of readily available market prices stemming from a liquid or active market. If prices are readily available then **most of the assets** are '**marked to market**'. When prices are not available from an active market a model is used based on available and observable market data (this was particularly the case with structured assets).

The use of '**mark to model**' seems to be predominant on the **liability side**.

The answers seem to be in line either with the fair value hierarchy of IAS 39 or the hierarchy established in TS.I.A.2 respectively.

Concerning the **value of each category of assets and liabilities** that were '**marked to model**' the narrative answers were very limited. Some conclusions can be drawn by the quantitative figures provided by the undertakings. As far as the asset side is concerned, **reinsurance** is the item that was mostly marked to model (by around 60% of the respondents) while the remaining asset categories were marked to market (only a minor part of the other asset components was marked to model, corresponding to less than 20% of the respondents); on the liability side, marking to model was used for deferred taxes and employee benefits: more than half of the respondents affirmed that they almost fully marked these items to market.

The **characteristics of the model** used and the **nature of input used** when '**marking to model**' were provided in nearly half of the answers. The respondents mentioned e.g. "discounted the future best estimate cash flows", "modelled by cash flows" or "input values were observed on the market or provided by well-know data vendors", "Reuters, Bloomberg", "correlation determined through historical data".

However many undertakings were silent on this question or provided information on such a general level that it could not be considered useful.

Concerning the **difference between economic values obtained and accounting figures** the answers were very limited, most of the undertakings did not provide any data on this issue. Only one undertaking **quantified** the difference in aggregate for three categories of assets and liabilities.

From the analysis of the data received, the following differences were mentioned:

- differences resulting from deferred acquisition costs,
- differences due to **hidden reserves**,
- differences resulting from the use of **different interest rates for discounting** cash flows for accounting purposes and QIS4 purposes or the use of different assumptions when projecting cash flows,
- differences stemming from **holdings in subsidiaries** that own property, and subsidiaries that are insurance companies as well as other types of subsidiaries,
- the valuation of intangibles or bond portfolios 'held-to-maturity' (including deferred taxes) creates a difference between economic values obtained and accounting figures.

Answering the question on the **nature of assets and liabilities** for which 'mark to market' or 'mark to model' respectively was used, some supervisors confirm that 'mark to market' is the predominant valuation method for the asset side, followed by the use of internal models.

One supervisor expressed the concerns that undertakings might have underestimated the amount of assets that were 'marked to model' compared to assets that were 'marked to market'.

For the **liabilities side** few supervisors confirm 'mark to model' to be the predominant valuation method.

Very few supervisors elaborated on the question concerning the **value of each category of assets and liabilities** that was 'marked to model' quantifying the use of 'mark to market' or 'mark to model' respectively for different categories of assets and liabilities as percentage of total assets.

Only one supervisor expressed its concerns regarding the limited information provided by the undertakings on the **characteristics of the models** used and the **nature of input** used when 'marking to model'; greater elaboration on this point would be very welcomed from its viewpoint.

Two supervisors expressed their view that a better differentiation between the valuation 'mark to market' and 'mark to model' would enhance the use for the undertakings. **Detailed guidance on how to apply the principles** was suggested. This was also emphasised for the use of 'mark to model' for **illiquid markets** or under the circumstances that no reliable input data for the model are available.

6.8 Application of IFRS for Solvency II purposes – issues and suggestions

Many countries did not report on any particular problem areas or mentioned only immaterial problems. It seems undertakings did not encounter any material problems or were satisfied with the approach chosen. Another reason might be that undertakings simply applied IFRS as a proxy for the economic valuation of their balance sheet items.

Amongst the comments received from undertakings that applied IFRS for QIS4 purposes, the following **issues** were raised:

- some countries questioned the economic value basis for **employee benefits** or **deferred taxes** if based on IFRS as a proxy;

- some others stated that problems were faced concerning the '**look-through principle**' in some cases and the valuation of certain unlisted or structured assets (e.g. inflation-linked bonds);
- the application of IFRS valuation increases the **volatility of the portfolio** which does not reflect the long-term perspective of the life insurance business.

The following suggestions concerning areas for further work on the use of IFRS were provided by some countries:

- many undertakings from various countries recommended that an **alignment between Solvency II and IFRS on Insurance Contracts - Phase II** should be aimed for. Harmonisation is especially necessary as regards the definition of an insurance contract. Differences between the two regimes are accepted by the undertakings insofar as differences are justified by different underlying principles for general purpose accounting and regulatory accounting. Furthermore cost-benefit constraints need to be taken under consideration by CEIOPS in order to ease the administrative burden on the undertakings' side.
- Undertakings in one country expressed their interest in the application of the '**held-to-maturity**' category under IAS 39 also for Solvency II purposes.
- It is a predominant view on the undertaking's side that the **use of 'mark to model'** (for IFRS purposes) needs to be discussed in detail before using this valuation model for solvency purposes. Especially guidance on when and how to use 'mark to model' was strongly requested by undertakings.
- Furthermore, some undertakings underlined that they would welcome a **market consistent valuation for regulatory purposes** as this is already the basis for the internal risk management purposes.
- Two supervisors expressed their view on the need to provide **more guidance on the valuation principles under IFRS** for those (mostly smaller) undertakings that are not using IFRS as general accounting regime.

7 Technical provisions

7.1 Main findings

Design of the valuation method for technical provisions

In general, undertakings and supervisors support the **design** of the proposed method for calculation of technical provisions, including the proposed simplifications and proxies. Many supervisors reported considerable consistency in the valuation approach used. However some supervisors reported that a wide variety of methods was used by undertakings with no evidence of convergence and that there was also some doubt as to whether the Technical Specifications have been applied consistently across countries.

The difficulties encountered with the valuation of the insurance liabilities could be summarised as difficulties encountered as a result of **data requirement**, difficulties relevant for **small and medium sized undertakings** and difficulties related to the methodology prescribed in the QIS4 Technical Specifications.

Segmentation of data according to the QIS4 specification proved difficult for undertakings where, as was often the case, segmentation was not consistent with their current reporting. Undertakings had difficulties in splitting the data by lines of business as proposed in QIS4. A number of participants commented that the required two-dimensional segmentation of their business into both LoBs and geographical locations was not practical for them, and would lead to individual segments that would be too small for an appropriate actuarial analysis. Segmentation of data by both line of business and geographic area was considered unduly onerous.

Many undertakings have also commented that the prescribed methodology for calculating the best estimate is **data intensive** and that this has caused problems for many insurance undertakings. Especially small and medium sized undertakings reported that they would not have appropriate data and resources to carry out a stochastic valuation of the value of their liabilities. Undertakings in some countries believe that a deterministic approach should be an acceptable alternative for determining the best estimate liability.

Practical difficulties encountered for the QIS4 valuation of technical provisions relate to insufficient guidance on the inclusion of **future premiums**. A number of undertakings in different jurisdictions mentioned that the definition of future premiums was unclear, and in particular the distinction between future premiums in respect of existing business and new business. Supervisors are often concerned that future premiums were not treated consistently across their

market in QIS4, each undertaking having performed its own interpretation of the criteria for inclusion of future premiums in the Technical Specifications.

There was some diversity of opinion on the calculation of **future discretionary benefits**. Further difficulties have arisen concerning the valuation of **options and guarantees**, the calculation of **net technical provisions** and the uncertainty regarding the weight to place on **future large claims**.

In addition, many undertakings found the specifications for calculating the **risk margin** complex and hard to follow. This resulted mainly from the difficulty involved in accurately projecting the SCR. Some undertakings also felt that the segmentation of business within the risk margin was inappropriate and added considerably to the complexity of the calculation. Most undertakings commented that diversification between lines of business, between risk types, and between geographies and legal entities should be taken into account with some stating that from an economic point of view it is more correct to value the liabilities based on the undertaking's own portfolio. A number of questions were also raised regarding the appropriateness of the 6% cost of capital rate

The consistency of technical provisions could be improved by providing more precise guidance on the above issues.

Simplifications and proxies

The simplifications and proxies proposed in the specifications were generally **welcomed** by participants and supervisors. However, the extent to which simplifications and proxy techniques were applied in the valuation of technical provisions differed between markets, as well as between the individual components of the valuation.

Comparison with Solvency I technical provisions

In general the value of technical provisions calculated for QIS4 was lower than the current value of technical provisions. For life insurance business this is mainly because of the use of a higher discount rate, the absence of any zero floor, the recognition of expected profits on future premiums and charges, and the use of realistic assumptions (no implicit prudence margin, which is partly offset by the inclusion of an explicit risk margin in addition to the best estimate) in the best estimate calculation. In addition many life insurers encountered negative mathematical provisions, especially when future premium have been included, and surrender values which were greater than the mathematical provisions. Unit-linked products were mostly defined as hedgeable obligations. In the valuation of QIS4 liabilities the management actions and policyholder's behaviour, such as lapses, renewals and surrenders, was taken into account.

For non-life insurance business this is caused by discounting of future cash-flows, the exclusion of equalisation and natural catastrophes reserves from the technical provisions, and excluding implicit safety margin included in technical provisions through prudent and cautions assumptions offset by the inclusion of an explicit risk margin. There were also some country specific reasons where local GAAP does not allow reinsurance to be taken into account in the calculation of the incurred but not reported claims provisions and where expected reimbursement were not allowed.

7.2 Methodologies adopted

7.2.1 Life insurance

The approach adopted by life undertakings was generally **more consistent** across countries than in QIS3. For most lines of business, technical provisions were calculated by most undertakings using a deterministic projection of best estimate future cash flows. Calculations were done on a policy by policy basis and best estimate assumptions were derived based on analysis of past experience.

Best estimate cash flows were generally discounted using the interest rate curves supplied by CEIOPS. However some undertakings in one country used the curve provided by the national actuarial association derived from the government bonds zero-coupons yield curve. The rationale for this choice is often that the zero-coupons curve better fits the economic scenario generators that were already in place in the undertakings. Others explained that there was some inconsistency in using marked-to-market valuations of bonds (in their view better explained by government bonds interest rates) and discounting future cash-flows with swap rates.

For lines of business which included embedded options and guarantees, stochastic techniques were generally used with a model points approach. However, undertakings in some countries used closed form solutions in order to value options and guarantees.

A number of supervisors noted that undertakings had adopted an approach which was consistent with their market consistent embedded value (MCEV) calculations.

For unit-linked business, different approaches have been observed:

- technical provisions were set equal to the unit fund (i.e. applying a surrender value floor);
- or the unit fund less present value of future profits emerging from unit-linked business.

One supervisor observed that the risk margin has not been always calculated on unit-linked business independently of its classification as hedgeable or non-hedgeable contract.

Premium reserves in respect of life business were common in some countries, in particular for group and health business. These were generally calculated based on written premiums.

7.2.2 Non-life insurance

A **larger variation** of methods was used to calculate technical provisions for non-life undertakings.

Run-off triangles were widely used by undertakings for the determination of the best estimate of claims provisions. Principally the chain-ladder or Bornhuetter-Ferguson methodology was applied, occasionally with adjustments for claims inflation.

Other methods mentioned by some undertakings are Mack, Fisher Lange, the stochastic method, using the tool provided by CEIOPS, the expected claim ratio method, the method by Hodes, Feldblum & Blumsohn, and Benktander method.

The most common techniques adopted by undertakings to calculate claims provisions were:

- Chain-ladder techniques based on paid claims, claims incurred or number of claims;
- Bornhuetter-Ferguson techniques based on paid claims or claims incurred;
- De Vylder least squares;
- Loss ratio methods;
- Stochastic, for example bootstrap or Mack method;
- Frequency/severity analysis.

Often these techniques were used to derive best estimate provisions gross of reinsurance. In such cases, amounts net of reinsurance were determined using one of the Gross-to-Net proxies provided in the specifications or similar techniques.

Claims which had been reported but not yet settled, particularly large claims and claims of an exceptional nature were dealt with on a case by case basis by undertakings in many countries. Actuarial judgment was applied to determine the most appropriate method.

Premium provisions were often calculated using proxy techniques based on the unearned premium reserve and the provisions for unexpired risks as shown under local GAAP with further adjustment for the expected loss ratio if required.

In some cases it was not clear whether undertakings had made any adjustment to the unearned premium reserve.

Some more specific views that were expressed:

- In one country some undertakings split data based on size of claim.
- Concerning the underlying data, in one country, some undertakings commented that for their business it would not be appropriate or feasible to allocate internal loss adjustment expenses to individual accident and development years. Those undertakings therefore used claims triangles data excluding such internal expenses and valued these expenses separately. Other types of data which were considered by undertakings to be unsuitable for actuarial analysis based on claims triangles were large single losses (where e.g. case-by-case based methods were applied) and asbestos claims.
- In one country, some undertakings believe that the choice of the method used to determine the best estimate depends on the business examined. For long-tail and complex risks, they agree that, in general, the adoption of more than one actuarial technique and set of assumptions is advisable, but it should not be generally imposed, as the choice of the method/s has to be evaluated case by case according to the best practices. For short-tail and non-complex LoBs they consider that, in most cases, one method may be sufficient and that the adoption of alternative actuarial methods will most likely add no significant improvement to the analysis.
- In one country, a captive used loss development factors based on latest development year when run off triangles were not available.
- In one country, there may be extra prudence in the best estimate if the large claims that are estimated by means of case by case estimation have not been excluded from the paid-type run-off triangles.
- One supervisor indicates that it may be helpful to develop more guidance on the issue of expenses and their integration into an actuarial analysis and the separation of large claims data from claims data triangles.

7.2.3 Health insurance

Very few undertakings commented on health business. Undertakings in one country welcomed the inflation neutral approach as outlined in the QIS4 specification. In another country, it was noted that non-life chain-ladder techniques had been used.

7.2.4 Reinsurance

Supervisors in only one country commented explicitly on the methodology adopted by reinsurers. This was consistent with that described above for both life and non-life business.

7.2.5 Simplifications and proxies

The simplifications and proxies proposed in the specifications were generally welcomed by participants and supervisors.

The extent to which simplifications and proxy techniques were applied in the valuation of technical provisions differed between markets, as well as between the individual components of the valuation. Some supervisors reported that the majority of their undertakings did not make extensive use of simplifications or proxies. These supervisors reported that where simplifications and proxies had been used this was mainly due to a lack of time or resources, an inadequate degree of granularity or quality of data. In other countries, simplifications and proxies were more widely applied, especially by small and medium-sized insurers.

It could also be observed that the use of simplifications and proxies for the calculation of technical provisions was considerably more widespread with respect to certain components of the valuation. In particular, this was the case for the determination of the risk margin, the calculation of amounts relating to assumed or ceded reinsurance and the determination of premium provisions in non-life insurance.

The majority, if not all, of undertakings (independently of their size) used simplifications to project the SCR for the purposes of calculating the **risk margin**. The risk margin proxy and helper tab for non-life were also extensively used by undertakings.

The most common simplifications used were the duration simplification and the simplification based on best estimate ratios.

Finally, several jurisdictions give the feedback that the difference between a sound actuarial technique, a proxy or a simplification is not always clear-cut. Some jurisdictions believe the methods suggested as proxies or simplifications could also be recognised as sound actuarial methods (e.g. chain-ladder or Bornhuetter-Ferguson).

One jurisdiction believes it is necessary to further develop guidance on the range of actuarial techniques available, and to establish more transparent application criteria for the use of simplifications and proxies. Otherwise, there is the risk that proxy techniques or simplifications, rather than being applied in situations where this is appropriate with regard to the nature, scale and complexity of the underlying risks, are regarded as a makeshift solution. This would be

contradictory to the general aim of Solvency II to set incentives for improving the quality of insurers' risk management frameworks.

One supervisor commented that they did not support simplifications or proxy approaches in general.

7.2.5.1 Use of simplifications

In general simplifications were used by **life undertakings** simply because the implementation of more complex approaches were deemed too expensive or because of a lack of resources both in terms of time and actuarial expertise.

In contrast to life business, simplifications and proxies were commonly used by **non-life undertakings**.

In general supervisors commented that simplifications (or where available proxies) had been used:

- For short tailed lines of business with non-complex risks;
- To take account of remaining risks relating to older accident years where only insufficient data is available;
- More generally, because of insufficient data of appropriate quality and granularity;
- For the valuation of amounts recoverable from reinsurance contracts or SPVs;
- For amounts relating to assumed reinsurance; and
- For the calculation of premium provisions.

Only one supervisor commented on the valuation of technical provisions within **captives**. Standard methodologies as described for non-life business above or benchmark loss development factors were used. It was also noted that captive reinsurers rely heavily on information received from the ceding undertaking. This supervisor also made the point that a split of outstanding reserves by underwriting year was needed to perform these calculations which was not the case if proxies were applied. Results for the total technical provisions were similar in both cases.

7.2.5.2 Use of proxies

Participating undertakings in several jurisdictions have reported that they have applied proxies for non-life companies. Proxies which were specifically mentioned to be applied frequently are:

- Market-development-pattern proxy;
- Bornhuetter-Ferguson based proxy;

- Case-by-case based proxy for claims provisions;
- Expected loss based proxy;
- Premium based proxy;
- Claims-handling-cost-reserve proxy;
- Discounting proxy;
- Gross-to-net proxy;
- Annuity proxy;
- Risk margin proxy; and
- Scaling to completion proxy.

In addition to the reasons for the use of proxies and simplifications in general mentioned above, some participants used proxy techniques to compare the results with the outcomes obtained from the exact calculation.

A number of undertakings also commented that they used the Best Estimate Valuation Tool provided in the specifications, which applies the standard chain-ladder algorithm based on paid claims data to determine the best estimate.

Concerning reinsurance, only few undertakings were able to determine amounts relating to reinsurance recoverables (or net figures) by applying actuarial reserving techniques based on reinsured or net triangular claims data. Instead, many participants used triangle analysis techniques only for the calculation of best estimates gross of reinsurance, and derived the reinsurer's part of gross provisions by applying one of the two Gross-to-Net proxies. The wide use of Gross-to-net proxies underlines that it is difficult for the undertakings to get data net of reinsurance.

However, some undertakings remarked that an application of this proxy may lead to poor results in the case of excess loss covers, where the risk mitigating effect of the reinsurance cover would be underestimated. It was also remarked that the use of both types of Gross-to-Net proxies described in the specifications on the same portfolio sometimes resulted in materially different valuations.

A similar situation could be observed with regard to the determination of premium provisions, where only a few participants were capable of carrying out an actuarial projection of future cash flows arising from future claim events. Therefore, most participants had to rely on one of the two proxy techniques described in the specification. As to these two options, most participants used the simple Premium-Based Proxy. However, some participants remarked that an application of the Premium-Based proxy would often lead to valuations that would materially differ from more economic valuations. The Expected-Loss-Based proxy would better match with the insurer's internal perceptions on the riskiness and profitability of its business.

7.2.5.3 Market data based proxies which were provided by some CEIOPS Members in their national guidance

Collecting market data which describe average risk characteristics in the non-life LoBs (or sub-LoBs) may be helpful both in the context of deriving market-based proxies and as benchmark information for the undertakings' risk assessment in the individual LoBs. Accordingly, some supervisors have provided market data for applying market data based proxies.

Some supervisors agree that further work on the collection of this kind of market data should be encouraged.

Market data based proxies have been proposed in 12 countries. Small, medium-sized and large (national) insurance markets are all represented in this sample.

The market data proxies most frequently referred to are the proxies for market development factors (MDFs) and market payment patterns (MPPs). Proxies for MDFs based on e.g. chain-ladder techniques have been provided in nine jurisdictions, while proxies for MPPs based on e.g. Bornhuetter-Ferguson techniques have been provided in three jurisdictions.

Some countries have provided other market data proxies that may be applied when calculating the provisions for claims outstanding, including frequency/severity proxies, claims ratio proxies, proxies for claims handling expenses, discounting proxies and risk margin proxies.

Only one country has stated explicitly that a premium based proxy has been applied for stipulating the premium provisions. However, some of the other proxies being provided (e.g. the claims ratio proxies and discounting proxies) may be relevant also in this context.

Regarding the calculation of the provisions for claims outstanding (except the discounting aspect), market data based proxies have been provided in a majority of the 12 jurisdictions for "Motor – Third-party liability" (10 jurisdictions) and "Motor – Other classes" (8 jurisdictions). With respect to the three accident and health lines of business (LoB) it may be noticed that proxies have been provided in 10 jurisdictions for at least one of these LoBs or some sub-lines of one of these LoBs. Moreover, proxies for the general liability LoB have been provided in six of the jurisdictions that have provided proxies for QIS4 purposes. Finally, it may be noticed that proxies have been provided for all (relevant) LoBs in four jurisdictions. The details are summarised in the following table.

Table 17: Use of market data based proxies for provisions for claims outstanding in individual lines of business

Country	Motor third-party liability	Motor other	Accident etc. ¹⁸	General liability	All other lines of business
Belgium	X	X	X	X	X
Bulgaria ¹⁹					
Denmark	X	X	X	X	X
France	X	X	X	X	
Germany	X		X	X	
Italy	X	X	X		
Luxembourg			X		
Norway	X	X	X	X	X
Poland	X	X	X	X	X
Portugal	X	X	X		
Sweden	X	X	X		
Slovenia	X				

All five jurisdictions that have provided discounting proxies, have elaborated such proxies for (almost) all LoBs.

A more detailed analysis of the number of undertakings and the number of proxies used (per undertaking) has not been possible, as only part of the undertakings explicitly reported on their use of proxies in the spreadsheets and qualitative questionnaires.

In general, the comments related to calibration issues are rather sparse. Only in a few jurisdictions undertakings or supervisors have commented on the data collection issues or the calculation techniques applied when estimating the proxies. These comments concern to a large extent the data that must be available in order to use chain-ladder techniques.

¹⁸ In some jurisdictions proxies have been provided for only one of the three accident and health LoBs or even only for some of the sub-LoBs of the accident and health LoBs.

¹⁹ Proxies proposed for the premium provisions only.

7.2.5.4 Use of case-by-case approaches

Undertakings in several countries have reported that they apply the case-by-case approach for large claims or exceptional claims. For these types of claims it is noticed that the case provisions are often based on expert opinions or set by specialists.

Some other examples have been identified where (at least) some undertakings have explicitly stated that they use the case-by-case approach, e.g.

1. cases where run-off triangles are incomplete, available data (in general) are sparse or aggregate methods are not available; and
2. cases where the estimation of technical provision are carried out for small portfolios or (specialised) sub-lines of business.

Moreover, some supervisors have noticed that case estimates are applied for non-life annuities. The methods applied by the undertakings in such cases are referred to as actuarial present values or “normal” life insurance methods (including e.g. reference mortality models).

In a couple of countries some undertakings have reported that they apply the case-by-case approach more generally, e.g. as the main methodology for stipulating the provisions for RBNS claims (in combination with simple methods for the treatment of future inflation and/or discounting).

On the other hand, some supervisors have stated explicitly that the case-by-case approach has not been applied by the majority of the undertakings or applied only in some limited or clearly defined circumstances. It seems reasonable to believe that this is the case for other countries as well.

In the feedback from the undertakings there are only a few references to the case-by-case proxy as described in the QIS4 Technical Specifications. One supervisor stated that the case-by-case proxy was applied for calculating the provisions for RBNS claims.

Other supervisors state clearly that case-by-case valuation is rarely the default method, that the simple case-by-case approach is avoided or that they are sceptical to use case estimates as a stand alone method.

The supervisors in one country state that the case-by-case proxy is applied for calculating the provisions for reported but not settled claims.

Finally, the need for more stringent guidance and criteria regarding the use of the case-by-case approach is stressed by the supervisors in one country.

7.2.5.5 Treatment of large claims

Some countries report that one or more companies split the claims in “small” and “large” claims which are analysed separately (the large claims, for example, one

by one). The need for this and what is regarded as large claims or extreme events, naturally, varies between lines of business and companies. In many cases all claims regardless of size seem to have been analysed together.

With respect to standard claims, the projection of cash-out flows generally involved the application of an actuarial technique, mainly run-off triangles. Among them, the chain-ladder method, followed by Bornhuetter-Ferguson, seems to have been the most extensively used.

Some supervisors perceive that guidance, either national guidance provided by the supervisor either developed by the industry, has been a useful resource, mainly for those undertakings with less developed actuarial skills.

7.2.5.6 Treatment of annuities

A majority of the undertakings reported that the volume of annuities arising from non-life insurance contract is negligible or null. Most undertakings answered that non-life annuities are separated from claims cash-flows and valued as life insurance obligations.

A few undertakings mentioned a variety of methods for the valuation of annuities: case by case, book value, simplified method using an annuity factor calibrated internally based on historical data and discounting factor.

The use of the annuity proxy was explicitly reported by only very few of the participants. In one country many of the undertakings seem to have used this proxy because only a few companies reported a best estimate for life insurance provisions separately in the QIS4 spreadsheet. Only few undertakings mentioned that the threshold (as specified in the annuity proxy) should be reflected further.

Undertakings from one country answered that their non-life insurance portfolios contain a relevant amount of annuities, mostly valued in LoB-run-off triangles, so that some participants used the annuity proxy because of lack in experience in valuation as life obligation.

Most of the supervisors responded that the volume of annuities arising from non-life insurance contract is negligible or null. In most countries the separation of non-life annuities and their valuation as life insurance obligations does not appear problematic. There is a general agreement that the principle-over-form approach with regard to the valuation of annuities should be applied.

One supervisor takes the view that further consideration would be needed to define an appropriate threshold (it has to be reflected, whether a fixed threshold is necessary or the general principles for application of proxies are sufficient), and that more guidance regarding the treatment of annuities is required.

7.3 Suitability of the methodologies and reliability of the results for the value of technical provisions

7.3.1 Technical provisions – general

In general, undertakings expressed **support for the high-level framework** for the calculation of technical provisions.

Overall, undertakings assessed the **suitability and practicability** of the proposed methods for the calculation of the technical provisions positively, whereby the methodology concerning the best estimate valuation received higher marks than the proposed methodology for the determination of the risk margin.

The simple average of the results submitted by the European countries to CEIOPS is presented below:

Table 18: Technical Provisions - Average country grades

Average country grade	Suitability	Practicability	Reliability/accuracy
Best Estimate	3.6	3.5	3.5
Risk Margin	3.0	3.5	2.9

As is demonstrated by the following table, this assessment does not vary considerably between life and non-life insurers:

Table 19: Technical Provisions in Life and P&C - Average country grades

Suitability - Assessment of best estimate provisions	All business segments		Life insurer		Property & Casualties insurer	
	Mean	Number of Firms with available data	Mean	Number of Firms with available data	Mean	Number of Firms with available data
Total / Average	3.60	766	3.66	209	3.65	364

The majority of companies have not indicated any major difficulties in producing technical provisions estimates. Where such difficulties were mentioned, they related to:

- The complexity of the **spreadsheets and documentation** – some participants remarked that separate life and non-life versions of the spreadsheets and documentation would be preferable and that some of the input sheets should be split into several sheets;
- **Segmentation** – many life and non-life undertakings indicate that the segmentation of policy contracts as used in QIS4 is difficult or not clear, including the segmentation into proportional and non-proportional reinsurance treaties;
- The different degree of **granularity** between internal data and QIS4 requirements, and a lack of historical data;
- **Complexity** – the calculation of best estimate reserve and risk margin involves building model to project future cash flows, taking into account all products, options embedded in the products and all risks that are involved. Building such a model requires a lot of time and resources. In life insurance, the complexity also relates to the policy by policy basis of the calculations, particularly for the lapse risk module;
- A **lack of time** or other **resource constraints** to perform all required calculations and to gather the necessary data;
- The necessity to **calibrate IT tools** to perform the large number of simulations required.

Some participants pointed out that, the more complex the model is, the more the results will be not readily understandable and the higher the risk not to be able to identify the real source of risk of the business.

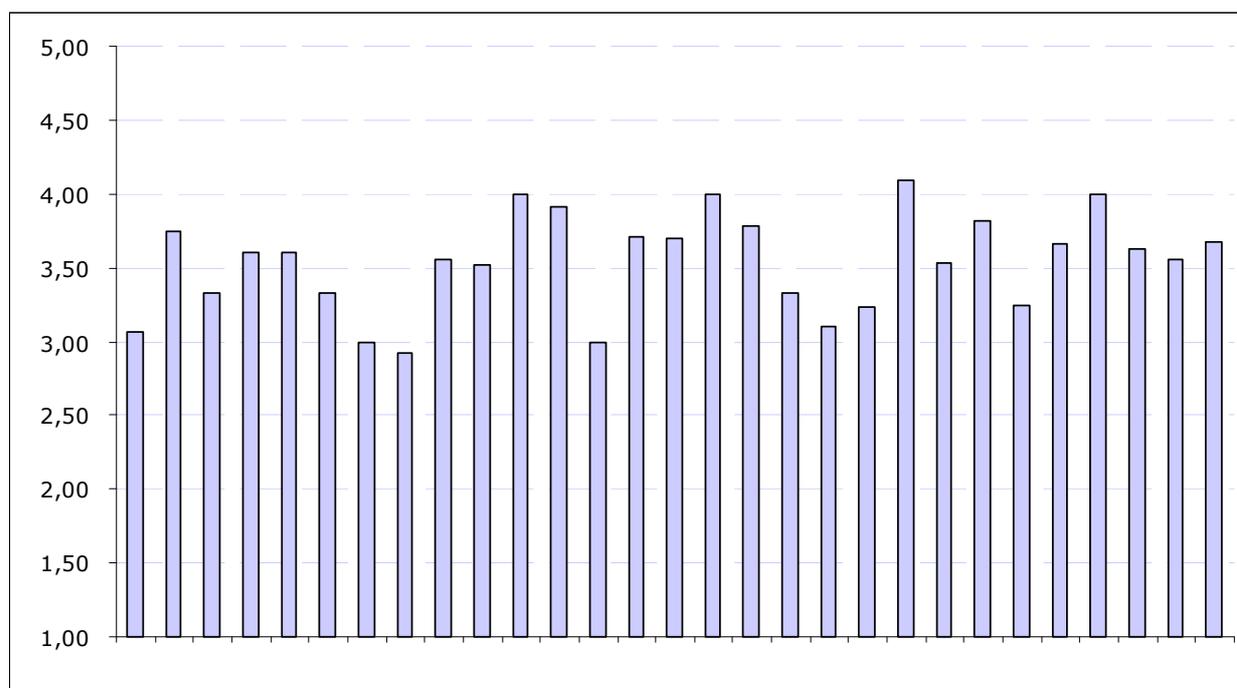
Some participants argued that it was appropriate to continue to use traditional methods to derive best estimates, with the use of stochastic methods limited to the assessment of uncertainty and variability around the best estimate.

Supervisors commented that many small companies will not have the appropriate size of data and also the required resources available to carry out stochastic valuations, and consider that the deterministic approach (including probability-weighted results on a range of scenarios where necessary) should be regarded as an acceptable alternative. One supervisor expressed the view that deterministic methods are indispensable for life and health business and should remain a possible valuation method under Solvency II. On the other hand another supervisor commented that a deterministic model would be inappropriate in their case as a large proportion of contracts include options and guarantees which could not be captured.

On average **undertakings** valued the **reliability and accuracy** of the results for technical provisions as satisfactory, with means mostly in the range of 3 to 4 (out of 5). Very few countries reported on the differences between insurance undertakings according to activity and, in case where they did, the differences do

not appear to be material. When differentiating undertakings according to size, no conclusions can be drawn as in some countries, scores were higher for large undertakings, while for others the opposite is true.

Figure 22: Reliability of results for the value of technical provisions (all undertakings, 5=good)



The perception of the **supervisors** on the **reliability and accuracy** of the results is nuanced. Concerns clearly exist and different reasons are given for this:

- QIS4 was described as very burdensome for participating undertakings with a very demanding schedule. It is likely that this reflects on the quality of the data. Also, for the same reason, the verification of the data by supervisors is not as thorough as would be expected under Solvency II. This in turn does not provide much comfort on the reliability of the data.
- The uncertainty surrounding the assumptions in the valuation of insurance liabilities (trends in the risk factors, option take-up rates, time horizon for cash flow projection, projection of SCR, estimation of tails, shape of the probability distribution, etc.) and in particular uncertainty regarding the appropriate use of simplifications and proxies to derive the insurance liabilities for some parts of the portfolio.
- One supervisor commented that best estimate assumptions are a subjective decision and that this uncertainty would impact on the comparability of technical provisions. They suggested that this issue be

addressed at Levels 2 and 3, for example via public disclosure of assumptions.

- Another supervisor mentioned that they had gathered data on the mortality assumptions used by undertakings and that there was a wide variation in the data. However they conceded that this was possibly justified by the heterogeneity of life undertaking portfolios.

Any checks that were made often only covered key numbers. Supervisors in one country reported that these checks also included an analysis of outliers, and that most of these outliers seem to reflect different risk profiles. However supervisors in another country reported that doubts on the quality of the quantitative contributions from a number of undertakings led to the exclusion of their submissions from the country report.

On average, undertakings seem to prefer **guidance over prescriptive rules** for the valuation of technical provisions, although some more detail would be welcome.

Explanation of the following graphs: The weighted average of prescriptive rules for technical provisions is 3.06 and guidance for calculation of technical provisions is 3.64. The weighted average of simplification for methodology of technical provisions is 3.30.

Figure 23: Need for prescriptive rules for the valuation of technical provisions (all undertakings, 5=highest)

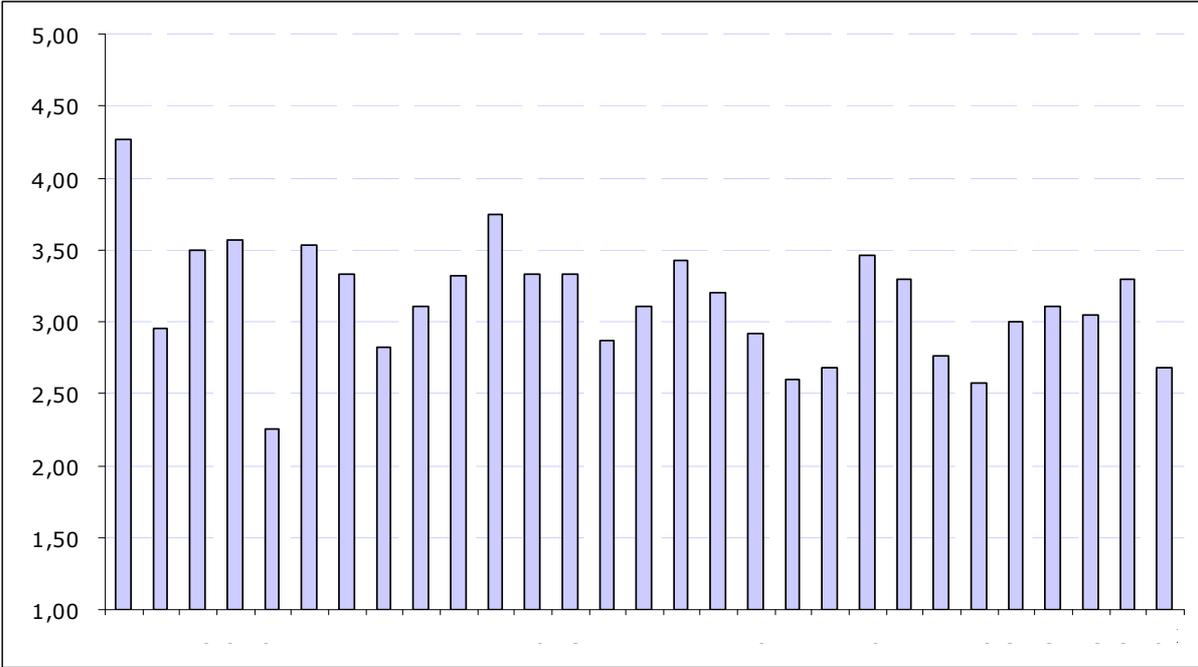
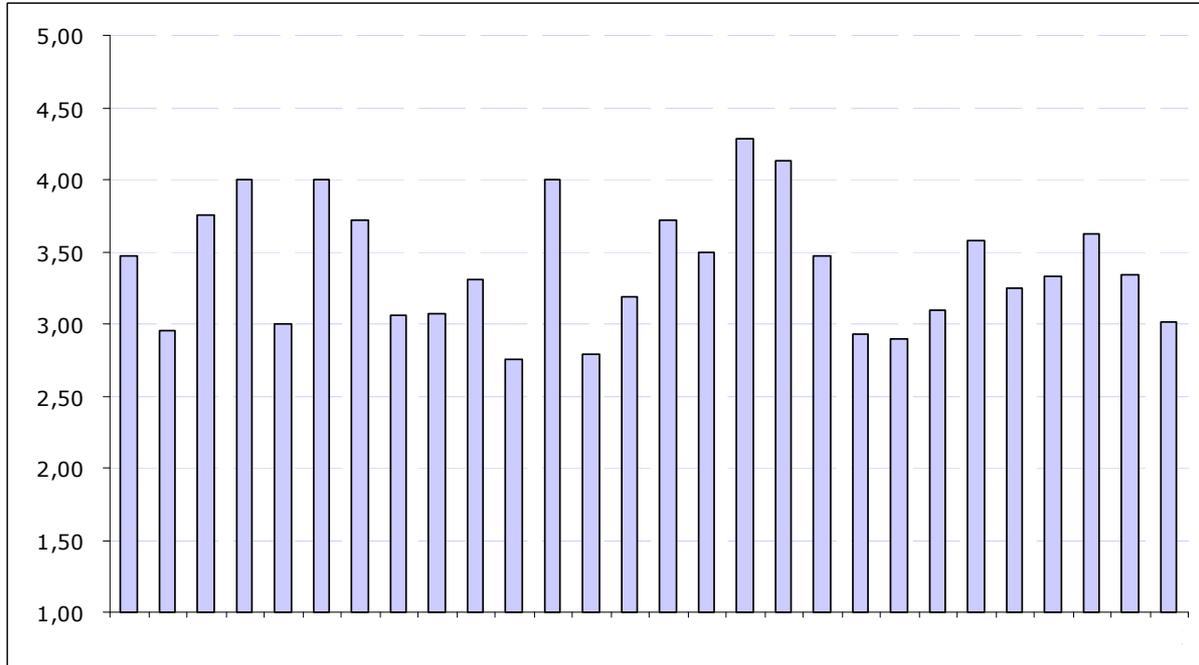


Figure 24: Need for guidance for the valuation of technical provisions (all undertakings, 5=highest)



Figure 25: Need for simplifications of methodology for the valuation of technical provisions (all undertakings, 5=highest)



7.3.1.1 The treatment of future premiums

It appears that only a few undertakings commented on the appropriateness of the definition of future premiums in the Technical Specifications. Those who did however clearly expressed the need to clarify the criteria for the inclusion of

future premiums to ensure a consistent application of valuation principles in all countries.

This also appears to be true in non-life business where the lack of specific guidance raised many doubts among undertakings. In particular, some non-life undertakings commented that there should be an allowance for future premiums over the next 12 months, arguing that it would be more consistent with the approach retained in the SCR.

Undertakings' views are not univocal on the relevance of taking into account future premiums, with the consequence of lowering the best estimate provisions, given that the policyholders have the option of whether to pay them.

Some supervisors expressed their support for the general approach outlined in QIS4 specifications for future premiums. However, supervisors are often concerned that future premiums were not treated consistently across their market in QIS4, each undertaking having performed its own interpretation of the criteria for inclusion of future premiums in the Technical Specifications. This **lack of harmonisation** also appears between the markets themselves. The criteria set for the inclusion of future premiums were therefore not clear enough in QIS4 Technical Specifications.

Some supervisors also expressed the view that for some life insurance contracts, the inclusion of future premiums may significantly decrease the technical provisions and consequently increase the free capital of insurance company and therefore improve solvency position of an entity. They think that this impact should be taken into account before defining the criteria.

Some supervisors expressed reservations on the recognition of the part of **future margins** which emerges as a consequence of the inclusion of future premiums as Tier 1. Whether future premiums are fully recognised, some supervisors also thought that further adjustments to the SCR would be needed.

Supervisory reservations were expressed about the recognition of future profits that may arise from future premiums and their availability to cover losses (e.g. from increased lapses) in a one-year horizon. These questions are linked with own funds and SCR issues: when future profits are recognised through the inclusion of future premiums, further consideration should be given to the way such capital, which is not readily available, should be treated (is Tier 1 adequate?). This would also imply further work on the SCR.

7.3.1.2 Future management actions

Several undertakings reported no modelling on future management actions, the use of simplified assumptions or more sophisticated models (e.g. internal models, EEV, MCEV). Some mentioned that the inclusion of future management actions in the valuation of technical provisions was based on prescriptive and

expected management actions (assumptions on reactionary management actions, if any, are included on the SCR only), taken from internal rules, or based on historical and market practice.

Undertakings in several countries view the use of assumptions for future management actions as **complex** and highly subjective. From this, several undertakings explicitly regarded the use of future management actions as inappropriate in the standard formula.

Assumptions on future management actions were used on (it is not possible to distinguish between technical provisions and the SCR):

- Asset allocation
- Profit sharing
- Dividend schedules
- Dynamic hedge programs
- Valuation of options and guarantees
- Changes in the level of premiums
- Adjustments to smoothing policy

Some undertakings linked the use of future management actions assumptions with contractual or legal constraints.

Several supervisors highlight the **complexity and subjectivity** of the issue, the heterogeneity of results, and the potential for undermining the significance and comparability of solvency calculations. Some possible solutions are:

- Setting of benchmarks or some kind of minimum requirements
- Further analysis on how the judgement can be controlled and restricted; if necessary, development of Level 2 and Level 3 measures to address it; public disclosure of key assumptions relating to technical provisions and SCR calculations by the insurers in their annual report on solvency and financial condition
- Issuing detailed guidance and clarification
- Limit the inclusion of future management action assumptions to prescriptive management actions, while requiring clear explanations for any allowance of reactionary management actions.

For one supervisor, consistency with undertakings' published principles and practices of financial management (PPFM) and the principle of treating customers' fairly (TCF) is of utmost importance.

7.3.2 Best estimate life

Overall, supervisors and undertakings were **supportive of the proposed design**, which was considered to be robust and market consistent and to provide an incentive for effective risk management. A number of undertakings in different countries commented that the approach was consistent with their embedded value calculations.

However the **practical implementation** of the methodology proved more challenging. Although some of the difficulties were specific to the QIS exercise – tight timescales and multiple versions of spreadsheets caused a strain on resources for many undertakings – undertakings also raised a number of issues with the underlying methodology. These varied to some extent across countries.

The following difficulties were commonly mentioned by supervisors:

- Undertakings had some difficulty understanding the technical specification, particularly areas in which a number of possible approaches to a given calculation were proposed. This was considered confusing by undertakings and as a result many felt that results would **not be consistent** across undertakings and countries. However, when national guidance has been provided to undertakings, this has improved the comparison between undertakings. It was suggested that additional guidance on which methods should be used in different circumstances would be helpful.
- Within some jurisdictions, undertakings found the **modelling requirements** for QIS4 to be **onerous**. Smaller undertakings lacked sufficient flexibility in their models for example the use of term structure for interest rates rather than a single discount rate. Larger undertakings commented that run times were very long, particularly for stochastic policy by policy calculations.
- A number of undertakings had difficulty calculating the best estimate technical provisions according to the specified product **segments**.
- A number of undertakings across countries questioned the suitability of using **market and generally available information** to estimate an assumption on the basis that the portfolio is transferred to a different undertaking. For expenses and many other provisions, it was thought that it is appropriate and practical to use “own company” experience to estimate certain liability cash flows since in most cases the risks are specific to the portfolio of the insurer.
- The **modelling of expenses** was an area of difficulty for undertakings within certain countries. Some undertakings commented that there was an inconsistency between run-off assumptions and the use of going-concern parameters. Some participants think there is an inconsistency between run-off assumptions and the use of going concern parameters to project

future expenses. Several undertakings commented that more detailed guidance should be provided concerning assumptions on projection of future administrative expenses. Supervisors commented that expense assumptions, in particular no recognition of unrealised economies of scale, is the major issue for start-up companies. The consideration of third party administration expenses is not deemed a sufficient solution.

- Undertakings within some countries had difficulty modelling **reinsurance** business, in particular non-proportional reinsurance. As a result some undertakings applied a net/gross factor based on local GAAP to calculate net reinsurance provisions.
- A number of undertakings in different countries mentioned that consistency with **IFRS 4** would be desirable.
- A number of undertakings in different countries mentioned that the **definition of future premiums** was unclear, and in particular the distinction between future premiums in respect of existing business and new business.
- Undertakings in one country thought that a higher discount rate term structure should be set for annuities to reflect the illiquid nature of the liabilities.

7.3.2.1 Future discretionary bonuses

First of all, the **existence** of future discretionary bonuses varies.

One supervisor mentioned that pure future discretionary bonuses are rare in their market.

Another supervisor considers that future discretionary bonuses and policyholders' reasonable expectations are 'alien' concepts in their market. Existing rules stipulate that a minimum of 80% (or more) of surplus investment yield above guaranteed rates must be irreversibly allocated to policyholders, thus giving little discretion to insurers on the allocation of future bonuses. For this reason, supervisors consider that the value of zero for future discretionary bonuses presented by most undertakings may be justifiable.

One supervisor also mentioned the existence of minimum levels of profit sharing within contract clauses as a result of which the term 'discretionary' is ambiguous. Nevertheless supervisors consider that the definition of future discretionary bonuses includes those expected future benefits which are not purely at the discretion of the insurer, due to contractual clauses, but linked to future performance.

There was some **diversity of opinion** on the calculation of future discretionary benefits:

- Some undertakings thought that it was **appropriate** to calculate explicitly the value of future discretionary benefits and they had found this helpful for managing other areas of their business such as pricing. However other undertakings thought that identifying explicitly the value of future discretionary benefit did not add any value.
- Some supervisors reported that there were no problems regarding the **definition** of future discretionary bonuses. In one country, undertakings were assisted by national guidance on the calculation of life technical provisions issued by the supervisor. Undertakings in one country found it difficult to understand the finer classification in TS.II.D.22. Undertakings in some countries did not find the definition of future discretionary bonuses clear and suggested that further guidance is needed. One supervisor says that the definition is no straightforward for health insurance, because part of the surplus is used to avoid adjustments in future premiums.
- Regarding the **valuation** of future discretionary bonuses, small undertakings in one country said that a stochastic model must be used which may suggest that the valuation of future discretionary bonuses is too complex under QIS4. Some supervisors consider that further guidance is necessary. One supervisor highlighted that future discretionary bonuses are difficult to value due to complex structures in products and pricing.

Further problems were mentioned:

One supervisor mentioned the reflection of **dynamic lapses** on future discretionary bonuses as an area for further work.

Three supervisors refer to the split of future discretionary bonuses between life segments, namely between savings and survivorship. The solution proposed is to limit the segmentation of the best estimate to the first level only or to introduce a split by segregated fund.

Difficulties were also reported on the explicit separation of future discretionary bonuses from the best estimate provisions. Two solutions were mentioned:

- Calculate future discretionary bonuses as the 'total' value of the best estimate (combining guaranteed benefits plus future bonuses) minus a deterministic projection with future bonus rates set to zero;
- Estimate future discretionary bonuses as a margin above the reduction in benefits in an extremely adverse equity scenario.

Undertakings and supervisors in one country commented that it was difficult to model the **legal requirements** of profit participation and also future discretionary benefits stemming from mortality and expense results.

In any event, there was general agreement that the value of future discretionary benefits should be calculated in a **market consistent** manner.

Explanation to the graphs hereunder: The weighted average of the suitability of valuation of 'future discretionary benefits' for life insurance policies is 3.11, incentive for effective risk management of valuation of 'future discretionary benefits' for life insurance policies is 3.08, reliability and accuracy of results of valuation of 'future discretionary benefits' for life insurance policies is 3.14 and practicability of valuation of 'future discretionary benefits' for life insurance policies is 3.08.

Figure 26: Assessment of future discretionary benefits – Suitability (all undertakings, 5=highest)

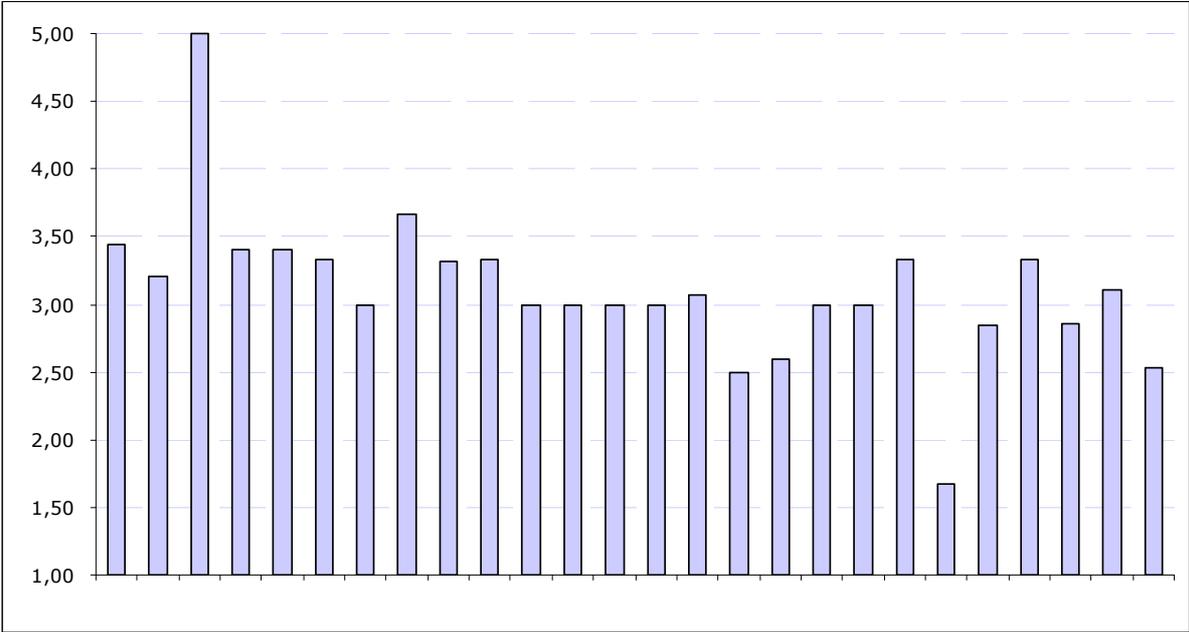


Figure 27: Assessment of future discretionary benefits – incentive for effective risk management (all undertakings, 5=highest)

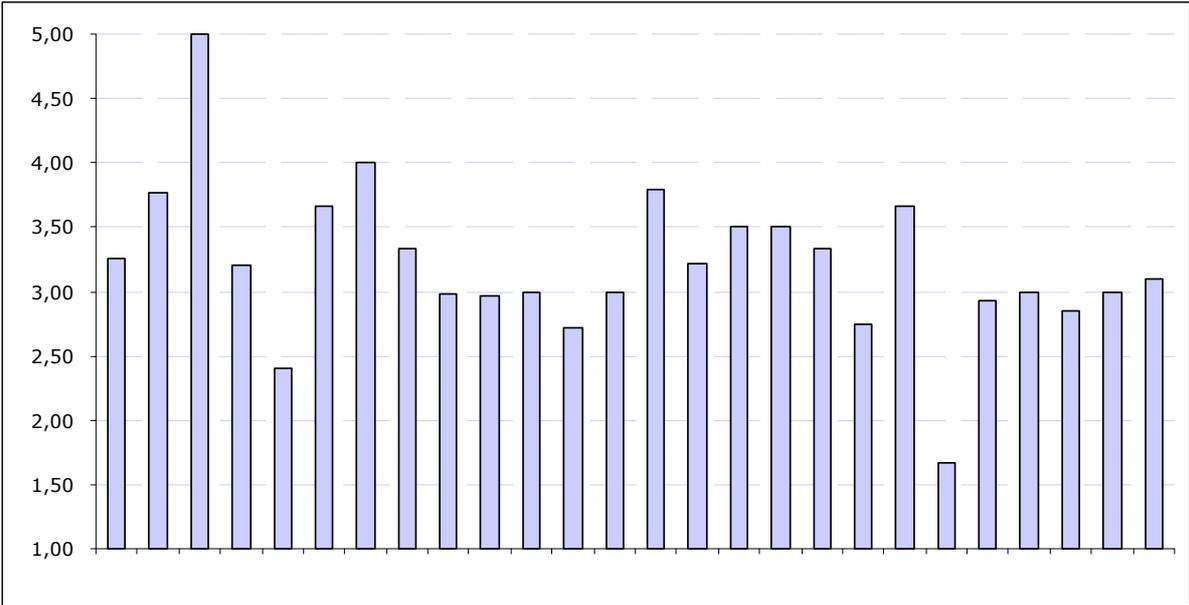


Figure 28: Assessment of future discretionary benefits – reliability and accuracy of results (all undertakings, 5=highest)

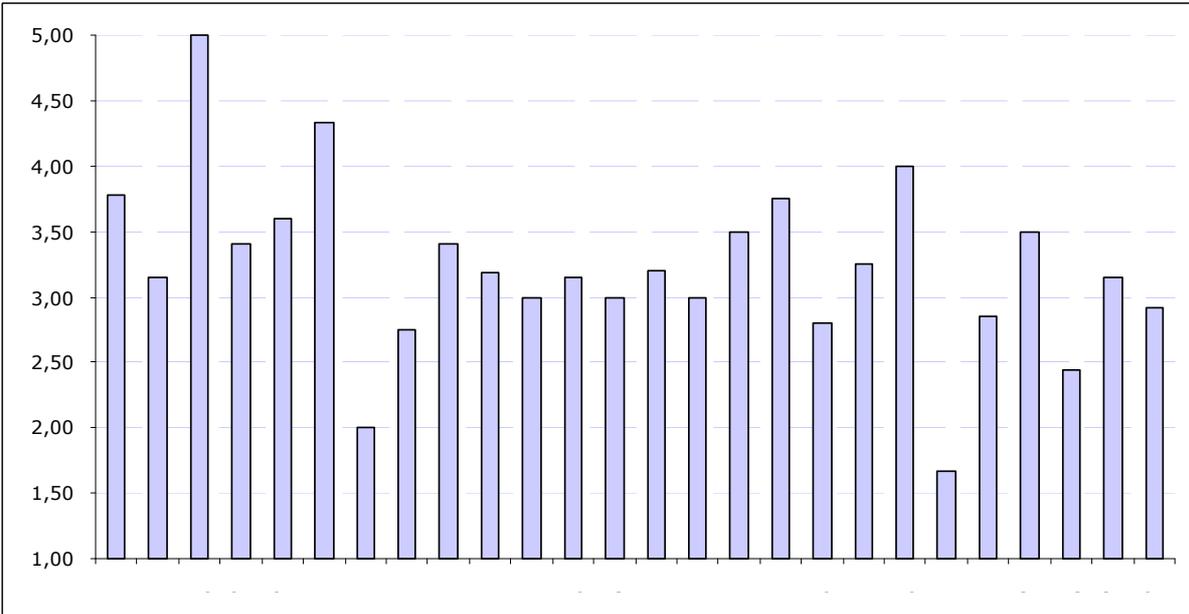


Figure 29: Assessment of future discretionary benefits – practicability (all undertakings, 5=highest)

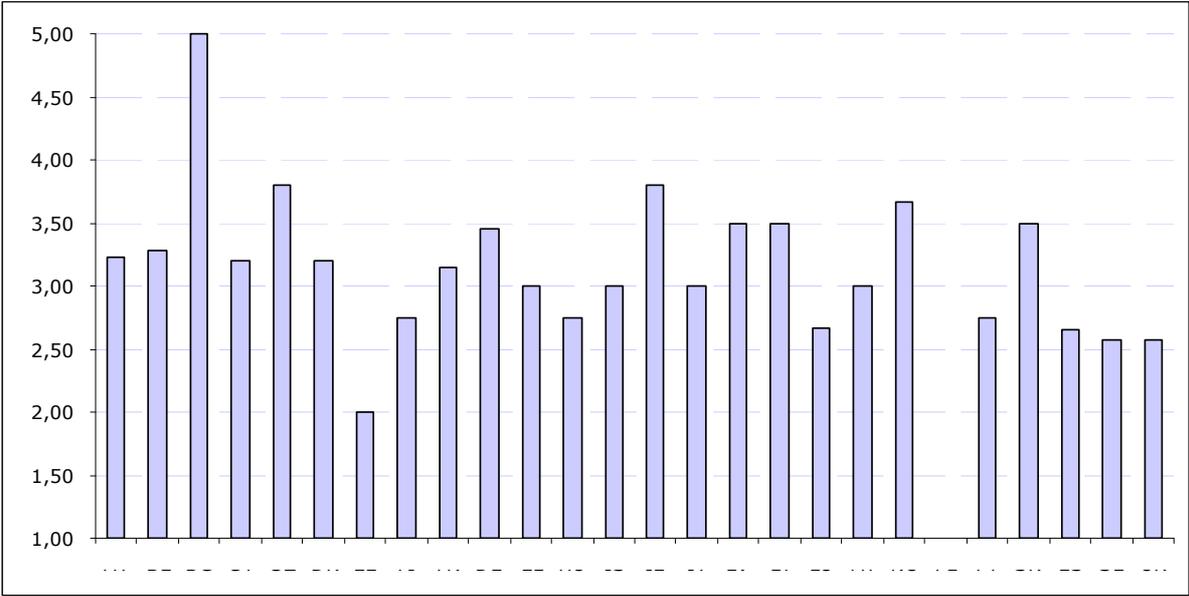
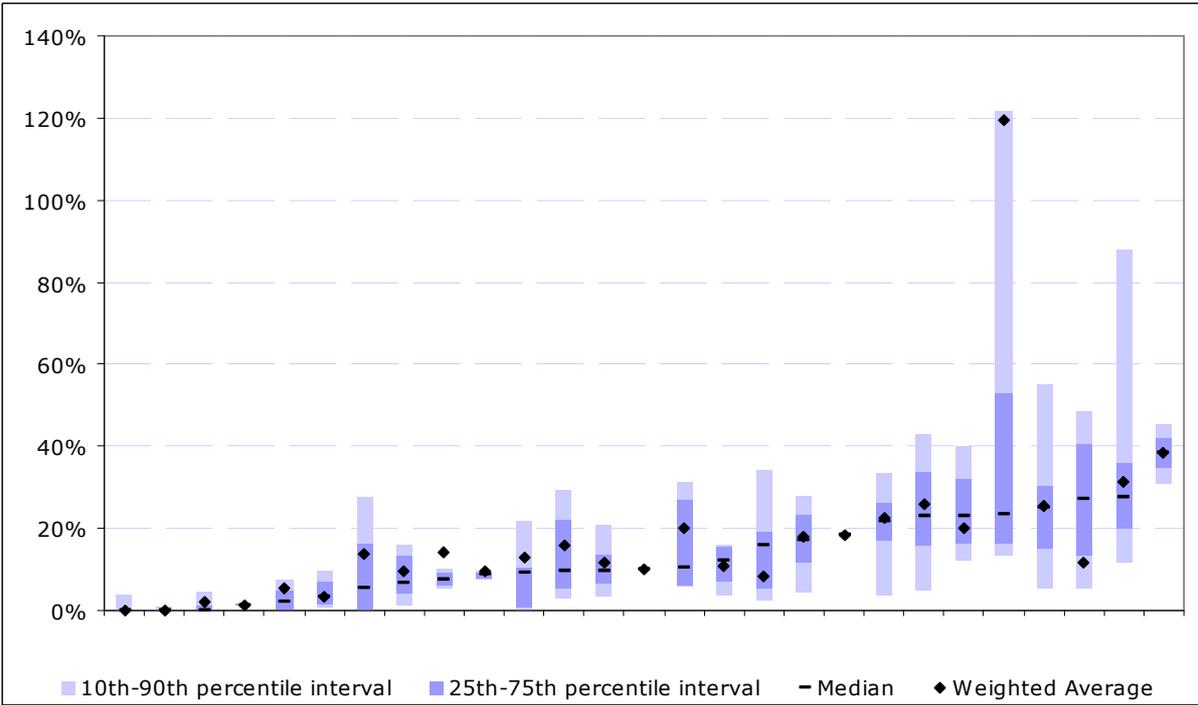


Figure 30: Ratio of future discretionary bonuses to QIS4 best estimate (net) provisions for with-profit policies (all undertakings)



The weighted average of the ratio of future discretionary bonuses to QIS4 net best estimate varied considerably between countries, and ranged between 0% and 40%. In one country this ratio is 120%.

7.3.2.2 Options and guarantees

In general, undertakings in many countries supported a **market consistent valuation** of options and guarantees. However one undertaking commented that the proposed approach for valuation of options and guarantees is inconsistent since basing technical provisions on observable policyholder behaviour is not consistent with the no-arbitrage principle. In their view, it is not possible to specify the appropriate treatment of options under Solvency II since there is no definitive academic opinion on the subject.

Undertakings in one country followed the guidance of their insurance association and followed a closed form solution approach. Undertakings in this country also argued that **stochastic modelling** should be used for internal models only.

Supervisors in another country thought that there is a risk that the results of complex stochastic models will not be understood.

Large undertakings appear to broadly use a stochastic valuation of liabilities which takes into account the price of options. Some entities use a closed formula such as Black&Scholes or a closed formula approach fitted to a national market. In some markets, EEV methodology is considered adequate to value options in life insurance business.

Some undertakings - mainly medium and small entities - find it overly **complex** to value options according to a stochastic method and the underlying no-arbitrage theory. Deterministic scenarios have been used in these cases, with or without taking into account changes in policyholders' behaviour. In some markets, the idea is expressed that stochastic calculations should be left to internal models and that a deterministic approach can be adequate when the standard approach is used.

Other undertakings find it too complex and burdensome to try and value options and guarantees separately. It is not always clear in these cases if the time value of options and guarantees is included in the best estimate or if they are valued at nil. The latter seems to be the case for some entities.

Even where a proper methodology appears to be applied to value embedded options, the lack of historical data and the high degree of sensitivity to the underlying hypotheses, are often mentioned as limits to a proper valuation of these options.

Explanations to the following graphs: The weighted average of the suitability of valuation of options and guarantees for life insurance policies is 3.13, incentive for effective risk management of valuation of options and guarantees for life insurance policies is 3.22, reliability and accuracy of results of valuation of options and guarantees for life insurance policies is 3.03 and practicability of valuation of options and guarantees for life insurance policies is 3.01.

Figure 31: Assessment of the suitability of valuation of options and guarantees for life insurance policies (all undertakings, 5=highest)

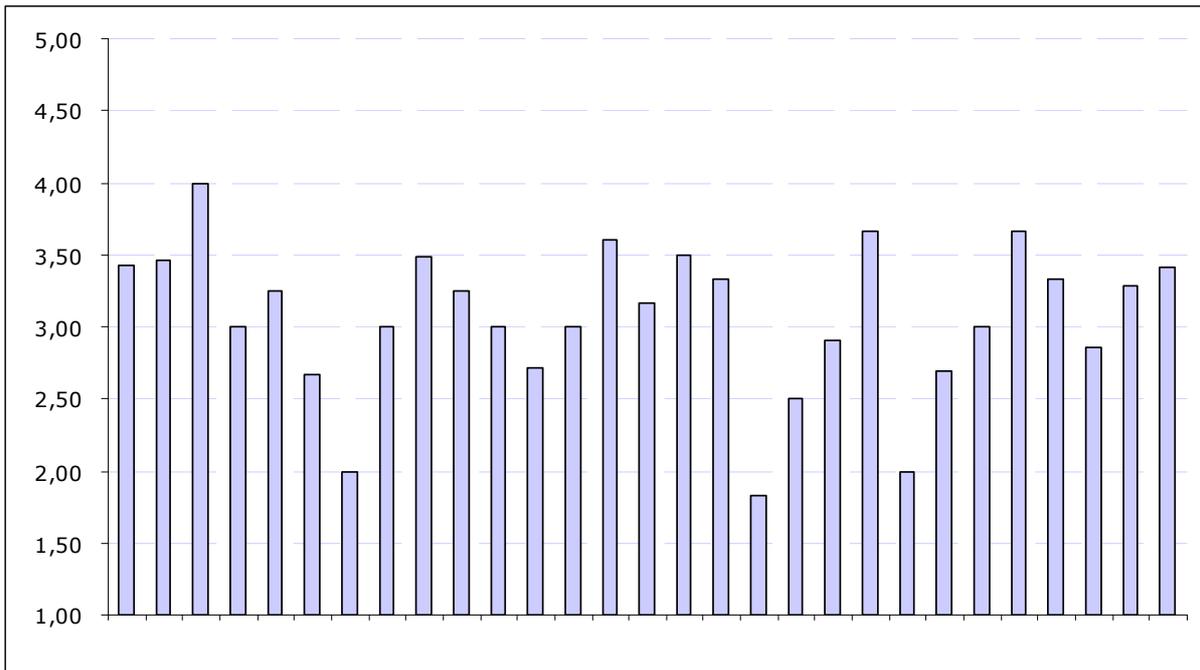


Figure 32: Assessment of the incentive for effective risk management for valuation of options and guarantees for life insurance policies (all undertakings, 5=highest)

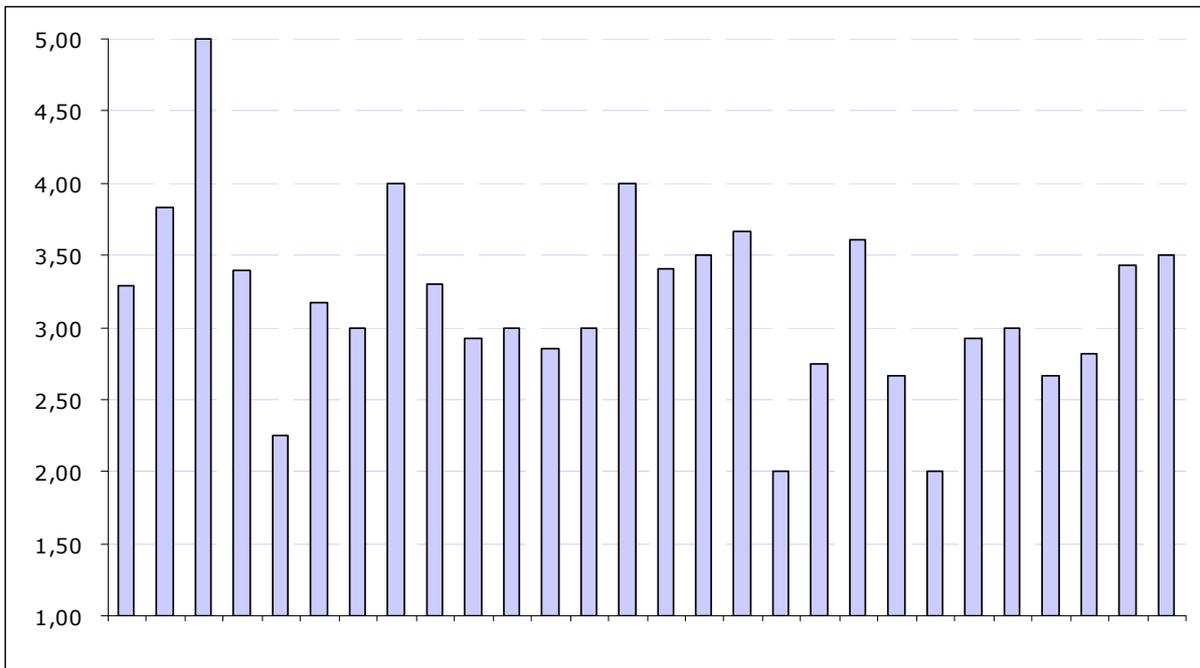


Figure 33: Assessment of the reliability and accuracy of results of valuation of options and guarantees for life insurance policies (all undertakings, 5=highest)

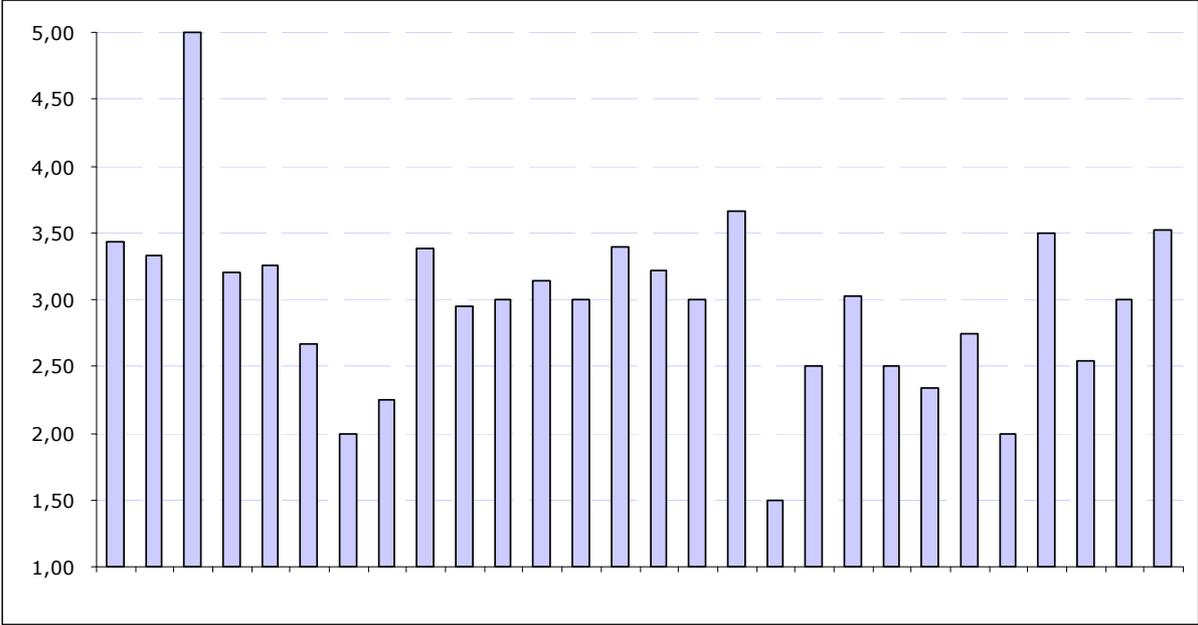
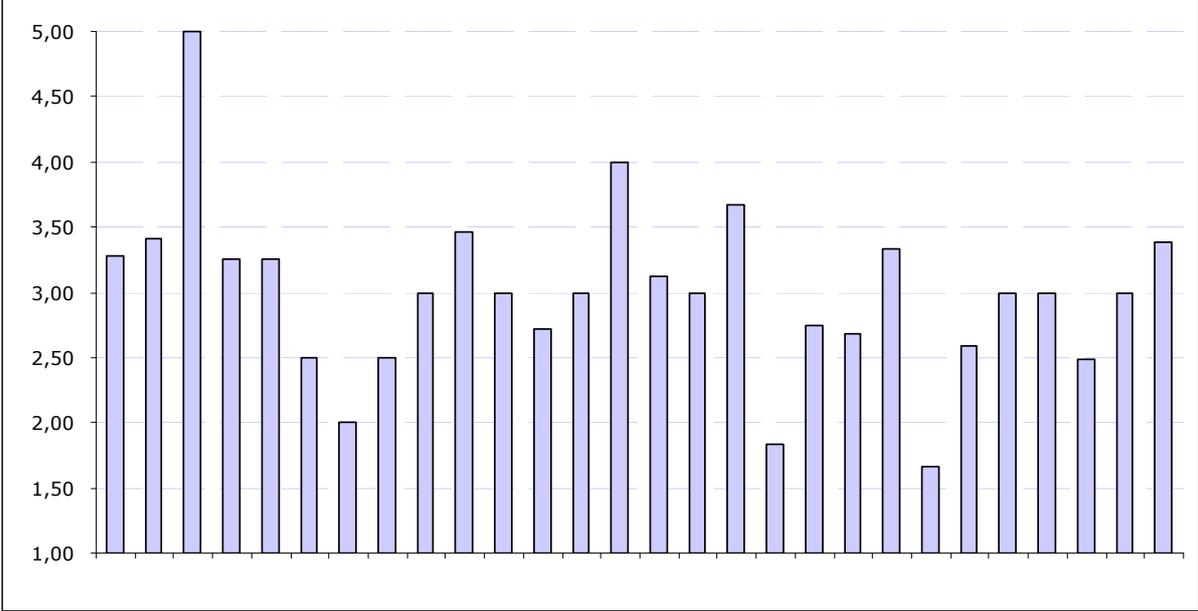


Figure 34: Assessment of the practicability of valuation of options and guarantees for life insurance policies (all undertakings, 5=highest)



Some supervisors point to the fact that there are probably only a few options with **material value** in their market and that these options are mostly out of the money. In other countries, current life contracts appear to have options of significant cost.

Supervisors recognise that many small undertakings would probably not have the resources required to implement a stochastic model for the valuation of options and guarantees at the current time. Some simplifications may therefore be needed in this area.

Explanation to the following graphs: The weighted average of the suitability of assessment of best estimate provisions is 3.64, incentive for effective risk management of assessment of best estimate provisions is 3.38, reliability and accuracy of results of assessment of best estimate provisions is 3.55 and practicability of assessment of best estimate provisions is 3.49.

Figure 35: Assessment of best estimate provisions – Suitability (all undertakings, 5=good)

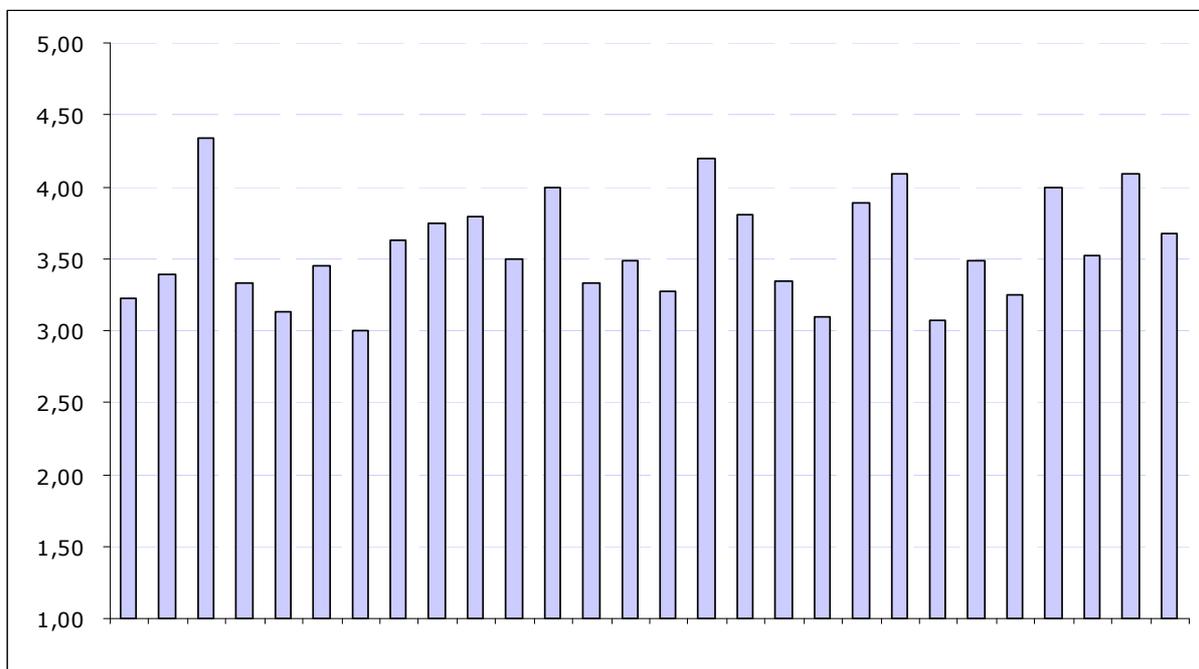


Figure 36: Assessment of best estimate provisions – Incentive for effective risk management (all undertakings, 5=highest)

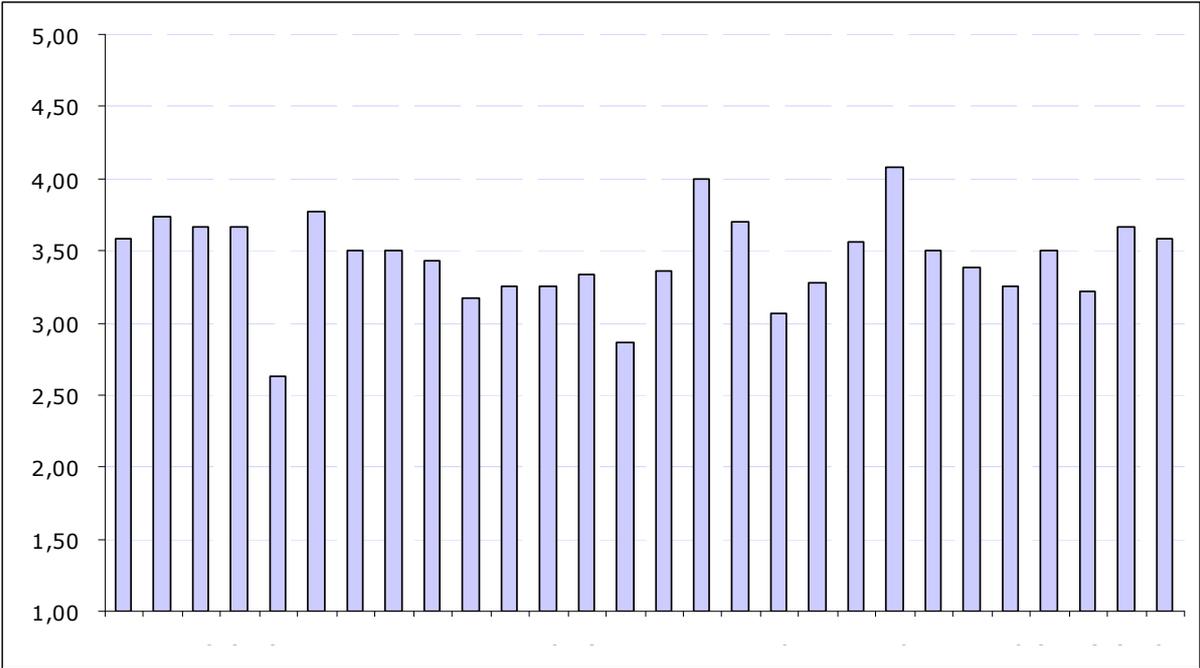


Figure 37: Assessment of best estimate provisions – Reliability and accuracy of results (all undertakings, 5=highest)

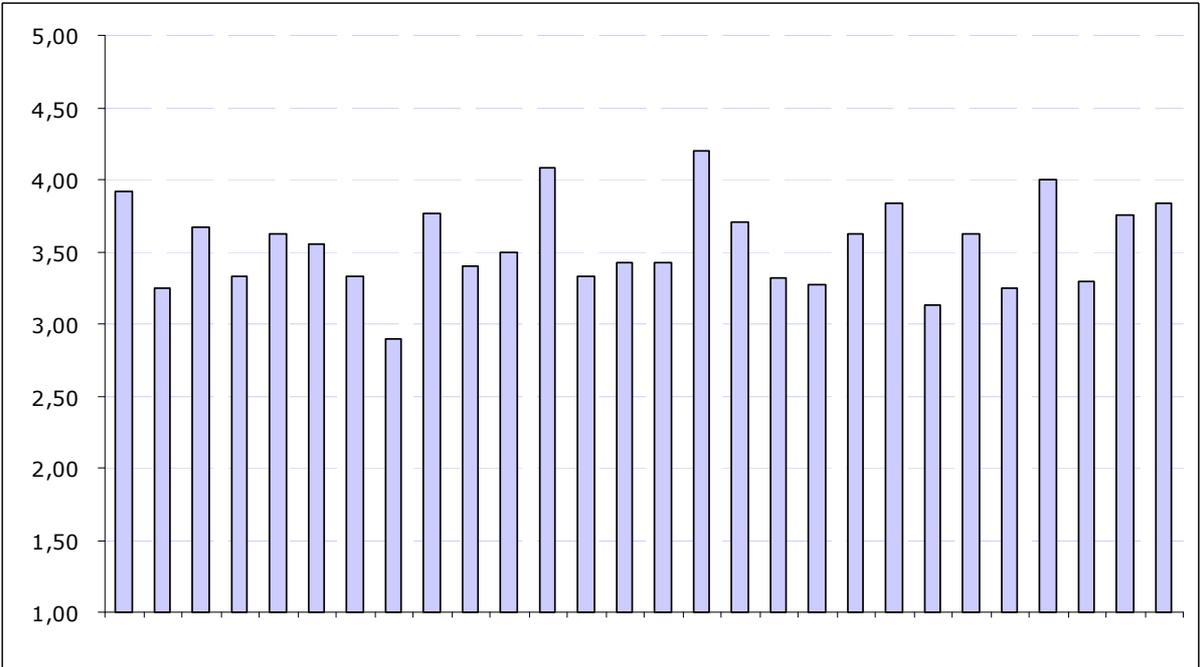
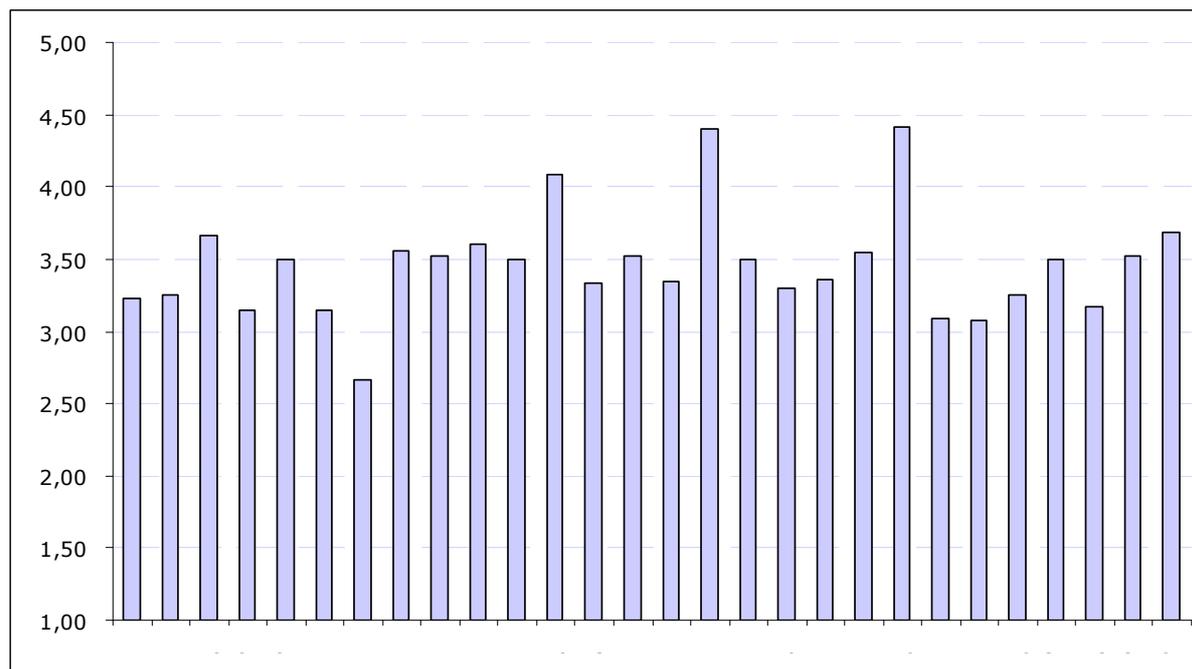


Figure 38: Assessment of best estimate provisions – Practicability (all undertakings, 5=highest)



7.3.3 Best estimate non-life

Non-life undertakings did not calculate the mean provision using an explicit probability weighted average of future cash flows approach. Some undertakings commented that, while the QIS4 specification appeared to prescribe stochastic reserving methods, with traditional methods being regarded as simplifications, they did not believe the **traditional methods** should be regarded as proxies. One undertaking commented that stochastic methods should be limited to assessing uncertainty and variability around the best estimate.

A supervisor pointed out that the guidance relating to the determination of technical provisions, including the description of simplified methods and techniques and proxies, needs to be further improved to better align the choice of methods used in practice with the underlying Solvency II principles. Application criteria should be defined.

Non-life undertakings experienced the following difficulties in calculating the best estimate technical provisions:

7.3.3.1 Best Estimate Valuation Tool

The Best Estimate Valuation Tool provided in the QIS4 package was generally seen as a useful support for the best estimate valuation of non-life provisions.

Some participants pointed out that the tool does not allow calculation based on a time period of less than a year and remarked that given the typically short duration of credit insurance exposure, this should be improved.

7.3.3.2 Segmentation

Segmentation of data according to the QIS4 specification proved **difficult** for undertakings where, as was often the case, segmentation was not consistent with their current reporting. A number of participants commented that the required two-dimensional segmentation of their business into both LoBs and **geographical** locations was not practical for them, and would lead to individual segments that would be too small for an appropriate actuarial analysis. Segmentation of data by both line of business and geographic area was considered unduly onerous.

It was also remarked that guidance should be given in how to proceed further in allocating the internal data to the QIS4 segments. Changing the allocation rules could in some cases lead to a significant change in Net Best estimate provisions (per QIS4 segments) and hence influences the SCR calculation.

Some undertakings commented that it would also be helpful to distinguish between material losses and personal injuries regarding third party liability LoB.

Some examples have been given by undertakings where the QIS4 segments are **not sufficiently granular**. This is the case for e.g. the following segments:

- Marine, aviation and transport
- Fire and other property damage
- Miscellaneous non-life insurance

In one country, it was observed that the undertakings have been encouraged by the supervisor to apply a more granular segmentation than the one described in the QIS4 Technical Specifications.

In this context, the manner in which the more granular lines of business (LoB) or homogenous risk groups (HRG) have been aggregated to the QIS4 segments has been briefly indicated for some countries:

- In some cases there are country-specific rules (e.g. guidance issued by the supervisor) regarding the aggregation from the LoBs currently used in the national reporting systems to the QIS4 segments. In general these reporting systems are more detailed than the LoBs applied for licensing purposes. However, for some countries, it is stated explicitly that the basis is the LoBs applied for licensing purposes.
- In other cases, the segmentation applied is based on undertaking-specific (internal) LoBs or even contacts which are aggregated via HRG to the

QIS4 segments. For some undertakings this segmentation is available due to the already existing best estimate calculations.

Moreover, the split between geographical regions has been identified as difficult to achieve in practise.

However, the more granular LoBs that the undertakings have applied in a number of countries, have been described in some detail by a few undertakings or for a few countries only.

Finally, in some countries, at least some undertakings have reported that they have experienced difficulties regarding the aggregation from their undertaking-specific segmentation to the QIS4 segments. In these cases it is referred to e.g. the undertakings' reporting and commercial needs, problems related to the splitting (or unbundling) of complex products, the design of insurance classes (e.g. based on product structures) implemented on a national level etc.

Supervisors recognise that there may be some products where difficulties may arise in unbundling the risks. However one supervisor pointed out that it is best actuarial practise to reserve risks at a homogenous level – i.e. motor injury, motor damage etc. so companies should have access to a split or a sensible methodology to split the reserves into more appropriate risk groups.

The supervisors in one country have stressed the need to reconsider the split between geographical regions. Moreover, they point out that further guidance seems necessary with respect to the allocation of reinsurance business in cases where this business constitute only a small part of an undertaking's overall business.

The supervisors in another country comment that even if the HRGs are the basis for calculating the best estimate technical provisions in non-life insurance, it seems unrealistic to draw a comprehensive list of exiting HRGs as they are strongly dependent on the specificities of the underlying contacts.

Finally, it should be pointed out that supervisors in some countries have referred to classification problems related to some LoBs, e.g. health insurance and motor insurance, as well as to the fact the allocation of the more detailed LoBs between the QIS4 segments has probably not been done consistently across the participating undertakings.

7.3.3.3 Discounting

Discounting of cash flows proved difficult in cases where there are **no cash flow patterns**. This was the case for very large claims, for small lines of business, or in countries where the insurance industry is less developed.

7.3.3.4 Calculation of premium provisions

Some participants remarked that the current methodology would open the door for redefining the **composition of lines of business** in such a way that losses on some policies may be compensated by profits on other policies (whereas positive and negative effects should be added, to avoid arbitrage).

Many undertakings in different countries thought that further guidance was required in the valuation of premium provisions. Most undertakings used the premium based proxy (unearned premium reserve plus local GAAP provision for unexpired risk) or expected loss based proxy. Those participants pointed out that a proper actuarial valuation would either not be possible for them, or would have been too time-consuming in the context of QIS4. Among those insurers that attempted a more economic valuation of premium reserves, some used the Expected-Loss-Based proxy described in the technical specification, and reported that this would lead to a better approximation of the Solvency II standard than the Premium-Based-proxy. One supervisor commented that although the consideration of future premiums is correct from a market consistent perspective, it can cause some very strange effects.

Some participants suggested that additional guidance should be given on the treatment of **acquisition costs** when calculating the best estimate of premium reserves.

It was also commented by some participants that the inclusion of future premiums in the provisions for non-life LoBs should be thoroughly analysed, as some of the effects and incentives for future risk management may not be fully understood.

Supervisors noted that further **discussion and guidance** on appropriate methods for the valuation of premium provisions seems necessary. For example, simplified methods should also be made available for the premium provision, especially with regard to small insurers or it should be clarified whether negative premium provisions in individual LoBs (or even for the insurer's portfolio as a whole) should be accepted.

A supervisor pointed out that the premium-based proxy does not deliver an adequate approximation to the Solvency II valuation principles and would not be consistent with more sophisticated valuation techniques for premium provisions.

7.3.3.5 Valuation of reinsurance recoverables

Many participants remarked that, due to changes in their reinsurance programme over time, claims data triangles net of reinsurance would typically contain **irregularities** which would render them unsuitable for an immediate application of standard actuarial reserving techniques. A thorough analysis of reinsurance effects would often require the availability of more detailed data on the risk

mitigating impact of the reinsurance cover on large single claims. The estimation of cash flows for reinsurance recoverables would therefore be problematic.

Also many participants commented that the estimation of cash flows for accepted reinsurance (these appear on the liability side, not on the asset side: they cannot be denoted as “reinsurance recoverables”) would cause problems, considering that suitable statistical data for accepted reinsurance was not available. A number of participants remarked that more guidance should be provided on how to treat non-proportional reinsurance.

Participants also remarked that allocating the reinsurance data (assets) to the QIS4 segments was much more difficult than allocating (from internal line of business structure to the QIS4 segments) the gross data.

Non-life insurers found the valuation of reinsurance contracts particularly difficult:

- **Segmentation** of data according to the QIS4 specification proved difficult, in particular identifying the split between proportional and non-proportional. Undertakings commented that it was difficult to allocate the proportional part of assumed reinsurance business to the relevant line of business for direct insurance business as assumed reinsurance data is often unavailable.
- The **gross-to-net proxy** was used by some undertakings as net claims data triangles are unsuitable for immediate application of actuarial reserving techniques since they often contain irregularities.

Undertakings within one country commented that it is difficult to use actuarial techniques to calculate the best estimate reinsurance provision taking into account all contractual details.

A supervisor stated that the adjustment for reinsurers’ expected loss seemed overly complicated compared to the impact that these items had on the value of the technical provisions. The assessment of the reinsurance counterparty default in the risk margin calculation equally caused problems.

More guidance should be developed concerning the valuation of reinsurer’s shares in technical provisions. To avoid over-reliance on very simple techniques such as the Gross-to-Net Proxy, guidance on other more sophisticated actuarial techniques which would be better aligned with the true risk mitigating effect of reinsurance covers should be sought.

7.3.3.6 Long-term insurance in non-life business

Undertakings from most countries have not reported any specific difficulties with respect to long-term non-life insurance business or mentioned that the issue is not applicable for their undertakings.

The problem noted were the difficulties in making an **accurate best estimate** of the eventual claims payments for long tailed Asbestos, Pollution, Health insurance business and/or claims subject to an uncertain level of future inflation.

There were also difficulties with calculating the **risk margin** which were related to projecting the SCRs or underlying cash-flows and provisions into the future. Some undertakings reported that the risk margin calculated via a Cost-of-Capital approach is higher than that resulting from a quantile approach due to the “truncated SCR” at year 0.

The supervisors’ view is that these issues need further consideration by CEIOPS with involvement from the industry and the Groupe Consultatif.

7.3.4 Best estimate health insurance

The comments on health business came mainly from undertakings and supervisors in one country who welcomed the inflation neutral valuation approach. Undertakings within this country used closed form solutions in the valuation of future discretionary benefits. The valuation options and guarantees were largely ignored as they are not material for health business.

Supervisors in another country commented that further guidance on risk mitigation is required where there is yearly ability to change the level of premium as is often the case with health business.

7.3.5 Risk margin

7.3.5.1 Practicability of proposed methodologies

Undertakings in most countries **support the cost of capital approach** for determining the value of the risk margin for non-hedgeable risks. They consider the CoC-approach as clear, the CoC methodology as appropriate and practicable and the CoC as a robust way to calculate the market value margin. However undertakings in a small number of specific countries objected to this method since, in their opinion, the method is impractical and unrealistic and the use of approved actuarial methods would be easier and more transparent. A number of undertakings commented on the fact that the risk margin depends to a large extent on the projected SCR so any limitations in the standard formula would also impact on the risk margin.

A number of participants criticised the **technical difficulty** of the risk margin calculation and the lack of more technical support.

Some undertakings stated that the calculation of the risk margin by LoBs needs a breakdown of underwriting, counterparty and operational risk SCR by LoBs that is difficult to apply.

Concerning the **helper tab** for the non-life risk margin, a number of participants pointed out that the method implemented in this table produces separate risk margins for premium provisions and claims provisions, and commented that the computations would lead to unsuitable results with regard to the premium provision risk margin. This was explicitly supported by one supervisor.

As concerns the non-life **risk margin proxy**, this supervisor doubts whether the method appropriately reflects Solvency II valuation principles. In some economically important LoBs, the size of the risk margin on average amounts to up to 11% of the best estimate, so it is apparent that the risk margin has a material impact on the overall solvency position of the insurer.

In life insurance, some participants commented that the requirement TS.II.C.11 for splitting the risk margin to so many parts for reporting purposes would be unnecessary because the whole with-profit business is measured at one time due to the management decision rules of the extra bonuses. Therefore, it is also impossible to follow the specification TS.II.C.13 that no diversification benefits arise from grouping of technical provisions calculated per segments. The Article 79 from the Framework Directive Proposal requires impractical measurements.

Supervisors agree that more guidance is needed on the choice of the various proposed simplifications, which differ in their degree of complexity and risk-sensitivity.

One supervisor points out that further clarity should be given as to whether the calculation of the SCR should include or should exclude the risk margin

Some suggestions have been made by supervisors:

- It could for example be clarified that the first level of simplification described in the specifications could be used as a “default” calculation method. For other, cruder simplification methods application criteria should be established to ensure that they are only applied in circumstances where this is justified with respect to the nature of the insurer’s risk profile.
- One supervisor points out that the risk margin of life and health insurers is large compared to the amount of own funds (it would be great to have some figures here). Therefore, simplifications should be applied in a prudent manner in life and health insurance.

Other practical issues with regard to risk margin:

- Undertakings had difficulty breaking down the best estimate technical provisions by line of business; one undertaking commented that they

thought this had not been done consistently across undertakings and countries.

- Most undertakings used simplifications to project the SCR adopting either the duration approach or the ratio of SCR to best estimate approach. The simple risk margin proxy was also used by some non-life undertakings. Undertakings expressed concern at the variation of results depending on the chosen simplification. In particular many undertakings commented that the simple risk margin proxy for non-life undertakings produced results which were too high. Undertakings felt that more guidance on the correct method was required.
- One undertaking suggested that the helper Tab was not working correctly where there are negative best estimate technical provisions.

7.3.5.2 Suitability of the methods and reliability of results

Some participants commented that the descriptions and possible simplifications left too much room for **interpretation** and subjective judgement.

In non-life insurance, some participants applied both the main approach provided by the helper Tab, and also the simplified method outlined in formula TS.II.C.25 in the QIS4 specifications, and found that these two approaches yielded materially different results.

In life insurance some participants remarked that the risk margin calculated by the Cost of Capital methodology seems to be unreasonably high **compared to today's risk margin**. The main reason for this would seem to be the longevity shock, where the mortality rates are assumed to decrease (permanently) by 25% for each age and duration. The 25% decrease in mortality rate seems also very high, when the best estimate already includes a longevity improvement. The decrease in the mortality rate should be less than 25% or it should depend on age and duration (decreasing by increasing age).

However, some undertakings regarded the CoC-approach as an inappropriate measure of risk which cannot give the right incentives for risk management. Specifically, it was mentioned that:

- the CoC-approach may be unsuitable for capturing risks slowly evolving over a long period of time and therefore it is not adequate;
- the cost of capital approach may be inappropriate for credit insurance. The argument being that the products allow cedants to cancel cover immediately for new exposures implying that the run-off patterns in extreme scenarios are much shorter than considering the business as a going concern;

Among undertakings that were supportive of the cost of capital approach, the following points were raised with regard to the design:

Diversification effects

Most undertakings commented that diversification between lines of business, between risk types, and between geographies and legal entities should be taken into account with some stating that from an **economic point of view** it is more correct to value the liabilities based on the undertaking's own portfolio. Not recognising such diversification benefits in the calculation of the risk margin may overstate the fair value of liabilities when treating the company as a whole. Only one undertaking thought that allowance for diversification was not appropriate as business could be sold on a book by book basis.

A small number of undertakings thought that the projected SCR should allow for the impact of diversification between all non-hedgeable risks.

Some undertakings commented that non-hedgeable financial risks should also be included.

Some supervisor points out that from a supervisor's perspective, the assumptions regarding the notional receiving entity, transference of one line of business leading to insolvency due to removal of some diversification benefit and the arguments make a lot of sense. The approach for calculating the risk margin, assuming the transfer of each line of business to an empty reference undertaking – thus not recognising diversification between lines of business – is justified in prudential regulation.

Cost-of-Capital rate

A number of questions were raised regarding the **appropriateness of the 6%** cost of capital rate and the work of the CRO Forum was referenced by several undertakings. They argued that is questionable whether such a choice would lead to a reliable proxy for the cost of transferring a portfolio to a willing third party. Others felt that the cost-of-capital factor of 6% may overstate the true CoC for companies that may hold or acquire these liabilities, and argued for a factor in the range of **2%-4%** instead. One undertaking thought that a single cost of capital rate which is the same across all lines of business and countries is unlikely to be appropriate.

Further consideration should be given to the appropriateness of the 6% cost of capital factor in light of the CRO Forum research.

Choice of risks to include

Some undertakings expressed confusion as to whether or not **non-life catastrophe risk** should be included.

Also, some participants commented that further clarification with respect to the inclusion of the **premium risk and the market risk** in the CoC calculations would be needed, since they are already considered in the SCR for the current year.

One supervisor noted that deeper analysis is necessary in relation to the recognition of the **risk mitigating effects** of future profit sharing and deferred taxes in the risk margin. The projection of this effect until run off of the liabilities appears to be very challenging from a technical point of view. One undertaking suggested that the risk margin can be reduced via internal reinsurance.

Explanations to the following graphs: The weighted average of the suitability of calculation of the risk margin is 3.07, incentive for effective risk management of calculation of the risk margin is 3.01, reliability and accuracy of results of calculation of the risk margin is 2.97, choice of parameters for calculation of the risk margin is 2.88, calibration for calculation of the risk margin is 2.78 and practicability of calculation of the risk margin is 3.00.

Figure 39: Assessment of the suitability of the calculation of the risk margin

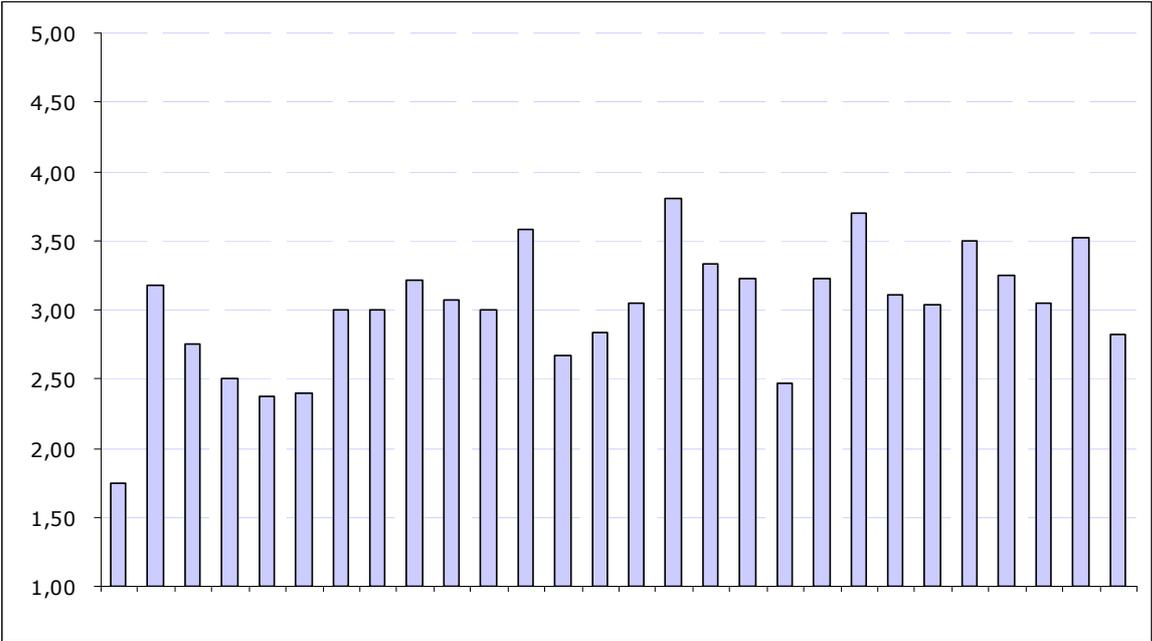


Figure 40: Assessment of the incentive for effective risk management for the calculation of the risk margin

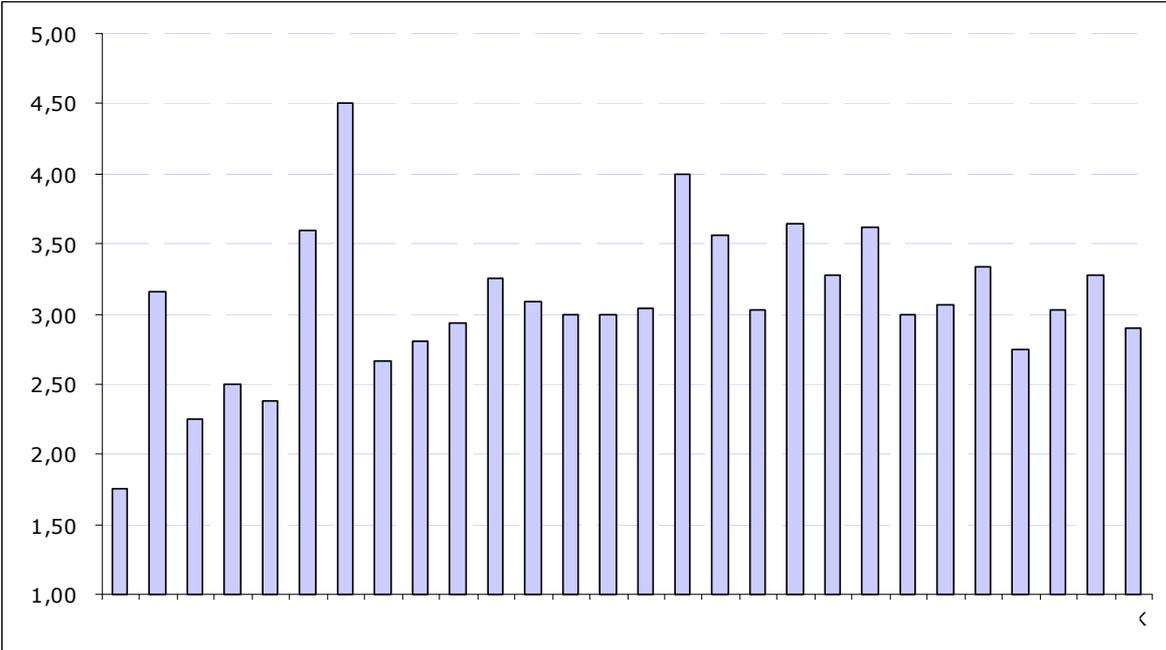


Figure 41: Assessment of the reliability and accuracy of results for the calculation of the risk margin

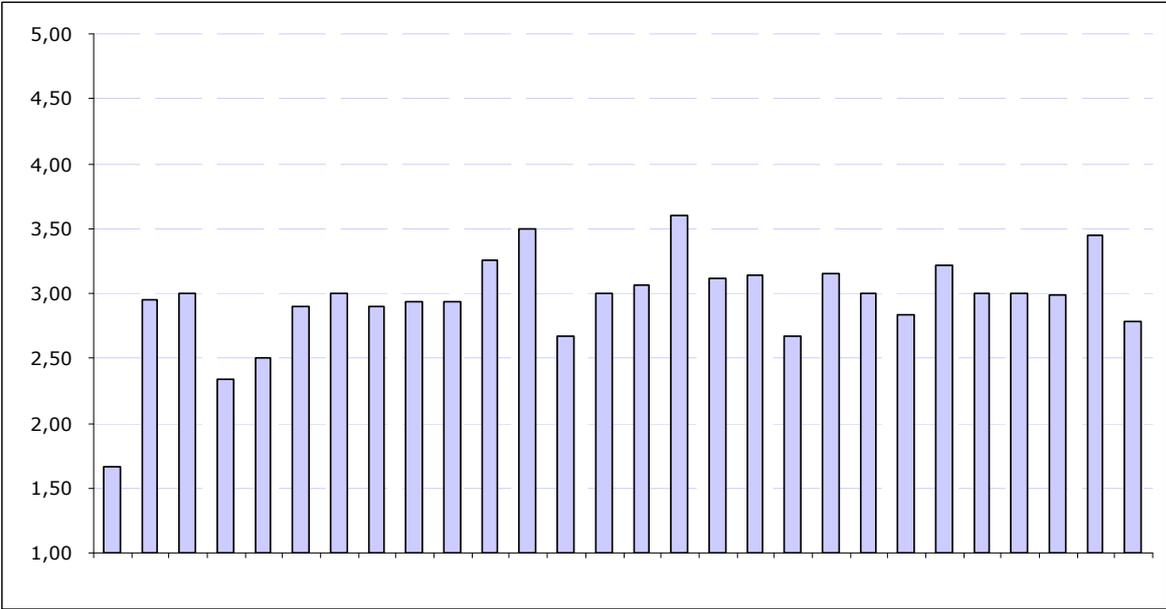


Figure 42: Assessment of the choice of parameters for the calculation of the risk margin

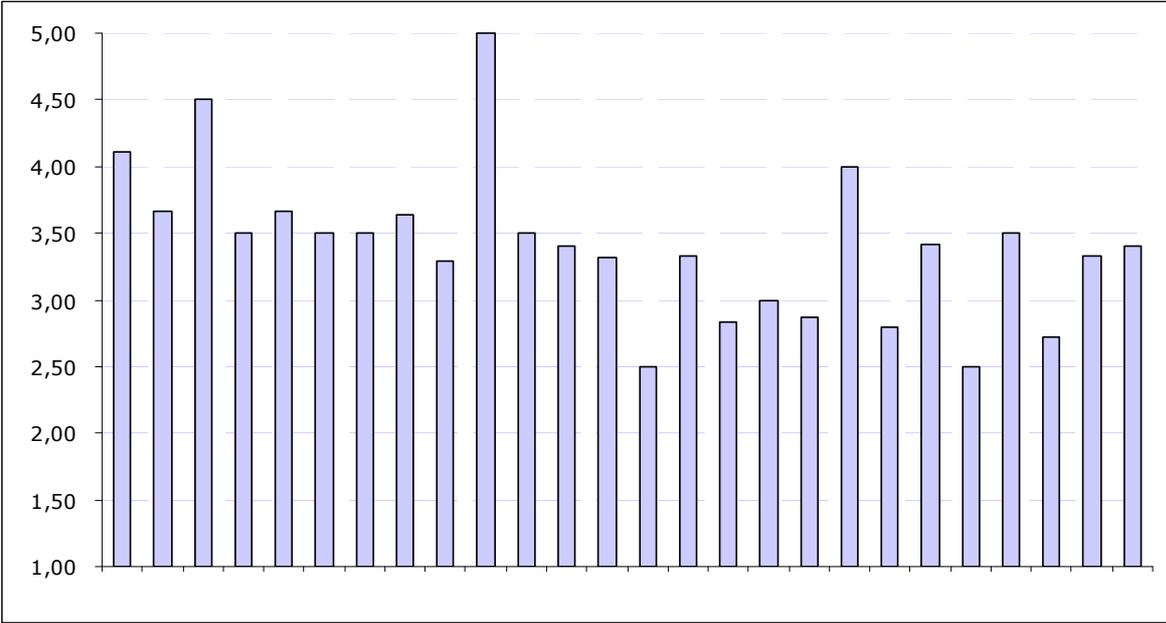


Figure 43: Assessment of the calibration for the calculation of the risk margin

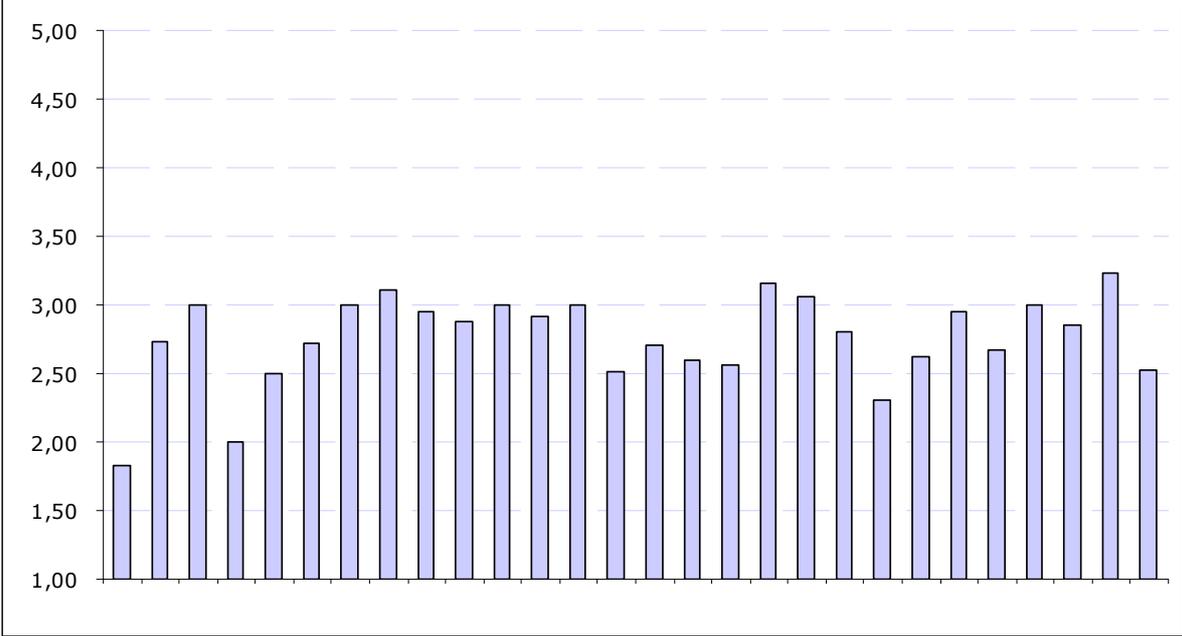


Figure 44: Assessment of the practicability for the calculation of the risk margin

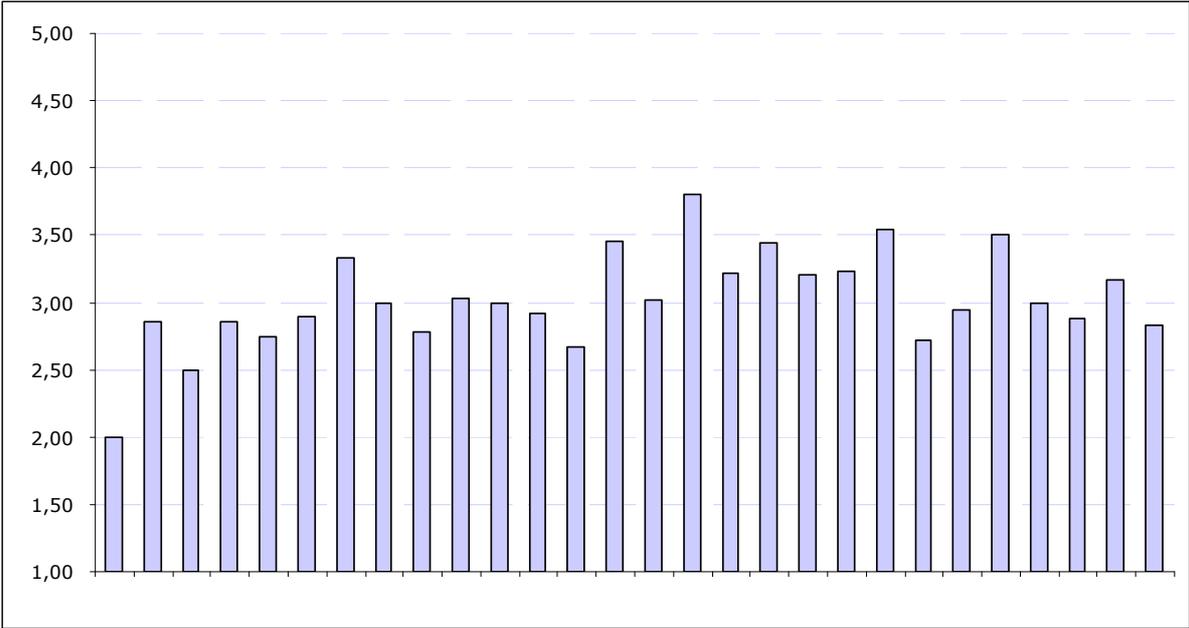


Figure 45: Ratio of (net) risk margin to QIS4 (gross) total non-hedgeable provision – Total Life Business

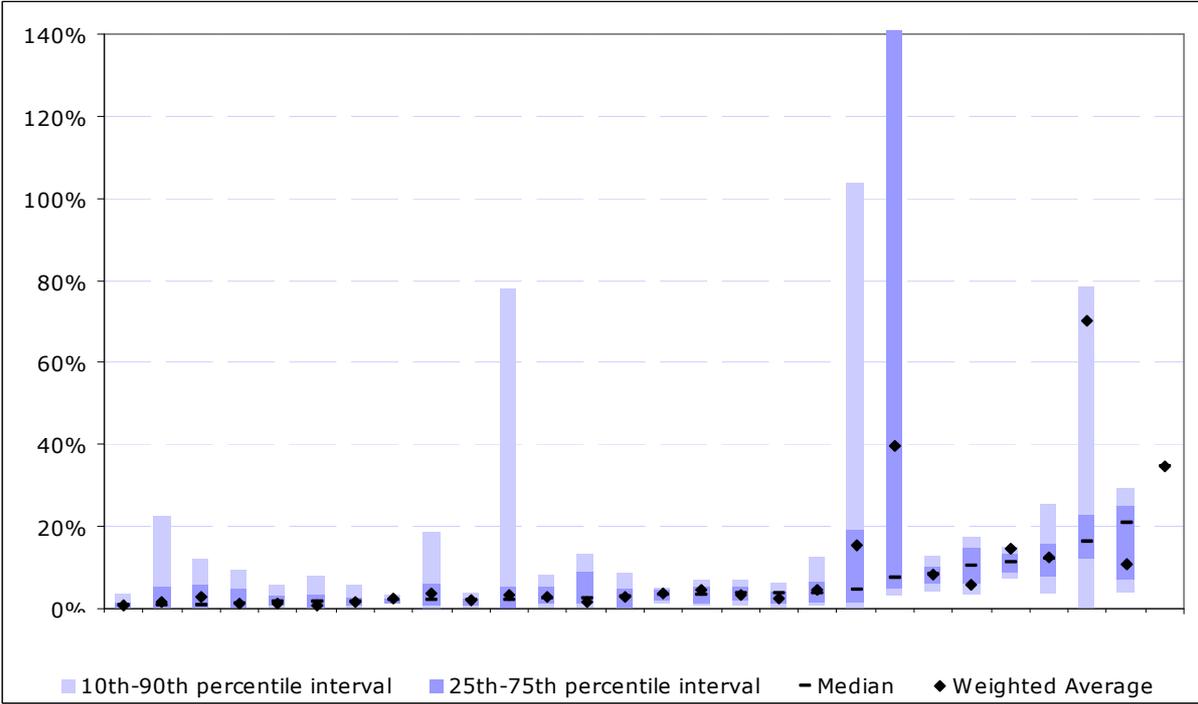
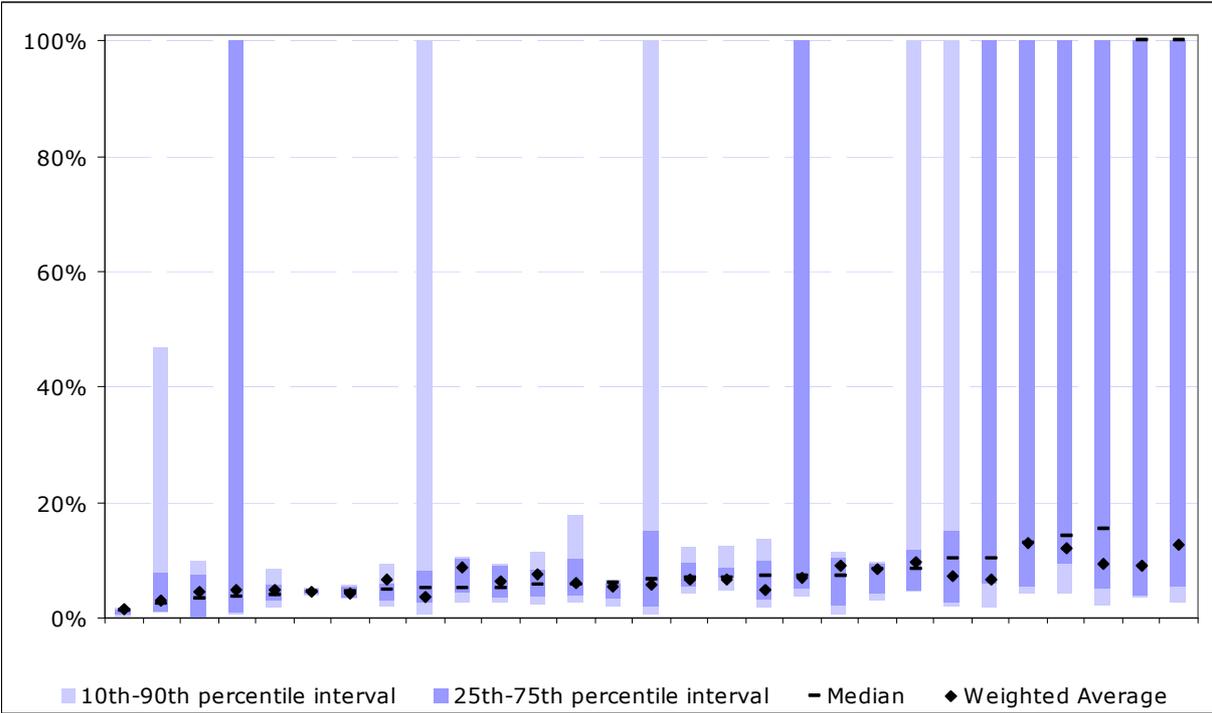


Figure 46: Ratio of (net) risk margin to QIS4 (net) total non-hedgeable provision – Total Non-Life Business



7.4 Quantitative impact on the amount of technical provisions for different lines of business

7.4.1 Differences between QIS4 and local GAAP

Supervisors and most of the undertakings reported that the **main differences** between QIS4 and local GAAP figures with respect to technical provisions resulted from different valuation principles. Local GAAP results are based on prudent valuation principles and QIS4 Technical Specifications are based on market-consistent valuation principles. In other words, the implicit margins for prudence were removed and replaced by an explicit risk margin.

In particular, the **discount rate** is different to that used for local GAAP in many countries, for example in some countries, the discount rate under local GAAP is the same as that used for pricing.

Furthermore, under local GAAP, anticipated profits on **future premiums** and charges are often not recognised in the calculation of technical provisions. The requirement that these future profits be included in the value of best estimate liabilities under Solvency II is then a major change from local GAAP.

Concerning the “**current exit principle**”, some undertakings took a more critical view and noted that, in most cases, the risks underlying the insurance obligations would be specific to the portfolio of the insurer and that there would generally be no observable market to gauge risks and costs against. Also, in the ordinary course of business insurance companies would normally retain insurance liabilities and would not transfer them to a third party.

7.4.2 Life insurance

The main differences between QIS4 and **local GAAP** are that GAAP assumptions for life insurance business include **conservative** mortality, morbidity and accident rates, use a fixed interest rate (based on yields at point of sale, less a conservative margin) to discount future cash-flows or the discount rate is based on the yield on the assets backing the liabilities. In addition, QIS4 provisions included an explicit allowance for the value of future bonuses. Furthermore there is an explicit requirement that the technical provisions cannot be lower than the surrender value and that mathematical provisions cannot be negative with the exception of Zillmerised provisions.

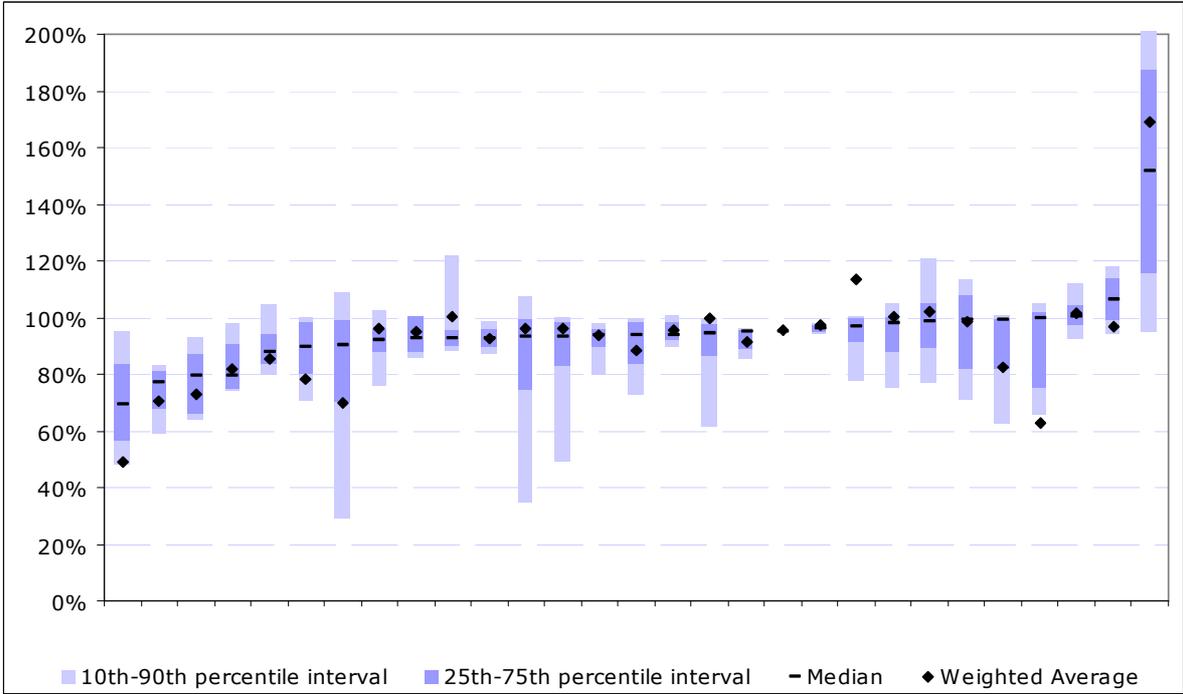
In addition, there was no requirement for an explicit risk margin under local GAAP. The risk margin was implicitly included in the technical provisions.

There were also a number of **country specific reasons** for differences between QIS4 and local GAAP figures:

- In one country, small insurance undertakings assess their technical provisions using a traditional net premium valuation approach which only includes an implicit allowance for future bonuses. However for large insurers, the technical provisions for with-profits contracts include explicit allowance for all expected future bonuses, together with a market consistent value for financial options and guarantees. Therefore differences between local GAAP and QIS4 figures are greater for smaller insurers than larger insurers.
- The QIS4 Technical Specifications prescribes the risk-free discount rates adjusted to market value where risk-free rates vary with the maturity of liabilities.
- The mortality and disability tables used to value QIS4 technical provisions were based on the risk characteristics of the undertakings portfolio which are usually less conservative than those used in pricing basis. However, generally due to the size of their portfolio, many undertakings used their national statutory tables.
- Under GAAP the latent gains and future returns are not attributed to policyholders by means of future discretionary benefits.

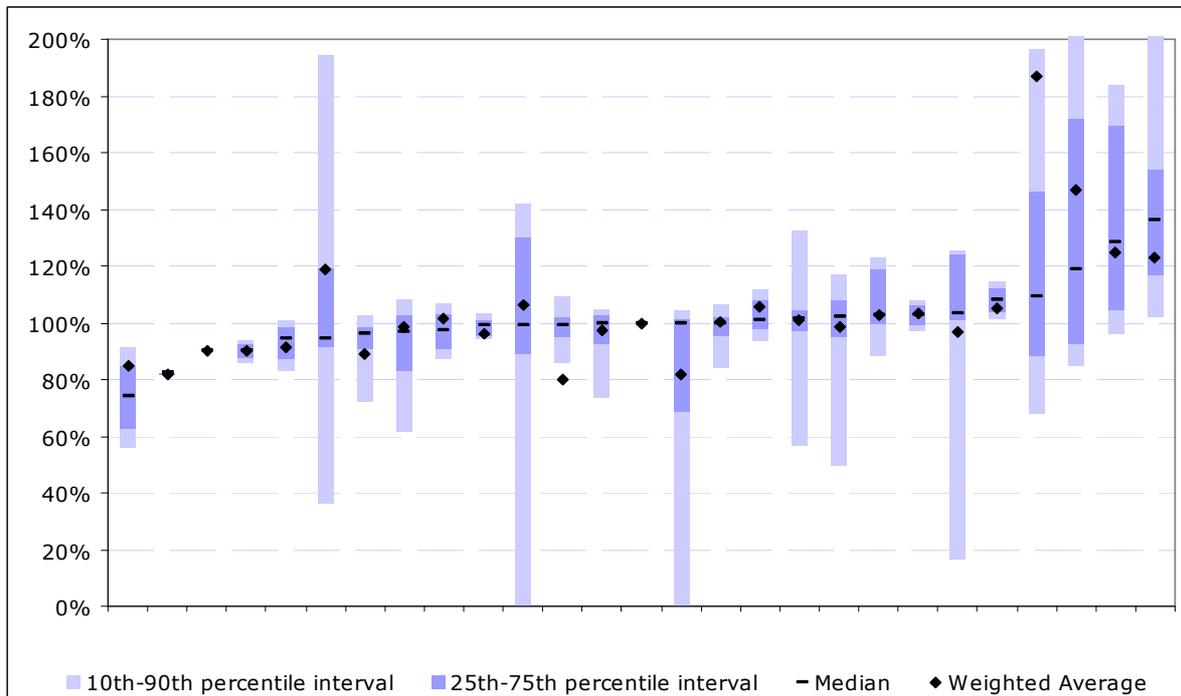
- In the valuation of QIS4 liabilities, policyholders’ behaviour, such as lapses and surrenders, was taken into account. Management actions were also taken into account in the calculation of future discretionary benefits.
- Some undertakings reported that a positive result of riders decries the technical provisions for life insurance.
- Under QIS4 some undertakings also include expected renewals in the valuation of the technical provisions and cost of guarantees.
- Under local GAAP future cash-flows for unit-linked products cannot be taken into account (i.e. technical provisions are equal to the unit reserves).

Figure 47: Ratio of QIS4 (net) provisions to Solvency I (net) provisions for life business (all undertakings)



The net QIS4 technical provisions (the sum of net best estimate and risk margin) are for most countries lower than Solvency I net technical provisions. The weighted average of the ratio of QIS4 net technical provisions and Solvency I net technical provisions is for most countries between 50% and 100%.

Figure 48: Ratio of surrender values to QIS4 best estimate (gross) provisions for policies which include the right to lapse (all undertakings)



In the majority of the countries the weighted average of the ratio of surrender values to gross best estimate is around 100% (Figure 48). But in some countries and in some insurance companies the surrender values are higher than the QIS4 gross best estimate.

Risk margins in life business are less than 5% of the size of best estimate provisions for about three quarters of undertakings though outliers can be observed in a number of countries. Risk margins are particularly low for with-profit policies and unit-linked contracts, but tend to be higher for without-profit policies and life reinsurance (Table 20).

Figure 49: Ratio of (net) risk margin to QIS4 (net) best estimate provision (total life business)

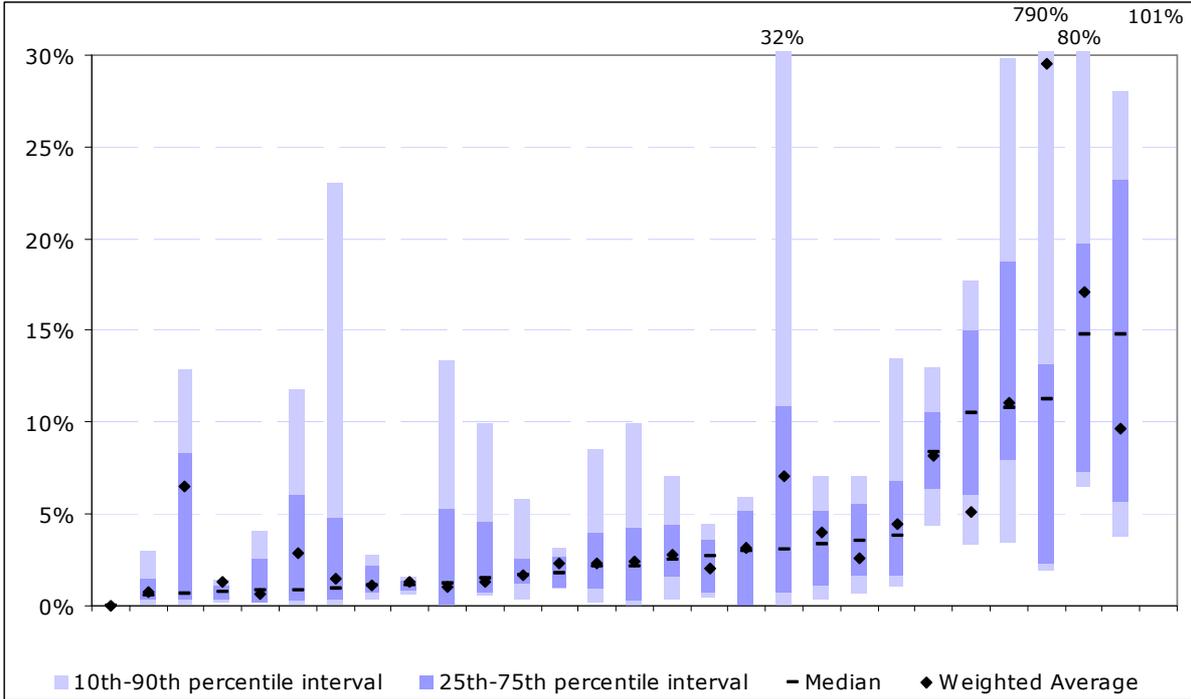
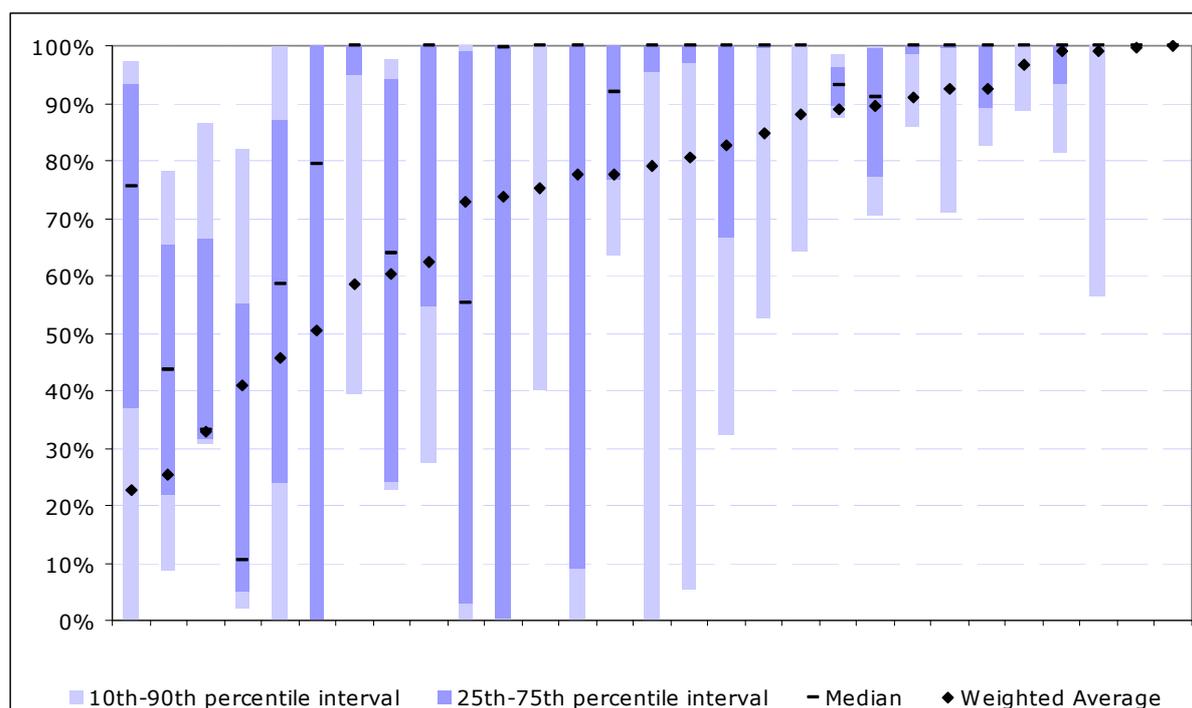


Table 20: Ratio of (net) risk margin to QIS4 (net) best estimate provision by segments (total life business)

	10th	25th	50th	75th	90th	Average	Sample size
	percentile						
With-profit policies	0.0%	0.5%	1.2%	3.4%	7.2%	4.7%	(414)
Linked policies	0.0%	0.0%	0.3%	1.4%	5.1%	6.0%	(390)
Without-profit policies	-1.9%	0.0%	3.0%	9.1%	29.4%	16.6%	(360)
Reinsurance	0.0%	0.0%	1.2%	8.3%	15.9%	11.2%	(64)

Figure 50: Ratio of non-hedgeable (gross) provision to QIS4 best estimate (gross) provision (life business, all undertakings)



7.4.3 Non-life insurance (including health insurance)

For non-life insurance business, the local GAAP in some countries allows the discounting of technical provisions only under certain conditions. In the majority of countries, the current technical provisions are not discounted with the exception of non-life annuities. Instead of the implicit safety margin included in the technical provisions through prudent and cautious assumptions under the local GAAP, explicit risk margins were required in QIS4 Technical Specifications.

Supervisors reported that under the requirements of local GAAP, the outstanding claims for the non-life insurance are established based on the principles of caution and on a single-loss basis. Discounting future cash-flows in the calculation of the premium and claim provisions, and in some countries including recoveries, are the major changes from local GAAP.

The supervisor in another country believes that non-life technical provisions were underestimated.

In many countries, insurance undertakings hold equalisation provisions and some also hold provisions for natural catastrophes and provisions related to the guarantee scheme under local GAAP. These provisions become part of the equity under QIS4.

The technical provisions for health insurance for which the same principles as for life insurance apply, were calculated by using discount rates which were equal to

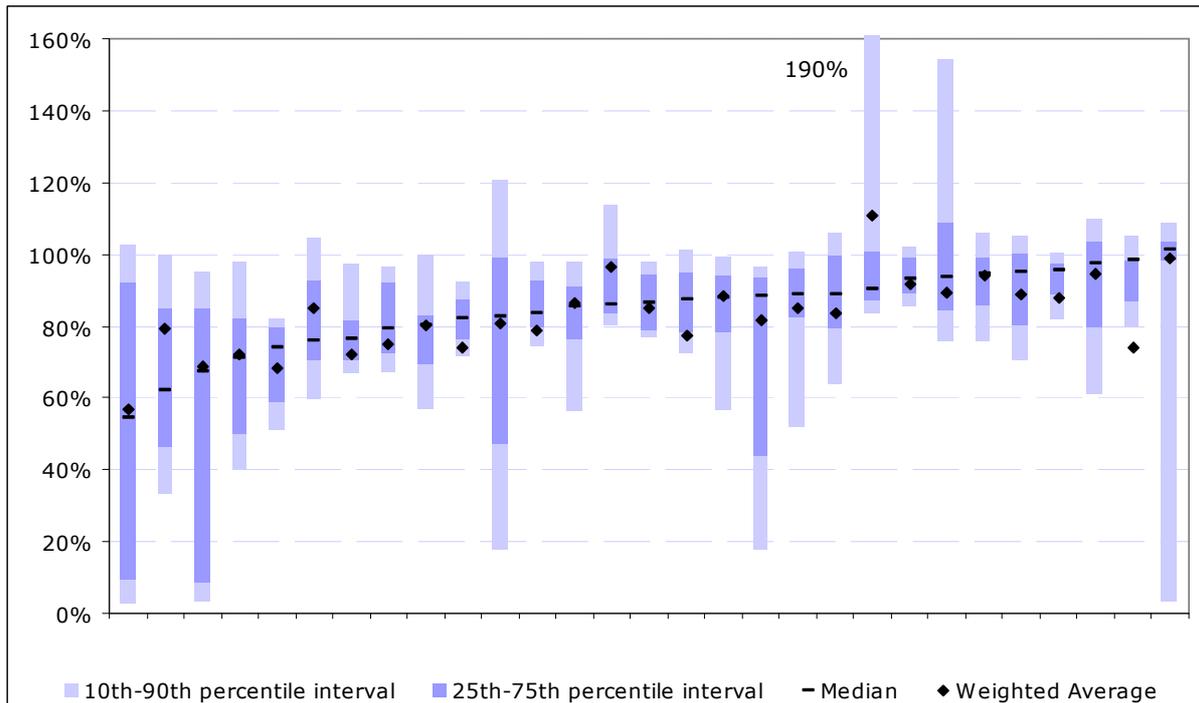
the risk-free rate. There was also adjustment to future premium so that future premiums were considered in the valuation of liabilities (i.e. death products and chronic illnesses insurances).

Supervisors reported that the technical provisions for health insurance are mainly affected by the change in the interest rate and the move to best estimate parameters.

Again there were also a number of country specific reasons for differences between QIS4 and local GAAP figures:

- Premium provisions under the QIS4 Technical Specifications recognise the profit at an early stage.
- Some undertakings did not use run-off triangles to calculate claims provisions under QIS4.
- Under local GAAP expected reimbursement are not allowed.
- Under local GAAP the technical provisions for bonuses and rebates are not calculated stochastically but as a percentage of technical provisions.
- Deferred acquisition cost on assets and liability side are netted out under QIS4 Technical Specifications.
- The reinsurance share of the provisions and recoverables against reinsurance are grouped in the same item "Reinsurance". This is not convenient as discounting should not be applied in the same way to the two items.
- In one country, local GAAP does not allow reinsurance to be taken into account in the calculation of the incurred but not reported claims provisions.

Figure 51: Ratio of QIS4 (net) provisions to Solvency I (net) provisions for non-life business (all undertakings)



Risk margins for non-life business are higher than those in life business. As a percentage of net best estimate provisions they are, on average, between 3% and 8% in most countries; about three quarters of undertakings reported a ratio of less than 10%.

Among the lines of business with the highest risk margins in relation to the best estimates are credit & suretyship (10.5%), legal expenses (10.7%), as well as the three non-proportional reinsurance lines (between 11.4% and 20.6%).

Figure 52: Ratio of (net) risk margin to QIS4 (net) best estimate provision (total non-life business)

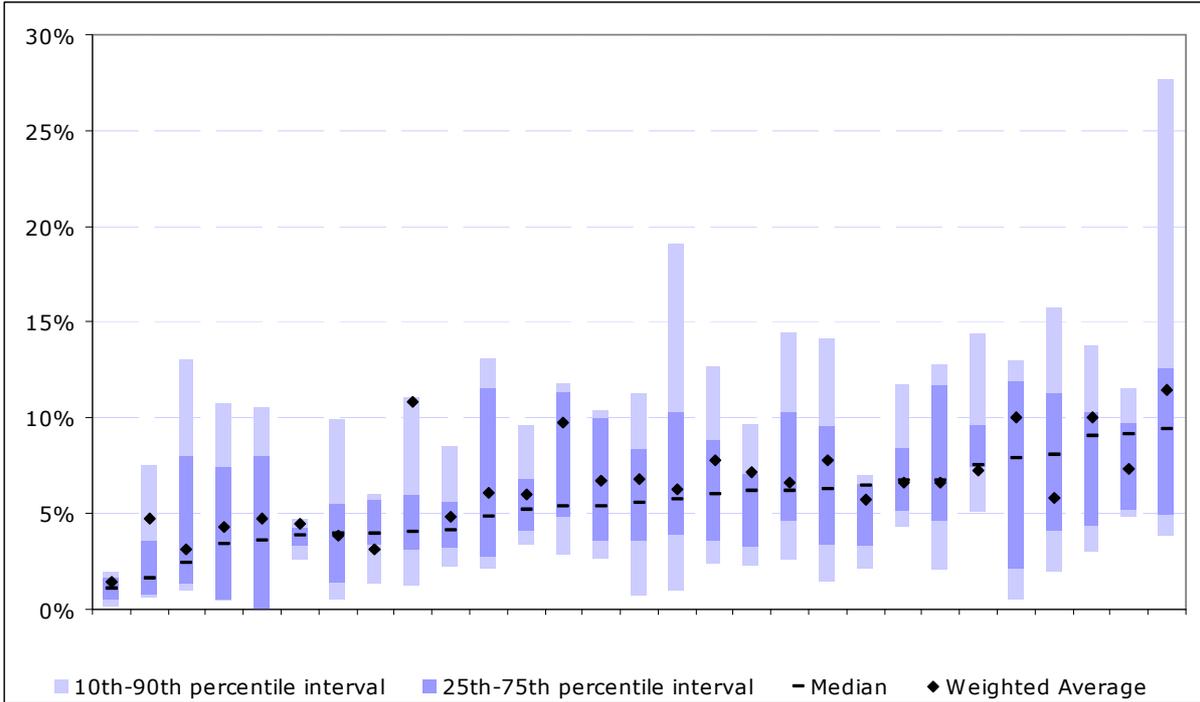


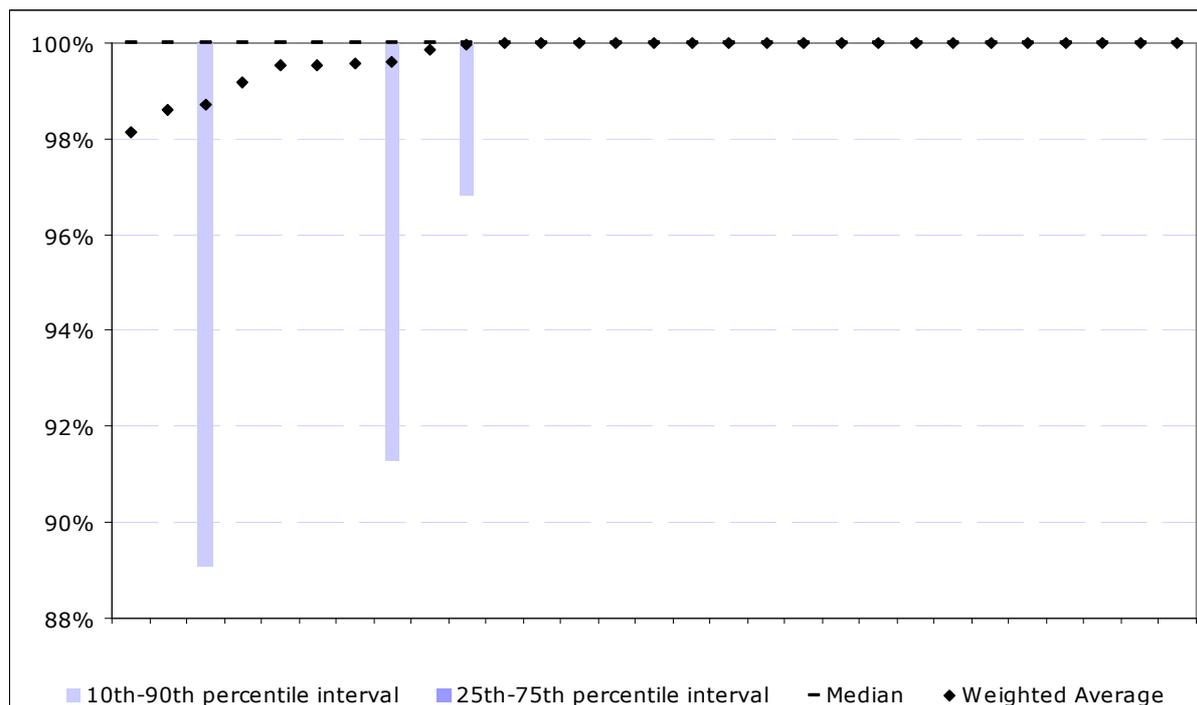
Table 21: Ratio of (net) risk margin to QIS4 (net) best estimate provision by lines of business (total non-life business)

	10th	25th	50th	75th	90th	Average	Sample size
	percentile						
Workers' compensation	0.9%	1.4%	2.7%	7.7%	10.9%	8.4%	(27)
Health short-term	0.5%	1.1%	2.6%	6.0%	11.1%	5.5%	(349)
Health (other)	1.4%	2.7%	4.6%	8.4%	12.0%	8.4%	(308)
Motor, third party liability	2.0%	3.1%	6.7%	11.2%	15.7%	9.7%	(158)
Motor, other classes	2.3%	4.0%	6.0%	10.8%	13.6%	7.9%	(390)
Marine, aviation and transport	0.8%	1.3%	1.9%	4.0%	6.0%	3.4%	(352)
Fire and other damage to property	1.7%	3.0%	4.4%	9.0%	12.9%	7.6%	(288)
Third-party liability	1.1%	2.5%	3.9%	6.0%	10.3%	5.3%	(495)

Credit and suretyship	3.0%	5.6%	9.9%	14.0%	16.9%	10.5%	(455)
Legal expenses	1.8%	3.5%	5.4%	9.0%	15.5%	10.7%	(170)
Assistance	1.0%	2.2%	3.9%	5.4%	7.2%	5.9%	(180)
Miscellaneous non-life insurance	0.4%	1.3%	2.5%	6.0%	11.8%	7.5%	(130)
Non-proportional reinsurance property	1.1%	2.3%	4.6%	9.6%	15.4%	20.6%	(281)
Non-proportional reinsurance casualty	0.4%	3.9%	6.3%	11.3%	17.0%	11.4%	(82)
Non-proportional reinsurance MAT	4.6%	7.3%	12.6%	17.1%	21.0%	18.1%	(72)

Non-life provisions are largely considered non-hedgeable. Undertakings in more than half of the countries reported no hedgeable elements at all, on average the share of hedgeable elements is about 1.5%.

Figure 53: Ratio of non-hedgeable (gross) provision to QIS4 best estimate (gross) provision (non-life business, all undertakings)



7.4.4 Discounting

The QIS4 Technical Specifications prescribed the use of certain risk-free interest rate term structures for the discounting of insurance cash-flows.²⁰ For the Euro as well as most other currencies the term structure was derived from swap rates. For some markets without liquid swap rates like Iceland, the term structure was derived from government and state secured housing bonds, and in Romania the term structure was derived from government bonds.

Some participants expressed concern on the high **effect** the discounting had on the technical provisions. Others considered discounting as not appropriate for provisions which do not exhibit reliable cash-flow patterns (e.g. for very large claims or small LoBs in non-life insurance).

In addition to the calculations with the prescribed interest rate term structure, undertakings could use an **undertaking-specific term structure** for the valuation of technical provisions. Overall, only few undertakings made use of this option. However, in one market large undertakings generally applied their own term structure. The reasons for the deviations from the specified curve varied. Some undertakings applied the term structure of their internal models for reasons of practicability and consistency. Another group of insurers based their

²⁰ Cf. TS.II.B.10-14, TS.XVII.A

own curve on the rates of government bonds or the money-market, for example because these are more liquid than swap-rates at some durations. Some insurers used the option to derive flat interest rate curves for reasons of practicability.

A number of undertakings expressed concern about the methodology adopted by CEIOPS and adapted it accordingly:

- The prescribed curve takes account of conjectural market effects for short-term maturities.
- It makes insufficient use of all the available market quotes along the yield curve.
- It seems that the Bloomberg par yields have not been converted into zero coupon bond yields before performing bootstrapping.
- Using bid rather than mid point is deliberately prudent.
- US Dollar and British Pound swap curves incorporate a semi-annual settlement on the fixed leg which was not taken into account in the QIS4 curve.

Other undertakings considered their own choice of interest rate curve to be more appropriate without giving an explanation.

In one market some undertakings added an illiquidity premium to the discount rate for the valuation of annuity business.

Most of the undertakings which used an undertaking-specific interest rate term structure considered the effect on the values of technical provisions to be immaterial. Other undertakings reported differences in the rates of up to 18 basis points.

7.4.5 Effect of the taxation basis

Most life undertakings assumed that there would be no change to the taxation basis i.e. that tax would continue to be calculated based on Solvency I technical provisions. However one undertaking assumed that, although there would be no change to the taxation rules, any reference to Solvency I technical provisions would automatically be replaced by the Solvency II equivalent. This affects the timing of taxation payments. Some undertakings went further and excluded payments of tax based on shareholder profits. Non-life undertakings either calculated gross of tax or stated that this question was not applicable.

Supervisors for most countries commented either that this was not applicable or that undertakings had assumed that there would be no change to the taxation basis. Supervisors in one country commented that there is considerable uncertainty over the taxation basis that will be used following the introduction of Solvency II and that undertakings had taken different views as to whether or not

the taxation basis would continue to relate to Solvency I after the introduction of Solvency II. However the impact on results does not materially affect the overall conclusions that can be drawn from QIS4. The supervisors believe that it will be necessary to prepare guidance for undertakings on how to take account of future taxation payments in the balance sheet, and in the calculation of the SCR.

8 Own funds

The objective of QIS4 in relation to **own funds** was to collect further information, especially on the implementation of the tiering structure, as the specification of the previous impact study was limited to the high level principles set out in the Framework Directive Proposal. In QIS4, the Technical Specifications now include much more detailed guidance on how those high level principles could be implemented in practice. Specifically, elements are classified in relation to how well and when they absorb losses compared to paid-up ordinary share capital, or paid-up initial fund.

The **main findings** are:

- Eligible own funds **increase** by 27%. This is mainly due to:
 - Solvency II valuation adjustments (which account for most of the increase), including the impact of future premiums. How deferred taxes are reflected in these adjustments is, however, unclear.
 - Reclassification of equalisation provisions into own funds.
 - Inclusion in full of hybrid capital instruments, subordinated liabilities and ancillary own funds, subject to the Solvency II limit structure, into own funds.
- On average **95% of total own funds** have been reported in **Tier 1**, 4% in Tier 2 and 1% in Tier 3. Overall, the **classification** of own funds is **deemed suitable and practicable** by undertakings and supervisors.
- The majority of **hybrid capital instruments** and subordinated liabilities have been reported in **Tier 2** because they do not satisfy the loss absorbency requirements or criteria relating to permanence and absence from requirements/incentives to redeem. A **shift to a reporting date approach** when classifying capital instruments would result in a reclassification into a lower tier for a significant number of instruments. A number of undertakings and supervisors stressed the importance of grandfathering in relation to hybrid capital instruments and subordinated liabilities.
- QIS4 results reinforce that the issue of **ring-fenced funds** may be **significant** for at least seven countries, but both undertakings and supervisors have **mixed views** on the suitability and practicality of the QIS4 methodology.
- In most countries, the number of undertakings that have reported **ancillary own funds is limited**. The volume of ancillary own funds reported is small in relation to basic own funds (2.5%) and total own funds (2.4%). Most undertakings and supervisors **agreed** with, or did not object

to, the **40:60 split** of supplementary mutual member calls between Tier 2 and Tier 3.

- Very few undertakings have reported **group support** at the solo level.
- There was **no useful feedback** on the **valuation** of ancillary own funds.
- Some undertakings and supervisors commented that it was **unclear** how to classify **reserves and provisions**, such as equalisation reserves/provisions.
- **Surplus funds** are confirmed to exist in eight countries, totalling EUR 42 billion. In the majority of these countries, surplus funds are reported in limited undertakings, though in terms of volume this represents only one quarter of total surplus funds. The remaining three quarters of surplus funds are held in mutuals and mutual type entities, reported in two countries.

8.1 Impact on own funds

8.1.1 Overall increase in own funds

Applying the QIS4 Technical Specifications, total own funds for all countries **increase** by 27% in comparison to Solvency I. The increase is largely due to three factors:

1. **Solvency II valuation adjustments** (which account for most of the increase), including the impact of future premiums, to the extent that these have been recognised by undertakings. The valuation adjustments result from the move to a market consistent valuation approach under QIS4.
2. **Reclassification of equalisation provisions** into own funds.
3. **Inclusion in full of hybrid capital instruments, subordinated liabilities and ancillary own funds**, subject to the Solvency II limit structure, into own funds.

Owing to the fundamentally different approaches to the design, recognition, classification and computation of own funds under Solvency I and Solvency II, any comparison of the two needs to be made carefully. There are items in Solvency I which no longer appear as specific own funds items in Solvency II; for example profit reserves, revaluation reserves and other Solvency I specific items. In some cases these may have resulted in decreases in own funds, but in others may have been reallocated into another item, for example into the reporting line "Other".

The graphs below show the composition of the Tiers as reported by undertakings in QIS4.

Out of the most important capital component, Tier 1, the main proportions are attributable to common equity, retained earnings, and valuation adjustments. Surplus funds, as defined in the QIS4 Technical Specifications, appear to be of minor importance, contributing approximately 6% of Tier 1 capital elements, though their importance is high in specific countries.

Figure 54: Composition of Tier 1 (all undertakings)

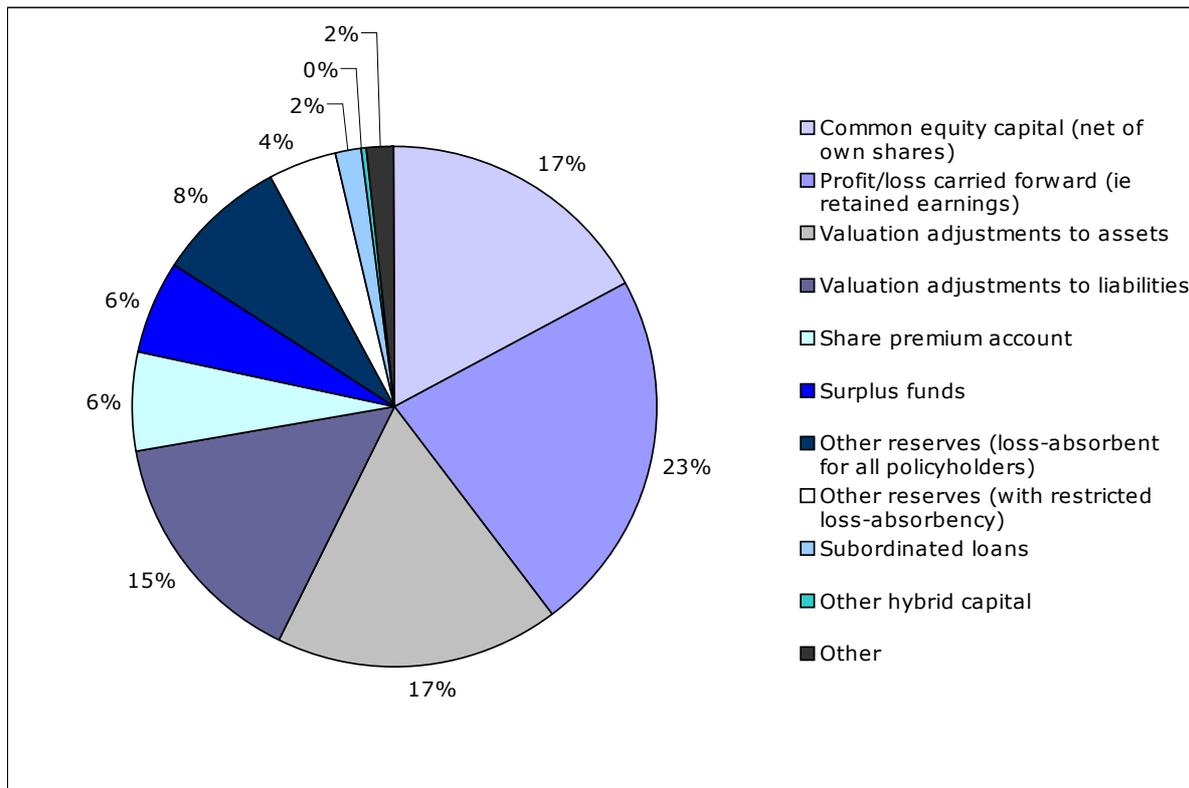


Figure 55: Composition of Tier 2 (all undertakings)

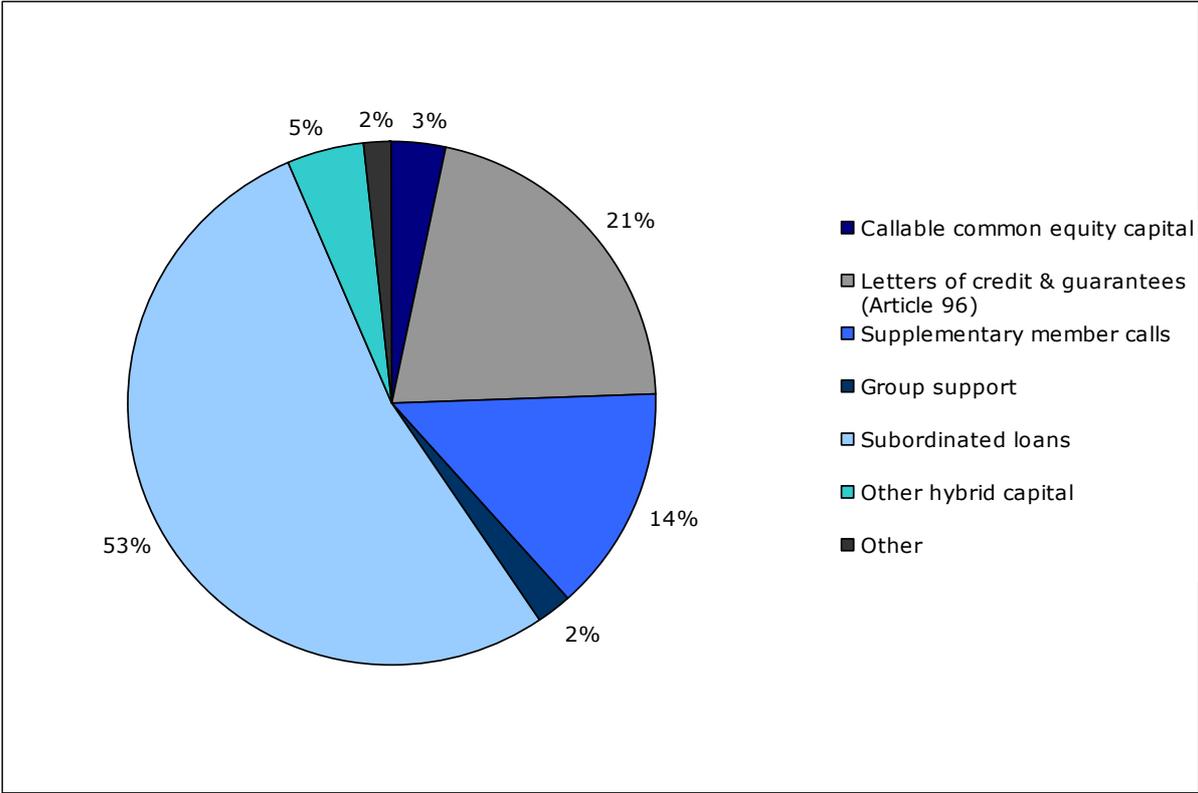
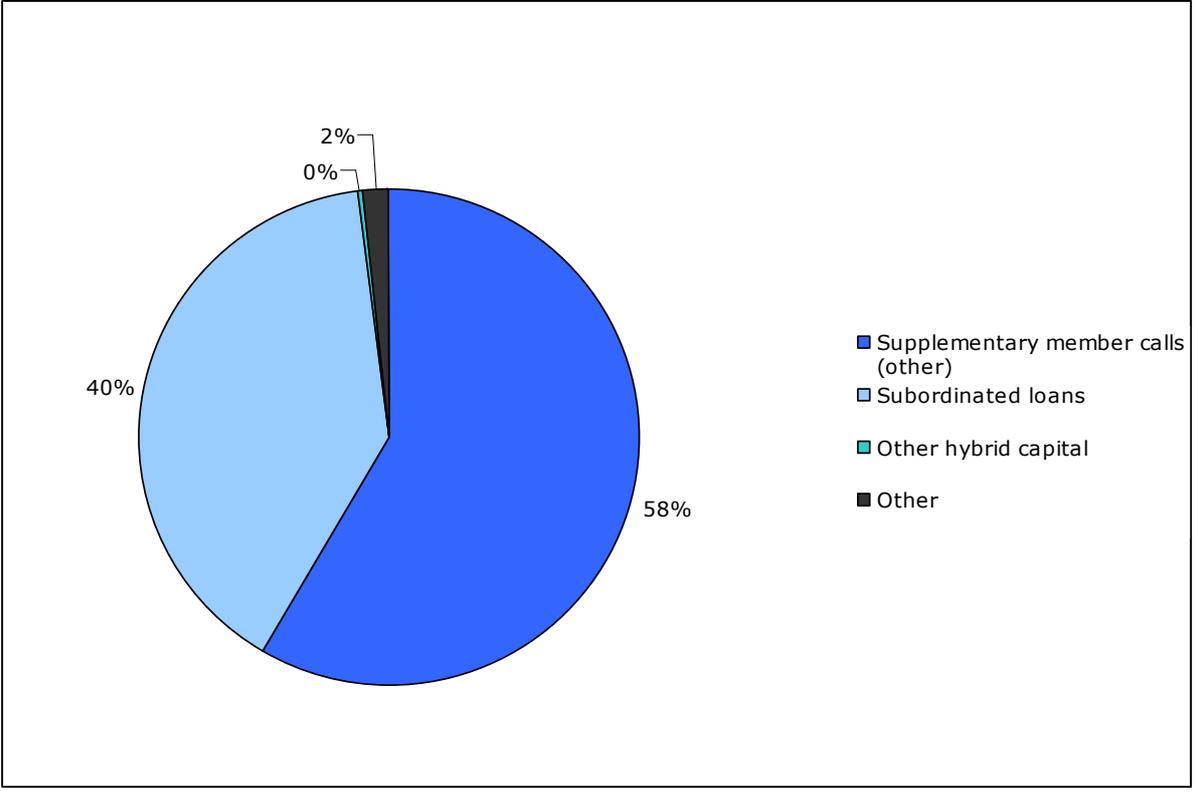


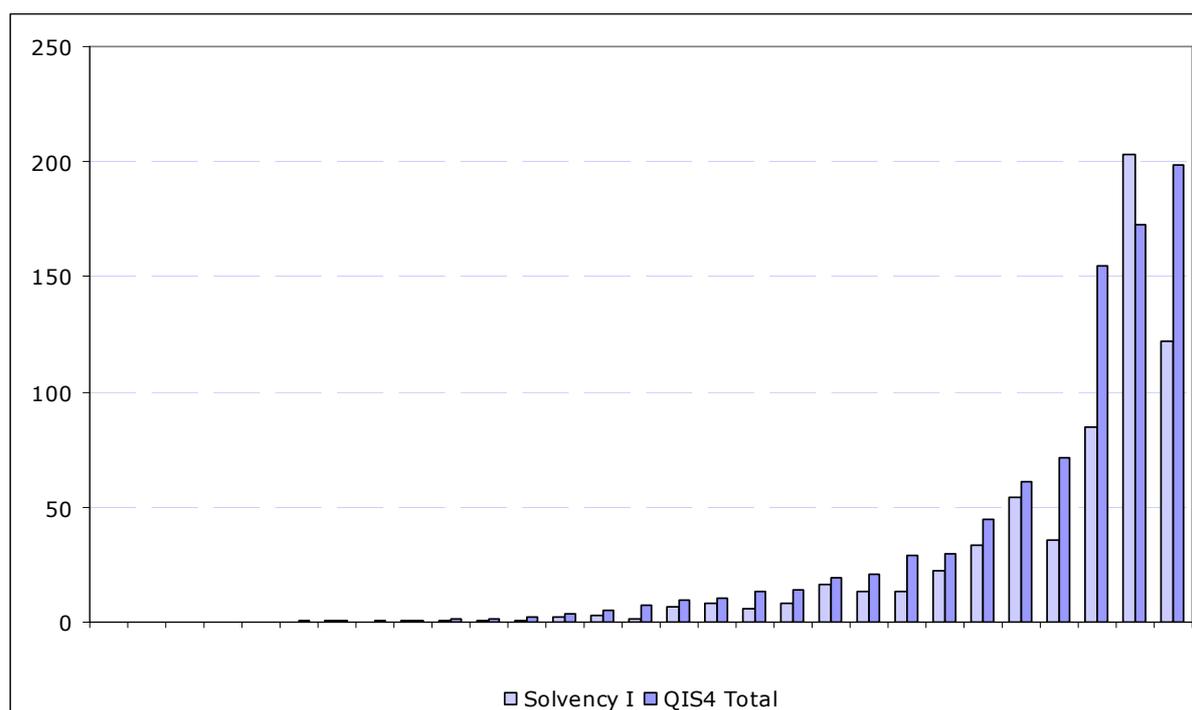
Figure 56: Composition of Tier 3 (all undertakings)



8.1.2 Increase/decrease across countries

Own funds increase in most countries. There is one notable exception, where total own funds decrease for life insurers as a result of recognising future expected benefits for profit sharing contracts and recent market losses for annuity businesses. Figure 57 shows the increase/decrease of own funds across countries.

Figure 57: Total own funds under Solvency I and QIS4 (all undertakings, EUR billion)



8.2 Suitability of criteria for classification of own funds

Overall, the **classification of own funds is deemed suitable** by undertakings and supervisors. Undertakings provided different views as to whether the classification is conducive to or in line with risk management. Some supervisors reported that a clearer definition of hybrid capital instruments is needed.

On average, **95% of total own funds have been reported in Tier 1**, 4% in Tier 2 and 1% in Tier 3. However, in some countries, own funds reported in Tier 2 and Tier 3 are not negligible.

The amounts reported in **Tier 2 and Tier 3 are mainly hybrid capital instruments, subordinated liabilities, unbudgeted supplementary member calls (mutuals) and letters of credit.**

While QIS4 is consistent with the QIS3 results that the majority of own funds is Tier 1, the detailed specification of QIS4 appears to have assisted in the classification process and appears to make the results more reliable in most cases.

8.3 Practicability of proposed approach to classify own funds

Overall, the proposed **approach to classifying own funds is deemed practicable** by undertakings and supervisors.

Undertakings generally **supported the principle-based approach**, although they would welcome greater clarity on some aspects (e.g. the distinction between other reserves that are loss-absorbent for all policyholders and those with restricted loss-absorbency); and noted that in this sense national guidance had been helpful.

Undertakings voiced mixed views as to whether the characteristics for classifying instruments into Tiers are clear.

In relation to the major impacts arising from a different approach to classification set out in QIS4, a number of undertakings and supervisors stressed the **importance of grandfathering** to ensure a smooth transition to Solvency II, particularly in relation to issued capital instruments.

Some supervisors noted **some classification difficulties** for reserves not specified in the list, and some raised concerns about the reliability of the reported classification of hybrid capital instruments and subordinated liabilities (“hybrids”/“hybrid instruments”). One supervisor noted that the use of the term “substantially” in the draft Level 1 text may have led some undertakings to apply their own interpretation of the characteristics for classifying instruments into Tiers, despite the Technical Specifications stating otherwise.

Many undertakings reported that the **treatment of deferred taxes** is unclear and confusing. Supervisors reported that insurers have not all reported deferred taxes on the same basis, although the impact on own funds cannot be quantified.

Some undertakings continue to view the three-Tier structure as too complex, although in the vast majority of cases, the QIS4 specifications, together with the Tier structure and limits, **do not result in capital adequacy breaches** and hence the need to raise additional capital. Out of 1,366 reporting undertakings in QIS4:

- 35 undertakings reported Tier 1 below one third of SCR
- 19 undertakings reported Tier 3 above one third of SCR

- 25 undertakings reported Tier 1 below one half of MCR
- 53 undertakings reported Tier 2 above one half of MCR.

8.4 Analysis of specific issues tested in QIS4

8.4.1 Ring-fenced funds

8.4.1.1 Summary

- QIS4 results reinforce that the issue of ring-fenced funds is significant for a number of jurisdictions and some supervisors consider that the quantitative results may even understate the number of ring-fenced funds in existence.
- Undertakings and supervisors have mixed views on the suitability and appropriateness of the QIS4 methodology.
- There is general agreement that only the amount of own funds within the ring-fenced fund that is needed to meet the capital requirements of the ring-fenced funds can be used to meet capital requirements. However, many do not agree that using a proportionate amount of the SCR as the capital requirement for the ring-fenced fund is appropriate. This is mainly because the existence of ring-fenced funds could remove diversification benefits.
- Several undertakings, other than life insurers that write with-profits business, reported ring-fenced funds. This has prompted several supervisors to call for a clearer definition of ring-fenced funds.

8.4.1.2 Number, size and amounts held within ring-fenced funds

In most countries for which the issue of ring-fenced funds is relevant, the **number of undertakings that reported ring-fenced funds was relatively small** (circa 1 or 2 undertakings). In two countries (PT, UK) ring-fenced funds are more prevalent. In one of these countries (PT) it was commented that although only a few undertakings reported the existence of ring-fenced funds, in practise this issue affects most life undertakings that operate in the market. In the other country (UK) a total of 17 QIS4 undertakings reported 31 ring-fenced funds.

Few undertakings with ring-fenced funds reported the amount of **own funds held within ring-fenced fund structures**. However, where numbers were reported the amounts tended to be low relative to total own funds (<5%). One

country reported that based on the Solvency I information the size of ring-fenced funds represent 13% of total life assets; however the size of ring-fenced relative to own funds was not given.

A number of countries either indicated that ring-fenced funds were not applicable in their jurisdiction or did not express a view on this question.

8.4.1.3 Ring-fenced fund structures and transferability

Most ring-fenced funds were reported by life insurers that write with-profits business, but other types of ring-fenced funds were also identified. One country noted that most of the ring-fenced funds reported related to regulatory ring-fenced structures for pension contracts. In another country one P&I club treated a small part of its capital as ring-fenced, as funds are either established to achieve an underwriting licence from specific states or as an escrow fund after the company has purchased an insurance portfolio.

Supervisors in some countries commented that **a clearer definition of ring-fenced funds was needed**. Where undertakings, other than life insurers that write with-profits business, reported ring-fenced funds there was some uncertainty over whether it was the intention of QIS4 to capture these structures. For example, one country commented that it was unsure whether the type of ring-fenced fund reported by one of its P&I clubs should be considered “ring-fenced” for the purposes of QIS4.

In the cases where with-profits funds are closed to new business, the **restrictions in relation to transferability** that were reported were as follows:

- In one country regulations require own funds within the ring-fenced fund to be distributed over the remaining life time of the policyholders, so that shareholders (in most cases) have no right to capital, other than from a (limited) share of the annual distributions of profits.
- In another country two closed with-profits funds were reported. In one case 100% of the surplus must be retained for the benefit of the with-profits policyholders, in the other case 90% must be retained.

These so-called 90/10 with-profits funds were also common in two countries.

In the case of open ring-fenced funds, almost all QIS4 undertakings in one country set out the mechanisms for making transfers to shareholders out of the ring-fenced funds and the restrictions that these transfers are subject to.

For this country the percentage of own funds held within ring-fenced funds that would be excluded by the cap was on average 46.5%, which is 16.7% as a percentage of total available own funds. While for another country where ring-fenced funds are prevalent no numbers were given by QIS4 undertakings on the amounts of own funds restricted within a ring-fenced fund, it was commented

that this would not be negligible. Supervisors from this country estimate this to be between 25% and 30% of the own funds within the ring-fenced funds.

Supervisors in a couple of countries **emphasised the significance of this issue** in a number of jurisdictions. Two countries commented that the issue may be more significant than is evidenced by the QIS4 results. One of these supervisors commented that it has sourced externally available information to show that there are a total of 64 ring-fenced funds for the largest with-profits providers. The other supervisor also noted that even small undertakings have tens of funds. Both countries noted the importance of agreeing a suitable approach to own funds. Further, the former supervisor commented that, since transfers of own funds outside the ring-fenced fund are generally prohibited or restricted, the policy approach for Solvency II should reflect the fact that the amount of own funds with a ring-fenced fund are not available to absorb losses that arise in other funds.

To illustrate this further, one country noted that under their national law a ring-fenced fund must be established for life insurance, unit-linked insurances, health insurances if this is performed on the same basis as life insurance, tontines, capital redemption insurance, and for non-life insurance if they have mathematical provisions. These ring-fenced funds do not contain own funds.

In another country, life insurers have funds within insurance undertakings that are separated from the rest of the undertaking (segregated funds). When setting up these funds, particular assets are assigned to the fund to cover the liabilities generated by the insurance contracts within those funds. The return on these assets is partly attributed to the policyholder and is in accordance with the terms of the contract, the remainder being at the free disposal of the insurance undertaking. As the assets are assigned to the fund and separated from the other assets of the undertaking both under Solvency I as under Solvency II rules, the excess of assets over liabilities is to be considered as own funds. However, unlike ring-fenced funds structures in other jurisdictions, assets can be transferred in and out of the fund. This makes it difficult to confirm that these own funds are actually trapped in the fund and are not able to meet the contribution to the SCR from the other parts of the business. This is also the case in this country for insurance products relating to the Royal Decree that are considered to be ring-fenced fund arrangements because there is no special separate fund for the assets backing the liabilities. Similarly, for the old composites in this country a similar approach applies. There are assets assigned to the non-life activity than in principle constitute dedicated funds in coverage of liabilities. Investment returns can however be transferred from one part of the business to the other and transfers of assets from one to another part of the business are also allowed.

8.4.1.4 Eligibility restriction up to the proportional contribution of the ring-fenced fund

There were **mixed responses** from undertakings and supervisors across countries over whether the methodology as to **the eligibility restriction** set out in QIS4 was suitable and appropriate. Most undertakings and several supervisors **agreed** that it was not appropriate to allow own funds within a ring-fenced fund to meet the SCR for the whole undertaking. They supported the approach proposed for QIS4 whereby only the amount of own funds within the ring-fenced fund that is needed to meet the capital requirements of the ring-fenced funds can be used to meet capital requirements.

Several undertakings **partially agreed** with the methodology proposed and noted its consistency with the restrictions applied to non-fungible capital between entities of the same group. However, these undertakings, along with a number of supervisors, stated that they did not consider it appropriate for own funds to be restricted to the proportional contribution of the ring-fenced fund in the undertaking's SCR. This is because the undertaking's SCR is decreased by diversification. Most supervisors remarked that using a proportionate amount of the SCR is not appropriate because the existence of ring-fenced funds could remove a significant proportion of diversification benefits from the SCR calculation. It was also suggested by some undertakings that this approach does not work well where the risks in the ring-fenced fund dominate the calculation of the overall SCR and differ from the risks outside the ring-fenced fund. One country commented that if a proportionate amount of the SCR is used, the SCR will cease to have any economic relevance and will not function as an effective intervention point. Instead, most undertakings and supervisors suggested that own funds should be restricted to an amount that is needed to meet the SCR of the structure since this more appropriately reflects the true loss absorption capacity of capital within the ring-fenced fund.

However, a number of **alternative approaches** were also proposed. In one country it was suggested that a **separate capital calculation** should be carried out for the ring-fenced fund, with any shortfall being provided by the main fund. This was likely to be relevant to a few undertakings in that country. Further, it was proposed that the monitoring and reporting of the solvency of a ring-fenced fund should be done at **fund level and not purely at company level**. Undertakings in another country commented that given the short duration of the funds only interest rate, equity and property risk should be taken into account when determining an appropriate SCR for the ring-fenced fund.

Undertakings in several countries asserted that the existence of ring-fenced funds should not impact on the calculation for diversification of the overall undertaking. On the basis that diversification reflects the fact that the 99.5%

loss of the company is lower than the sum of the 99.5% losses of individual funds.

Other undertakings **did not agree** however with the proposed restriction and commented that the proposed limitation on own funds within a ring-fenced fund may be **overly burdensome**. In one country it was commented that the methodology could be time consuming where undertakings have a large number of ring-fenced funds. The supervisor in this country emphasised the importance that any policy approach agreed takes into account the potential regulatory burden for undertakings, including small undertakings, which may have a number of ring-fenced funds. In these circumstances, a simplified approach may be more proportionate.

Undertakings in one country took the view that the approach proposed was too strict where the future profits linked to the ring-fenced funds belong to shareholders, for example in the case of pensions business. In such circumstances, it was suggested that this capital should be isolated before applying the methodology.

Other undertakings commented that ring-fenced funds should be **assessed on a case-by-case basis**. In contrast, undertakings in another country disagreed and suggested that the treatment of ring-fenced funds should be the same among all countries.

8.4.1.5 Impact on risk margin, SCR, MCR and own funds of restriction on compensation of profit/losses between business segments or products

A number of countries noted that they have **no data to quantify the potential impact** of the approach or the amounts of own funds restricted within ring-fenced funds are negligible. One country, where only one undertaking had reported ring-fenced funds, indicated that there was only a limited impact.

In one country, several undertakings indicated that a **significant amount of own funds** (defined as greater than 0.1%) **would be excluded by the cap**. In another country it was noted that the ratio of the BSCRs for single entity versus the aggregate of fund by fund is 195%, while the ratio of SCR (adjusted) for a single entity versus aggregate of fund by fund is 26%.

In most cases, there is either no data on the impact of the approach or the amounts of own funds restricted within ring-fenced funds are negligible. However, for some undertakings the amounts are more significant. In these cases, it is particularly important that the policy adopted reflects the true availability of own funds to absorb losses. Where a transfer from the ring-fenced fund is prohibited or subject to clear restrictions, only those own funds needed to meet the adjusted SCR of the ring-fenced funds should be considered to be available to absorb losses. Own funds restricted within a ring-fenced fund are not

available to absorb losses that occur outside the ring-fenced fund. Consequently, own funds in excess of the amount needed to meet an 'adjusted' SCR for the ring-fenced fund should not be taken into account when assessing the availability of own funds for the undertaking as a whole.

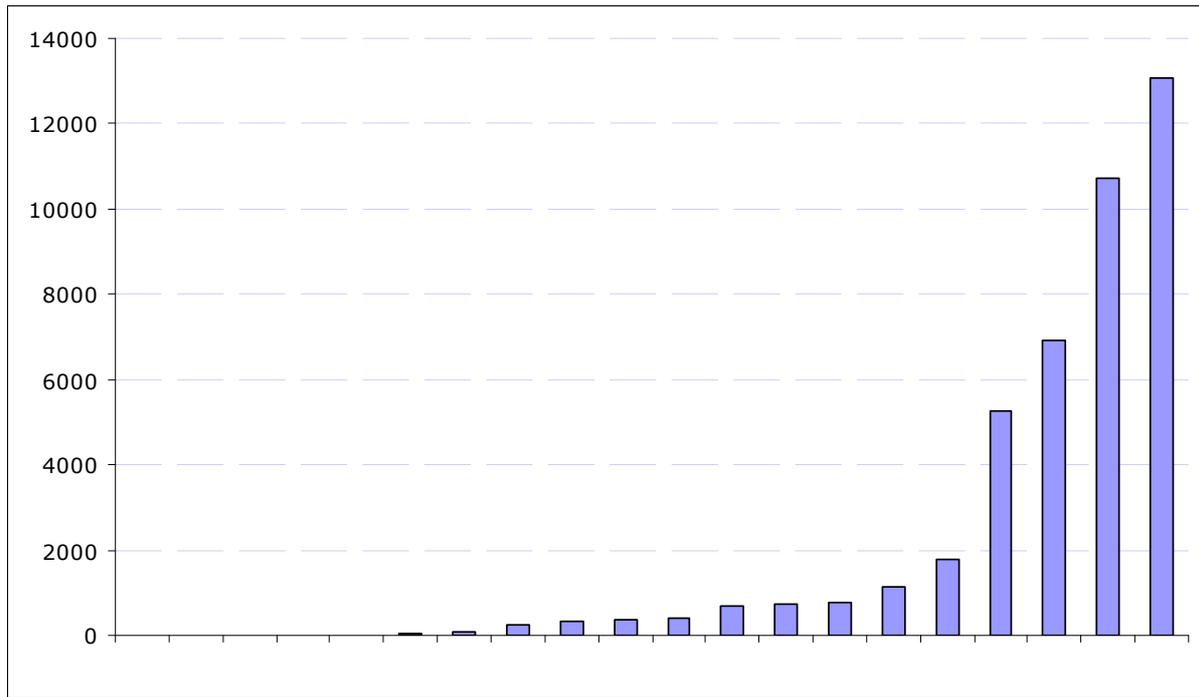
8.4.2 Hybrid capital instruments/subordinated liabilities

8.4.2.1 Summary

- The total volume of hybrid capital instruments and subordinated liabilities in issue across countries is EUR 42,581 million. However, issuance is concentrated in four countries.
- The majority of hybrid capital instruments and subordinated liabilities has been reported as Tier 2. The main reason for classification in this tier rather than in Tier 1 is that these instruments do not satisfy the loss absorbency requirements i.e. temporary write-down or conversion. Several instruments also do not meet the criteria relating to permanence and absence from requirements/ incentives to redeem.
- A shift to a reporting date approach when classifying capital instruments into tiers would result in a reclassification into a lower tier for a significant number of instruments.
- Generally there was no support amongst countries for splitting the classification of hybrid capital instruments/subordinated liabilities according to their debt/equity component.

8.4.2.2 Significance and impact

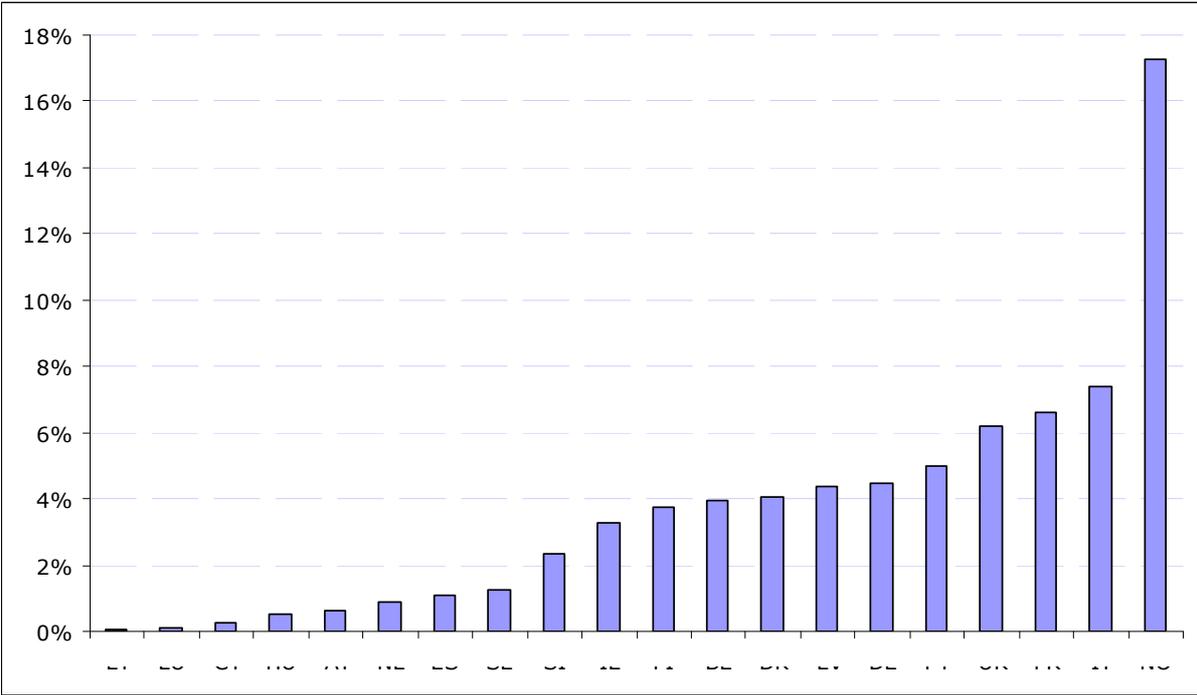
A number of countries **did not report hybrid capital instruments** or subordinated liabilities. The chart below shows the total amount of hybrid capital instruments and subordinated liabilities issued across countries.

Figure 58: Volume of hybrid capital and subordinated debt (EUR million)

The **total volume of hybrid capital instruments** and subordinated liabilities in issue across countries is EUR 42,581 million. Amounts reported ranged from zero (as in the countries listed above) to EUR 13,076 million, with four countries (DE, FR, IT, UK) reporting circa 85% of the total volume hybrid capital instruments and subordinated liabilities.

The chart below shows, for each country, the amount of hybrid capital instruments and subordinated liabilities as a proportion of total own funds. This provides an overview of the relative significance of these items, hence, the potential significance of **grandfathering**, in those countries.

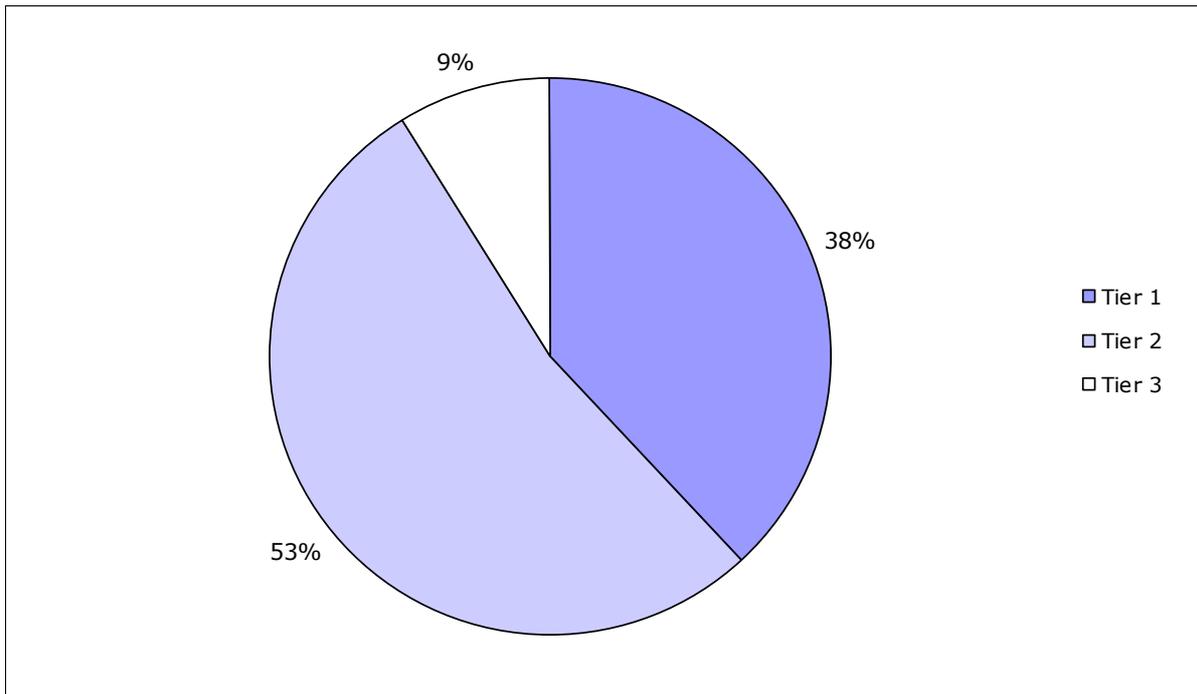
Figure 59: Hybrid capital and subordinated debt instruments as a percentage of total own funds



Hybrid capital instruments and subordinated liabilities **as a proportion of total own funds** ranged from zero to 17%. On average hybrid capital instruments and subordinated liabilities as a percentage of total own funds was **circa 2%**.

Tier 1 hybrids as a percentage of total Tier 1 own funds ranged from zero to 6%. Tier 1 hybrid capital instruments and subordinated liabilities as a percentage of total Tier 1 was also circa 2%, Tier 2 hybrid capital instruments and subordinated liabilities as a percentage of total Tier 2 is 59% and Tier 3 hybrid capital instruments and subordinated liabilities as a percentage of total Tier 3 is 40%.

Figure 60 below shows the **breakdown of hybrid capital** and subordinated liabilities instruments by Tier. The percentage of these capital instruments reported as **Tier 1 is 38%, as Tier 2 is 53% and as Tier 3 is 9%**. These percentages need to be interpreted with some caution. Not all the classifications reported in QIS4 have been double-checked by supervisors against the terms and conditions of the instruments; while spot checks by supervisors indicate that more instruments should probably have been classified in a lower Tier.

Figure 60: Tiering of hybrid capital and subordinated debt instruments

The following two figures illustrate how these types of capital instruments are broken down between Tiers. This seems to replicate the total picture presented above that in most countries hybrid capital instruments and subordinated liabilities were reported as Tier 2.

Figure 61: Relative importance of hybrid capital/subordinated debt tiering (EUR million)

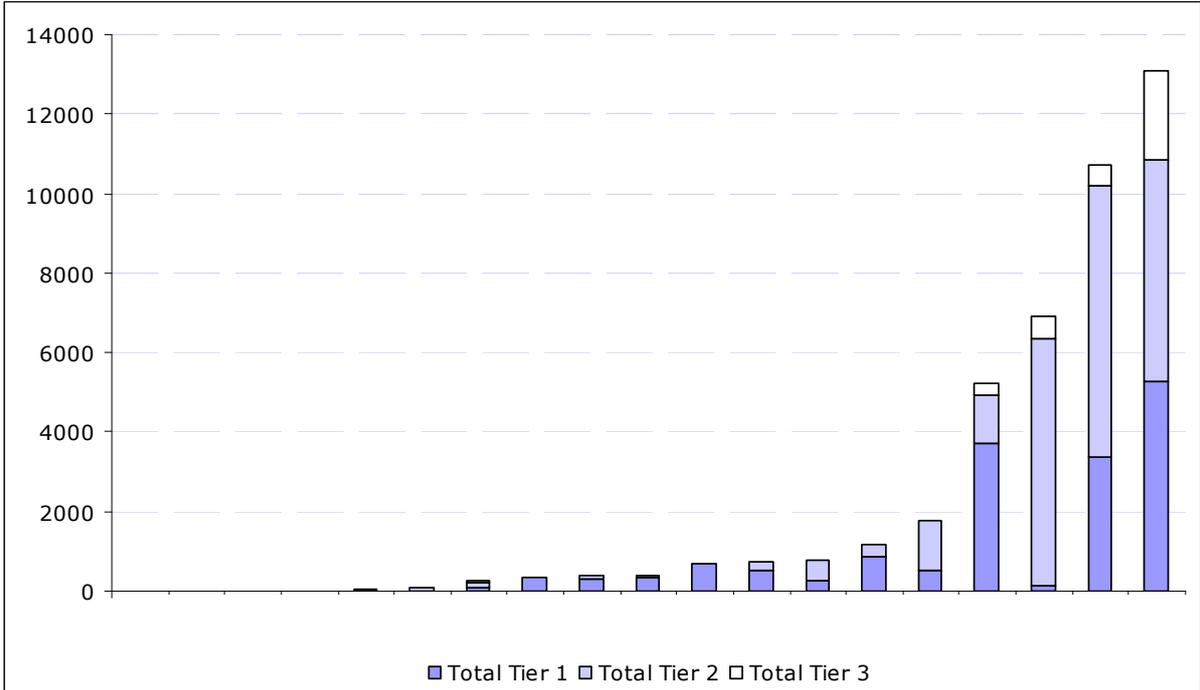
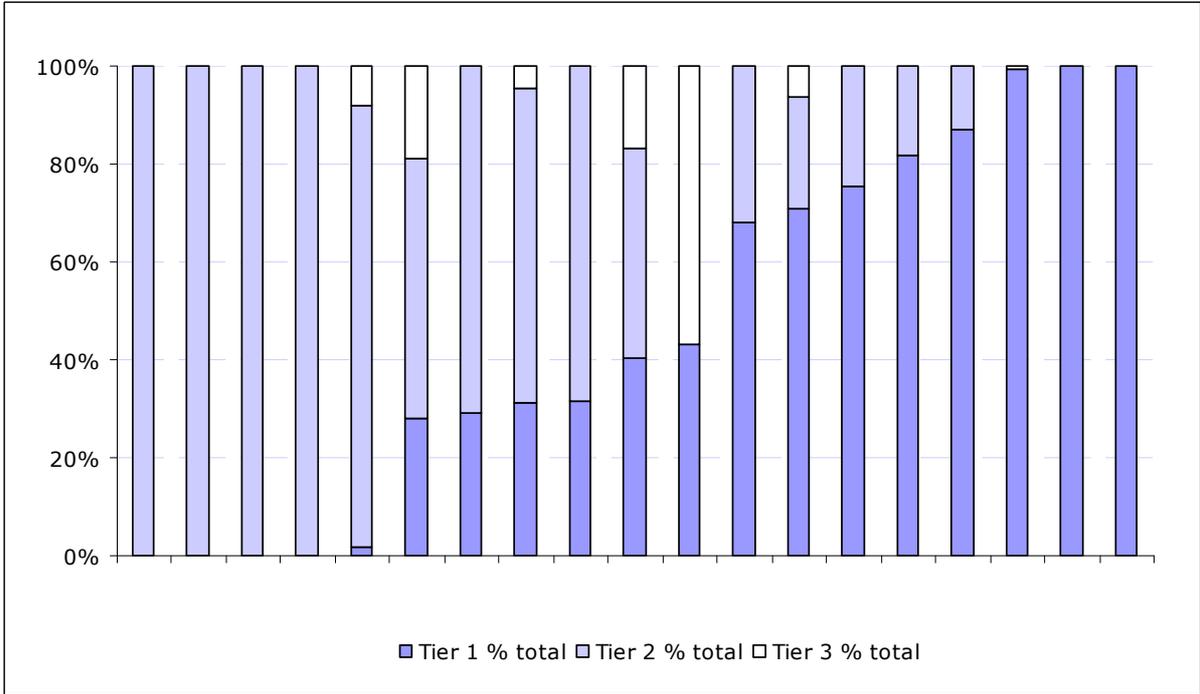


Figure 62: Hybrid capital / subordinated debt tiering



Supervisors in a number of countries indicated that they had not received detailed information about hybrid capital instruments and subordinated liabilities. Three supervisors commented that the classification of instruments into either

Tier 1 or Tier 2 **may be incorrect**. One of them indicated that in all likelihood a number of instruments reported as Tier 2 would only be eligible as Tier 3 because they do not fully meet the QIS4 requirements for Tier 2. Another supervisor indicated that one undertaking had reported an instrument in Tier 1, which should have been reported in Tier 2. The third highlighted the likelihood that a number of the instruments classified as Tier 1 may not fully satisfy the QIS4 requirements for Tier 1. This may also be the case for other jurisdictions that do not currently require write-down and conversion features in capital instruments.

One supervisor noted that it considered the split between Tier 1, Tier 2 and Tier 3 reasonable and that they opined that undertakings in this country have broadly followed the classification criteria set in the Technical Specifications.

One supervisor commented that although for solo entities the volume of hybrid instruments and subordinated liabilities compared to total own funds is relatively small, these instruments do make up a much greater proportion of the total own funds reported by groups. This was considered consistent with general market practice whereby these types of instruments tend to be issued by a parent or holding company and then potentially down-streamed to subsidiaries as higher quality capital.

Please refer to chapter 13 on groups for further information on this issue at group level.

8.4.2.3 Reasons for classification below Tier 1

The **main reasons** why hybrid capital instruments and subordinated liabilities have **not been classified as Tier 1** are as follows:

8.4.2.3.1 Full loss absorbency in a going concern

Three countries indicated that the lack of a conversion or write-down mechanism was the main reason for hybrid capital instruments and subordinated liabilities not being classified as Tier 1. However, the fact that this feature is not currently a requirement in these countries makes its lack of inclusion in the terms of capital instruments unsurprising.

8.4.2.3.2 Permanence and free from requirements / incentives to redeem

Several countries grouped the characteristics of permanence and free from requirements to redeem and indicated that hybrid capital instruments and subordinated liabilities had not been classified in Tier 1 either because the maturity was too short (legal maturity, call date or step-up date) or because the step-up characteristics did not meet the criteria. In a number of countries, instruments have maturities or step-ups before 10 years.

One country commented that some subordinated debt would only be able to qualify as Tier 3, because deferral of repayment is up to a maximum of five years and not indefinitely. Also, some instruments in this country that are issued by a non-EEA subsidiary would move from Tier 2 to Tier 3 under Solvency II because of a term in these instruments that allows the overseas supervisor to require the redemption of the securities.

8.4.2.3.3 Absence of mandatory fixed charges

Two countries indicated that subordinated liabilities reported by their undertakings would be classified as Tier 2 rather than Tier 1 because coupons are cumulative.

In another country it was noted that some subordinated debt would only be able to qualify as Tier 3, because coupons cannot be deferred indefinitely if a minimum solvency threshold is breached.

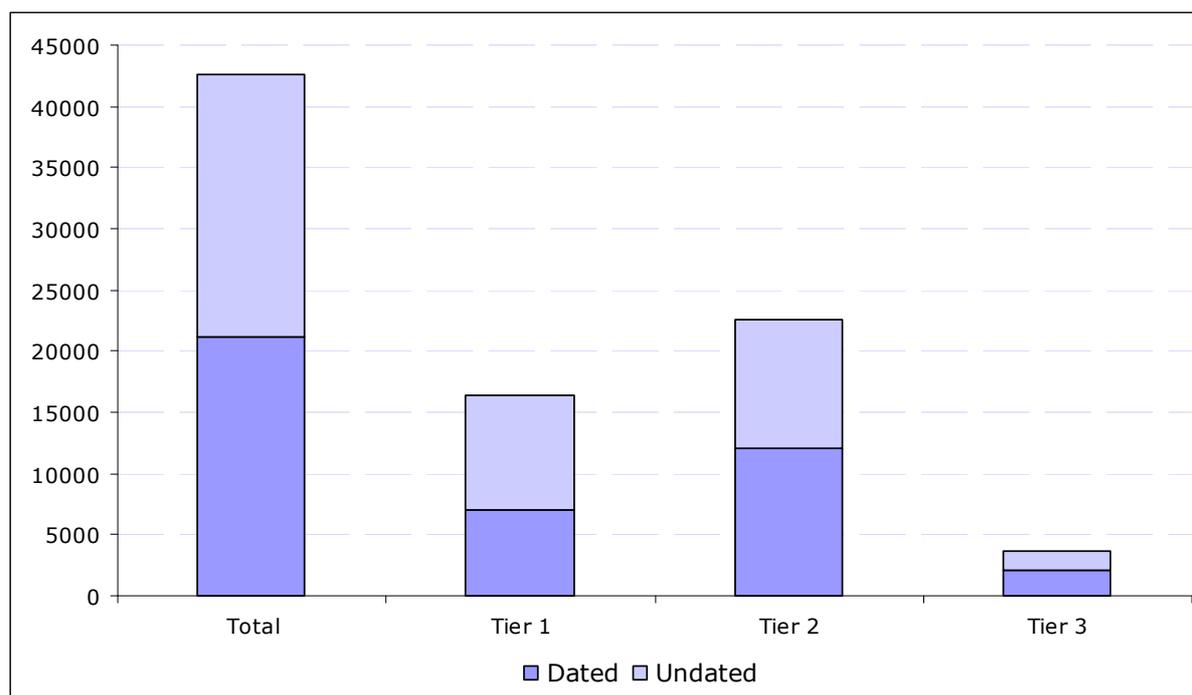
In two countries, undertakings shared the view that the requirements for coupon deferral/cancellation at a trigger point had been satisfied where the trigger point at which coupons must be cancelled or deferred for an indefinite term is based on the undertaking's current capital requirement (determined under Solvency I criteria). These provisions would either need to be updated to fit the new regime or would need to be addressed through grandfathering.

At the same time, supervisors in a number of countries indicated that it was **not possible** in some or all cases **to determine why** capital instruments had been classified in a Tier **other than Tier 1**. Other countries noted that all instruments of this type had been reported as Tier 1 and that this question was not relevant to them.

As a general comment, one country highlighted a need for further clarification on how to classify capital instruments into Tiers.

8.4.2.4 Perpetuality characteristics

The charts that follow illustrate the split between dated and undated instruments where the issue date is used to classify instruments. These show that there is an approximately **even split between dated and undated instruments**. In relation to those instruments classified as Tier 1 the proportion of dated instruments is lower than undated instruments and for Tiers 2 and 3 the number of dated instruments is higher.

Figure 63: Own funds structure and perpetuity (EUR million)

The majority of countries that answered indicated that either there was a lack of information from undertakings on the potential impact of using reporting date or that the information, where this was provided, was potentially unreliable.

Several countries highlighted that the proportion of dated instruments in their country is relatively small. This is mainly attributed to the **regulatory restrictions** currently in place in these jurisdictions **on the use of dated instruments**. Even where current rules allow for higher limits for dated instruments, several countries indicated that this limit often was not reached. It was also noted that the maturity features of capital instruments may also be driven by non-regulatory reasons such as rating requirements for equity credit. Nonetheless, it is anticipated that the number of dated instruments could increase when Solvency II is implemented, since these would be eligible as Tier 1.

The conclusion drawn by most countries is that **the shift from issue date to reporting date** would result in a **significant number of instruments changing classification** from Tier 1 to Tiers 2 or 3 or from Tier 2 to Tier 3. The impact is particularly significant for Tier 1 instruments. A few indicated that the greatest impact would be if restrictions were placed on minimum remaining time periods to calls and step-up dates. However, this view may have been influenced by the fact that a greater proportion of capital instruments in some countries are undated.

Comments also tend to suggest that a significant proportion of capital instruments are scheduled to be or are likely to be redeemed in the next five

years. Market data tend to show that most dated instruments are redeemed at the call date (particularly if this is combined with a step-up) and are not left outstanding until legal maturity. Under Solvency I, the value of subordinated liabilities is amortised in the remaining five years, making it more likely that the instrument will be redeemed before the amortisation period commences. Therefore, step-up and call date can generally be seen as the maturity date for dated instruments. Similarly, for undated instruments there are few examples where instruments with incentives to redeem have not been redeemed at the step-up date. The situation is less clear for undated instruments without a step-up (i.e. instruments with pure calls) as there are examples of instruments not being redeemed at the call date.

Several supervisors indicated a **preference for using issue date**.

Other specific comments made were as follows:

- One country commented that the shift from issue date to reporting date would downgrade the classification of around half of the amount of Tier 1 dated instruments, for which the period to legal maturity would fall from over 15 years (issue date) to less than 5 years (reporting date). Undertakings from this country indicated that the information on undated instruments showed a similar trend, as while most undated instruments have a time period from issue date to step-up and call date that is longer than 10 years, few have 10 years remaining before maturity/step-up and call date if the reporting date criteria is used.
- In another country it was possible to conclude that the impact of moving from the issue date to the reporting date would be most significant for undated instruments with an issuer call and interest rate step-up. The issuer call and interest rate step-up would, in the case of 90% of instruments²¹, occur within the next 5 years and therefore would be reclassified as Tier 3. In contrast, a significant proportion (80%) of dated instruments would continue to be classified as Tier 1 even if the reporting date approach was adopted. This is because these instruments have remaining maturities of greater than 30 years.
- Another country indicated that if issue date was replaced with reporting date, dated subordinated loans outstanding would be reported in Tier 3 rather than Tier 2. This would also be the case for an outstanding undated subordinated loan, but it would be reported in Tier 1 rather than Tier 2.
- One country commented that if reporting date was used rather than issue date for undated Tier 1 instruments with step-ups, a number of these would only be eligible as Tier 2 or 3 because the remaining periods to

²¹ This percentage is for those undertakings that provided the relevant information.

maturity would be less than 10 years. There was a similar trend in the case of undated Tier 2 instruments, with a couple being downgraded to Tier 3 if reporting date was substituted for issue date. In relation to dated Tier 2 instruments, undertakings from this country indicated that the most significant impact for these instruments would result from replacing issue date with reporting date for the legal maturity and the call/step-up and call date. This is because the remaining periods before the call/ step-up and call dates for these instruments are generally less than five years.

8.4.2.4.1 Issue date/reporting date analysis

Several supervisors commented that the absence of information restricted the ability to provide meaningful conclusions on the issue date/ reporting date analysis. Three supervisors also noted that undertakings had not provided comments on this.

In relation to the average duration of insurance liabilities comments from countries were as follows:

- In one country, the average duration of insurance liabilities reported was 5 years, i.e. 8 years for life undertakings and 3 years for non-life undertakings.
- In another country only a few undertakings provided information about both the average duration of their insurance obligations and about the maturity features of their hybrid capital instruments and subordinated liabilities. In one of these cases, both the remaining period of the undertaking's dated instrument and the time to maturity at issue date significantly exceeded the average duration of the undertaking's insurance liabilities. In another case, the undertaking's liabilities have an average duration of 9 years and a dated capital instrument that matures in 2 years (issued 10 years ago); and an undated instrument with a call and step-up date 10 years from issue date, and under 5 years from reporting date.
- One country noted that dated subordinated loans reported have a sufficient duration in relation to the insurance obligations it covers. It was noted that the proportion of these instruments when compared to total own funds was relatively small.
- In another country the average duration of undertakings' insurance obligations for all insurers is 5 years, with the average being 9 years for life undertakings and 3 years from non-life undertakings.

On the whole, **views were mixed on the issue date/ reporting date issue** and possible solutions for Level 2 implementing measures.

Two countries reiterated their support for an approach based on issue date, commenting that the reporting date approach increase funding costs without prudential benefits.

Another country supports achieving an **approach on the maturity features of capital instruments**, which is consistent with the duration of insurance liabilities. They do not consider that the issue date option alone permits this and suggest that a possible alternative could be to use a simple amortisation mechanism when the redemption or step-up date is imminent. This country also took the view that if the reporting date approach is chosen, duration criteria should be adapted to allow for some issued hybrids to be classified in Tier 1.

One country questioned the practicability of aligning the duration of hybrid capital instruments and subordinated liabilities with the duration of the insurer's insurance liabilities.

Supervisors from another country concluded that it **did not consider the issue date/reporting date debate an issue for all insurers**. Further, relating the average duration to the call and step-up date from issue date was unlikely to require grandfathering. The supervisor did not indicate a preference for issue date or reporting date but thinks that a pure reporting date approach could be disruptive and grandfathering should be considered. With respect to issue date, this supervisor commented that if such an approach was adopted regulators would need closer monitoring of capital adequacy under Pillar 2. Suggested alternatives included applying the issue date with an amortisation mechanism in relation to the maturity or call and step-up date, on the basis of preset periods, e.g. 5 years, 10 years or on the basis of the average duration of the insurer's insurance obligations.

Another country **favours the use of the reporting date** on the basis that they consider that it most accurately reflects the quality of the capital item.

Supervisors from another country suggested that further consideration should be given to how the information collected on the average duration of insurance obligations can be used to determine minimum maturities for capital instruments for all undertakings. Such an approach may be appropriate if the average durations of insurers' liabilities are similar across countries. An alternative would be to consider whether the duration of an undertaking's capital instruments should be compared to the duration of its insurance obligations to determine whether the duration is sufficient on a case-by-case basis. This would be a more principle-based approach and less prescriptive, but may be more suited to the Pillar 2 assessment. Generally, the supervisor considers it misleading to distinguish between dated and undated in terms of whether issue date or reporting date is used. It is possible that introducing additional requirements for dated instruments, where step-ups have been included in undated instruments to

create a similar effect to the maturity date (often termed a synthetic maturity), could lead to regulatory arbitrage.

8.4.2.5 Alternative Coupon Settlement Mechanism (ACSM)

Two countries stated that **none** of the undertakings with hybrid capital instruments or subordinated liabilities had ACSM under the terms of the instrument.

Three other countries indicated that this question was **not applicable** for the majority of undertakings. In one of these countries, one undertaking gave an example of an ACSM clause which allows the issuers to raise funds to satisfy deferred interest by issuing or selling Payment Shares for cash proceeds and/or by issuing Placement Securities. "Payment Shares" are newly issued ordinary shares or qualifying mandatory convertibles and "Placement Securities" are any instruments issued or guaranteed by the issuer that have substantially the same terms and conditions as the bonds, equal regulatory capital treatment and equal equity credit from rating organisations. In the other country, **one undertaking** provided details of the ACSM clauses in its capital instrument. Under the terms of its Tier 1 hybrid instrument and subordinated liability settlement of deferred coupons can either be in the form of new issuer's common shares, subject to a cap of 2% of the issuer's market capitalisation per annum, or with securities with the same features ranking junior to or pari passu with the existing securities and subject to a 15% cap (this is 25% in the case of the Tier 1 subordinated liability) of the principal amount of these securities. The payment of deferred coupons must be settled through ACSM within 5 years. If, despite using best efforts, the issuer fails to settle deferred amounts within this time, the accumulated distributions would be abandoned. Furthermore, in bankruptcy, any accumulated claims of these securities would be pari passu with saving shares (which are just senior to common shares). The ACSM mechanism allows the instrument to mirror the economics of a "non-cumulative" tout court instruments. The securities are basically "non-cash cumulative", indeed, in case of financial distress the issuer will be able not to divert resources for the satisfaction of hybrid's creditors, preserving therefore financial resources and avoiding any mandatory fixed charges. This is strengthened by the "best effort" nature of the obligation to settle deferred coupons and by the cancellation provision, in case the issuer is not able to actually settle under the ACSM clause.

In another country **several undertakings** commented on the ACSM clauses within their hybrid instruments. The different ACSM clauses described were either

1. Payment of deferred coupons is in the form of ordinary shares which have a fair market value equal to the deferred interest.
2. Payment of deferred coupons can be the form of i) unused members' contributions/ levies in respect of the current calendar year; ii) Payment in

Kind (PIK) securities providing these have the same market value as the relevant interest payment; or iii) other externally-generated capital items that are eligible for inclusion in the same or higher stage of capital as the capital securities in issue.

The first mechanism was the more common of the mechanisms reported with the second mechanism only being reported by one respondent.

One undertaking provided a more detailed description of its ACSM clause. It was indicated that the terms prevent settlement with ordinary shares that have been repurchased during the last six months and prevents the undertaking repurchasing shares in the market six months after the settlement occurs. The undertaking must also maintain the necessary corporate authorisations to issue shares in order to settle deferred coupons under its ACSM clause. Under the current rules in this country, undertakings with ACSM clauses must have a sufficient amount of authorised and unissued capital instruments and the authority to issue them to be able to include this feature.

8.4.2.6 Other hybrid capital

A number of countries commented that **very few capital instruments** were reported in this category.

One supervisor noted that their current rules only permit subordinated liabilities to be eligible as capital and eligibility is conditional on instruments meeting Solvency I requirements.

Another country indicated that the main feature distinguishing subordinated liabilities and hybrid capital instruments was the legal nature of these instruments.

A third country stated that hybrid capital instruments tended to refer to those instruments that fulfil the criteria for inclusion as Tier 1 capital in the banking sector i.e. they are perpetual non-cumulative fixed income instruments that are designed to cover losses in a going concern situation, which may have a call and step-up after 10 years.

Similarly, in a fourth country hybrid capital instruments are generally interpreted to mean Tier 1 instruments with the same degree of subordination as preference shares and similar features. Subordinated liabilities are instruments with features such as cumulative coupons, shorter minimum maturities, which qualify as Tier 2. However, it was noted that the two terms are often used interchangeably.

8.4.2.7 Split classification

Supervisors and undertakings across countries were **opposed to the idea of splitting the classification of hybrid capital instruments/subordinated liabilities according to their debt/equity component.**

Many undertakings quoted that the classification of own funds into Tiers is covered in the Directive and will also be covered in the implementing measures. Furthermore, splitting items would add an additional layer of subjectivity to the analysis. This would probably lead to shifting and unstable supervisory policy which is unhelpful for the long-term stability that an insurer's balance sheet needs.

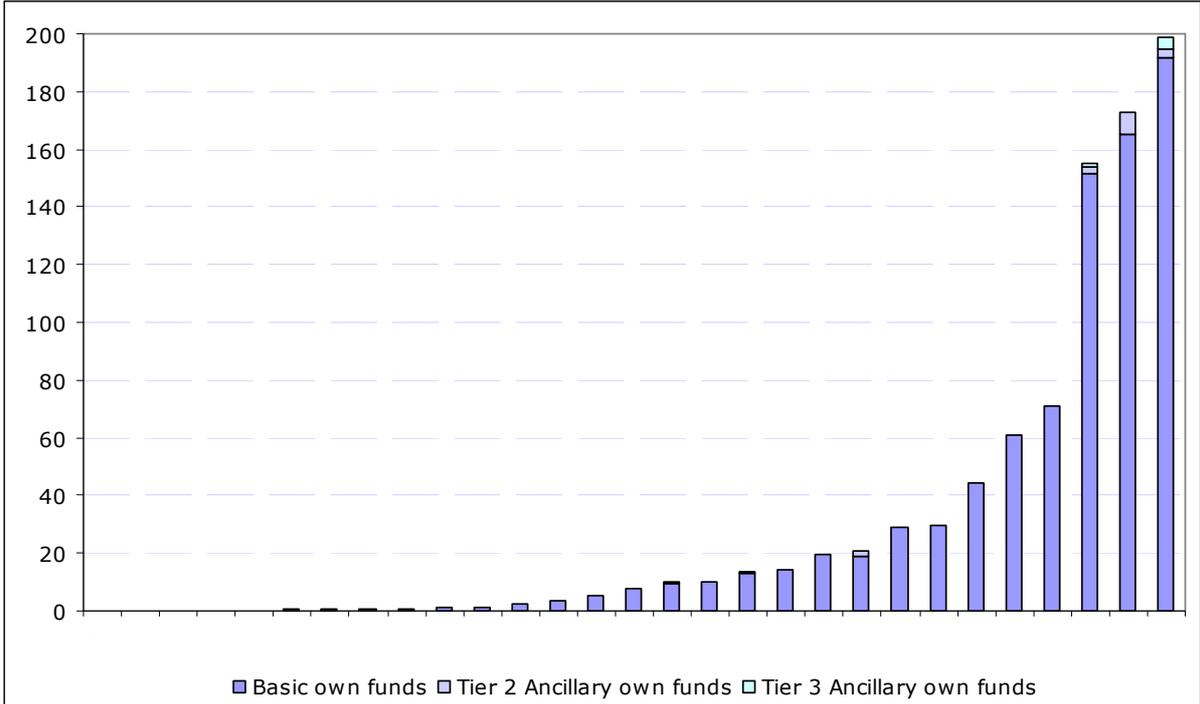
Further, the majority of undertakings noted that capital instruments are already classified into basic and ancillary own funds and into Tiers and argued that splitting items into their debt/equity components would add unnecessary complexity into the classification process. It was also noted by undertakings in one country that in practice it would be difficult to isolate the capital and debt components of these capital instruments.

The **majority of supervisors agreed on the drawbacks of splitting capital instruments.** Specifically, most of them commented that such an approach would add additional complexity to the classification of capital instruments with seemingly no additional prudential benefit. Four supervisors explicitly indicated a preference for classifying capital items wholly in one Tier.

8.4.3 Ancillary own funds

In most countries **only a few undertakings have reported ancillary own funds.** The volume of Ancillary Own Funds reported is **small in relation to Basic Own Funds** or total own funds.

Figure 64: Tier structure (all undertakings, EUR billion)



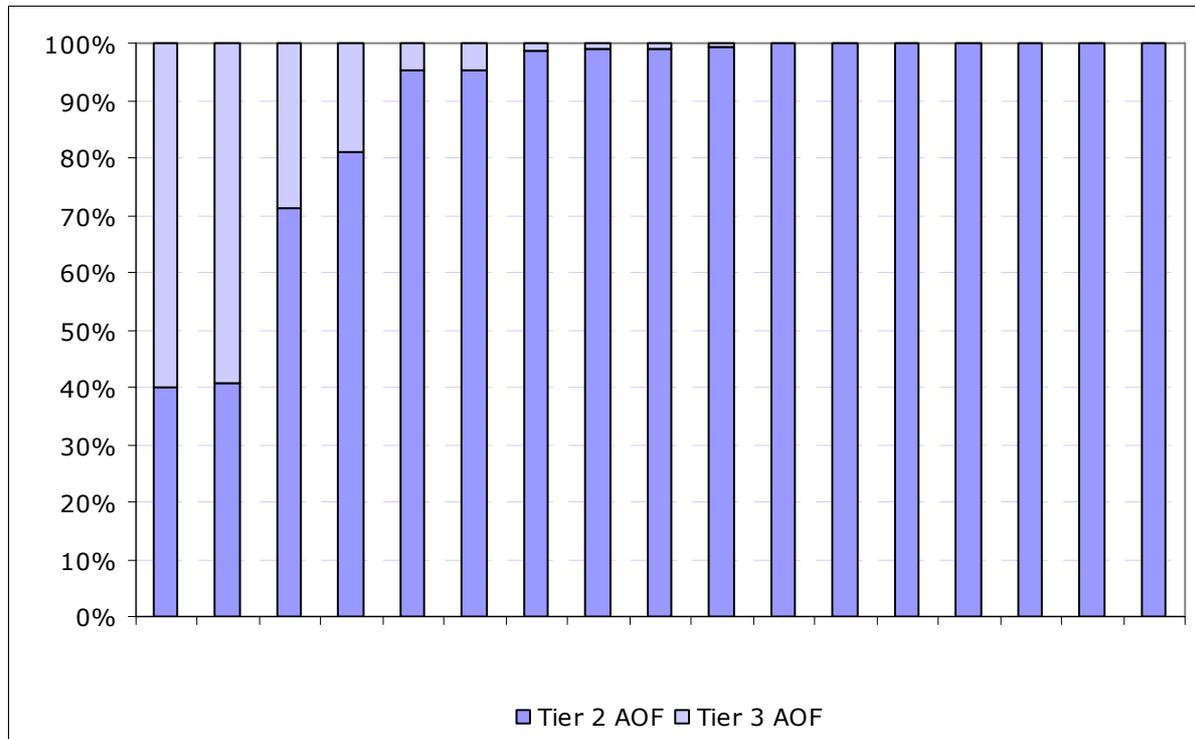
As shown in the chart below, the percentage of ancillary own funds in relation to Basic Own Funds is lower than 10% in all countries.

Figure 65: Tier structure (all undertakings, in percent of total own funds)



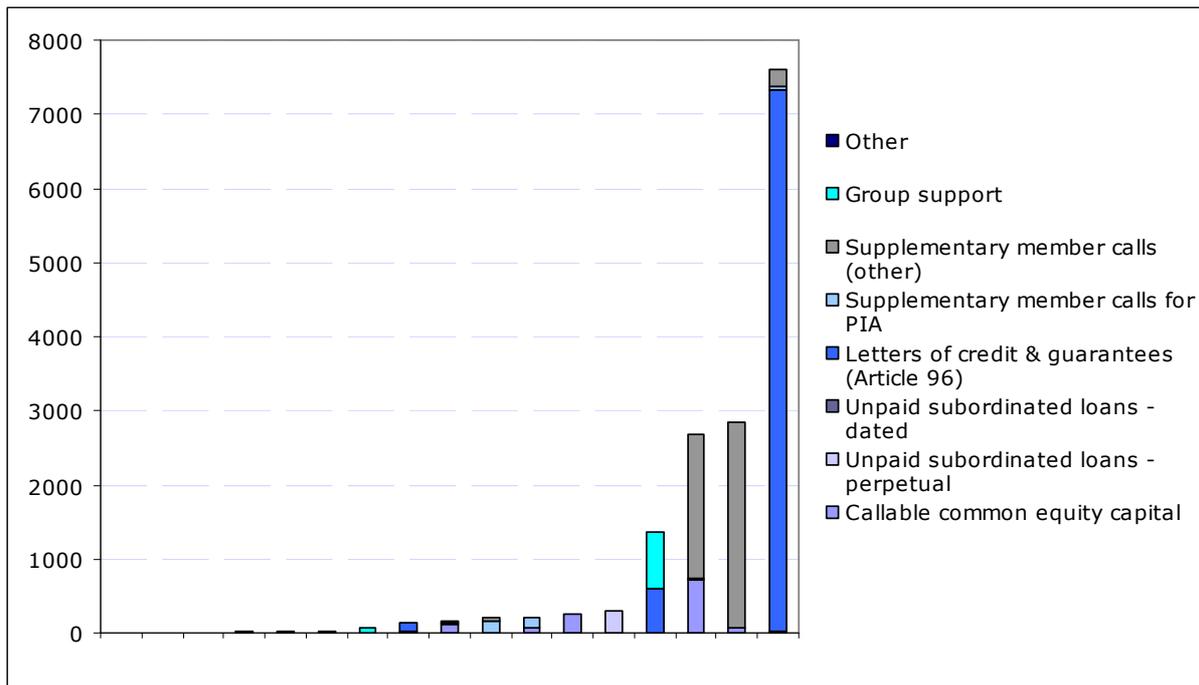
Where ancillary own funds were reported, Tier 2 AOF (Ancillary Own Funds) exceed the volume of Tier 3 AOF, except in two countries. The higher proportion of Tier 3 for these countries results mainly from the 40-60% classification of supplementary member calls.

Figure 66: Ancillary own funds structure (all undertakings, in percent of total ancillary own funds)



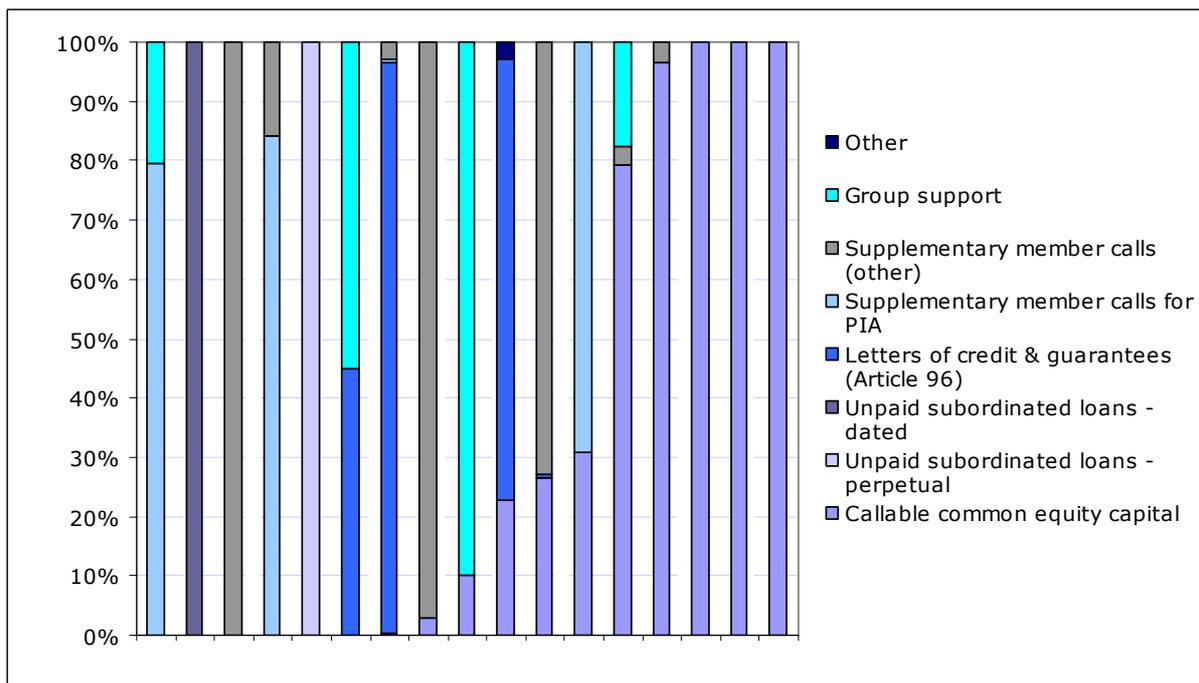
Ancillary own funds reported as Tier 2 are largely supplementary member calls, mainly reported in two countries (DE, FR) and letters of credits and guarantees (Article 96), reported in another.

Figure 67: Tier 2 ancillary own funds structure (all undertakings, EUR million)



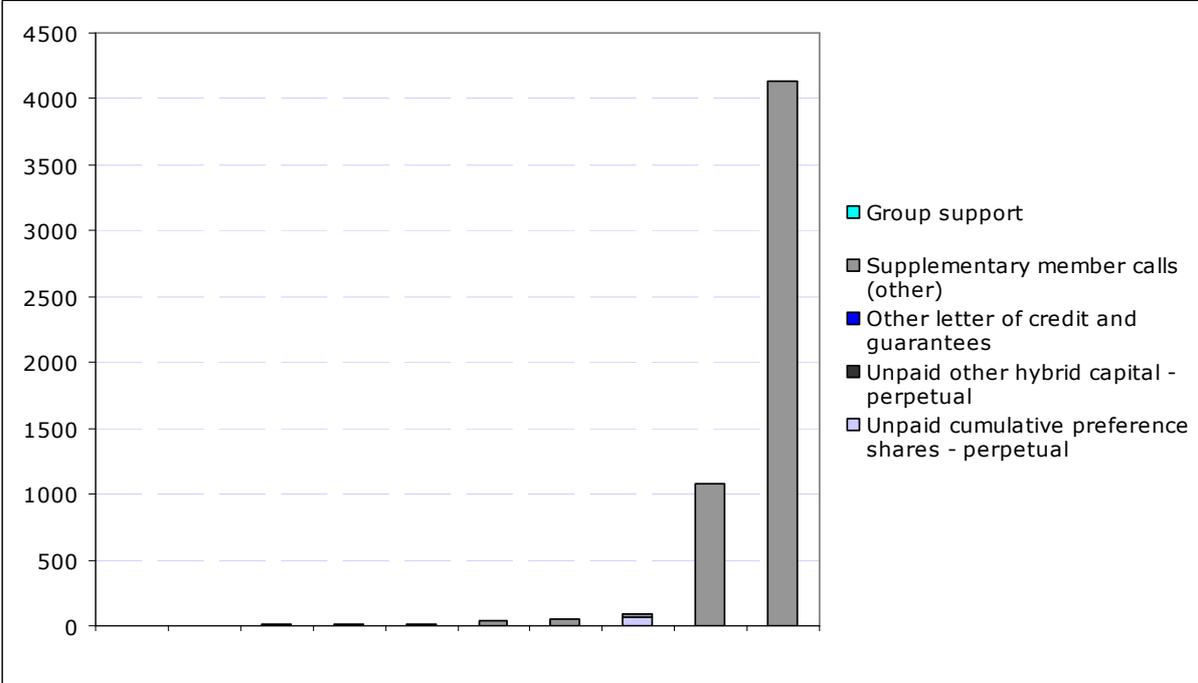
But when analysing the breakdown in each country, it is important to highlight the relevance of unpaid subordinated loans, letters of credit and guarantees, supplementary member calls (DE, FI, FR), group support, supplementary member calls for PIA and callable common equity capital.

Figure 68: Tier 2 ancillary own funds structure (all undertakings, in percent of total Tier 2 ancillary own funds)



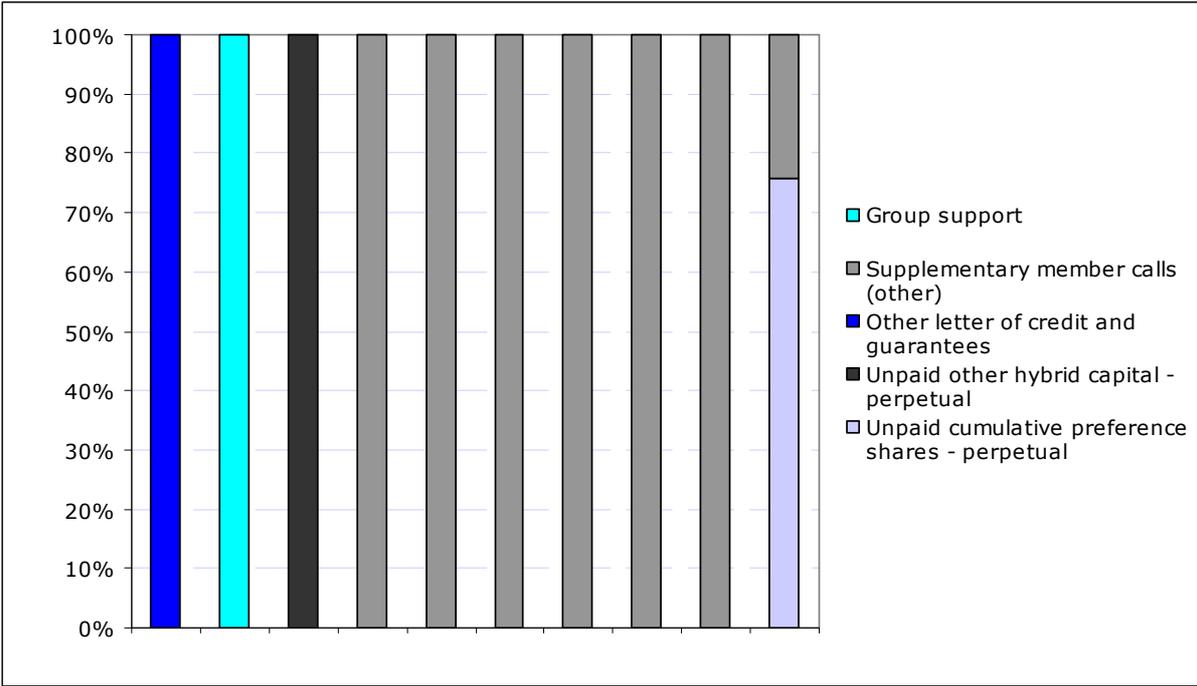
Tier 3 Ancillary Own Funds are mainly made up of supplementary members' calls (with the 40-60% criteria).

Figure 69: Tier 3 ancillary own funds structure (all undertakings, EUR million)



Some countries also reported amounts in 'other letters of credit and guarantees' and 'unpaid instruments'.

Figure 70: Tier 3 ancillary own funds structure (all undertakings, in percent of total Tier 3 ancillary own funds)



It should be highlighted that the reason for the classification in Tier 3 was not reported, with the exception of the 40-60% criteria for the supplementary member calls.

8.4.3.1 Information on recoverability

There are **very few responses** to this question.

In one country (DE) the few responses received indicated that their counterparties would pay but they did not say why. The undertakings in this country have no experience of past calls. They count these instruments for the solvency margin but up to now there has been no need to make calls.

In another country (FR), regular periodic calls and proper information of the policyholders seem to be key elements for a high recovery rate. The counterparties of unbudgeted supplementary member calls are the policyholders. The recoverability of the funds therefore depends on the awareness of the policyholders of this option and on their willingness to pay. In this regard, the rates of recovery of these calls may vary significantly from one entity to another. Some entities have made regular supplementary calls and report a rate of recovery close to 100%. The amount of one such call was around 10% of the premium. On the other hand, mutuals making a supplementary call for the first time, of a high amount compared to the premium, may get lower rates of

recovery. The diversity of situations makes it difficult to define an average rate of return on unbudgeted supplementary member calls.

In a third country (UK) only very few undertakings responded to this question. Several respondents recorded supplementary member calls in their quantitative spreadsheets, but not all provided the specific information requested in the spreadsheet. All respondents who provided information in the spreadsheet recorded 100% as the callable amount in relation to unearned premiums. The majority of these responded that no calls have been made in the past and several did not provide any information. Only one undertaking indicated that past calls have been made and reported that the average default rate was zero and the average time taken for recovery was 60 days.

8.4.3.2 Valuation

There are **only a few responses** to this question and **views are mixed**.

Most countries reported that ancillary own funds have been **valued at nominal value** as valuation basis. Some undertakings consider that for Solvency II purposes the valuation basis should reflect the amount that would be available in case of financial stress. In two other countries it was commented that with respect to the unbudgeted supplementary calls the P&I clubs have stressed that the callable amounts are unlimited. In yet another country, one undertaking indicated in relation to supplementary member calls that valuation was based on one year's estimated total call, this is equal to the total amount that the mutual is able to call within a year. One undertaking commented that uncalled shares should not be valued as part of the company's capital until it is paid-up by shareholders.

Most supervisors indicate that mutual member calls are valued based on the maximum amount that according to the articles of association can be called. In one country 100% of this value was reported. Another undertaking in this country has not used the option to include callable amounts in the own funds and another has removed the possibility to call for supplementary premiums from its articles of association. Another country has used an amount corresponding to approx. 70% of the written gross premiums.

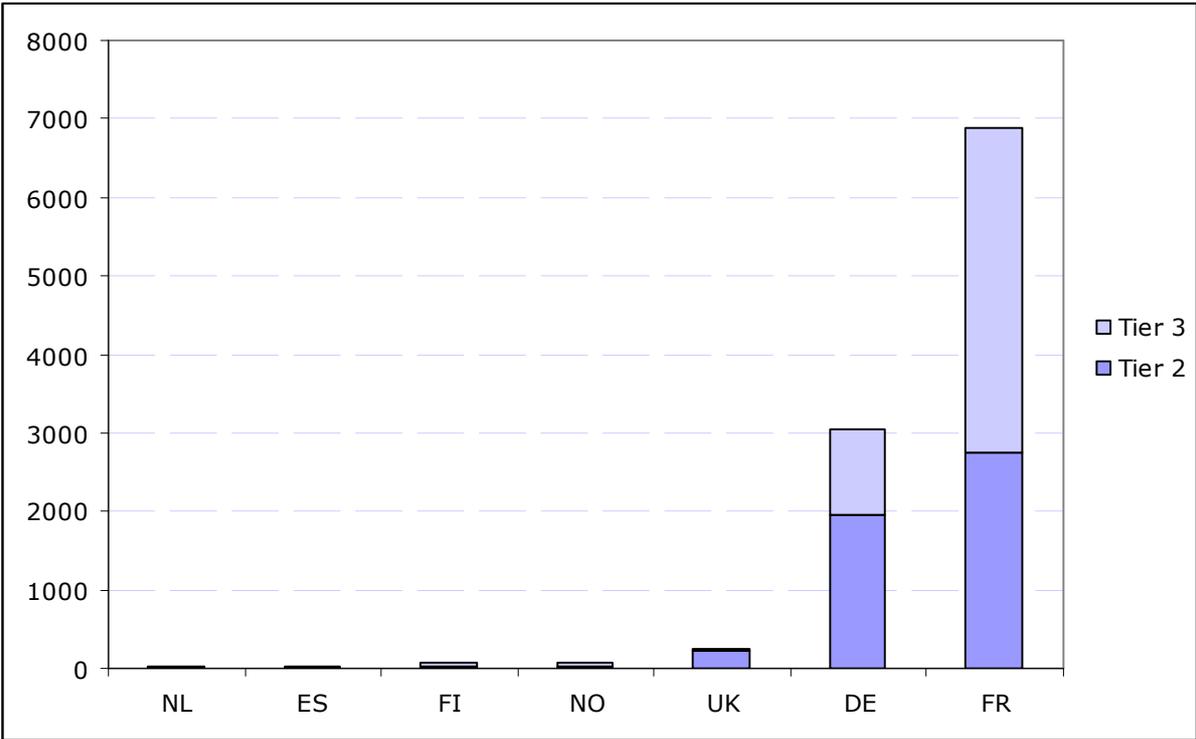
In a third country, the supervisor considers that nominal value does not reflect the Loss Absorbency Capacity of the item. A fourth supervisor mentioned the lack of information for this question, and indicated that it is not clear in all cases whether valuation of ancillary own funds is at nominal value or whether undertakings have just opted not to provide this information.

8.4.3.3 Unbudgeted supplementary member calls

Seven countries (DE, ES, FI, FR, NL, NO, UK) have reported supplementary member calls others than PIA for an overall amount of EUR 10.3 billion. For two of these countries (FR (EUR 7 billion) and DE (EUR 3 billion)) this equates to more than 95% of the total amount reported. The total amount of ancillary own funds reported by undertakings of QIS4 (EUR 10.3 billion) is ten times higher than the amount they reported under the current Solvency I regime (EUR 948 million).

More detailed analysis tends to suggest that the amounts reported in QIS4 have to be **considered cautiously**. Some undertakings have indeed reported amounts of supplementary member calls that are greater than those reported under Solvency I. On the other hand, many mutuals which have the possibility to make supplementary calls have reported a zero amount.

Figure 71: Supplementary members’ calls (all undertakings, EUR million)



Four countries (LU, NO, SE, UK) have reported PIA supplementary member calls, for a total amount of EUR 362 million.

Overall, 48% of supplementary member calls other than PIA have been classified in Tier 2 and 52% in Tier 3. The split is 40%-60% in most countries, except for two (DE, UK), where the amounts reported in Tier 2 are higher than the amounts reported in Tier 3. In the case of one country (UK) this is because some P&I

clubs have reported their supplementary member calls in supplementary members' calls other than PIA.

It therefore appears that most of the undertakings applied the requested 40%-60% split of unbudgeted supplementary members' calls between Ancillary Tier 2 and Tier 3. Few comments have been reported in this area. Some undertakings would however support a 50-50% split. Others think there should be no split between Tiers and some suggest a 100% classification in Tier 2.

The 40-60 split specified for QIS4 is generally considered to be a workable approach. It has also been reported that some mutuals that have the possibility to resort to supplementary member calls according to their statutes have not used that opportunity to increase their own funds.

Some undertakings expressed the view that Solvency II should allow the use of entity-statistical data to classify the calls into Tiers, being aware that this historical information may in most cases not be available. Very few information on past calls has been provided by undertakings.

It appears from the reported answers that very little historical information is available concerning past supplementary calls. Although these calls would mainly occur in stressed times, supervisors seem to consider that their level of recoverability is potentially high.

A few comments from undertakings however have also pointed to the fact that the recovered amount of these calls will probably be less than 100%, which may justify some restriction on the eligible amount that can be included within eligible own funds. On the other hand, some undertakings assert that the whole amount of calls should be taken into account.

As an alternative method, a few undertakings indicated they would find it more logical to take into account the mitigating effect of supplementary member calls in the calculation of the SCR, rather than including them in own funds.

Beyond the split between Tiers, the valuation of supplementary member calls is rarely addressed. This however appears to be an important issue as no nominal value exists in most cases. Some countries express the view that the estimation of the recoverable amount of supplementary member calls should be realistic and taken into account the amount of premiums and the financial situation of the mutual. One country suggested allowing undertakings to value these at an amount that they would reasonably be able to call-up within a one year time horizon.

8.4.4 Surplus funds

In all, **surplus funds were reported in 17 countries**, significantly more than expected. However, in a number of cases, these data are considered to have

been **reported mistakenly**, since surplus funds do not exist in these countries. In total, EUR 42 billion were reported.

The table below shows the amounts of confirmed surplus funds as a proportion of total own funds and a break-down on mutuals/mutual type undertakings and limited undertakings. This provides a more informed overview of the relative significance of this item in countries.

Table 22: Surplus funds as percentage of total own funds (EUR million)

	Total own funds	Total surplus funds	Surplus funds in mutuals and mutual type undertakings	Surplus funds in limited undertakings	Total surplus funds as a percentage of total own funds
Austria	13,558	219	0	219	1.6
Bulgaria	76	10	0	10	13.8
Denmark	19,386	1,526	0	1,526	7.9
Germany	155,123	9,574	1,411	8,163	6.2
Greece	760	184	0	184	24.2
Ireland	20,533	39	0	39	0.2
Poland	14,130	59	0	59	0.4
Sweden	60,759	30,588	30,588	0	50.3
Total	271,608	42,199	31,999	10,200	

For a majority of countries, surplus funds are reported in limited undertakings. In one country (DE) 85% of the surplus funds are reported in limited undertakings and the rest in mutual undertakings. In another (SE) only mutuals and mutual type undertakings can have surplus funds.

Significant amounts were reported in three countries (DE, DK, SE). Surplus funds **may also be significant** for certain insurers in other countries. In QIS4, two countries (BG, EL) reported a higher proportion of surplus funds to own funds compared to the average.

From countries where surplus funds play a significant role the following feedback was received:

- In one country (SE): For the undertakings that reported surplus funds in QIS4, 99% of own funds are surplus funds; these mutuals and mutual type insurers (limited undertakings, owned by shareholders, run by mutual principles and not able to pay dividends) are not permitted to hold funds

other than surplus funds; these funds are considered to be fully loss-absorbent.

This country noted that for undertakings with surplus funds it is of extreme importance that surplus funds are classified as Tier 1 funds, so they can be used in full to cover MCR and SCR. In fact, these surplus funds are fully loss absorbent and therefore fulfil the characteristics of Article 93 and the main criteria for classification into Tier 1 in Article 94. These undertakings have no other own funds except the share capital in mutual type insurers, which is very small. Should the surplus funds be classified as Tier 2 or Tier 3, the undertakings would not be able to cover MCR and SCR. This applies to a majority of non-unit-link insurers. At the same time, these undertakings have a very large surplus above SCR.

- In another country (DE), surplus funds usually are determined as the amount of the current provision for bonuses and rebates that is not expected to be distributed to current policyholders.
- In a third country (DK), surplus funds as special bonus provisions have similar characteristics as equity. The conditions attached to special bonus provisions secure that such funds can cover losses on the same conditions as equity. Equally they take part of the profits on the same terms as shareholders. Only life insurance and pension undertakings may build up surplus funds. Special bonus provisions may be used in the insurance undertaking of the policyholder. The funds may not be used for non-life purposes. Making contributions to the surplus funds and the conditions associated are part of the contract with the policyholder. Each year the policyholder receives information of the yield gained on his/her share of the surplus funds and the actual amount of the policyholder's parts of the total amount of surplus funds.

Other countries comment the following:

- One country (AT) commented that surplus funds are a special part of the technical provisions but are classified as an own fund item in Tier 1 and therefore the same methods are used for the valuation
- A second one (BG) noted that the reported surplus funds are 29% of the undertakings total own funds.
- Another country (CZ) noted that one undertaking reported surplus funds, however these are not regulated by the local legislation. The undertaking is a member of a foreign (DE) insurance group, therefore the supervisor assumes the undertaking reported the surplus funds to obtain a consistent classification within the group. The surplus funds amounted to 21% of the undertaking's basic own funds. No details on surplus funds and the methods of valuation thereof were submitted.

- A fourth country (IE) noted that only one undertaking had any surplus funds. No explanation was given and the amount was very small.
- A fifth country (PL) reported that one undertaking reported surplus funds as 9.5% of its total own funds.

Most of the seven countries that have confirmed that surplus funds **do not exist in their jurisdiction** only have smaller amounts of surplus funds and therefore have not analyzed the item. One country noted that one undertaking had reported surplus funds, but that this amount is likely to be part of the own funds held in a ring-fenced fund for with-profits policyholders and therefore should have been reported as 'other reserves with restricted loss-absorbency'.

Another country commented that QIS4 does not produce any information allowing an assessment of whether there is a level playing field between undertakings having the possibility to include surplus funds in own funds, and those that do not possess this capacity. Neither does it permit an appraisal of whether there is a level playing field between pension funds and insurance companies with pension schemes.

A third country stated that almost no surplus funds were reported. The supervisor however noted that adapting the treatment of future discretionary bonuses to the specifics of the local with-profits business will need further consideration. In this regard, it is worth examining whether surplus funds may have a place in the future regime in the local market.

A fourth country suggested that more detailed guidance regarding "surplus funds" would prevent future misunderstandings.

8.4.5 Other reserves

There was **not much feedback** on this question. The undertakings which reported on this issue distinguished, as requested, between other reserves which are loss-absorbent for all policyholders and other reserves with restricted loss-absorbency.

8.4.5.1 Other reserves which are loss-absorbent for all policyholders

In this category, undertakings mentioned the following other reserves that are loss-absorbent for all policyholders:

- Legal reserves, available reserves, revaluation of assets, untaxed reserves;
- Capital reserve;
- Voluntary reserves;

- Statutory Reserve Capital (which can be used to cover losses if retained earnings is not big enough to cover losses);
- “Capitalisation reserve”, defined as an untaxed bond equalisation reserve used to smooth the effect of interest rate fluctuations on bonds valuation; free reserves;
- Legal reserve; residual reserve; retained earnings; statutory reserves; initial organisation funds; revaluation of properties reserve (revaluation of some properties according to market value required by law); free reserves;
- Legal reserve; retained earnings; profit of the year;
- Legal reserves; revaluation reserves; accrued profit; difference between the QIS4 definition of own funds and the legal definition of own funds;
- Specified untaxed reserve;
- Capital reserves; legal reserves; catastrophe reserves; profit that arises from supplement health insurance;
- Obligatory reserve fund;
- Reserves relating to movements in foreign exchange for assets/liabilities held by overseas branches; capital contributions paid by the parent company; available for sale reserves; reserves for unit-linked-losses; data quality reserves to cover problems in the estimation of expenses; product reserves calculated by external consultants (brought through as a proxy for the realistic reserve and capital requirements); surplus assets required by the non-profit fund on the demutualisation of the undertaking; a balancing item to reconcile with supervisory returns.

8.4.5.2 Other reserves with restricted loss-absorbency

In the category of other reserves with restricted loss-absorbency, undertakings and countries mentioned the following:

- Legal reserves (because they may only be used to compensate losses according to local GAAP); update reserves; valuation adjustment reserve;
- Collective guarantee item (reserve which has been established to secure the claims of statutory lines of business – motor liability and workers’ compensation – in a liquidation or bankruptcy of an insurance company writing these lines);
- Reserve for guarantee fund;
- Catastrophe reserve;

- Own funds in a ring-fenced fund that is not able to cover losses outside the with-profit fund; IFRS unallocated surplus of the EEA participating business.
- Natural perils fund (quote “i.e. a rather simple system for equalisation provisions”);
- Provisions related to the guarantee scheme in non-life insurance.

Undertakings from some countries reported the equalisation reserve in other reserves. Whilst in some countries undertakings valued them as a reserve with restricted loss-absorbency, the undertakings’ views differed as some undertakings view them as a reserve with restricted loss-absorbency and others as a reserve loss-absorbent for all policyholders.

Furthermore, one supervisor recommended a clear definition of reserves with restricted loss-absorbency and a detailed presentation of the items included to prevent future misunderstandings.

Another supervisor explained further that its untaxed reserves are reserves which become taxable when they are reversed, except when they are used to cover a loss or to utilise a tax-loss carried forward. This supervisor stated that they should be classified as Tier 1 capital since they were loss-absorbent for all policyholders.

A third supervisor pointed out that the restricted reserves which were reported mainly relate to ring-fenced funds. While this country recognises that a different treatment for own funds restricted within a ring-fenced fund is necessary it has the view that generally all reserves should be considered Tier 1. Concerning equalisation reserves it pointed out that it does not think these will continue to be set up due to the new definition of technical provisions. The supervisor claimed that it will be important for clarity and transparency that there is a reconciliation identifying changes, but there will need to be a process for reconciling differences between the accounting and regulatory balance sheet.

8.4.5.3 “Other” items

Most of the undertakings **did not report any items qualified as “other”**.

In one country a premium fund (not for policyholders) was mentioned in this category.

In another country, very few elements were reported, amounts reported included specific hybrids with characteristics which do not fit into the classification criteria and the variation of own funds due to “cancellation of the deferred taxes costs and adjustments for fair value on invested assets”.

In two countries a couple of undertakings counted capital contributions that could be recovered from the parent group either as a “other” item or as a “other hybrid capital”.

Undertakings in another country mentioned other receivables and payables (excl. reinsurers) and accrual accounts.

In one country, two group-linked companies qualified net profit for the current year plus capital reserve as an item “other”.

Some undertakings have reported the variation of own funds due to cancellation of the deferred tax costs and adjustments for fair value on invested assets. The supervisor stated that the percentage of other items (excluding “other hybrid capital items”) of 11.6% total own funds and 13% total Tier 1 was affected by a number of large undertakings which have not indicated clearly what the amounts reported in “other” relate to.

One supervisor mentions that it seems that most undertakings included the profit/loss of the reporting year under this item.

Another supervisor pointed out that the local law does not allow other instruments than the ones mentioned in the Solvency I – Directives to be own funds. So “other” instruments as own funds do not exist in this country.

Finally, one supervisor pointed out that the risk equalisation fund in life insurance can only cover losses related to underwriting risk in a going-concern, but is subordinated to all other claims in a winding-up situation.

8.5 Effects of group support: the solo view

Very few undertakings have reported group support at the solo level. Therefore, it is difficult to draw any conclusions. In total, **EUR 848 million was reported in five countries.** Group support is a significant proportion of Tier 2 in one country and to a lesser extent in another country. However, no cases of group support in excess of the maximum amount that can be taken into account have been reported.

In one country, one undertaking included group support in Tier 2 without any explanation. The amount reported in this case was EUR 1 billion. In another country there was one reported case which was not considered material.

Furthermore, in one country, two undertakings (belonging to the same group) have reported group support in Tier 2. The proportion of group support to total own funds for these undertakings is 12% and 10% respectively. The group support is exactly equal to the difference between the capital requirements and

the own funds at solo level. The amount reported is below the maximum amount that could be taken into account.

In another country one undertaking has reported group support of EUR 4 million, which is 52% of the total of that undertaking's own funds. In total EUR 4 million is 0.01% of the total of all companies own funds. The reported group support is 65% of the maximum group support that can be taken into account from this undertaking (the difference between SCR and MCR).

A supervisor in one country has reported that one group provided information on the possible amount of group support that could be used to support a subsidiary. The supervisor assumes that groups have focused on the core group calculations and not had time to consider the quantitative amounts of Tier 2 and Tier 3 that could be used as group support to meet the difference between the MCR and SCR of a subsidiary. However, the responses to the qualitative questionnaire indicate groups are positive about the benefits of the regime in enhancing capital management. Groups have also noted the importance of factoring in limits on the transferability of capital that may limit the use of group support. Therefore, it might be expected that few groups would have used the theoretically 'maximum' amount of group support permitted under the Directive. However, it is not possible to test this hypothesis from the QIS4 data.

8.6 Main recommendations

As part of giving technical advice on implementing measures, CEIOPS should consider the following:

- **alternative ways** of satisfying the **sufficient duration** requirement for hybrid capital instruments and subordinated liabilities in the draft Level 1 text; in parallel with any **grandfathering** measures in relation to the classification of hybrid capital instruments and subordinated liabilities;
- no **split** classification of hybrid capital instruments/subordinated liabilities **according to their debt/equity component** as a possible policy approach;
- **clarifying** the treatment of **deferred taxes**;
- clarifying the **treatment** of **ring-fenced funds**, including a **clearer definition** of ring-fenced funds;
- **proceeding with** the **40:60 split** of **supplementary** mutual member **calls** between Tier 2 and Tier 3; subject to any changes to the Level 1 text proposal;

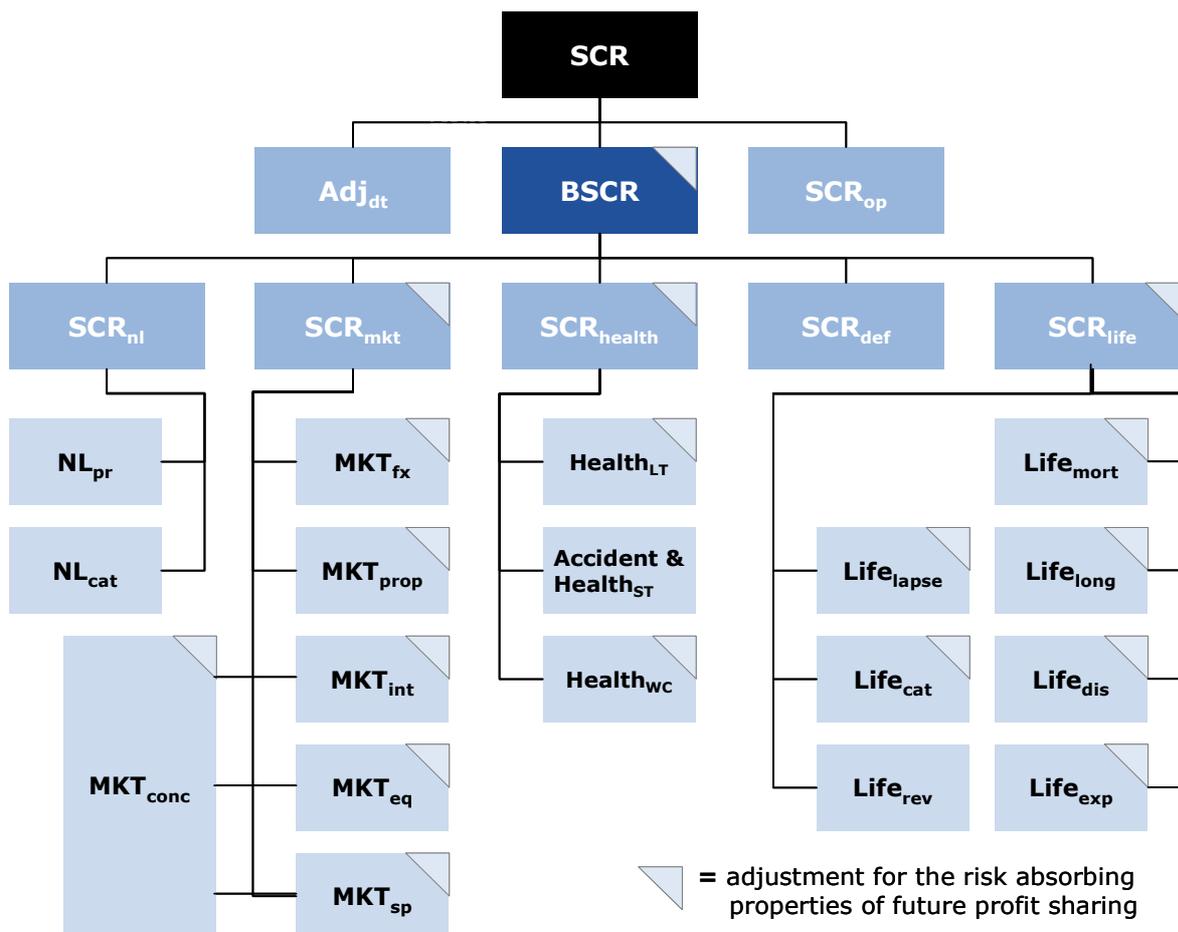
- **requesting further input** from undertakings on the **valuation** of ancillary own funds;
- analysing further the **composition** of the Tiers on the basis of own fund items which **currently exist** may be useful, to the extent that this is **consistent with** the criteria and characteristics set forth in the **Level 1 text** proposal. This could include a **clearer** classification of **reserves and provisions**, such as equalisation reserves and provisions, e.g. through a more granular approach.

9 SCR standard formula

9.1 Overall results

QIS4 has confirmed the support from industry and supervisors for the modular structure of the standard formula for the calculation of the capital requirements. This modular structure is composed of different risk modules and sub-modules, for each of which a capital requirement needs to be calculated (see Figure 72). These modules and sub-modules are then combined through correlation factors, through which diversification effects are taken into account. As diversification effects are difficult to calculate, the calibration of the correlation factors has been subject to many comments. Undertakings would also welcome more transparency on the calibration of the various (sub-) modules.

Figure 72: Modular approach of the SCR



9.2 Composition of the SCR

The Solvency Capital Requirement (SCR) is divided in three components: the Basic Solvency Requirement (BSR), the capital charge for operational risk, and the adjustment for deferred taxes. As can be seen in Figure 73, in most countries the SCR is largely dominated by the BSCR. Adjustments for deferred taxes can reach a sizable amount in some countries and are more prominent at life undertakings.

Figure 73: Proportion of BSCR in SCR (all undertakings)

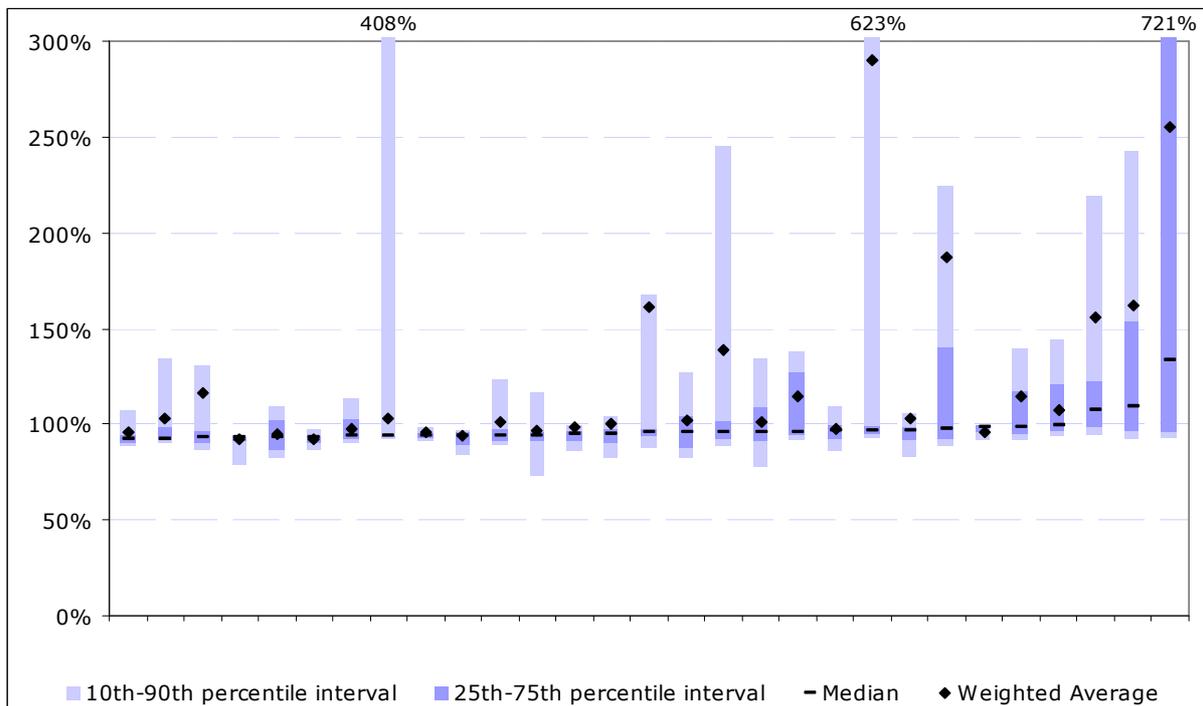


Figure 74: Proportion of BSCR in SCR (life undertakings)

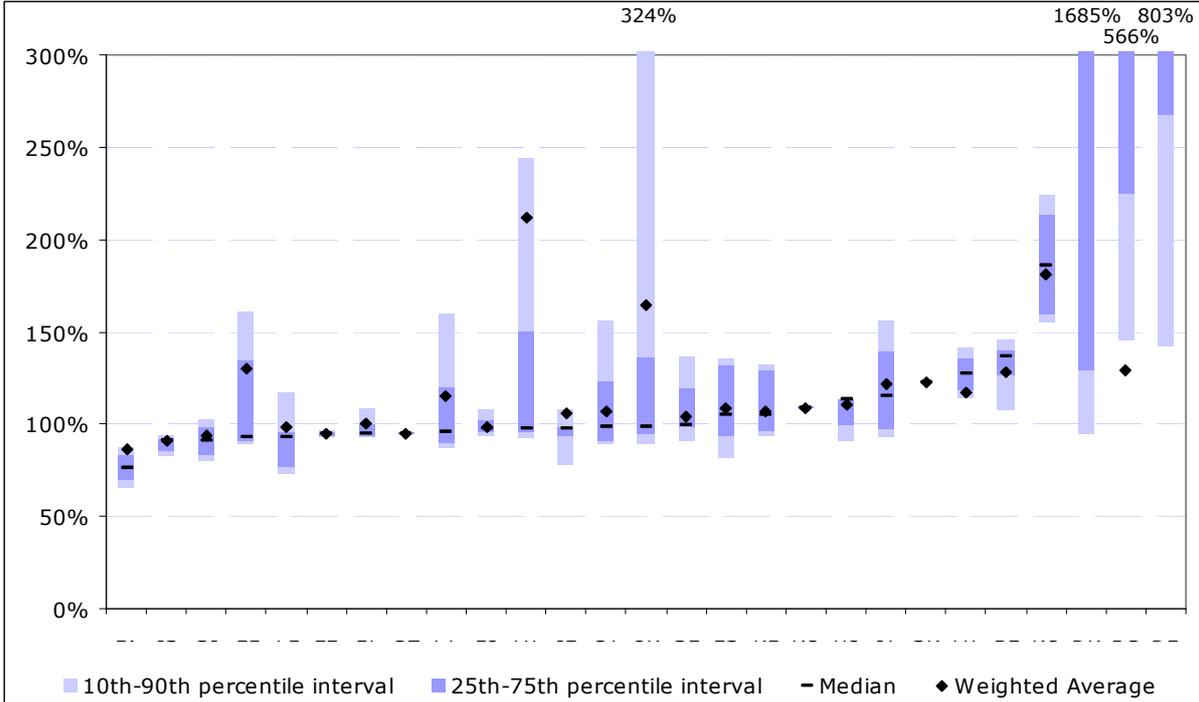
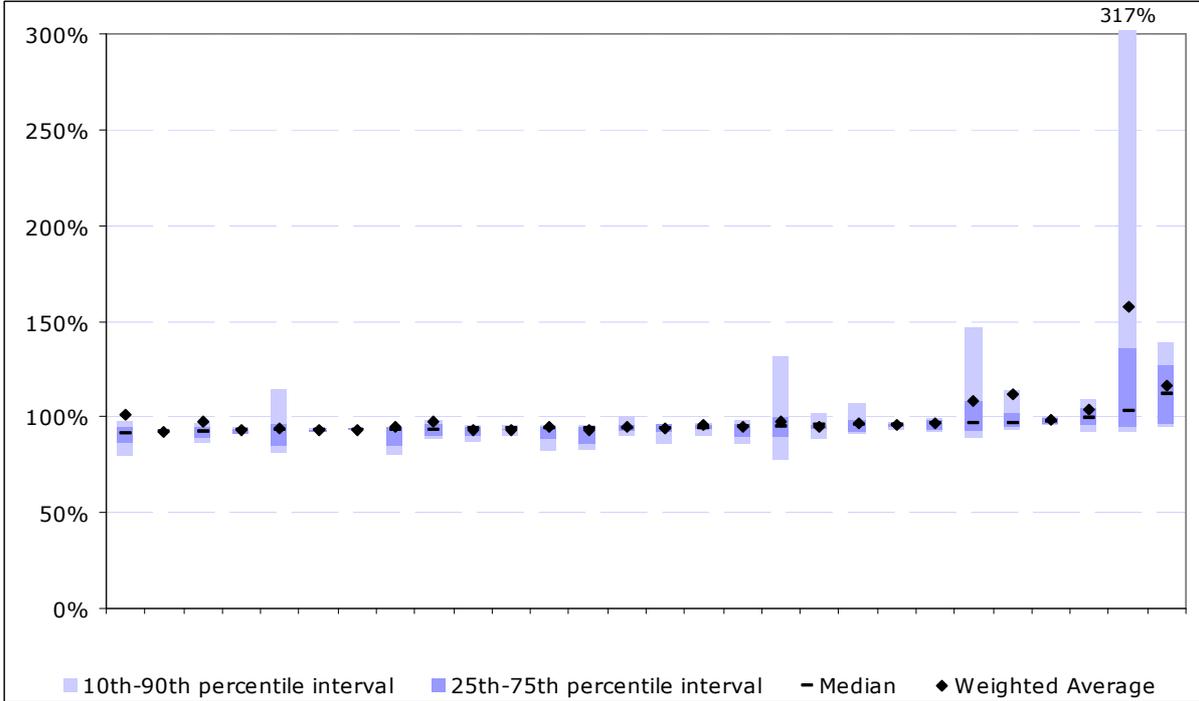


Figure 75: Proportion of BSCR in SCR (non-life undertakings)



9.3 The outcome of the Basic SCR calculations

9.3.1 Composition of the BSCR

The main components of the BSCR differ considerably depending on the business written. For life insurance undertakings the largest component is market risk followed by life underwriting risk, for non-life undertakings the respective underwriting risk and market risk rank highest. In most countries the diversification effect on the BSCR level is between 10% and 30% for life undertakings and between 15% and 35% for non-life undertakings.

Figure 76: Overall BSCR composition (life undertakings)

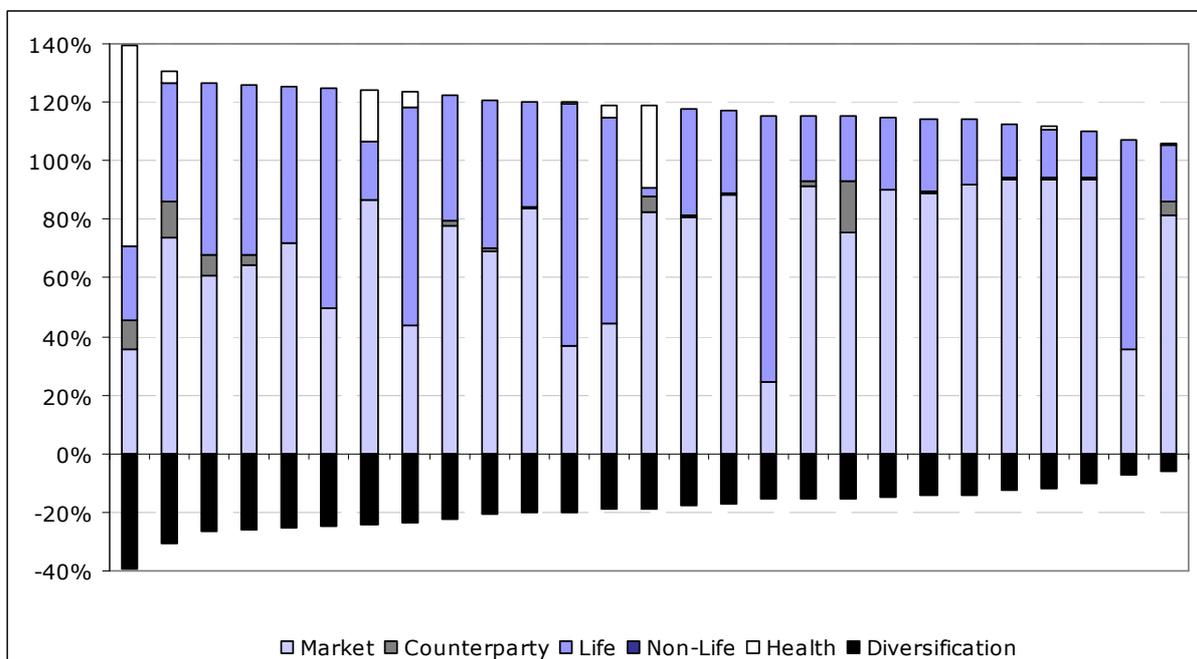


Figure 77: Overall BSCR composition (non-life undertakings)

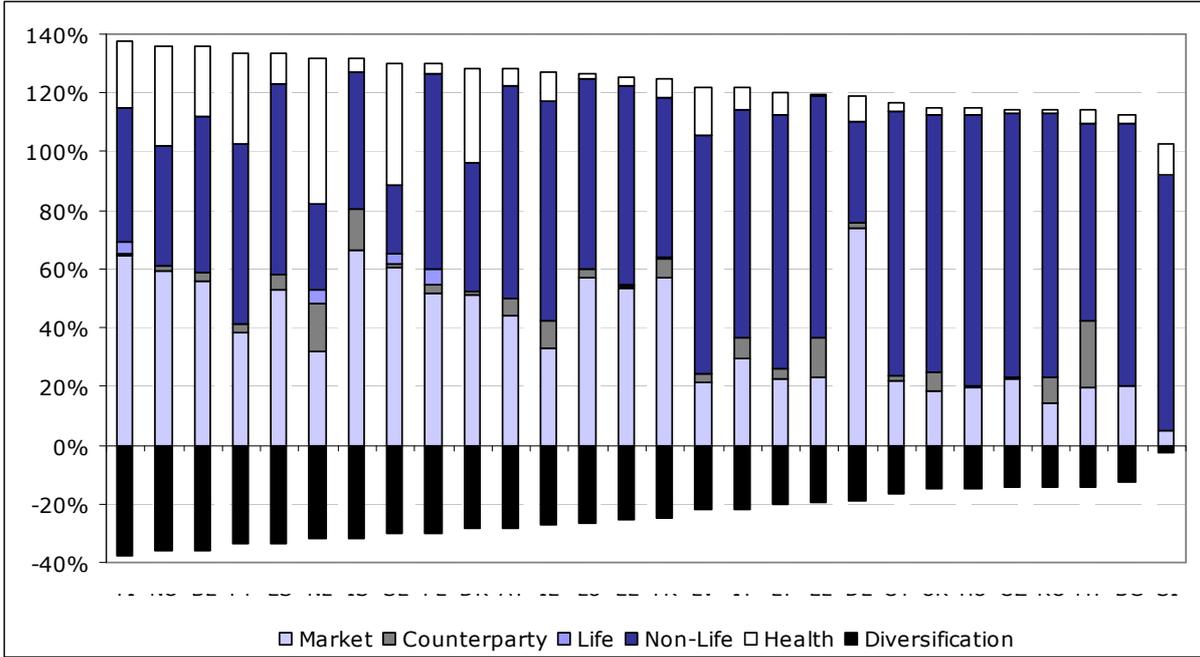
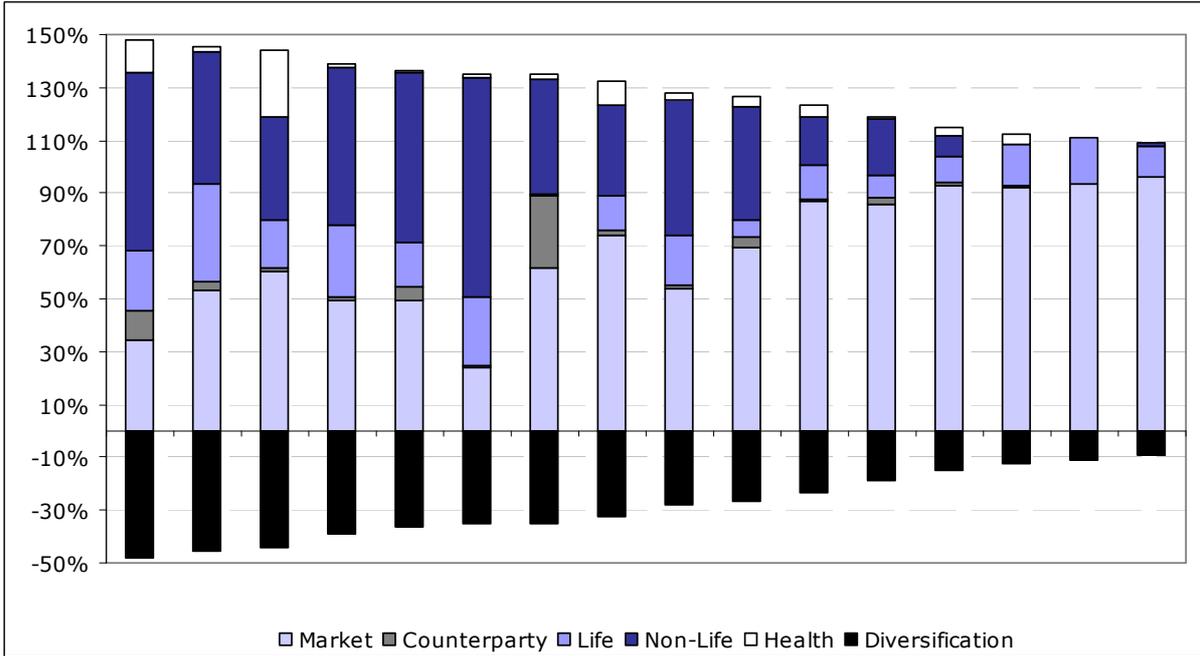


Figure 78: Overall BSCR composition (composites)



9.4 Market risk

9.4.1 Overall results

Market risk arises from the level or volatility of market prices of financial instruments. Exposure to market risk is measured by the impact of movements in the level of financial variables such as stock prices, interest rates, real estate prices and exchange rates. The market risk module consists of several sub risk modules: *Interest rate risk*, *Equity risk*, *Property risk*, *Spread risk*, *Concentration risk* and *Currency risk*. All modules also include a variant including the risk absorbing effect of future profit sharing. The market sub risks are combined to an overall capital charge for market risk using a specific correlation matrix. For the purposes of the calculation of the equity risk sub-module, as alternative to the standard approach, a “dampener” formula has been tested for liabilities with a duration of more than 3 years, for which the underlying rationale is the idea that (a) the capital needed to cover a fall in equity values for undertakings with long duration liabilities is smaller than for undertakings with short duration liabilities (i.e. mean reversion), and also (b) the probability that the value of the equity indices increase is small when the index is high and vice versa). CEIOPS also tested the impact of an alternative correlation for equity and interest rate risk.

The **main findings** for the market risk module are:

- The **dampener approach** tested in QIS4 resulted in a reduction of around 10% in equity risk capital based on the average of median results for all business segments. The **duration aspect** of the dampener approach was **opposed explicitly by many supervisors and undertakings**. Main reasons for this are a lack of theoretical and empirical justification, inconsistency with the 99.5% one-year VaR level and inappropriate incentives for risk management. However, there was one country (FR) in favour of having an equity capital charge determined in relation to the duration of the insurance liabilities (or to the holding period of assets) and to the current point in the financial cycle. This was supported by the industry in this country.
- Views regarding the suitability of the different approaches for the **treatment of participations** in the equity sub risk module are **mixed**. Whereas some undertakings and supervisors favour the differentiated equity stress approach (option 1), other parties criticise this approach and favour the across the board or look through approach (option 2 or 3). Several supervisors have not made up their mind yet on the best way forward in relation to participations.

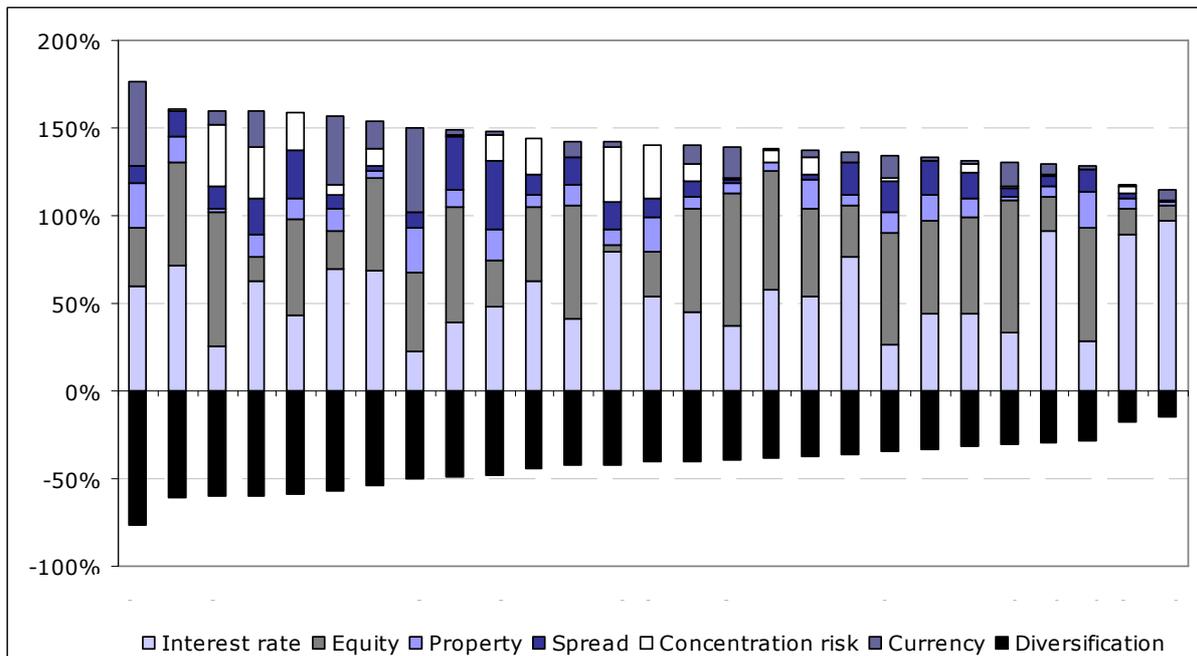
- Many undertakings and supervisors agreed that the **32% calibration of the equity stress** was **too low** for a 99.5% calibration, and there were suggestions that a figure of around 40% might be more appropriate.
- There are suggestions to introduce **sensitivity to the changes in the shape of the yield curve** for the interest rate module.
- It was also suggested that the **correlation between equity risk and interest rate risk** could be reviewed, and that **a higher correlation** would be **more appropriate**. The alternative correlation of 25% instead of 0% tested in QIS4 increases the capital charge for market risk on average by 4%.
- The obligation to provide a **calculation** of the SCR before application of the risk mitigation **effect of future profit sharing** (gross SCR) is considered **burdensome** and not necessary by many undertakings.

9.4.2 Quantitative outcome

Table 23: Market risk composition (EU average)

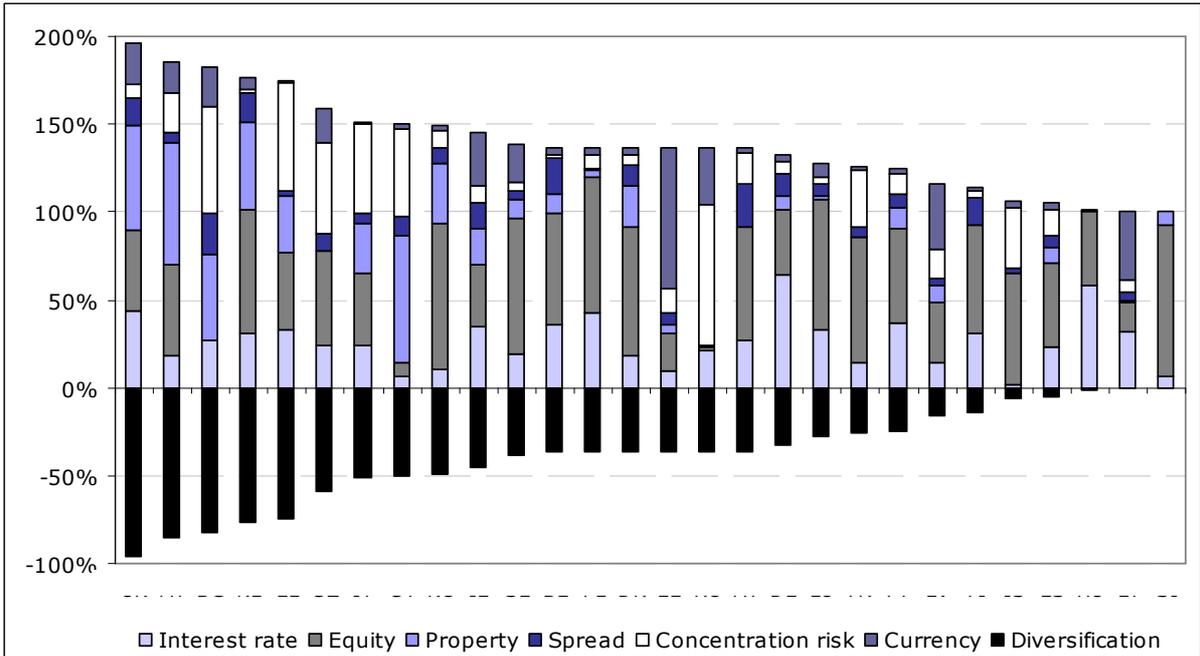
	Interest rate risk	Equity risk	Property risk	Spread risk	Concentration risk	Currency risk	Diversification effects
Life	51.1%	43.7%	7.7%	20.6%	7.2%	6.7%	-37.0%
Non-life	37.1%	47.9%	14.4%	11.4%	17.9%	6.0%	-34.7%
Composite	43.8%	52.1%	13.4%	14.5%	9.5%	2.8%	-36.1%

For **life insurance companies**, market risk is on average the largest component of the BSCR across countries, and forms about two thirds of the BSCR if diversification effects are included. The largest component of this risk module is the interest rate risk submodule, which forms over half of the market risk capital charge. This is closely followed by equity risk, comprising about 44% of the capital charge. Property risk, currency risk and concentration risk are each about 7% of the capital charge and, together with spread risk, form about 40% of the market risk charge. The diversification effect on this level of aggregation can be considerable, averaging 37% for all countries. However, large differences exist between countries (see Figure 79). For instance, in one country equity risk forms only 3% of the total charge for market risk, whereas in another country this may be as large as 76%.

Figure 79: Market risk composition (life undertakings)

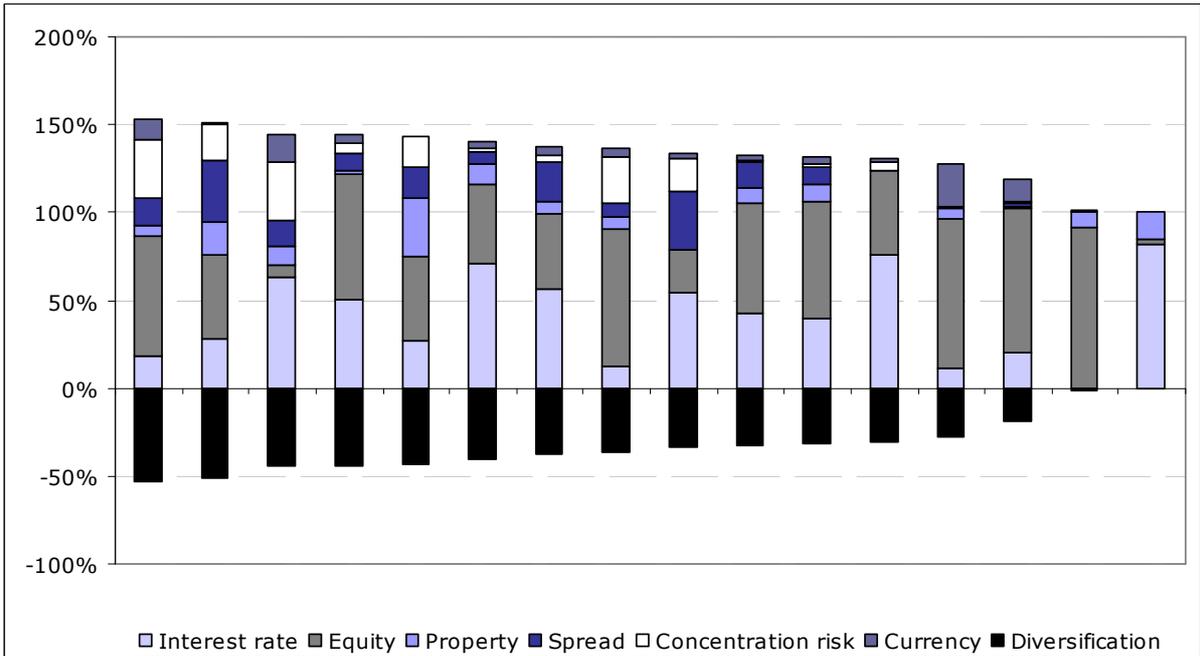
For **non-life insurance companies**, market risk forms about two fifth of the BSCR (one third when excluding diversification effects). Equity risk is on average the largest component of the risk charge across countries, and forms nearly half of the capital requirement for market risk. Interest rate risk and concentration risk are the second (37%) and third (18%) largest contributors to the market risk charge. The impact of diversification is on average 35%. Again, large differences exist between countries (see Figure 80), with one country at 3% showing the lowest charge for equity risk and another at 86% the highest.

Figure 80: Market risk composition (non-life undertakings)



Also for **composites**, equity risk (52%) forms the largest part of the market risk capital charge, followed by interest rate risk (44%). The other sub risk modules comprise each less than 15% of the capital charge, and combined form close to 40% of the market risk requirement. Diversification effects are again substantial at 36%.

Figure 81: Market risk composition (composites)



9.4.3 Suitability and appropriateness of design and methodology

9.4.3.1 Market risk: general comments

Interest rate risk

There are suggestions to introduce **sensitivity to the changes in the shape of the yield curve** for the interest rate module.

Concentration risk

The **inclusion of participations** into the concentration risk submodule was rejected by some undertakings as double counting. Other comments included the need for clarification of concentration risk on properties.

Currency risk

Some undertakings suggest using a **correlation matrix** for the treatment of the currency risk.

Other risks

The treatment of **inflation-linked bonds** is not addressed by the QIS4 specifications.

Some undertakings and supervisors noticed that the **risk of interest rate and equity volatility** is not modelled and missing in the standard formula.

9.4.3.2 Equity risk

Comments of both undertakings and supervisors mainly focused on the suitability of the design of the equity risk submodule.

First, the choice by certain undertakings to use or not the **look-through approach** to split diversified investment funds might have biased the evaluation of equity risk.

Second, there are many comments from undertakings that the treatment for **highly diversified, low-risk investment funds** is too harsh when not differentiated in the "Equity, other". Some undertakings also suggest a specific treatment for bond funds, differentiated from the general treatment of funds as "Equity, other". Supervisors mentioned that given the factual Technical Specifications, this might be a misunderstanding.

Within the equity risk submodules, two other issues regarding suitability received **most attention**, namely the application of the equity dampener and the treatment of participations.

9.4.3.2.1 Equity dampener

General approach

The **dampener approach** tested in QIS4 was **explicitly opposed** by many supervisors and undertakings. The reasons given were:

- There was disagreement with the underlying hypothesis of mean reversion of equity markets;
- The approach does not take proper account of the risk that a firm would be unable to demonstrate a solvent balance sheet in 12 months' time;
- Use of a dampener may result in inadequate policyholder protection, undercapitalisation and under-pricing of long-term business;
- The approach may be perceived as incentivising poor risk management practices;
- Questions were raised as to why equities should be singled out for more favourable treatment and why there was an inconsistency with the treatment of other risks;
- The method led to unnecessary complexity of calculation and difficulty in interpreting results. This was particularly true where there is risk mitigation (for example hedging strategies) in place and when used for profits sharing arrangements. Difficulties in estimating liability durations may translate to uncertainty in the SCR results;
- The test was considered unsuitable for situations where the policyholder bears investment risk or the insurer is affected by changes in equity values only indirectly;
- The approach was inconsistent with that used in internal models;
- There was an inconsistency with the measurement of risks at the level of 99.5% one-year VaR.

There was a suggestion that procyclicality should be taken into account in supervisory intervention (Pillar 2) rather than in the capital charge.

However, there was **one country** (FR) **in favour** of having an equity capital charge determined in relation to the duration of the insurance liabilities (or to the holding period of assets) and to the current point in the financial cycle. Moreover, this country considers that a specific treatment of participations should also be consistent with the holding period of assets. This was supported by the industry in this country. There was limited support from a few undertakings in other countries, with some however basing this on the premise that the impact on capital is small and others reiterating the practical calculation difficulties. Some undertakings support the approach based on durations, but consider that it should not be limited to the equity risk submodule, but extended to also other

sub risk modules (e.g. property risk). There were also some suggestions for refinements of the categorisation of equities under “global” and “other” categories.

Calibration

For the majority of jurisdictions the undiversified SCR equity risk capital tended to be lower under the dampener approach. One country expressed concerns that this approach would therefore result in undercapitalisation and potentially hinder a level playing field.

It was noted that the dampener approach used in QIS4 was under-calibrated relative to the 99.5% VaR standard.

Duration

Based on end 2007 market conditions, it was observed by one country that the **duration component** of the dampener approach tended to **dominate** over the cyclical component.

One country suggested a much short duration (3-6 months) if a dampener approach were to be used. Undertakings in another country also suggested reducing the reference market cycle, although other undertakings preferred a 5-year horizon instead. It was felt that the appropriateness of a three year cycle assumption could be hard to assess, but might be considered too cautious, thereby resulting in capital requirements that are too low.

Some undertakings felt that a duration approach could also be used where the liabilities were less than three years in duration.

Quantitative outcome

The **impact of the dampener** depended on the nature of the liabilities, but tended to be stronger in many cases for life undertakings (that is, a larger reduction in equity risk capital) than for non-life undertakings. Based on the average of median results for all business segments, the dampener approach resulted in a reduction of around 10% in equity risk capital. This can be broken down into around 13% reduction in capital for life undertakings compared with around 3% reduction for non-life undertakings. The linear dependency of the size of the equity shock related to the duration is clearer for the outcomes of life insurance undertakings than for those of non-life insurance undertakings. The results may however underestimate the impact as undertakings with the longest liabilities will be most likely to adopt the duration approach. For those undertakings that have tested the dampener approach and for which the average duration of their liabilities is over three years, the average duration of the liabilities of life insurance undertakings is 11 years, whereas the duration of the liabilities of non-life insurance undertakings is 6 years. This is substantially longer when compared to the average liabilities of all undertakings, for which the

average duration of the liabilities is respectively 9 and 2.5 years. The duration ranges however from close to zero in some countries, to over 6 (non-life) and 15 (life) years in others. There were also some anomalous results, however, thought to arise for example from spreadsheet errors.

There were associated other impacts – for example, one country noted that the dampener approach nearly doubled the adjustment for deferred taxes. Furthermore, distortions that may be created by this approach could mean that it is difficult to set a clear objective for undertakings intending to build internal models. Some undertakings found that the closed formula used for the dampener was not compatible with the recognition of their hedging policy (therefore resulted in a higher capital charge for this option than the default formula).

Table 24 illustrates the duration of liabilities per business type.²² The important result is that there is on average a difference of 6.6 years between the duration of the liabilities of life undertakings (10.3 years), and the duration of the liabilities of non-life undertakings (3.7 years). Reinsurers and captives have results similar to non-life undertakings.

Table 24: Duration of liabilities (years, all undertakings)

	10th	25th	50th	75th	90th	Mean	Standard deviation	Sample size
	percentile							
Life	5.0	6.5	8.9	13.4	17.2	10.3	5.6	(190)
Non-Life	0.6	1.6	2.4	3.8	6.0	3.7	5.6	(267)
Composite	3.7	5.4	7.4	9.9	14.5	8.4	5.1	(77)
Reinsurers	0.9	1.4	3.0	3.9	5.9	3.0	2.0	(21)
Captives	1.0	1.1	2.0	3.0	5.1	2.7	2.2	(37)

Table 25 illustrates the average and median duration of liabilities above three years per business type for undertakings having tested the dampener option.²³

For undertakings with an average liability duration above 3 years, the average duration of the liabilities of life undertakings increases to 10.8 years, and the duration of the liabilities in non-life to 7.1 years.

²² The information is extracted from the "I.General" table of the spreadsheet, cell D259, and is not related to answers about the dampener calculations (Data was collected just for informational purposes, about 700 usable answers)

²³ The information is extracted from "I.Scenarios, cell F45" and is used as input for the dampener (About 380 usable answers).

Table 25: Duration of liabilities (years, undertakings testing the “Dampener”)

	10th	25th	50th	75th	90th	Mean	Standard deviation	Sample size
	percentile							
Life	5.3	7.1	10.0	13.8	16.7	10.8	4.8	(87)
Non-Life	2.2	4.2	5.9	7.9	10.4	7.1	7.6	(92)
Composite	4.8	6.0	7.7	11.4	17.1	9.1	4.6	(49)
Reinsurers	2.9	5.0	5.0	6.0	12.7	6.9	6.0	(5)
Captives	3.2	4.9	5.3	6.9	9.2	6.1	3.5	(7)

Although the perimeters for both tables cannot be compared, as only undertakings with an average liability duration above 3 years will have tested the dampener, just for the sake of illustration, the following table plots a comparison of both sets of results.

Table 26: Comparison “All” / “Dampener” (years)

	Average duration liabilities	Average duration dampener
Life	10.3	10.8
Non-Life	3.7	7.1
Composite	8.4	9.1
Reinsurers	3.0	6.9
Captives	2.7	6.1

9.4.3.2.2 Participations

QIS4 offers three options for the treatment of participations and subsidiaries at solo level.²⁴

- Option 1 (differentiated equity stress approach): Undertakings should treat all participations and subsidiaries in the SCR calculation as if they were an equity investment. For participations and subsidiaries in which the undertaking owns more than 20% and for certain specific other participations and subsidiaries a reduced equity shock applies.

²⁴ For a comprehensive analysis of the treatment of participations, it is also relevant to consider how participations are valued as an asset on the balance sheet (See Chapter 6).

- Option 2 (across the board approach): Undertakings should treat all participations and subsidiaries in the SCR calculation as if they were a standard equity investment. No reductions apply.
- Option 3 (look-through approach): Undertakings may replace the solo SCR calculation with the group SCR calculation for the (sub)group formed by the undertaking itself and its subsidiaries and participations.

General approach

Views regarding the suitability of the different approaches for the treatment of participations are mixed.

A vast majority of undertakings from one country (IT) and some undertakings from four other countries (FR, SE, UK) **support option 1** (differentiated equity stress approach). Some of these undertakings referred to the stable relationship between undertaking and participation to substantiate their view, and added that they considered Option 2 charges to be penalising for strategic participations. One supervisor (IT) believes that the treatment of participation is a very relevant issue and supported the idea to test the option 1 as a possible way to take into account the long term nature of the investment in participation. Also another supervisor supports the option 1 approach (AT) because it is considered to be economically more realistic than the option 2 method.

However, several undertakings **criticised this option** as being too complex (DE, FR) or questioned its rationale (UK). Also some supervisors remark that it is too complex (DE), that the rationale of the distinction of participations is unclear (DE, ES) and that it produces a lower capital charge than the look-through approach (UK).

Two supervisors **prefer the option 2 method** (ES, NO). They are of the opinion that a reduced stress for participations is not reasonable and empirically not justified. It was mentioned that the current market developments have shown that financial institutions are more volatile than assumed under option 1 (ES).

Option 3 was also **supported** by some undertakings (HU, UK). In particular, it was considered to be more consistent to the way in which the business is managed. Other undertakings complained that direct holdings in participations are treated differently than holdings via a holding company in option 1 and 2 (AT).

Several supervisors have **not made up their mind** yet on the best way forward in relation to participations. Some of them noted that the difference is of minor importance for their market, that they have not received sufficient feedback in QIS4 or that further analysis is necessary. One country (UK) suggested that the treatment of participations should prevent double gearing of capital (also seen as a concern by DE) and should allow identifying where the risks and capital reside within a group. One country proposed a specific treatment of participations which

is consistent with the holding period of these assets. Neither method tested appeared to fully address these issues.

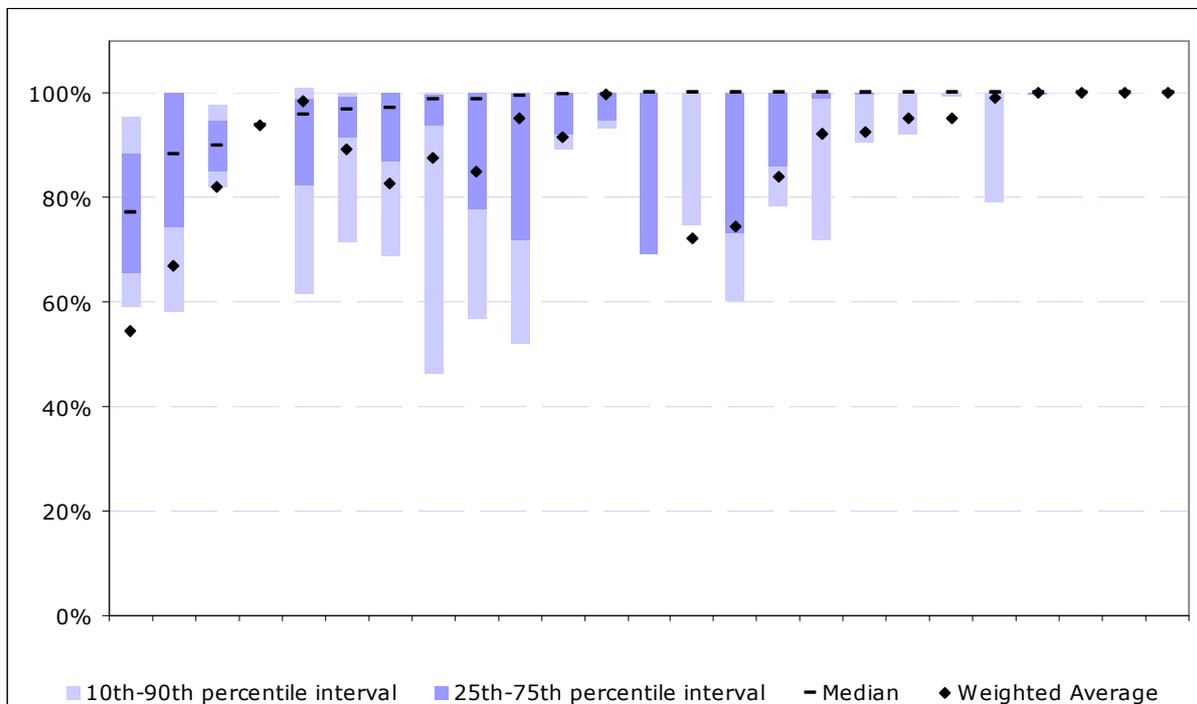
Quantitative outcome

For most undertakings the **difference between the option 1 and 2 approaches** is small. The equity capital charges according to both options differ by less than 10% for the majority of undertakings. However, there are undertakings for which a significant difference was observed. Some undertakings reported equity capital charges according to option 1 which are up to 50% lower than the corresponding option 2 results.

On the level of the overall SCR, outcomes are more even. The number of undertakings for which the choice of approach makes a significant difference to the overall SCR is lower, and also the relative difference between the overall SCR results is smaller.

Results of option 3 calculations were not collected in a systematic way in QIS4 due to its complexity. However, in one member state (UK) it was noted that the option 3 calculation that looks through to the underlying risks borne by the participation can result in a significantly higher SCR than the alternative methods.

Figure 82: Impact of different approaches to the treatment of participations (MKT_{eq} option 1 to option 2, all undertakings)



9.4.3.3 Interest rate risk

There are suggestions to introduce **sensitivity to the changes in the shape of the yield curve** for the interest rate module.

9.4.3.4 Property risk

Undertakings in one country commented that the module does not adequately reflect the situation when buildings are used in own activity and not held as an investment. In another country, undertakings suggest to split real estate risks in several sub-lines (residential, commercial, offices, etc.).

9.4.3.5 Spread risk

Some undertakings suggest differentiating between potential losses due to migration and default risk, and those due to a general change in the market price of credit risk. Undertakings in another country note that the current approach does not allow for risk mitigation instruments.

9.4.3.6 Concentration risk

The **inclusion of participations** into the concentration risk submodule was rejected by some undertakings as double counting. Some undertakings were concerned that intra-group operations are faced with a too high capital charge. Other comments included the need for clarification of concentration risk on properties. It was also unclear for some undertakings which assets are included in the denominator. Undertakings in one country criticise this module with respect to bank deposits from financial entities under Basel II and investment funds harmonised at a European level. In their view, these elements should be excluded from the module, as their issuers are subject to anti-concentration regulation.

9.4.3.7 Currency risk

Some undertakings suggest using a **correlation matrix** for the treatment of the currency risk.

9.4.3.8 General comments

The treatment of **inflation-linked bonds** is not addressed by the QIS4 specifications. Some undertakings and supervisors noticed that the **risk of interest rate and equity volatility** is not modelled and missing in the standard formula. Undertakings in two countries, though recognising the difficulties for valuation, felt that **liquidity risk** might be included in for instance the market or

credit risk charge. There was also confusion in which sub risk modules **mortgages** should be treated. One country states its preference for the spread risk module in addition to the interest rate risk module, instead of the counterparty default risk module.

9.4.4 Practicability

Comments on the practicability of the market risk module included:

- It was suggested that use of the **delta-NAV approach** is overly complex, requiring sophisticated modelling techniques (for example, internal models).
- Many insurers found the application of the **look-through principle** for the evaluation of the market risk for investment funds impracticable.
- The **currency risk charge** was seen as problematical for undertakings writing international business; particularly if this were to be applied to the currency of the free assets relative to the Euro, rather than to the currency in which the liabilities are denominated (or the currency of the local regulator)

9.4.5 Calibration

Comments on the calibration of the market risk submodules tested in QIS4 include the following:

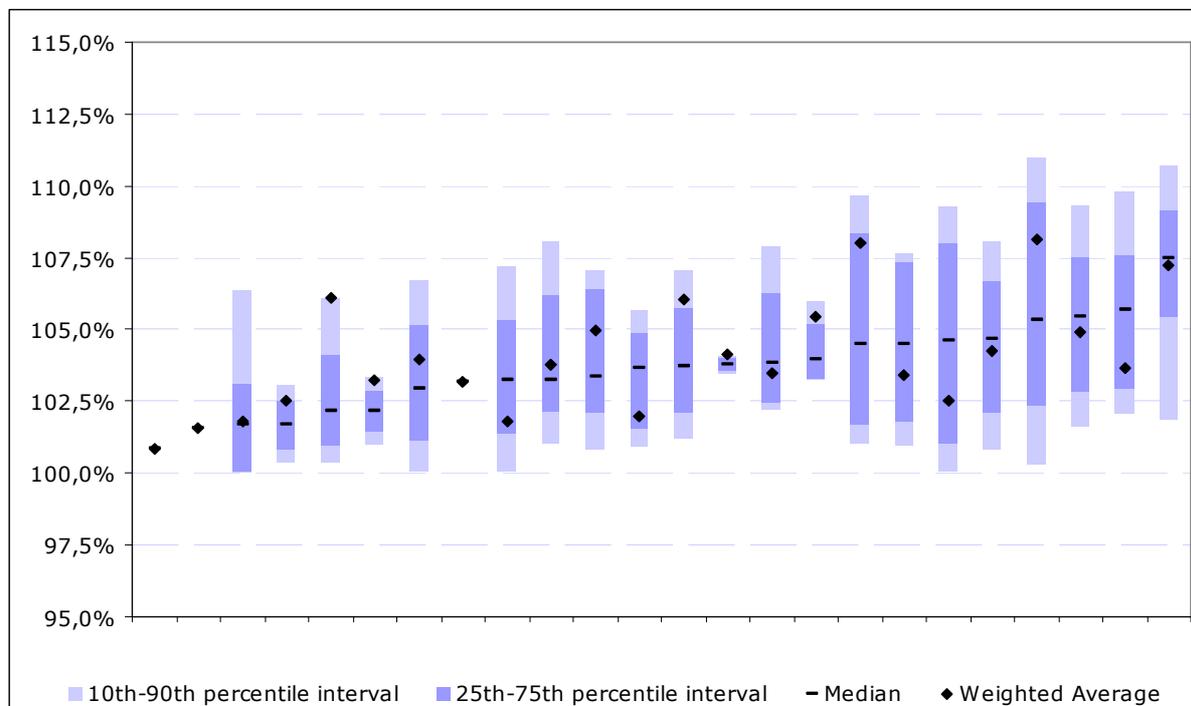
9.4.5.1 Equity risk

Many undertakings and supervisors agreed that the **32% calibration** of the equity stress was **too low** for a 99.5% calibration, and there were suggestions that a figure of around **40% might be more appropriate** for most undertakings. However some undertakings writing long-tailed business considered the stress too high. There was a suggestion that a stress which depended on current market conditions might be more realistic.

It was also suggested that the **correlation between equity risk and interest rate** risk could be reviewed. The **alternative correlation** tested in QIS4 (25% correlation instead of 0%), generally leads to a **4% higher capital charge** for market risk (see Figure 83). This increase is more or less the same for life (4.5%), non-life (4.1%) and composite (4.1%) insurance undertakings. In terms of the overall capital charge, this alternative correlation would imply on average a 2% increase of capital requirements (2.7% for life undertakings, 1.3% for non-life and 3.4% for composites).

Furthermore, more allowance was requested for diversification between equity markets by undertakings in one country.

Figure 83: Impact of alternative correlation on the market risk charge – SCR_{mkt} alternative correlation to standard SCR_{mkt} (all undertakings)



9.4.5.2 Interest rate risk

In some countries, undertakings considered the interest rate **shock** to be **too high**, while others found it **too low**. Undertakings in one country remarked that the stress scenario should also take the absolute level of the interest rate into account. Some undertakings asked for guidance on how to define the term structure for valuation of index linked liabilities and how to stress the term structure for index-linked bonds. Some undertakings asked for guidance on how to define the term structure for the valuation of index linked liabilities and how to stress the term structure for index-linked bonds.

9.4.5.3 Spread risk

The capital charges for credit spread risk were seen by some undertakings as too low for AA and AAA corporate bonds, but too high for lower rated bonds and for structured bonds, and especially for unrated bonds. Others would like to use internal ratings for unrated instruments, or suggest excluding instruments issued in OECD currency by supranational entities.

9.4.5.4 Currency risk

In some countries, undertakings as well as some supervisors considered the shock for currencies linked to the Euro to be too high, especially for pegged currencies.

9.4.5.5 General comments

Undertakings or supervisors from at least one country made the following comments:

- One supervisor suggests considering the calibration of shocks for assets and liabilities linked to inflation rates.
- Another supervisor recommended reviewing the calibration of the market risk module against the background of the current market developments.
- The risk of changes to implied volatility when valuing options and guarantees in the liabilities should be allowed for.
- The structured product charge was considered too simplistic, as no account was taken of nature/security of underlying assets or priority order/structure of tranches.

9.5 Counterparty default risk

9.5.1 Overall results

Counterparty default risk is the risk of possible losses due to unexpected default, or deterioration in the credit standing of the counterparties or debtors in relation to risk mitigation contracts, such as reinsurance arrangements, securitisations and derivatives, and receivables from intermediaries. The main inputs for the counterparty default risk capital charge calculation are the estimated loss-given-default (LGD) of an exposure and the probability of default (PD) of the counterparty. The PD in the QIS4 specifications is based on external ratings of the counterparty, or else prescribed by the QIS4 specifications.

The **main findings** for the counterparty default risk module are:

- The concept of the **loss-given-default** was considered to be an improvement compared to the QIS3 exposure measure. However, its calculation was considered to be **very laborious, impracticable and cumbersome** for many of the undertakings, in particular with regard to non-life reinsurance counterparties. Furthermore, some undertakings

considered the outcome to be too high while others suggested an increase. In particular, the choice of the 50% recovery rate was discussed.

- Many undertakings and supervisors stated that the **treatment of unrated counterparties** (intermediaries, policyholders, hospitals, reinsurance in federations) in the default module was not appropriate and considered it too high and penalising.
- Several undertakings and supervisors discussed the **scope of the module** and suggested to include or adjust the treatment of certain risks into the sub risk module.

Quantitative outcome

For life (3%), non-life (5%) and composite (4%) undertakings, counterparty default risk forms the smallest component of the BSCR (not counting non-life underwriting risk for life undertakings or life underwriting risk for non-life undertakings). However, differences between jurisdictions are considerable, as in some countries, the counterparty default risk charge can be as large as 15% for life, or even 23% for non-life undertakings.

9.5.2 Suitability and appropriateness of design and methodology

Despite the practicability issues (see paragraph 9.5.3), the concept of the **loss-given-default** was considered to be an **improvement** compared to the QIS3 exposure measure of “replacement cost” by several undertakings.

Several undertakings reported significant **inconsistencies** in the determination of the **risk factors**. The inconsistencies related to the use of Herfindahl indices to measure diversification effects and the Vasicek distribution. Suggestions to remove the inconsistencies by simple amendments were also made.

The **scope of the module** was also discussed. Some insurers proposed to **include** the default risk of bonds. Some undertakings also considered that the exemption of government bonds from the default risk in the standard formula creates a distortion for the internal models, which model a non-zero risk for these bonds. Others suggested including outstanding third-party recoveries of non-life insurance. Furthermore, a special treatment for intra-group reinsurance was requested by some insurers. Another view was in favour of **merging** the counterparty default risk module and the spread risk module. Other undertakings considered the distinction between spread risk and counterparty default risk to be imprecise.

9.5.3 Practicability

The main concern in relation to the QIS4 counterparty default risk module was the practicability of the calculation. In order to derive the capital charge, a **loss-given-default** (LGD) value for each counterparty had to be calculated. This turned out to be **very laborious** for many of the undertakings, in particular with regard to non-life reinsurance counterparties. Undertakings complained that in the case of many counterparties the calculations are far too complex in view of the low default risk that they are exposed to. The two-stage calculation approach where the effect of the reinsurance on the SCR has to be calculated separately ignoring each counterparty was very **impracticable and cumbersome**. Moreover, the description of the calculation in the Technical Specifications was not sufficiently detailed. Consequently, several undertakings were not able to produce the LGD values.

The Technical Specifications included **a simplified approach** to the **determination of LGD** where the values had to be calculated per rating bucket instead of per counterparty. Allegedly it was not sufficient to ease the calculation. However, the additional simplification for non-life reinsurance published as part of the QIS4 question and answer service was explicitly welcomed by some undertakings. Some undertakings proposed further simplifications.

Also further guidance was sought in relation to the **correct credit exposure towards policyholders**. Some undertakings believe that the recoverables used in the determination of the LGD should not include the adjustment for expected default. Other undertakings proposed an allowance of provisions for bad reinsurance debt in the LGD.

9.5.4 Calibration

The **treatment of unrated counterparties** (i.e. probability of default) received particular attention. Many undertakings stated that the treatment of intermediaries in the default module was not appropriate. As intermediaries are usually not rated or their rating is unknown, the risk factor for unrated counterparties had to be applied to their exposure. Several undertakings and supervisors believed the risk factor for these counterparties to be **too high**. This led to high capital charges which were considered to be **penalising**. Similar concerns were raised in relation to other unrated counterparties like policyholders or hospitals in health insurance. It was also noted that diversification between the intermediaries was not properly allowed for. In particular the treatment of undertakings outside of the EEA was considered to be penalising or inconsistent to the treatment of unrated EEA reinsurers. Some undertakings proposed to allow for internal rating based approaches for these special kinds of counterparties.

In relation to this, some undertakings welcomed the **option to derive the probability of default** of an unrated reinsurer on basis of its **solvency ratio**, while others noted that the outcome is very sensitive to changes in the solvency ratio. One supervisor explicitly mentions further work on this option is needed.

As regards the LGD, undertakings' views vary. Some undertakings considered the outcome to be too high while others suggested an increase. In particular, the choice of the 50% recovery rate was discussed in this respect. Supervisors seem to agree that the determination of the LGD needs further simplification.

Other comments on the counterparty default risk module include:

- Some undertakings requested further guidance in relation to the look-through approach.
- With regard to reinsurance of P&I clubs to unrated counterparties, some special arrangements were reported which are believed to eliminate the credit risk but the arrangements could not be accounted for in the module.
- In the counterparty default formula, there are also cases where the application of the Vasicek formula will not lead to a monotonically decreasing risk with decreasing concentration.
- Some undertakings proposed a special treatment for loans and mortgages to unrated financial institutions that is compatible with Basel II regulations in the banking sector.
- Some undertakings would find it interesting to use a "CEIOPS rating" for non-rated CEIOPS supervised counterparties.
- Two supervisors mentioned the need for further work on the distinction between counterparty default risk and credit spread risk or equity risk.
- Three supervisors stated that the inconsistencies in the determination of the risk factor should be removed.
- Some supervisors also mention the treatment of collaterals, guarantees and facilities and similar arrangements.

9.6 Life underwriting risk

9.6.1 Overall results

Lapse, expense and mortality/longevity risk were generally the **largest components** in the life underwriting module. However, the relative impacts of these varied significantly between countries. Lapse risk was, however, an important component for many respondents.

Table 27: Composition of the life risk charge (by type), EU average

	Mortality risk	Longevity risk	Disability risk	Lapse risk	Expense risk	Revision risk	CAT risk	Diversification effects
Life	10.2%	23.9%	9.2%	59.1%	19.9%	0.1%	15.8%	-38.1%
Composite	17.6%	21.5%	9.6%	42.9%	25.1%	0.3%	21.4%	-38.4%

Figure 84: Composition of life underwriting risk (life undertakings)

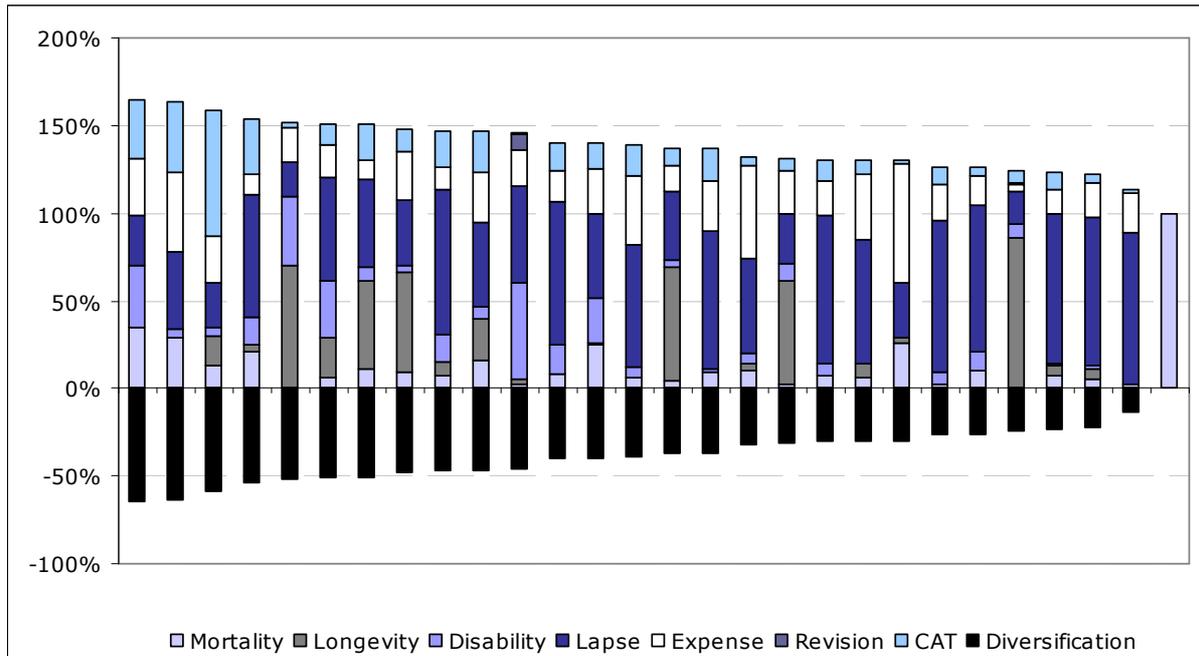
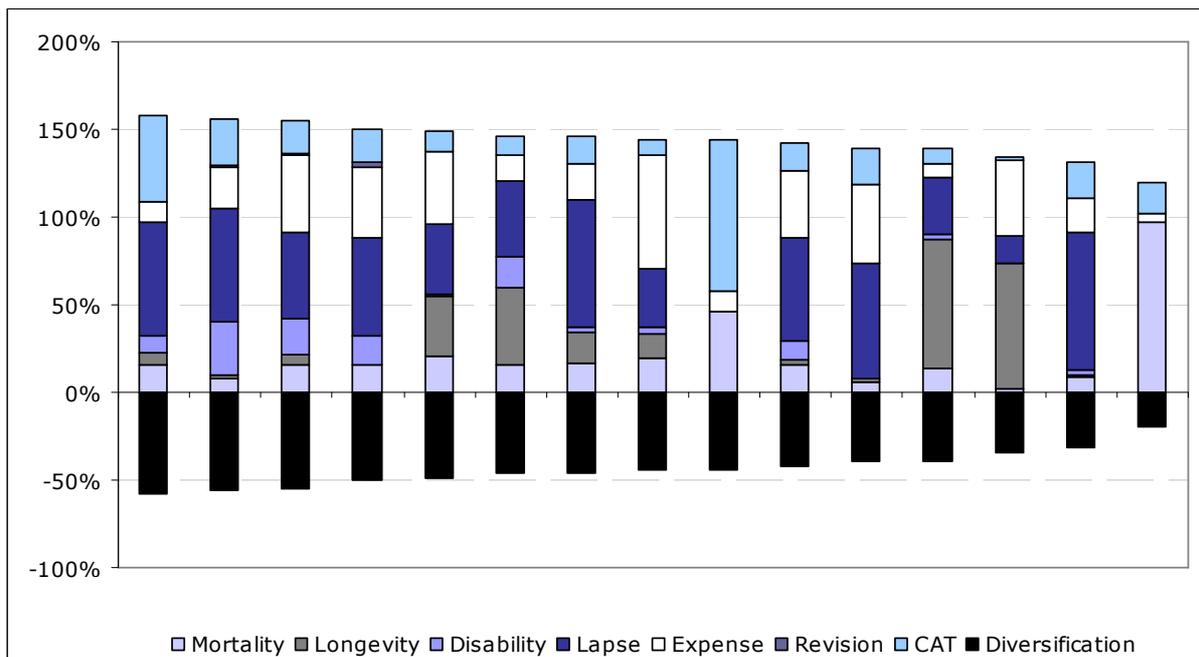


Figure 85: Composition of life underwriting risk (composite undertakings)



9.6.2 Suitability of methodology

9.6.2.1 General comments on methodology

There was some discussion about how to **allocate products** between the life, non-life, and health underwriting risk modules, and in particular where accident riders and health benefits should be included. One suggestion was to combine health and disability risk into a separate morbidity sub-module.

There was a suggestion from more than one country that **expense risk and lapse risk** should **each** be treated as a **separate new category** for all types of business, as these affect also non-life and health business: there were concerns that expense risk may be double counted otherwise.

Several countries argued that a **gradual change to inception rates and trends** would be more appropriate than a one-off shock, for biometric risks.

Two Member States argued that the **uncertainty in option take-up rates** should be reflected in the SCR.

Some respondents argued that **non-linearity** should be captured adequately in the standard SCR.

One undertaking commented that the standard SCR methodology should take account of any **possible losses on new business written in the next 12 months** (e.g. for group protection policies) after applying stress tests in respect of the mortality and disability risks.

It was suggested that further consideration should be given to the treatment of the **SCR for contracts containing embedded options**, including the interaction of mortality stress, lapse stresses, and changes in profit sharing and financial conditions.

9.6.2.2 Longevity risk

Several undertakings argued for an **age and duration dependent treatment of longevity**, reinforcing more general comments that a one-off shock is not the most appropriate form of stress for biometric risks. An improvement of X% per annum (over base mortality) was suggested as an alternative by one respondent.

9.6.2.3 Lapse risk

It was noted that there is **circularity in the SCR lapse risk component**: the calculation should take account of the addition of the risk margin that would reduce the potential loss on surrenders, and hence the SCR lapse component is overstated.

Clarification was sought as to whether lapse risk should take account of **reinsurance arrangements**.

There were some comments on **treatment of future premiums in this module**: two supervisors argued for consistent treatment of future premiums between the technical provisions and SCR. Some undertakings asked for clarification on this issue.

It was also suggested that a **scenario approach** would be more appropriate for lapse risk, allowing **impacts on differing lines of business** to be captured: the stress would be taken as the worst of (up, down) scenarios for the whole undertaking. It was argued that a different lapse and expense correlation might be appropriate depending on the direction of the worst scenario.

9.6.2.4 Revision risk

The **revision risk** module seemed not to be universally clear in some member states.

9.6.2.5 Life catastrophe risk

An **inconsistency** was noted between the **full and simplified** standard SCR approaches for Cat risk: whereas the full approach allows a negative contribution from annuity business, this is not possible under the simplified methodology.

9.6.2.6 Disability/health risk

One respondent suggested further consideration of **reactivation rates** for disability risk would be beneficial. Another argued that **recovery rates** should be taken into account. There was additionally some confusion over the treatment of disability in terms of **catastrophe risk**.

On **health** underwriting risks, there were various comments as to where these would most appropriately be treated: further narrative is included in the report on the SCR health module.

Support for the UK **alternative approach** in Appendix TS.XVIII.H of the QIS4 specification was noted by one country.

9.6.2.7 Bundling/unbundling of contracts

The vast majority of undertakings chose Option 1: **no unbundling** of contracts.

Where **unbundling** was applied (Option 2), generally the product contained no death and survival benefits contingent on the life of the same person, or an approximate approach was used, or the undertaking's models had been set up already to accommodate bundling of contracts.

The main reason cited for use of Option 1 was the **practical difficulty** in the calculation of **Option 2**; including the application of a minimum of zero at contact level for the whole mortality risk component. Comments from one country noted that IFRS classifications had been used to segregate groups of contracts, again leading to treatment under Option 1.

Where supervisors offered views, they generally agreed with undertakings in choosing Option 1, but one country argued that **more analysis** would be necessary before deciding on the most appropriate option.

Another two supervisors proposed consideration of only the **dominant shock**: it was suggested that this would prevent the holding of required capital for policyholders having both an endowment and a life annuity policy. One country added that this would also ease the calculation.

9.6.2.8 Extension of geographical diversification to life business

There were very few answers from undertakings on this issue. When available, comments from many supervisors were **against** the possibility of extending the benefit of **geographical diversification** to the **life business**, as they thought this might be too refined for the standard formula, and they were not convinced that geographical diversification effects in underwriting risk could always be found in stressed conditions.

Conversely, other respondents argued that **diversification** (both geographically and within risks) should be captured adequately in the standard SCR, in order to **encourage good risk mitigation practices**. For mortality, it was suggested that trends might be more correlated than parameter risk, across regions.

9.6.3 Practicability of calculations

The “**policy by policy**” calculation for the assessment of the **Life Lapse** and **Life Cat** risk is considered too **burdensome** for many undertakings. It was suggested that use of homogeneous risk groups (not necessarily rigidly prescribed, however) would be more appropriate than a policy-by-policy approach in the mass lapse event.

It was suggested by some undertakings that use of the **Delta-NAV approach is overly complex**, requiring sophisticated modelling techniques (for example, internal models).

Undertakings in more than one country noted difficulties in applying the **two-stage disability stress**, and suggested a simple, appropriately calibrated, single shock (as with mortality and longevity) would be more practical.

9.6.4 Calibration of module

9.6.4.1 General comments on calibration

A number of undertakings commented about the **lack of transparency** in the derivation of the standard QIS4 parameters for life underwriting risk, and the **need for the relevant evidence for the calibration** to be published.

It was suggested that the parameters could be allowed to be **variable according to prevailing economic and underwriting conditions**, noting in particular lapse and expense risks. In the same vein, one respondent commented that the standard parameters might be too strong for small undertakings.

Some undertakings were **in favour** of the use of **entity-specific** parameters for life underwriting risk. However, **many supervisors** believed that any **opportunity for cherry-picking** by undertakings would need to be discouraged: noting that mortality, longevity and sickness parameters are intended primarily to reflect general shocks or trends, and these are less likely to vary between undertakings.

9.6.4.2 Mortality risk

Among the comments on mortality risk calibration, there was **a range of opinions**. Some undertakings thought the calibration was too strong and without sufficient granularity; it was also thought that there was insufficient allowance for diversification. However, other respondents suggested the calibration was less prudent than a 99.5% level. It was also suggested that the trend stress should vary with the term outstanding. There was not much feedback, but it was stated by one undertaking that the shock for mortality risk was too high for large portfolios – it suggested 5% instead of 10%.

9.6.4.3 Longevity risk

Some undertakings felt the **longevity** shock was too **prudent**.

9.6.4.4 Disability risk

Some undertakings considered the calibration **too strong** (see also the comments on the methodology above).

9.6.4.5 Expenses

As there was **a range of opinions** on the calibration of the expense risk, no useful conclusion could be drawn.

9.6.4.6 Lapse and mass lapse

Several respondents registered agreement with the level of the **mass lapse** calibration, although undertakings in some other Member States suggested the lapse shocks were too strong, noting the dominance of this component over other life underwriting components as well as potential volatility in surrender strain. **Surrender or fiscal penalties** were noted as a **deterrent** to lapse, in this context (although tax and product design were mentioned by another respondent as a potential trigger for lapse). The mass lapse was viewed by some as a **“bank run” scenario**, and hence appropriately treated consistently across all lines of business, in contrast to QIS3. One Member State expressed concern, however, about the application of a mass lapse shock to retirement products with no potential for lapsation. Some undertakings suggested a shock event leading to mass lapse would not be prolonged over several years; instead experience would revert to normal after a much shorter time scale.

One undertaking queried whether for **reinsurance** policies the lapse referred to lapses on the reinsurance contract or on the underlying policies: it was noted likewise that it cannot be assumed for reinsurance that the policyholder will lapse on an economic basis. The uniform 30% assumption was criticised by one undertaking for reinsurance business, and it was argued that mass lapse at one cedant will not result in mass lapse for the reinsurer. The terms on which recapture can take place were also discussed as a factor in the case of mass cedants’ lapse on reinsurance.

9.6.4.7 Revision

Only little feedback was received on this issue. One of the undertakings, however, stated that the shock for revision risk is too low.

9.6.4.8 Life catastrophe risk

Some undertakings suggested **distinguishing by health status** (smoker/non-smoker) and allowing for **regional diversification**. The possibility of applying **entity-specific** parameters for catastrophe risk was suggested by some undertakings, particularly in the context of annually-renewable contracts. The application of this module in the case of **reinsurance** was questioned, particularly where the coverage is based on specified restrictions (time period, number of injured, type of claim).

9.6.4.9 Correlations

In one country, undertakings commented that the correlation between **lapse and longevity** appears high, particularly in the context of other correlations. The **mortality and longevity** correlation was also still considered too high. It

was suggested also that the **mortality and disability** correlation should be negative, similarly to the mortality and longevity correlation – although this view was not unanimous, and it was suggested **differences by line of business** might exist.

A couple of respondents suggested **correlating trends and levels of biometric risks separately**.

Another suggestion was that **catastrophe risk** should be positively correlated in terms of mortality and disability, with a factor reflecting the ratio of insured mortality to population mortality applied to the mortality catastrophe factor.

Finally, it was argued that the **lapse and expense** correlation should be dependent on the sign of surrender strain.

9.7 Non-life underwriting risk

9.7.1 Overall results

The design of the non-life underwriting modelling was based on crossing twelve individual lines of business with three sources of risk. The twelve retained lines of business were those existing in the Accounting Directive 91/674/EEC – less the accident and health modelled in the health risk module – with a more granular breakdown for inward reinsurance. The three sources of risk were the premium risk the reserve risk and the catastrophe risk. **Premium and reserve risks** were combined at the line of business level – with an allowance for diversification effects between lines of business – and then the result of this aggregation was combined with the **catastrophe risk** component.

The following graph displays the relative weights of the premium and reserve risk component and catastrophic risk component, as well as the diversification effects at the non-life underwriting risk module level, as collected by CEIOPS members.

Figure 86: Non-life underwriting risk composition (non-life undertakings)

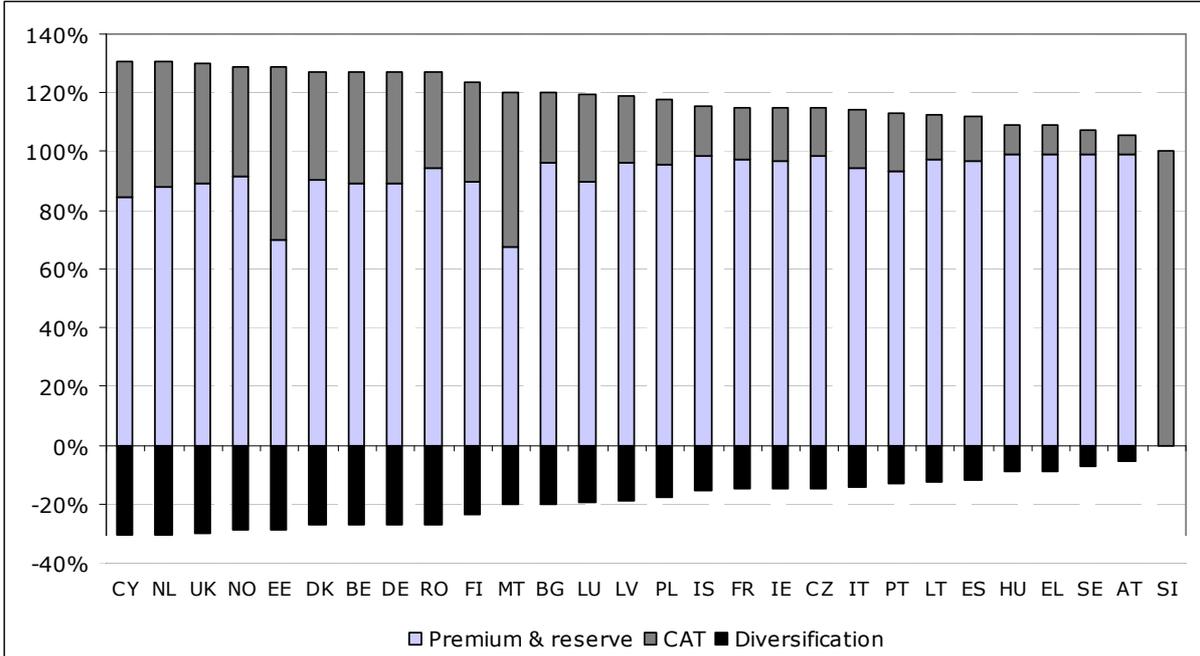
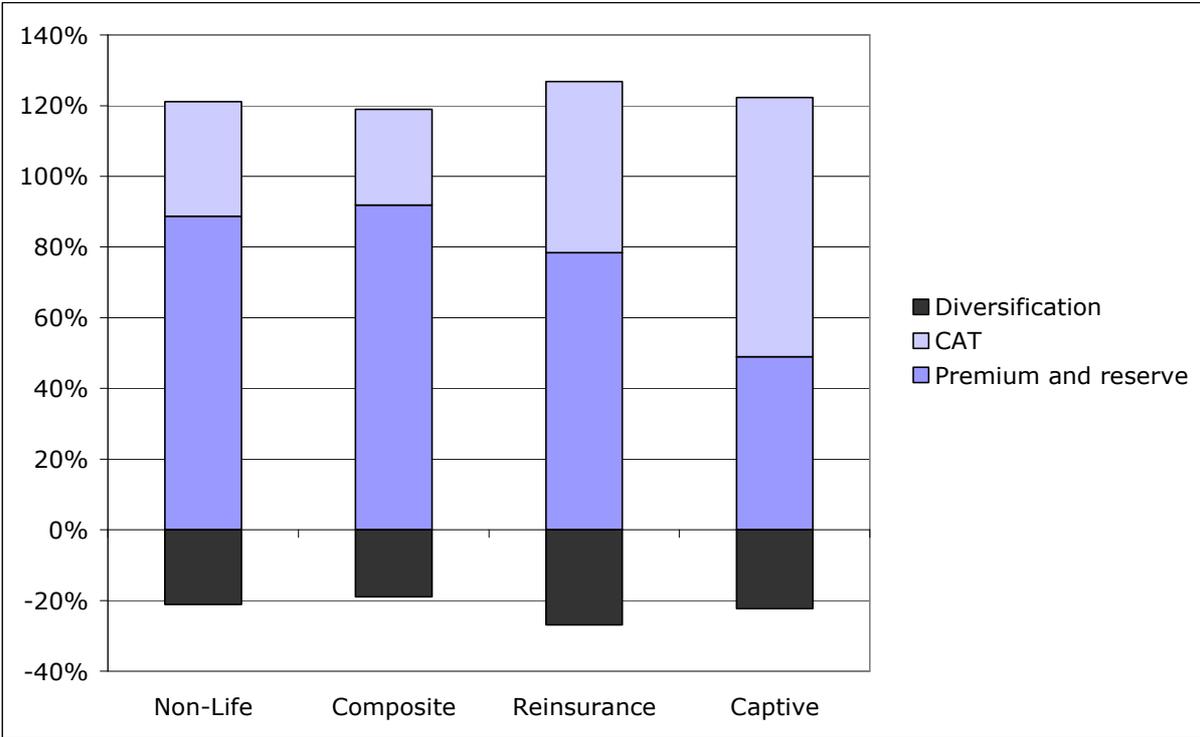


Figure 87: Non-life underwriting risk composition (all undertakings), by business segment, EU average



The QIS4 design for the premium and reserve risk was very similar to the one used for QIS3 (modular approach, aggregation through a correlation matrix of risk contribution assessed at the level of a line of business). Changes concerned

the introduction of an element of geographical diversification, refinement and extension on the possibility of using an undertakings' own experience and a different catastrophic risk component assessment.

Three methods were defined for the catastrophe risk component, the first one based on **standardised risk charges by lines of business**, the second one based on **standardised geographical catastrophe scenarios** provided by the supervisors and the third relied on using **personalised catastrophe scenarios**.

Geographical diversification was recognised using a blending formula for business underwritten or commitments existing in different geographical areas.

Two possibilities to include **undertakings' own experience** in the calculation were provided. The first possibility was to mix, using weight depending on the length of available historical data, an undertaking own past experience with the QIS4 default parameters. This first possibility was only available for the premium risk valuation. The second possibility was to allow undertakings use their **own parameters** calculated using a **methodology provided by CEIOPS** for both the premium risk and the reserve risk valuations.

The premium and reserve risk component was generally dominant in the composition of the non-life underwriting risk, albeit the catastrophe risk could be very material for reinsurers. Catastrophe risk was on average the main component for captives. This result should be linked to the frequent use of personalised scenarios by captives instead of the factor-based method to evaluate the catastrophe risk component (see 9.7.4.2). Annex B of this report contains a dedicated analysis of the situation of captives in one of the member states. For this subset of participants, the scenario-based outcome was on average 15 times the result of the factor-based method.

Table 28: Composition of the non-life risk charge (by type), EU average

	Premium and reserve	Catastrophe risk	Diversification effects
Non-life	88.8%	32.3%	-21,0%
Composite	91.8%	27.1%	-18.9%
Reinsurance	78.4%	48.4%	-26.8%
Captive	49.0%	73.3%	-22.3%

9.7.2 Suitability of design and methodology

Most of the feedback from undertakings or supervisors concentrated on the new aspects of the non-life underwriting risk modules. These **additions were generally welcomed**, at least on the principle that they set (recognition of geographical diversification, blending or replacing default parameters with undertakings own experience). At the same time a number of useful comments

were received outlining potential shortcomings, or overlaps between risk components, in the concrete QIS4 implementation. Views on the various methods allowed to evaluate the **non-life catastrophe risk** were **more mixed**. For this, some more work toward an adequate trade-off between risk sensitivity and comparability seems to be desirable.

In general, there was an **appetite for further discussion and clarification** of approach for this issue, rather than strong criticism of the design.

The issue of **non-proportional reinsurance** already noted in the previous QIS received less polished comment, accompanied with some wording like **inappropriate**. A number of undertakings and supervisors outlined the difficulties in encompassing the potentially non-linear effects of these risk mitigating instruments in the standard approach. A greater use of undertaking own experience, or a (partial) internal model, was proposed as a possible way forward to overcome these difficulties.

Many undertakings regretted the absence of **an allowance for future profit** or for the position in the underwriting cycle in the risk assessment, while some suggested that the formula should include a greater **element of sensitivity to volume**. Some undertakings would also welcome a **greater granularity** of the predefined line of business in order to better capture the diversification benefit. This request may be in reaction to the difficulties encountered by niche players, or providers of less mainstream insurance contracts to allocate their business within the predefined lines of business. Similar difficulties were reported to properly allocate underwritten business between lines of business (e.g. accident contracts), or even SCR risk modules, when the risk drivers evolve over time (e.g. the biometric risks influence on post-claim motor annuities, or some form of workers' compensation schemes) or can evolve over time (claims awaiting a decision on awarding or not an annuity settlement). These **practical classification** difficulties **can have an impact** on the assessed **overall risk profile** in particular when they trigger the use of different diversification assumptions with other risks.

9.7.3 Calibration and practicability

9.7.3.1 General comments

Contrary to the experience of previous QIS, it is worth noting that **few negative comments** were received on the **overall level** of the results of the non-life risk module. Those received were mostly related to **long-tailed** lines of business or **transport** (including marine and aviation business) related ones. For these, the results were estimated too high by participants.

Undertakings with activity in niche lines of business (e.g. in the 'miscellaneous' line of business) estimated that their business could not really fit in any of the

standard formula lines of business, and that no adequate calibration was provided by CEIOPS.

More detailed comments were received on the possibility to use undertaking specific data and on difficulties related to the possible need to change accounting practice from underwriting year to accident year.

9.7.3.2 Practicability of using undertaking-specific data

Many undertakings commented on issues relating to the choice, reliability and availability of suitable data to back entity-specific parameterisation.

One supervisor envisaged no problems with the use of entity-specific data, as this already forms a part of the prudential reporting framework in that country.

Several comments were made on the length of time series available and appropriateness for use in entity-specific parameterisation. Relevance of data has to be balanced against the need to capture long-term trends – however, some respondents queried whether sufficient entity-specific data would be available to parameterise at a 99.5% level.

Some respondents argued for a minimum length of time series, although one comment was received to the effect that the requirement for a minimum of 7 years' data, to be taken for at least 3 years since the business was first written, results effectively in a minimum of 10 years before undertakings can apply entity-specific data – this was thought to be overly restrictive. A limit on the number of years' data that can be used in the standard formula context was, however, considered an incentive for use of entity-specific data. Among those arguing for a minimum length of time series, some argued that this minimum should be the same for all undertakings, to ensure consistency. One concern raised in this context was the influence of the underwriting cycle on entity-specific data. In the entity-specific parameterisations calculated for QIS4, there was some variation in the length of time series used, with the range stretching from 1 year to over 40 years of past data. Many respondents mentioned time series of around 5-10 years.

The need for greater specification of criteria for assessment of data quality was raised. Again, it was argued that criteria should be consistent across all undertakings. It was thought that criteria should cover completeness, accuracy and appropriateness of data.

Some respondents noted difficulties in obtaining data in a suitable format: there were several problems such as extraction of data on an accident year basis and obtaining data with the classification splits needed for QIS4. The treatment of outliers and catastrophes within data sets was also mentioned: this can have a material impact, and inclusion of a catastrophe within a data set could be

considered to lead to double-counting of catastrophe risk. It was noted that any delay in reporting of claims can impact data for very long tailed business.

It was suggested that there was a need for guidance on use of approximations; for example, reported or ultimate loss ratios as at 12 months development were used as a proxy for historical best estimate, but may lead to over- or under-estimation of loss ratio variability.

There were several comments on validation and justification of data. Several respondents suggested that data could be taken from statutory accounting systems, and would therefore have been subject to audit and independent cross-check. However, there will be a need to clarify further the requirements for own data verification.

9.7.3.3 Practical difficulties for undertakings accounting non-life business on an underwriting year basis

Some undertakings commented that applying the model seems to be easier when using accounting designed on an accident year basis, or conversely raises practical difficulties for undertakings with accounting systems based on underwriting years.

Comments on the difficulties encountered were mainly developed by one supervisor.

The problems identified were as follows:

1. Resource intensive: many undertakings commented that while an underwriting year basis can theoretically be converted to an accident year basis, this is difficult in practice as there are many years of account, lines of business, territories and currencies. This exercise was time consuming, requiring a considerable amount of effort; consequently, the information was provided on an underwriting year basis.
2. Undertakings that use an underwriting basis but publish accounts on a local GAAP basis with differing assumptions stated that the requirements of Solvency II raise a number of new difficulties:
 - a) Historical loss ratios on an accident year basis will only be available from the date GAAP accounting was introduced in the undertaking. This may not be a sufficiently long enough period to easily use undertaking-specific parameters.
 - b) Underwriting year reserves are split between earned and unearned proportions. This approach implicitly uses the same loss ratio for the earned/unearned portion, but in practice the best estimate loss estimates for the earned/unearned split will be different. Therefore an assumption will have to be made.

- c) For discounting purposes in theory a different run-off pattern should apply to claims provisions (earned) and the premium provisions (unearned). These run-off patterns are not directly available because claims data on an accident year basis is not collected.

The main conclusion for this supervisor is that **providing data on accident year basis** would **involve large costs** for undertakings accounting for their business **on an underwriting year basis**, if it became a **requirement** under Solvency II.

9.7.4 Specific issues on the non-life underwriting risk components

9.7.4.1 Specific issues on the premium and reserve risk model

Some undertakings have criticised the design of the current premium and reserve module for the following reasons:

1. a tariff increase leads to a higher SCR, disregarding the rationale for the increase which could be motivated either by a parallel increase in the underlying level of risks (or the cost of claims), or the aim to improve profitability.
2. the component of tariff adjustments not proportional to the variation of underlying risks (and costs of claims) induces an increase in historical volatility that lasts for the subsequent SCRs until the reference year disappears from the horizon of net loss-ratio time series. This could induce behaviour oriented toward smoothing the used loss ratios, and not toward better risk management.
3. Similar potential artefacts in case of the merger (or portfolio transfer) of two undertakings with different loss-ratios: the merger will create a step in the data series, thus an additional capital charge, and in the case of a change in the reinsurance program, in particular for non-proportional reinsurance treaties.
4. Inconvenient threshold effects when a catastrophe event disappears from the horizon of a loss-ratio time series.

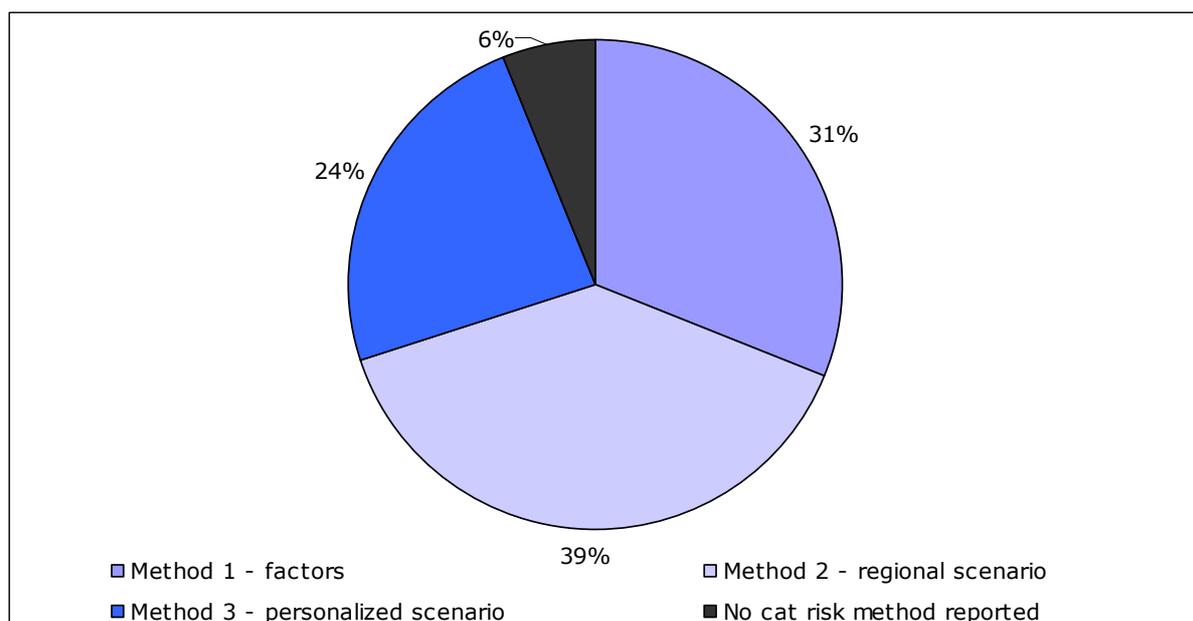
There were some comments suggesting that the approach in QIS4 was over-prudent. Examples cited were that the minimum of 5% above 2007 values is penalising for contracting books, and also that companies with prudent reserving history are penalised. Some considered the 5% floor for the premium risk volume factor too prudent and suggested its removal. One country expressed surprise that the premium risk parameters in the standard formula were less than the reserve risk parameters in the standard formula. Using **varying**

volatilities according to the country of risk exposure **instead of a single set of European parameters** was also suggested.

One issue receiving several comments was the methodology for credibility-weighted averages for premium and reserve risk. Some doubts were expressed, including that this approach could lead to an **overly smoothed result**, with insufficient sensitivity to the size of the undertaking. However, it was noted that a large market player with long experience might be expected to have more credibility to its own data. It was thought that the credibility weightings would benefit from justification, but one comment was that **the stepped approach was an improvement on the approach in QIS3**.

9.7.4.2 Specific issues on catastrophe risk

The catastrophe risk contribution to the non-life underwriting risk could be either valued using a **factor-based** approach, called *Method 1*, for which factors were provided for all the non-life lines of business or one of two flavours of **scenario-based** approach. The first scenario-based approach – *Method 2* – used common **regional scenarios** whereas the second scenario-based approach – *Method 3* – used **personalised scenarios** defined by participating undertakings based on their own assessment of a non-life catastrophe risk that is relevant to their own risk exposures, and calibrated to the SCR standard for Solvency II, namely 99.5% confidence of being able to cover the cost of claims that may arise over the following year. On average, 64% of the participating undertakings with non-life business used a scenario approach valuation – 39% using a regional scenario (Method 2) and 24% a personalised scenario (Method 3) – 31% used the factor-based approach (Method 1) and 6% did not report any non-life catastrophe risk capital charge (or a 0 one).

Figure 88: Non-life catastrophe risk valuation methods used

9.7.4.2.1 Factor-based versus scenario-based approaches – methodological feedbacks

Some methodological views were expressed by **supervisors**:

The **factor-based approach** (*Method 1*), was criticised both for not being sufficiently risk sensitive, and for not allowing properly for risk mitigation through non-proportional reinsurance.

Another supervisor expressed the view that the factor-based approach could provide a useful standard or **benchmark**, especially for smaller undertakings, and had concerns that the **common regional scenarios approach** (*Method 2*) will not be relevant for all undertakings, and could even encourage inappropriate risk management strategies by incentivising undertakings to write policies for exposures that are not covered by the defined scenarios (or to price such policies more keenly), in preference to those exposures that are covered in the scenarios.

It could be noted that available common scenarios for QIS4 did not cover all lines of business in all members states which can explain why, among the 798 participants that calculated a premium and reserve risk component result, only 750, or 94%, also provided a non-life CAT risk component result.

Another supervisor highlighted that on this issue, the best way forward would be to have CEIOPS defining methodologies to derive CAT scenarios for each line of business that would be consistently applied across Europe.

Views expressed by supervisors on the **personalised scenarios approach** (*Method 3*) were more mixed. The main argument in favour of this approach was that it is most likely taking account of the specific risk exposures of each

undertaking and so would be the most appropriate method to assess the Cat risk charge for medium and large sized undertakings. The main criticisms of this approach are that most insurers were either unable or found significant problems in deriving such scenarios, the scenarios of different insurers are very unlikely to be fully reliable and comparable as it is impossible to quantify – and sometimes even to identify – the relevant risks in most lines of business, and the different commercial simulation tools produce significantly different results. Moreover, such an approach was believed not to be within the scope of a standard formula.

The **undertakings' views** on the scenarios based approaches were mostly in line with the supervisors' views.

Regional scenarios were generally well accepted nationally when available, but criticised as not been harmonised throughout Europe, and allowing for a possible risk of unlevel playing field between undertakings.

Many undertakings welcomed the personalised scenario option, which was at the same time criticised for a possible risk of uneven level playing field between undertakings.

In practice various methodologies were used for the assessment of personalised scenarios, the main conclusion being that a common methodology for this assessment does not exist.

The following is a list of some of the personalised scenarios that were used by undertakings:

- Third-party vendor models as well as own experience and expert judgement.
- Commercial tools, alone or with an add-on because the tools were believed to understate the real risk.
- Weather Cat models from external providers calibrated to local exposure for each peril.
- Major Nat-Cat scenarios: Windstorm Europe (sub-scenarios on country level included), Earthquake Europe (sub-scenarios on country level included), Earthquake USA, Flood Germany, Hurricane USA.
- Major man-made scenarios: for Building Materials, Directors & Officers Liability and Auditors Personal Indemnity, Electro Magnetic Fields, Implants, Environment, Marine, Motor, Property, Repetitive strain injury.
- Simulations of wind storms.
- Scenarios for flood catastrophe.
- Scenarios for flood and storm catastrophe.
- The CAT scenarios were estimated at the group level and the allocated to individual companies.

- Internal models.
- Use of in house models.
- Country-specific scenarios as given by the Austrian supervisory authority were chosen.
- Meteoroid impact in a stadium visited by policyholders (50% dead, 50% invalid, consideration of reinsurance, 0.04‰-method).
- For accident insurance a factor-based approach that was part of the German national QIS3 guidance.
- Motor third-party liability/Workers' compensation: Possible scenarios explosion, traffic accident, food poisoning, avian flu.
- Specific scenarios for credit insurers for surprise default of very large exposure and for large surprise political event in a buyer country.
- Use of realistic disasters scenarios.
- Specific scenario for pandemic.
- Untypical cluster of large claims was chosen as scenario.
- 1/200 year storm affecting property and business interruption.
- Frost: Total loss to the largest single property risk 1/200 year event. Possible scenarios are frosting of the pipes, malfunctioning in distribution of electricity.
- For Fire, an explosion of a fuel storage centre on an urban site.
- Real flooding increasing its magnitude.
- The collision between a gas tanker and a cruise ship.
- Scenario for Workers' Compensation, considering a terrorist act (bomb) in the location with the higher concentration of risk.
- Probable maximum loss curves of 100 catastrophic risks have been obtained and 10,000 scenarios generated using the Monte Carlo method. For each scenario, its protection and reinstallation cost were applied.
- Maximum retained claim cost relating to a single large claim event above the present excess loss priority according to the reinsurance programme.
- Retention of their reinsurance treaties as a proxy for the non-life Cat charge.
- Historical maximum claims per sector were aggregated to catastrophic claims under the assumption of a correlation of zero.
- Empirical catastrophe events for each line of business were considered and then aggregated assuming zero correlation.

- Loss ratios in any particular year were doubled.
- Net retention of the catastrophe reinsurance agreement.
- Non-life cat event – storm. The deductible from the company’s reinsurance treaty was included as the company’s cost for this event.
- Workers’ compensation cat risk. Industrial disease was taken as a cat scenario, and the deductible from the company’s reinsurance treaty was included as the company’s cost for this event.
- An epidemic; market loss of EUR 100 million.
- Gross loss ratio on health (short-term) deteriorates by a further 10%.
- A high magnitude earthquake, which would imply a 50% increase in claims, affecting about 35% of current policies.
- For Motor third-party, ‘Mont-Blanc’ like claim, and unusual high bodily injuries (5, which is 5 times higher than our historic record).
- Sinking ferry while cruising on the Baltic Sea. Scenario: 2800 passengers on board.
- A storm affecting 150 constructions with damage of EUR 4,737 each.
- For general third-party, simulation of a claim in medical liability with 10 heavily affected victims.
- A 200-year storm of EUR 150 million total damage, and calculated the share of that.
- A plane crash; in case that 80 people died in airplane crash and have a death cover rider.

9.7.4.2.2 Accuracy, reliability, practicability, suitability and calibration

Apart from the methodological issues presented above, **very few comments** were received on these aspects, with only some remarks on the seemingly inappropriately **high calibration level** of the factors used in the factor-based approach in some markets.

9.7.4.2.3 Comparison of quantitative results

The factor-based approach is a method that could be applied by all undertakings. The scenario approach relied on the availability of appropriate common scenarios, or the availability of internal resources during the QIS4 timeframe to derive appropriate personalised scenarios, or the re-use of existing scenarios which may not have been calibrated within a 99.5% / 1 year risk assessment framework.

In the countries where regional catastrophe scenarios were available, on average 48% of participating undertakings used them. For the personalised scenario the equivalent proportion was 21%.

The following two figures display the distribution of the individual ratio of scenario-based catastrophe risk against the factor-based one for all the undertakings that provided data.

Figure 89: NL_{cat} regional scenario (method 2) vs. NL_{cat} factor-based (method 1); logarithmic scale

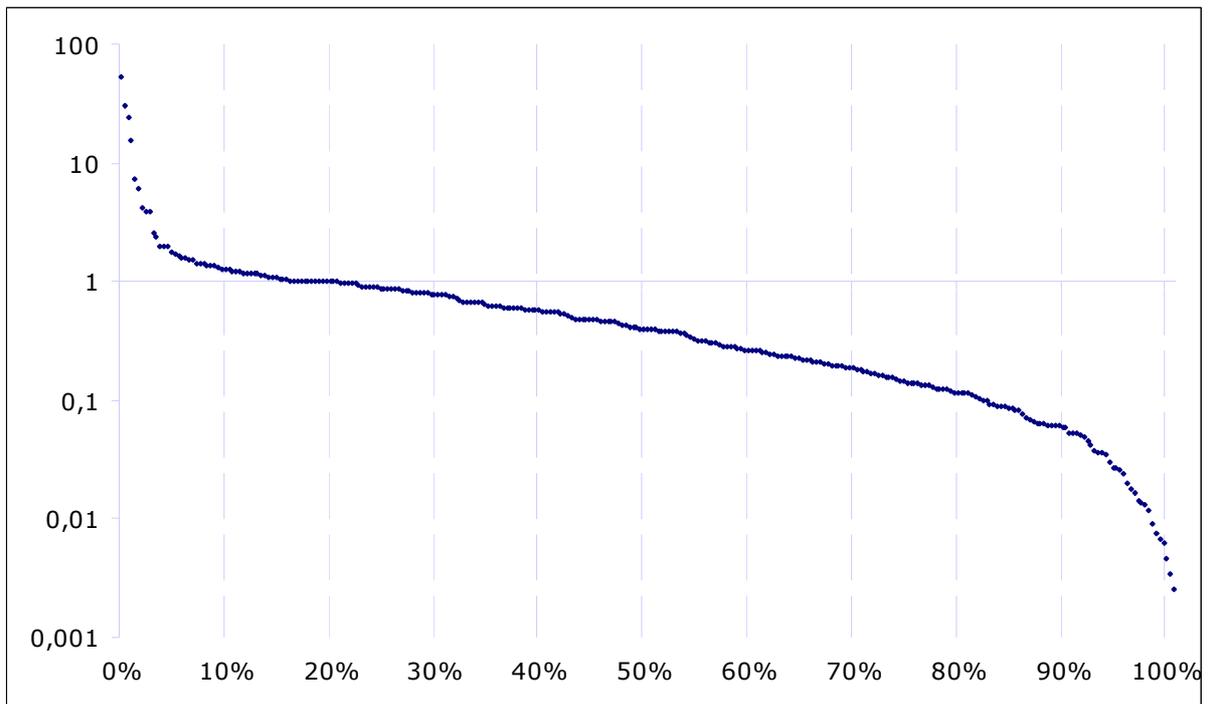
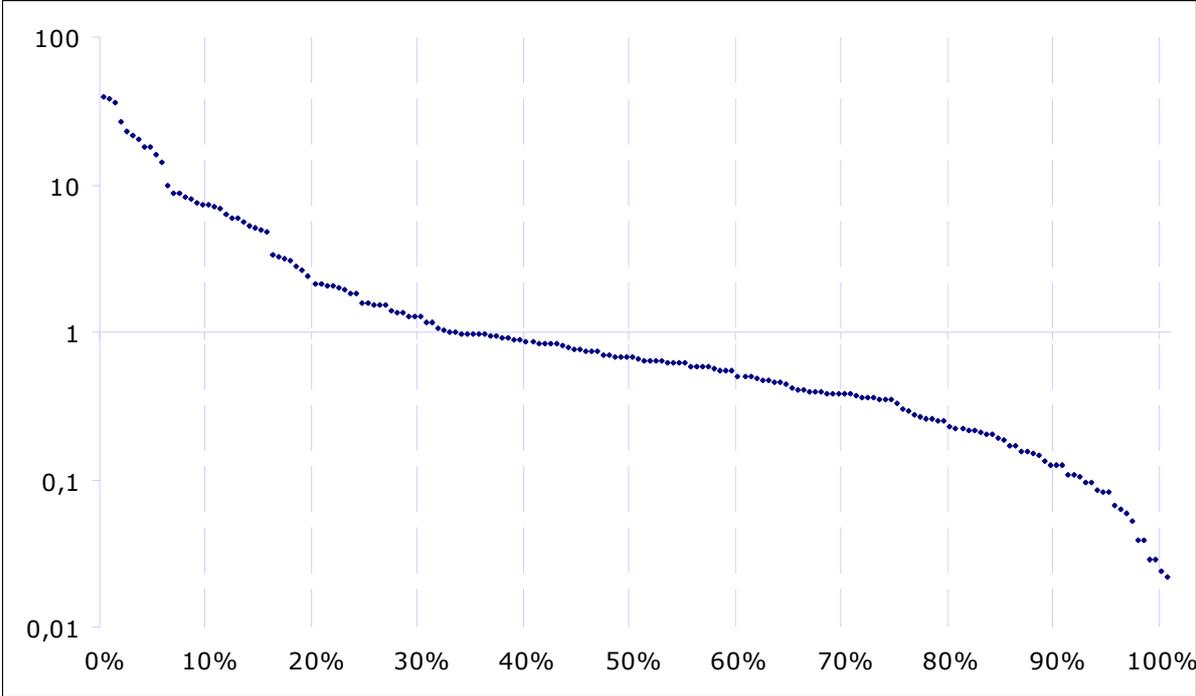


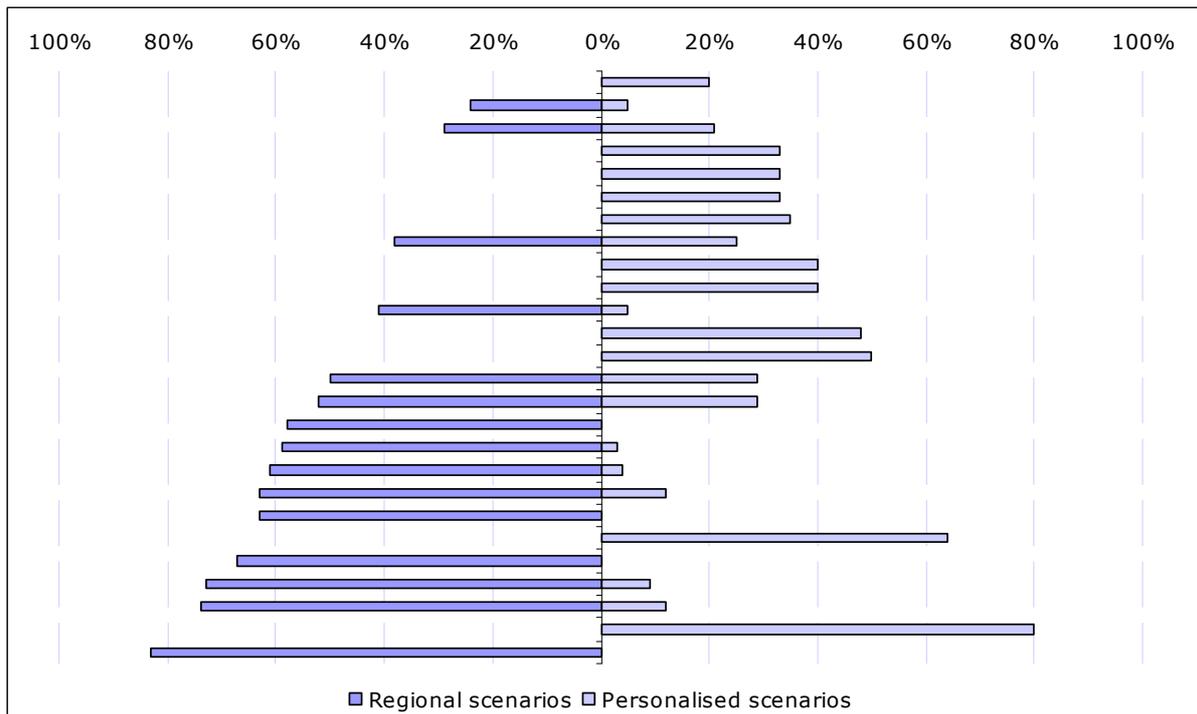
Figure 90: NL_{cat} personalised scenario (method 3) vs. NL_{cat} factor-based (method 1); logarithmic scale



The vertical range of these graphs shows visually that the effect of using a scenario-based approach instead of the factor-based one lead to widely different results for a significant proportion of undertakings. In both cases, only about 40% of the scenario results fall in the range of 50% - 200% of the factor-based result.

Only in a few cases did the regional scenario approach give results significantly higher than the factor-based approach (4% of undertakings were above the 200% threshold). This was far more frequent for the personalised scenarios (22%).

As can be seen in Figure 91, regional scenarios and personalised scenarios were used at the same time only in a few member states. The collected QIS4 data is as a result too sparse to draw valid conclusions on the comparative quantitative results of the predefined scenario for a line of business against an undertaking derived scenario. In countries where geographical scenarios were defined, an average of 57% of the participating undertakings used them while 11% used instead a personalised scenario. In countries where no geographical scenarios were defined, an average of 46% of participating undertakings used a personalised scenario.

Figure 91: Percentage of firms using regional or individual scenarios

The breakdown of the use of personalised scenario by size class of the undertaking shows the interesting result that **almost half** of these were transmitted by **small undertakings** (annual premiums of less than EUR 100 million), which can be a hint that “niche players” or specialised undertakings may have found that either the factor-based approach or the limited set of available regional scenarios – mostly available in the biggest members states –, were inappropriate in their specific situation.

Notwithstanding the high dispersion level of individual results, it can be noted that the reported scenario-based approach gave in more than half the cases a lower catastrophic risk charge than the factor-based approach. This is confirmed when looking at the weighted average by country which generally falls in the 20% - 80% range, except in some specific situations such as when there are a high number of captives in the sample. This result should be interpreted very cautiously: by allowing undertakings to choose between reporting on a scenario based approach or reporting on a factor-based approach, the QIS4 Technical Specifications may have opened the way to some “cherry-picking” where undertakings could assess the result of a scenario-based approach, and then only use it if the resulting risk valuation was less than the factor-based calculation.

9.7.4.3 Specific issues on geographical diversification

Following QIS3 market feedback, recognition of geographical diversification was modelled for QIS4 through the use of a diversification index (*the Herfindahl*

index) applied to premiums and provision volume measure in 54 predefined geographical areas.

This introduction of the possibility of taking into account geographical diversification has been generally **well received** by participating underwriters in some members states, albeit the consideration that regional diversification is too refined for the standard formula was also a reported feedback. Conversely, other respondents argued that both diversification (geographically and within risks) and non-linearity should be captured adequately in the standard SCR, in order to encourage good risk mitigation practices.

Some undertakings support the view that the “credit & suretyship” and “miscellaneous” lines of business, excluded from the module calculation in QIS4, should also benefit from geographical diversification.

The following table shows for the different lines of business, the percentage of participating undertakings – excluding reinsurers – for which the geographical diversification reduced the line of business contribution to the underwriting risk and the average reduction for the concerned undertakings. The two rightmost columns display the same information for the reinsurers alone.

Table 29: Influence of geographical diversification on solo undertakings

	Percentage of participants	Average reduction of the volume measure	Percentage of reinsurers	Average reduction of volume measure (reinsurers)
Health short-term	6%	12.2%	55%	14.8%
Health (others)	8%	12.4%	58%	12.1%
Motor, third-party liability	6%	10.2%	55%	12.1%
Motor, other classes	6%	10.2%	58%	15.8%
Marine, aviation and transport	23%	15.3%	76%	15.3%
Fire and other damage to property	17%	12.7%	63%	15.8%
Third-party liability	16%	12.1%	67%	12.2%
Legal expenses	4%	8.5%	25%	12.0%
Assistance	4%	12.3%	50%	8.2%
Non-proportional reinsurance property	39%	15.6%	70%	16.4%
Non-proportional reinsurance	34%	13.4%	81%	14.2%

casualty				
Non-proportional reinsurance MAT	50%	15.1%	75%	13.9%

The average reduction generally fell in the range 10% to 15%, and generally concerned only a few undertakings for the mass market lines of business (motor, fire and damage to property, third-party liability, health) since most undertakings – with the exception of reinsurers – write this kind of products only locally.

In many countries, the overall influence of the geographical diversification was at the market level **negligible** for the **solo submissions**, due to the weight of the mass market lines of business. The impact however was **particularly significant** for **geographically diversified solo undertakings**, such as **reinsurers** or transport specialists, or when the standard formula was **applied at the group level** (see chapter 13).

At the same time a number of negative comments were received on **its practicability** in the QIS4 form. Among them the choice of geographical areas and level of granularity (either too small or too large) were seen as having the potential to create an unlevelled playing field among undertakings. Some undertakings suggested that an element of differentiation between countries should be introduced reflecting the difference of diversification that can be obtained through underwriting risk across these different countries, but no methodological or concrete way forward was proposed.

An alternative method of calculation has been suggested instead of the used Herfindahl index: the use of a correlation matrix between geographical areas. But no suggestion was made however on the practicability of properly calibrating the correlations coefficients.

Many supervisors, while **supporting** the introduction of geographical diversification, would **not favour maintaining** the current method in the standard formula, but rather consider the use of undertaking-specific data, and/or the use of internal models. Other supervisors reject the allowance for geographical diversification because it cannot be modelled in a reliable and practicable way within the scope of the standard formula.

9.7.4.4 Specific issues on the use of undertaking specific data

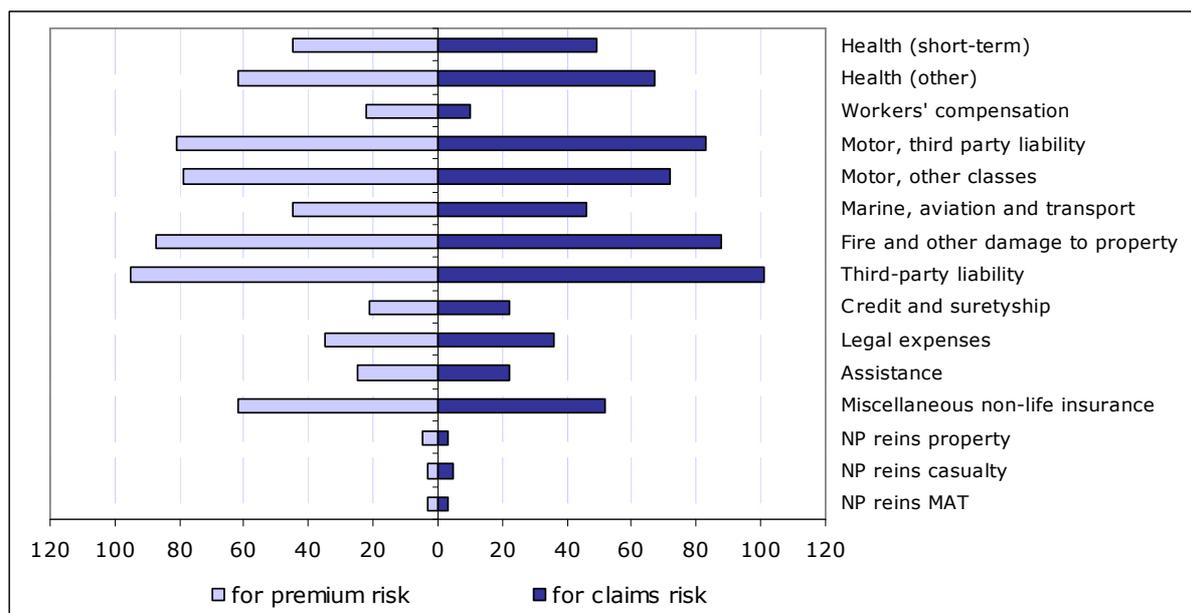
9.7.4.4.1 General comments

Most supervisors reported that **few undertakings** had **actually used** entity-specific data (other than as part of the standard formula in QIS4 for premium

risk), although in **many cases** there was **support for this possibility**, and several comments were received from participants.

A supervisor noted that the additional complexity of calculation required for undertakings using an underwriting basis in assessing loss ratios by accident year and entity specific standard deviations may have acted as a deterrent to using personalisation.

Figure 92: Availability of entity specific volatilities (number of individual use)



Entity-specific data calculations were **carried out predominantly** for **third-party liability lines**, although results were also produced for other lines of business. In **some cases** the results were found to be **significantly different** from the standard parameterisation, although there was **notable variation**. Some participants calculated estimates for alternatives to the standard parameterisation, but did not use these in their overall QIS4 results.

A **commonly-cited advantage** of using entity-specific data was the ability to **tailor** parameters to an undertaking's **particular business profile** and **management strategy**. For example, it could be possible to **allow for reinsurance strategy, merger activity, new business and run-off portfolios, or to recognise geographical diversification benefits or treat different lines written in the same category of business**. This was considered more appropriate than applying uniform EU-wide parameters.

Another **advantage** cited for use of undertaking-specific data was the possibility that this would **enable treatment** of **risks currently missing** from the standard formula approach.

Many respondents recognised the **similarities** with the **(partial) internal models** regime; some viewed the use of entity-specific data as a halfway house between the standard formula and internal modelling. Some respondents speculated that undertakings not wishing to undergo the process for partial internal model approval might prefer instead to set their own parameters within the standard formula where possible. However, it was noted that own parameters would require a **degree of scrutiny** from supervisors in order to ensure **compliance with the principles** of consistency, accuracy, relevance and completeness of data. Several respondents noted the need to ensure a harmonisation of rules and approaches in this case.

A **concern** mentioned by many respondents was the possibility for **cherry-picking of assumptions** by undertakings.

9.7.4.4.2 Methodology

Comments relating to methodology were varied. One common issue, however, was that the methodology should not be too rigid. It was argued that a **fixed methodology** would potentially **preclude future improvements** in the technical approach.

Some respondents felt that the specification of statistical distributions for risks was too rigid and the approach too mechanical. It was also questioned whether sufficient allowance for mitigation measures had been made. It was commented that the setting of entity-specific parameters **may need fairly sophisticated methodology**, for example considering individual years of origin for reserve estimates. It was queried whether this **may be more appropriate** for the approved **internal model** framework.

It was suggested that there was a need for guidance on use of approximations; for example, reported or ultimate loss ratios as at 12 months development were used as a proxy for historical best estimate, but may lead to over- or under-estimation of loss ratio variability.

A potential double counting of the effect of catastrophic losses, when one occurred within the historical time series used was noted.

The appropriateness of use of first observation loss ratios for long tailed business and historical loss ratios for entity-specific parameterisation was questioned. It was also questioned whether run-off results should be included in net loss ratios.

Some respondents argued that the calculation should not use a simple unbiased estimate – it should instead allow for estimation error decreasing with the length of time series.

It was thought that the assumption of variability in loss ratio being inversely proportional to premiums may not be correct in developing markets.

It was noted that the size of an undertaking or portfolio could impact the available pool of entity-specific data; conversely, one respondent argued that for an undertaking with large market share and many years' experience own data could be considered much more appropriate than market-wide data. Likewise, the existence and nature of reinsurance arrangements could impact entity-specific data. It was suggested that an undertaking's stability be taken into account when assessing suitability of own data.

Some undertakings suggest that the business cycle should be taken into account for the assessment of undertaking-specific parameters.

9.7.4.4.3 Impact

The impact of using entity-specific data varied considerably between jurisdictions and between lines of business.

Some reported a consistent reduction in SCR compared with the standard formula. However, others observed higher SCRs, and some respondents were unable to report any particular bias, with impact varying according to type of product.

Variations were sometimes large, with one supervisor reporting an increase of 3 times in SCR for one risk type compared with the standard parameterisation. Conversely, one supervisor reported no difference on average compared with the standard parameterisation, and another observed that the standard parameters fell largely within the interquartile ranges for the entity-specific parameters.

It was suggested that adverse claims development could reduce capital and increase requirements at the same time, resulting in a double-sided erosion of SCR coverage.

The possibility of observing increased volatility in the results of undertakings using entity-specific data was noted. For example, the SCR was found to be rather sensitive to the standard deviation used.

Some supervisors questioned whether the entity-specific approach was used only by participants that believed the standard parameters were too high, and highlighted the risk of cherry-picking if use of undertaking-specific parameters were allowed on a voluntary basis. However, it was suggested that this risk could be mitigated by insisting a firm could be disallowed from reverting to standard parameterisation once an entity-specific approach had been used.

9.7.4.5 Specific issues on the use of undertaking-specific data in the standard formula for the premium risk

The premium risk assessment used a credibility weighted mix of market parameters and undertaking-specific historical data. Undertaking-specific data

where combined with market parameters using variable weights depending on the length of available historical data. Under a minimum length, only the market data was used.

The following table compares the minimum and maximum length used for this mix by lines of business with the lengths of analysis used by participants that provided entirely entity-specific parameters (see above).

Table 30: Data history used for premium risk by line of business

	QIS4 min benchmark (years)	QIS4 max benchmark (years)	Available entity data (number)	% providing data for less than benchmark min	% providing data for more than benchmark max	Average (years)
Health (short-term)	3	5	28	0.0%	57.1%	6.8
Health (other)	3	5	48	0.0%	50.0%	8.4
Workers' compensation	7	15	8	37.5%	0.0%	8.8
Motor, third party liability	7	15	60	20.0%	10.0%	10.8
Motor, other classes	3	5	58	1.7%	46.6%	7.8
Marine, aviation and transport	5	10	45	4.4%	22.2%	9.2
Fire and other damage to property	3	5	67	0.0%	44.8%	7.8
Third-party liability	7	15	80	27.5%	7.5%	9.6
Credit and suretyship	7	15	22	22.7%	0.0%	8.0
Legal expenses	3	5	35	5.7%	57.1%	7.9
Assistance	3	5	27	3.7%	55.6%	8.1
Miscellaneous non-life insurance	5	10	35	17.1%	8.6%	7.3
Non-proportional reinsurance property	3	5	3	0.0%	66.7%	8.3
Non-proportional reinsurance casualty	7	15	1	0.0%	0.0%	15.0
Non-proportional reinsurance MAT	5	10	1	0.0%	0.0%	10.0

It can be noted that for all the business lines where the QIS4 Technical Specification gave a high weight to undertaking historical data when 5 years were available, about half the undertakings using their own calculations to derive entity-specific parameters used longer historical time series.

9.8 Health underwriting risk

The health underwriting risk module covers the risk of loss or adverse change in the value of health insurance liabilities and workers' compensation guarantees and is split in **three different sub-modules**:

- long-term health insurance that is practised on a similar technical basis to that of life assurance,
- short-term health & accident insurance, and
- workers' compensation.

While the former of these three sub-modules formed an own module in QIS3, the latter two sub-modules had been included in the non-life underwriting module prior to QIS4.

9.8.1 Main findings

The main findings regarding the health underwriting module are:

- There are **mixed views** about the **combination of the various types** of health insurance **in one module**: A number of undertakings were unsure about classifying particular types of insurance according to the sub-module structure provided.
- Some undertakings proposed to include health and disability risks as parts of a new **morbidity risk sub-module**.

9.8.2 Composition

Figure 93: Composition of health underwriting risk (all undertakings), by country



In some jurisdictions health business represents only a very minor part of the insurance industry. However, most supervisors provided at least some response on the health module, although some noted a poor response rate from participating undertakings. For a regional comparison, see Figure 93. Figure 94 through Figure 97 give an indication of the health underwriting risk composition and diversification effects associated with them, along business segments.

Representing the smallest portion within the health module, the long-term health submodule provides for the largest internal diversification effect.

Table 31: Composition of the health risk charge (by type), EU average

	Health long-term risk	Health accident and short-term risk	Health workers' compensation risk	Diversification effects
Life	17.9%	85.4%	2.0%	-5.3%
Non-Life	4.1%	80.4%	17.7%	-2.2%
Composite	0.5%	72.6%	32.3%	-5.4%

Figure 94: Composition of the health underwriting risk (all undertakings), by business segment, EU average

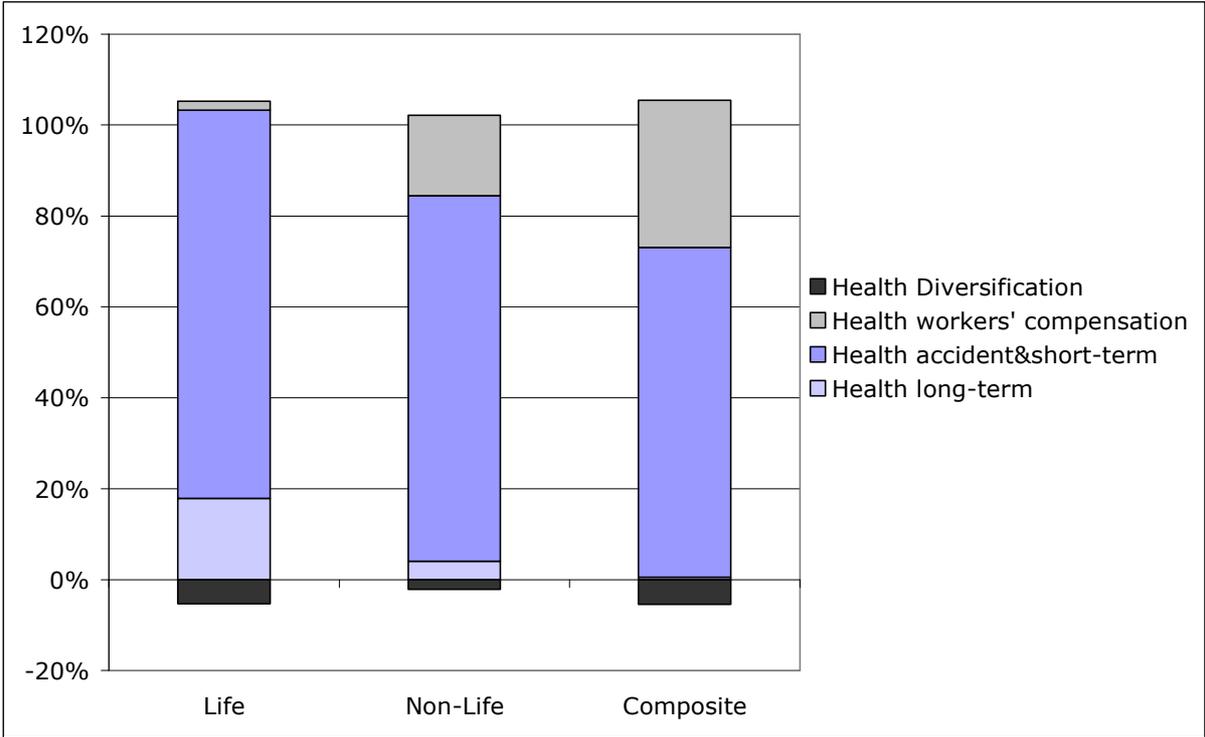


Figure 95: Composition of the workers' compensation submodule, by business segment, EU average

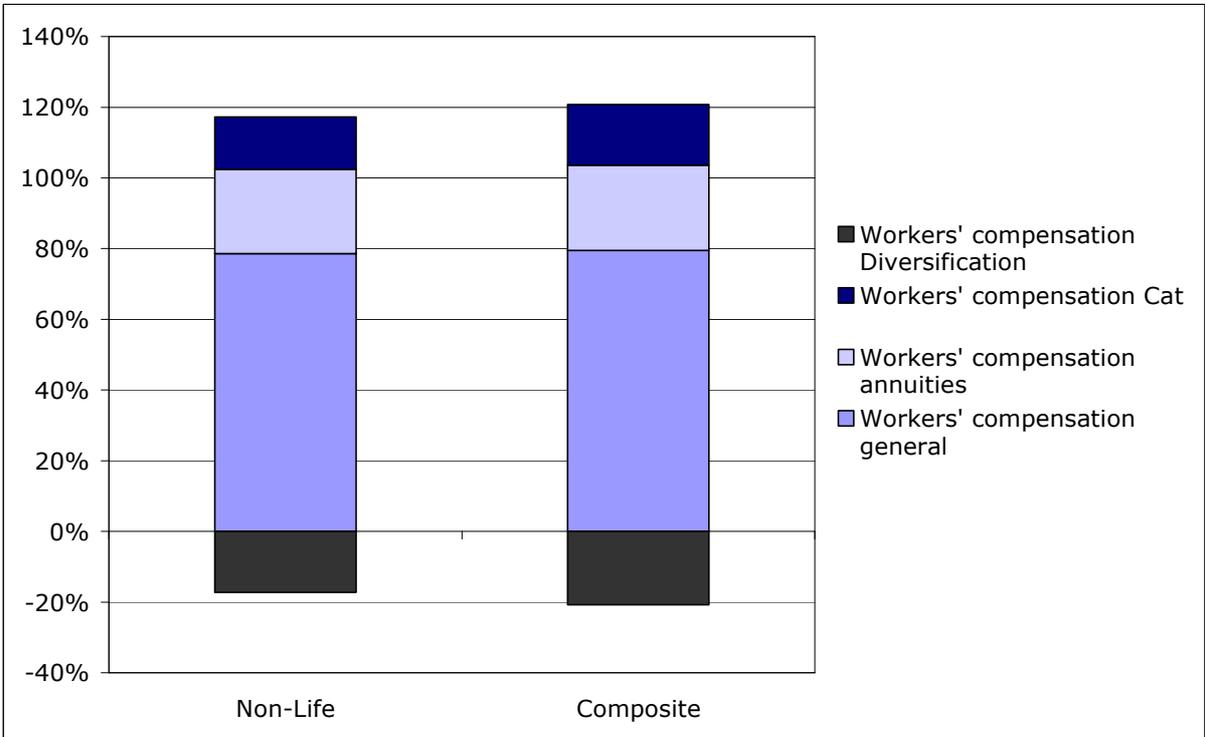


Figure 96: Composition of the short-term health submodule, by business segment, EU average

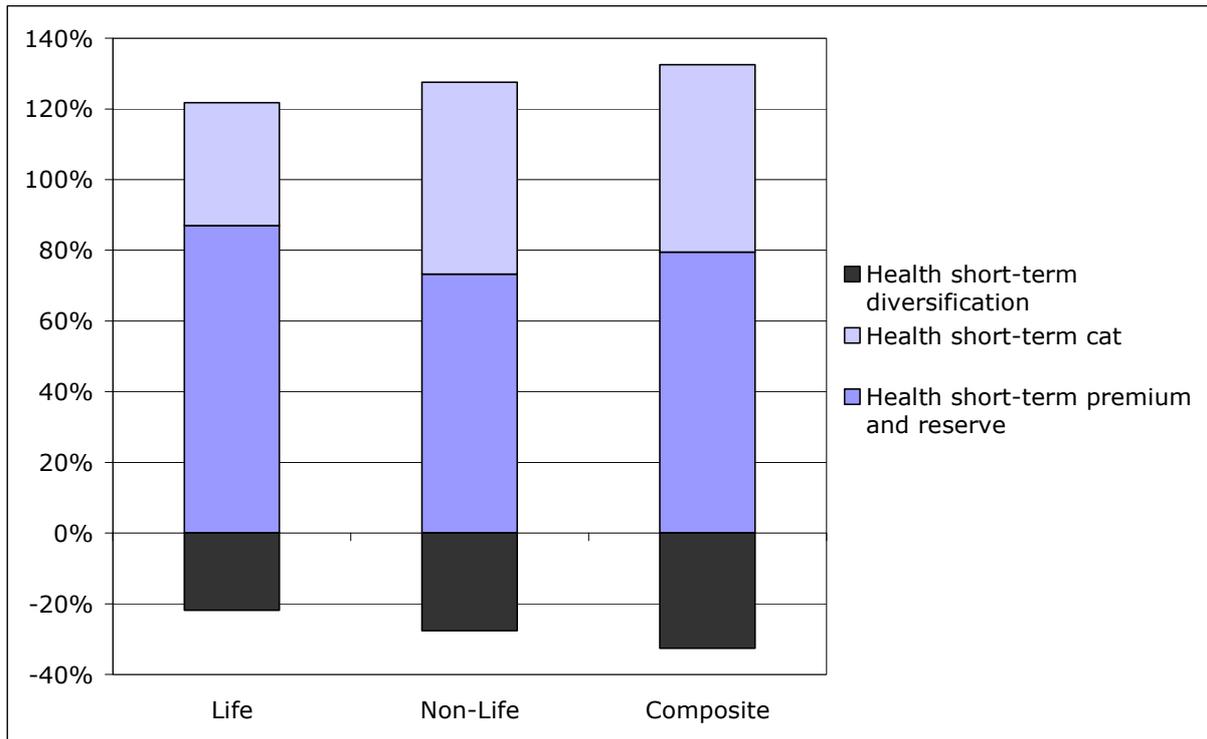


Figure 97: Composition of the long-term health submodule, by business segment, EU average

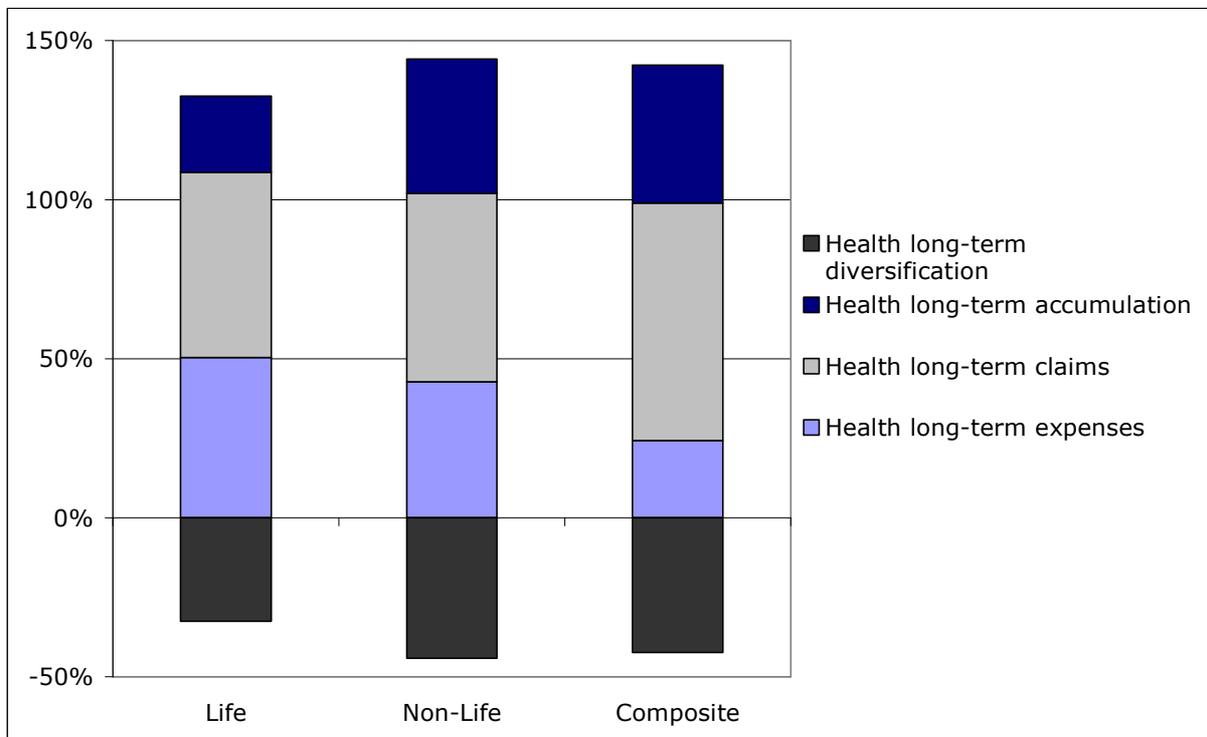


Figure 98: Ratio of SCR_{health} to BSCR (life undertakings)

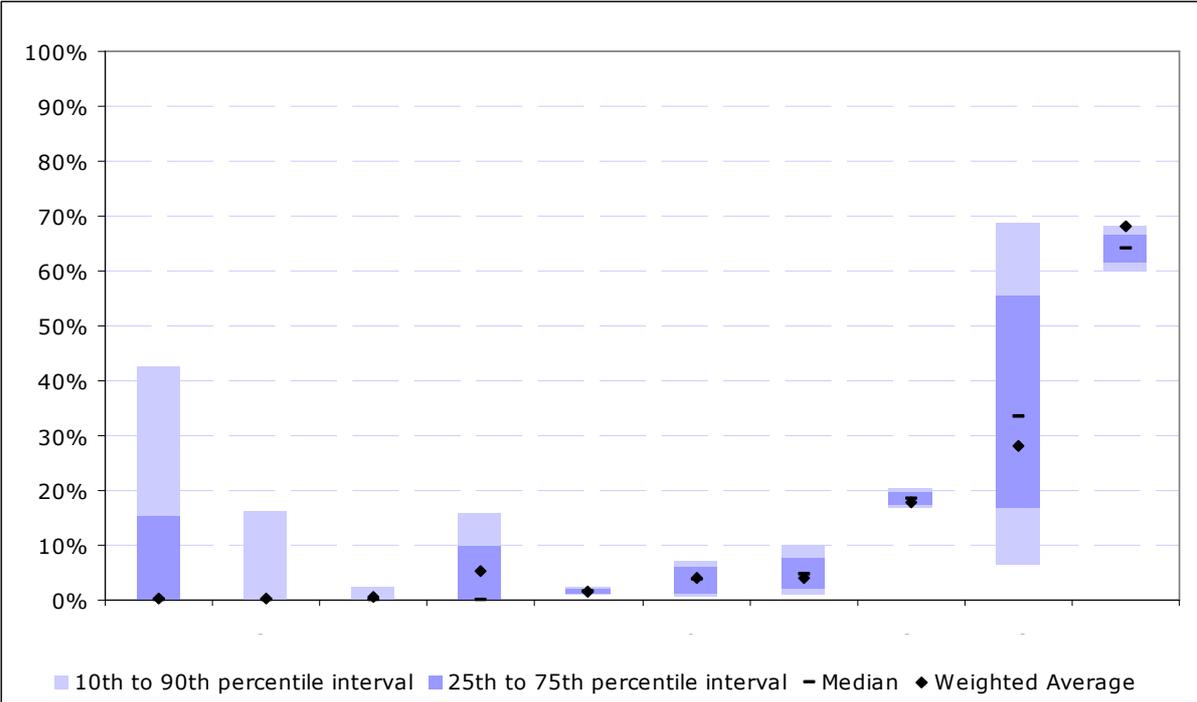
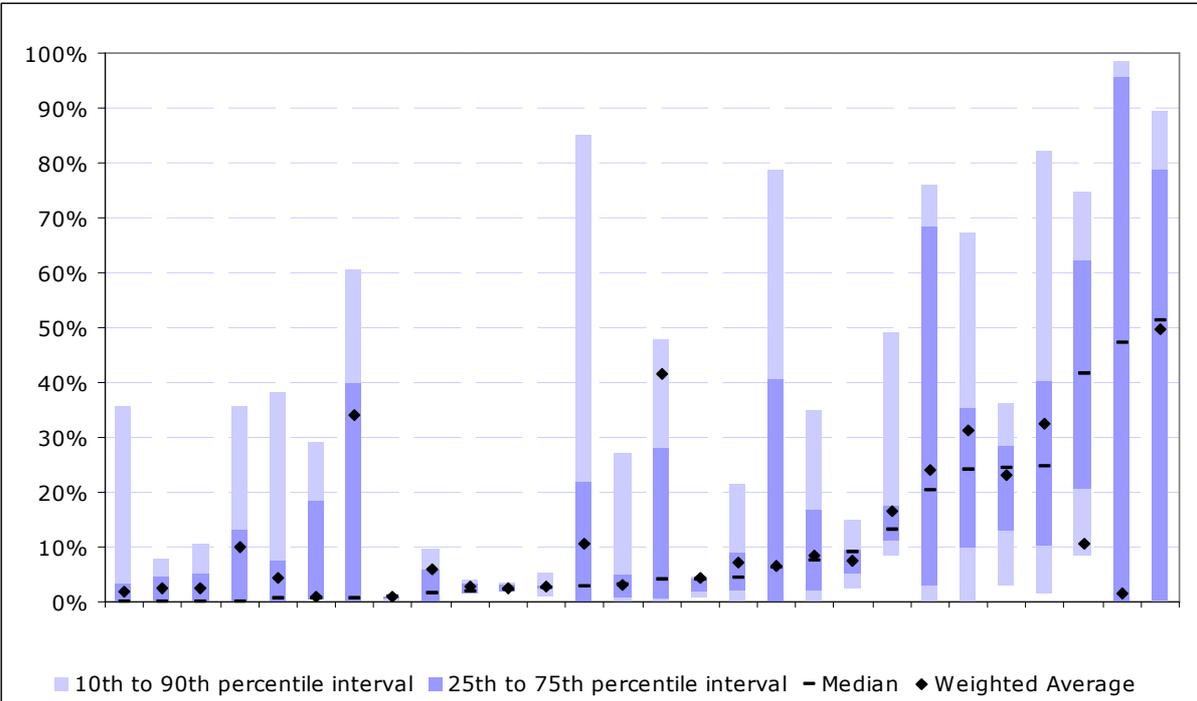


Figure 99: Ratio of SCR_{health} to BSCR (non-life undertakings)



keen to ensure that the relevant risks should be treated transparently and according to clear, well-structured formulae. It was noted, however, that different correlations with other risks could arise depending on the module chosen for treatment of a particular health contract; this could lead to inconsistencies. Further, there could be potential for confusion where risks could change from “non-life” to “life” over the lifetime of a contract (e.g. for some forms of workers’ compensation).

Not all supervisors found the form of the separate health module appropriate for the types of health business sold by undertakings in their jurisdictions. Permanent health insurance was cited as one example by one supervisor (UK), and workers’ compensation products also generated significant debate. It was noted that the diversity in viewpoints is due at least in part to the tendency for health insurance to interact with social security schemes in many countries, leading to corresponding diversity among contract structures. One supervisor (LU) suggested greater collaboration between CEIOPS and local regulators in order to optimise the approach in each case. It was suggested that a separate health module could provide an incentive for partial model building.

Undertakings in a number of countries (ES, HU, NL, PL, SK) argued that both health and disability risk should be treated within the life module as part of the morbidity risk sub-module, in order to achieve consistent treatment of similar risks. Undertakings from one country (CZ) added that the modular split between life assurance contracts and attached non-life riders would be rather artificial.

9.8.2.2 Calibration and methodology

In contrast to the comments discussed above, where undertakings and supervisors from several countries expressed views on the same issues, most of the responses on calibration and methodology issues arose from single countries. This may be a reflection on the particular products available and techniques used in these different countries.

Undertakings in some countries (AT, FR, NL (with regard to catastrophe risk), PL) noted practical problems or dissatisfaction with regard to the treatment of profit sharing, in particular for small/medium undertakings: it was felt that this could lead to an overstatement of the SCR.

There were some comments on catastrophe risk, from two perspectives. Firstly, it was noted that the methodology applied by participants varied – this may be a feature of the options available for non-life contracts in particular under QIS4. In one country (UK) it was questioned whether the morbidity catastrophe was sufficiently severely parameterised. In contrast, turning to the options available under a non-life approach, it was suggested that the catastrophe risk charge parameterised as 10% of the next year’s net earned premiums could be

considered too high, and was insufficiently sensitive to risk mitigation systems. This was considered to be a significant effect for the country in question (NL).

One undertaking (UK) commented on the form of the biometric stress events: these would be more appropriately formulated as a gradual change to the inception rates and trends rather than a one-off shock – the supervisor in this country supports the view.

Accumulation risk was also commented on by undertakings in one country (PL): it was thought that the calculations should be prospective rather than retrospective, and risk mitigation and changes in risk policy should be accommodated. It was also considered that the treatment of large portfolios could benefit from clarification.

One supervisor (AT) suggested the use of different factors for substitutive and non-substitutive business, noting in particular that the accumulation risk factor for non-substitutive business seemed to be too high.

9.9 Operational risk

QIS4 intended to assess the level of operational risk management within the undertakings, namely by identifying the existence of records of operational risk events and providing a first assessment of their quality. QIS4 also tested a similar standard formula operational risk module to that tested in QIS3. The QIS3 operational risk module had been criticised for not taking into account the quality of operational risk management within undertakings given it was based on 'volume' measures.

9.9.1 Main findings

The main findings from the operational risk section of the QIS4 exercise were:

- The average per country of the percentage of the **operational risk capital charge** to the total SCR ranged from 5% to 10%;
- 47% of the respondents felt that the operational risk charge is **adequately designed**, while 53% of respondents thought it was not adequately designed;
- One country responded that the operational risk charge as currently calibrated in the standard formula understates the operational risk requirement as set by the undertakings' own **internal model** sometimes by more than half;
- In relation to the **formula**, respondents stated that:

- The standard formula is too simplistic, since it is not risk sensitive, and rewards low pricing and reserving;
- The consideration of 100% correlation with other risks is not appropriate;
- The formula does not take into account the quality of the operational risk management processes of each undertaking, nor does it encourage the development of good risk management practices.
- The maximum of 30% of the BSCR for the capital charge is considered too high;
- The formula does not reflect the wide spectrum of operational risks that can materialise within an undertaking.
- The main suggestions to **remedy the perceived deficiencies** in the standard formula were:
 - The operational risk charge should be calculated as a percentage of the BSCR or the SCR;
 - The operational risk charge should be more sensitive to operational risks management;
 - The operational risk charge should be based on the entity-specific operational risk sources and the quality of the operational risk management process and the internal control framework
 - Diversification benefits and risk mitigation techniques should be considered.
- Regarding the qualitative questions posed about operational risk management systems, the responses indicated that there is a **wide range of practices** currently followed by undertakings, with some indicating that they have stochastic modelling techniques to quantify capital requirements for operational risk and others had yet to even start collecting and categorising operational risk losses. For example, 39% of respondents stated that they capture operational risk loss events and most of these then attempt to quantify these loss events;
- Among the undertakings that categorise the operational risk events, the most **common categorisation** used is the one proposed by the Operational Risk Insurance Consortium (**ORIC**)²⁵, which is based on the

²⁵ The Operational Risk Insurance Consortium (ORIC) is a partnership established between the Association of British Insurers (ABI) and the software company SAS that intends to provide a high-quality database cataloguing operational risk loss events. ORIC members receive, on a quarterly basis, information on losses due to failed

categorisation established by the Capital Requirements Directive (Basel II). A number of undertakings however stated that they used their own categorisation.

9.9.2 Quantitative impact on the Operational Risk Charge

Looking at the percentage of the operational risk charge to the SCR within QIS4, it is possible to conclude, as a first approach, that the average of that ratio per country ranged from 5% to 10% with 19 of 27 undertakings falling within this range.

Despite the fact that some undertakings criticised the value of the cap, established as 30% of the BSCR, the operational risk charge was, on average, around 6% of the SCR (lowest average of 2% and highest average of 9.5%) and in only 8 Member States did some undertakings register values higher than 30% of the SCR.

However, within the results from each country there is a significant variability between the maximum and minimum values respondents provided for the operational risk charge as a percentage of the SCR, as can be seen in the graphic presentations below. The graphs represent the maximum, median and minimum figures per country.

Figure 101 and Figure 102 provide an analysis of these results by country and type of respondent (i.e. non-life, life or composite insurer). Looking at the analysis, it is clear that material differences in the relationship between operational risk charge and SCR exist for life, non-life and composite undertakings.

Figure 102 compares the average values obtained for the specific business segments. Overall there seems to be greater variability in results for life undertakings than the results for non-life undertakings.

people, processes, systems or external events, by both monetary amount and narrative description. To feed the database, individual undertakings have to submit their own data on operational risk, with total anonymity.

Figure 101: Proportion of Operational Risk Charge in SCR (all undertakings)

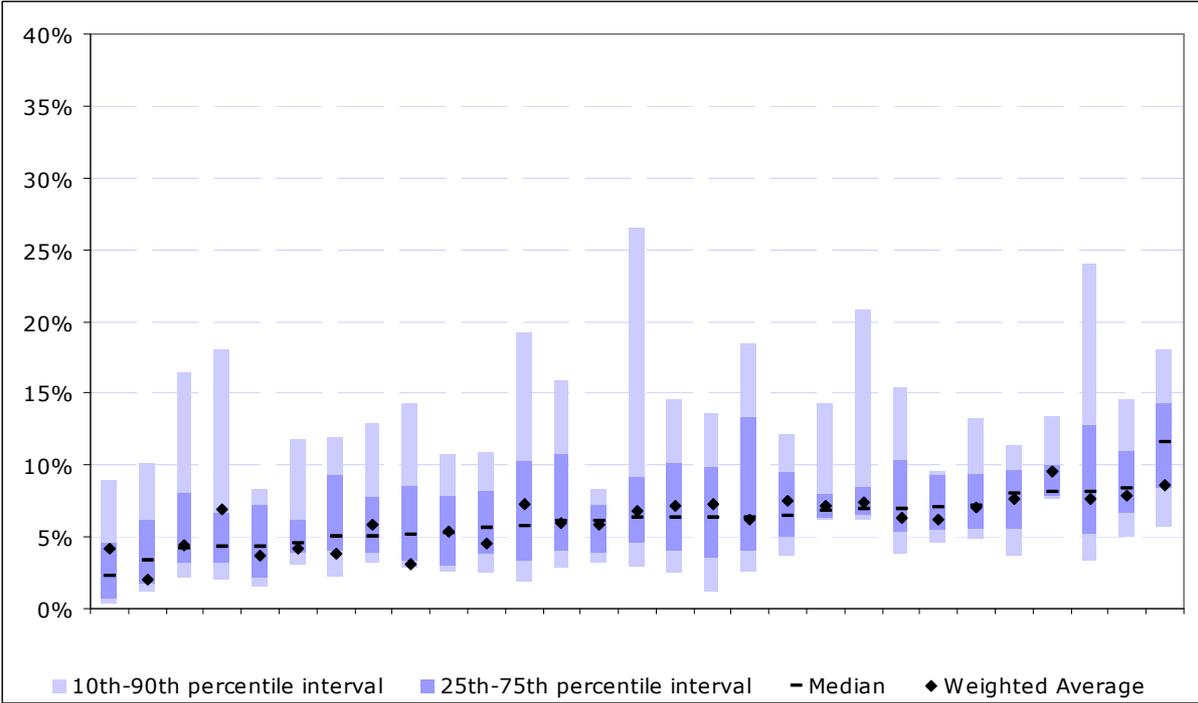
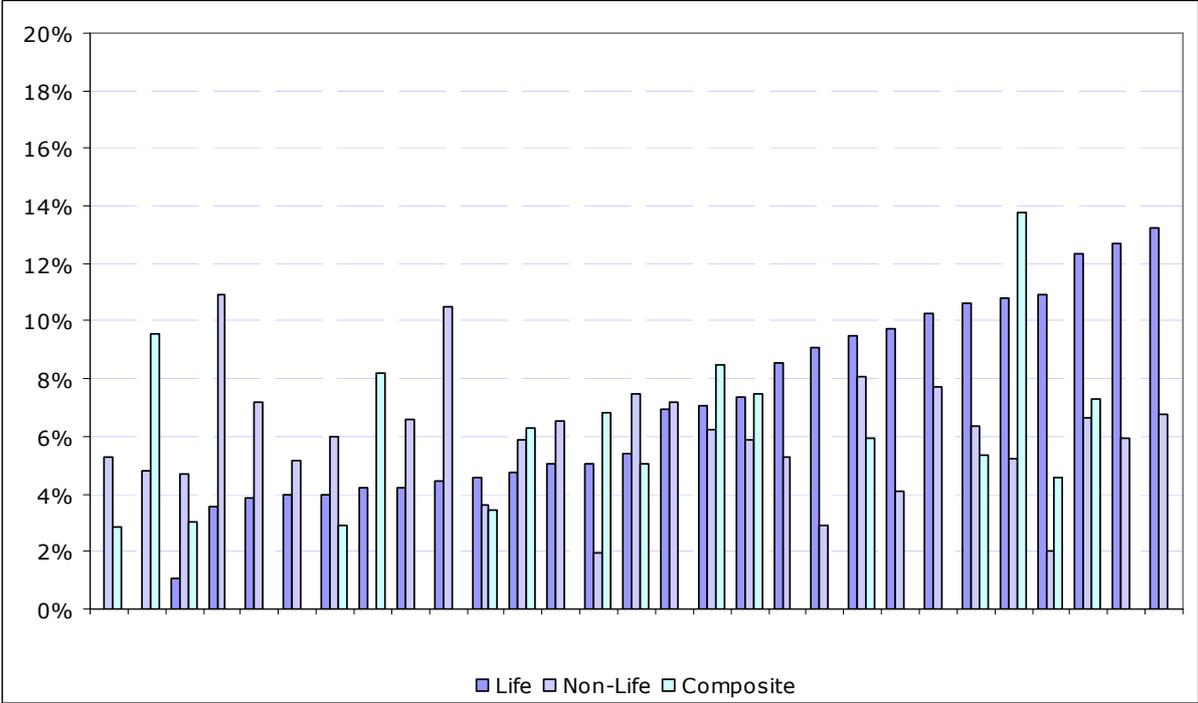


Figure 102: Proportion of Operational Risk Charge in SCR by business segments

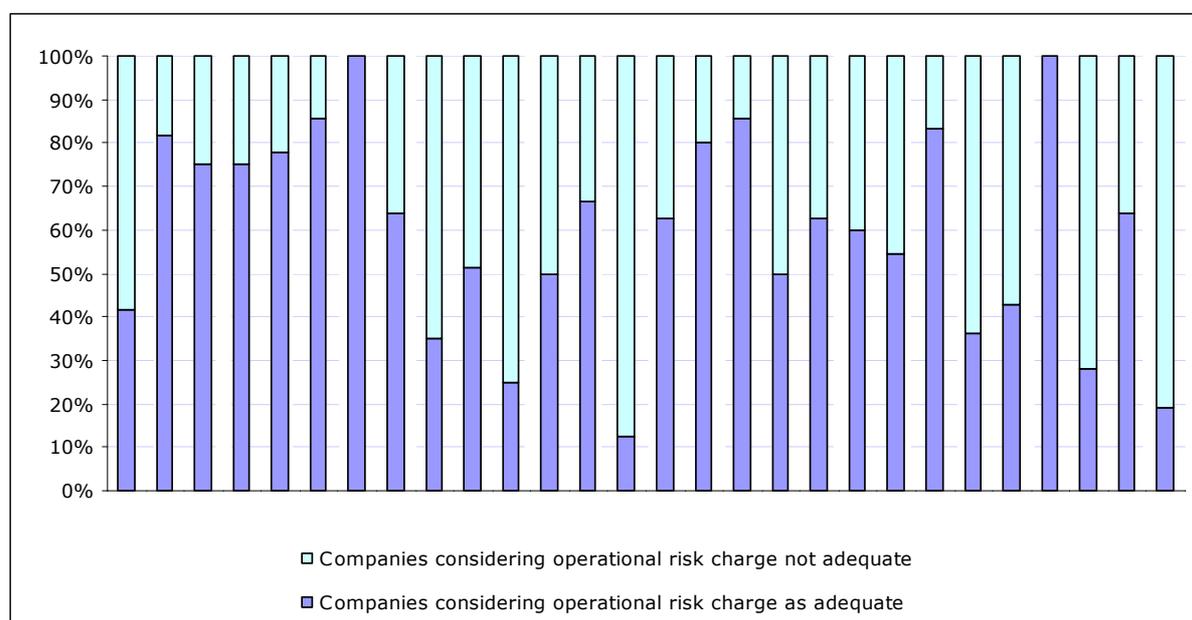


9.9.3 Design and methodology

Of the total number of undertakings that participated in QIS4, 608 undertakings (i.e. 43% of the total respondents to QIS4 exercise) answered the question on whether the operational risk charge is adequately designed.

Of the total number of respondents to the questionnaire, only 47% felt that the operational risk charge is adequately designed, while 53% believed that it is not adequately designed. However, in only 8 countries more undertakings responded that the formula was not adequately designed and calibrated. It was mainly the non-life insurers and the smaller undertakings that had a more positive opinion of the operational risk capital charge.

Figure 103: Adequacy of the operational risk capital charge formula



The undertakings that believe the formula is not adequate referred the following main criticism:

- The rationale for the factor model and its calibration is unclear;
- The formula is too simplistic, since it is not risk sensitive, and rewards low pricing and reserving;
- The consideration of 100% correlation with other risks is not adequate;
- The formula does not take into account the quality of the operational risk management processes of each undertaking, nor does it encourage the development of good risk management practices;
- The maximum of 30% of the BSCR for the capital charge was considered too high;

- The formula does not reflect the wide spectrum of operational risks;
- The use of premiums and provisions as volume measures gives wrong incentives, and rewards low pricing and reserving;
- The coefficient applied for the provisions is not consistent with the coefficient applied for premiums, considering the relative size of premiums and provisions in the balance sheet.

Some undertakings responded that the operational risk charge as currently calibrated in the standard formula in fact understates, sometimes by more than a half, the operational risk requirement as set by their own internal model.

Undertakings were invited to indicate some solutions to improve the formula used in order to overcome in order to overcome some of the criticism. The most commonly referred were:

- The operational risk charge should be calculated as a percentage of the BSCR or the SCR;
- The operational risk charge should be more sensitive to operational risks management;
- The operational risk charge should be based on the entity-specific operational risk sources and the quality of the operational risk management process and the internal control framework;
- Diversification benefits and risk mitigation techniques should be considered;
- The operational risk charge could follow a loss distribution approach (similar to the one in Basel II);
- The operational risk charge should be calculated through internal models only (i.e. there would be no standard formula);
- The formula should be more sensitive to operational risk events that have occurred in the past and technical provisions should be replaced by the frequency of occurrence of operational risk events or the cost of those events;
- Deriving required operational risk capital figures from past loss events is probably not the best solution to assess prospective risks, since an event that generated a loss in the past should have triggered a management action to mitigate the risk; therefore past losses are useful only to assess the gross exposures and not the actual net ones.

Some undertakings have encountered and reported what they believe are anomalies in the formula tested:

- Actions to reduce operational risk will tend to increase administrative costs, but for linked business this will increase the operational risk charge; and

- For undertakings which reinsure business within their group, the formula double counts the risk, as the gross premiums and provisions will appear in the formula for calculating the charge for both the undertakings, but the operational risk is unlikely to increase as a result of the reinsurance.

9.9.3.1 Objectives for the operational risk component of the SCR

There were two slightly different views among supervisors about the standard calculation of the operational risks, though each supporting the simple approach tested in QIS4:

- In the absence of any reliable data for the modelling and calibration of operational risk, CEIOPS should aim for a simple approach to operational risk in the standard formula. It is nearly impossible to find a real risk-based formula here;
- The objectives of the operational risk charge can only be properly tackled through internal models and Pillar 2 measures, as operational risk has a wide range of qualitative measures which cannot be taken into account reliably in the standard formula.

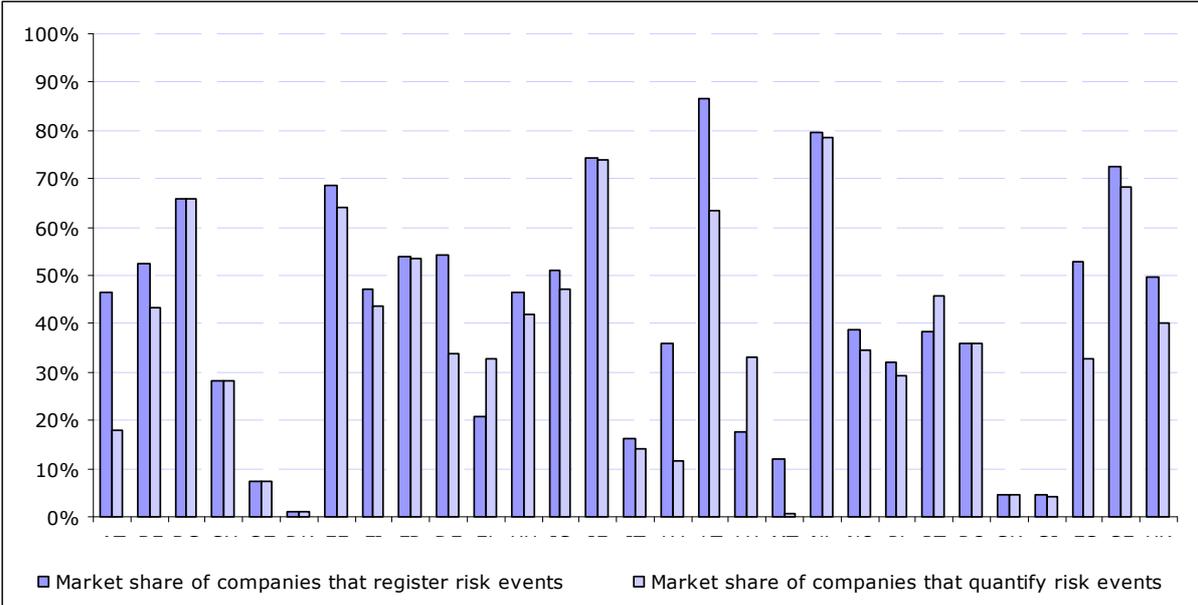
9.9.4 Result of the questionnaire survey

9.9.4.1 Record of events

From the results, it was possible to conclude that the average market share of undertakings which maintain a record of operational risk loss events is nearly 40% (the highest value being 86.5% and the lowest being 1.1%). Undertakings representing an average market share of 35% also quantify these loss events.

In four countries, undertakings representing more than 70% of the market share maintain a record of operational risk loss events, while that market share percentage is below 10% for four other countries. Regarding the quantification of the loss events, in only two countries did the undertakings who quantify these loss events have a higher market share percentage than 70% who quantify these loss events, whereas in five countries undertakings representing a market percentage below 10% undertake this activity.

Figure 104: Undertakings registering/quantifying operational risk events



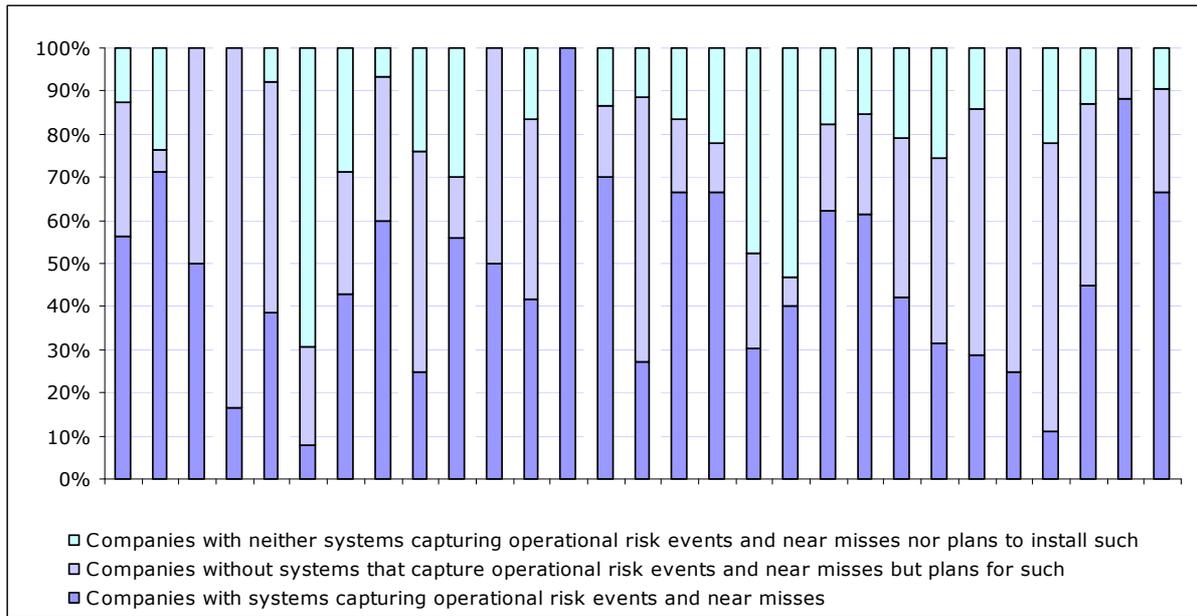
On average, it is life undertakings (corresponding to a market share of 43%) and smaller insurers (representing a market share of approximately 31%) that quantify their recorded operational risk events.

15 countries presented responses regarding the average number of risk events per year. Although a considerable number of undertakings keep records and quantify risks, the number of events recorded and quantified was not reported.

Amongst the countries that reported this information, there is a huge discrepancy in the average number of risk events per year reported. One country in particular reported a very high average number of events. However, the underlying reason may be that what is considered as an “event” can be interpreted in different ways and each undertaking uses its own definition of risk event. It can be noted that different reporting thresholds adopted by undertakings necessarily lead to non-comparable numbers.

Only one country reported information on the losses and potential losses resulting from operational risk events. However, some undertakings classify the events at least into “major” and “small” events.

Undertakings were asked if, even if they do not have a formal database of events, their risk management system captures the loss events and near misses in day-to-day management in practice. A large number of undertakings (48%) answered that their risk management system does capture loss events and near misses, while another 32% plan to implement such a system in the future.

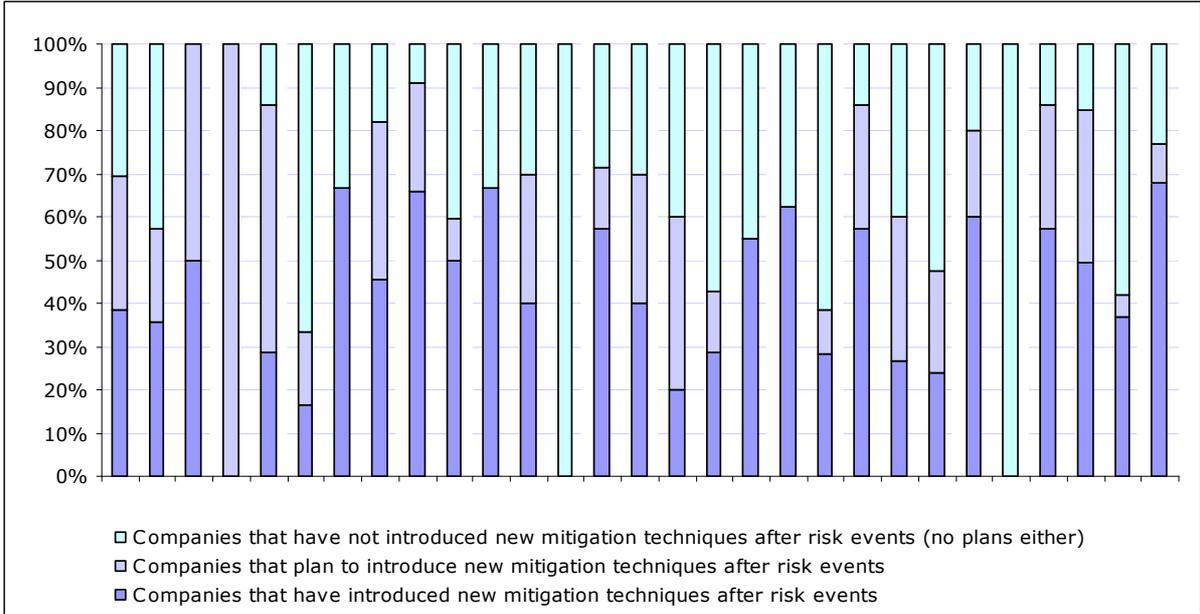
Figure 105: Availability of systems that capture risk events and near misses

Among the undertakings that effectively capture the events, 95% also capture the interrelations between the various risks identified. Regarding the follow up of the risk events, 65% of the undertakings refer to having implemented risk mitigation techniques after the occurrence of a material event.

The most common risk mitigation techniques that were mentioned were:

- Strengthening internal controls;
- Establishing internal rules;
- Improving risk awareness;
- Reviewing existing processes and procedures;
- Improving their business continuity plan.

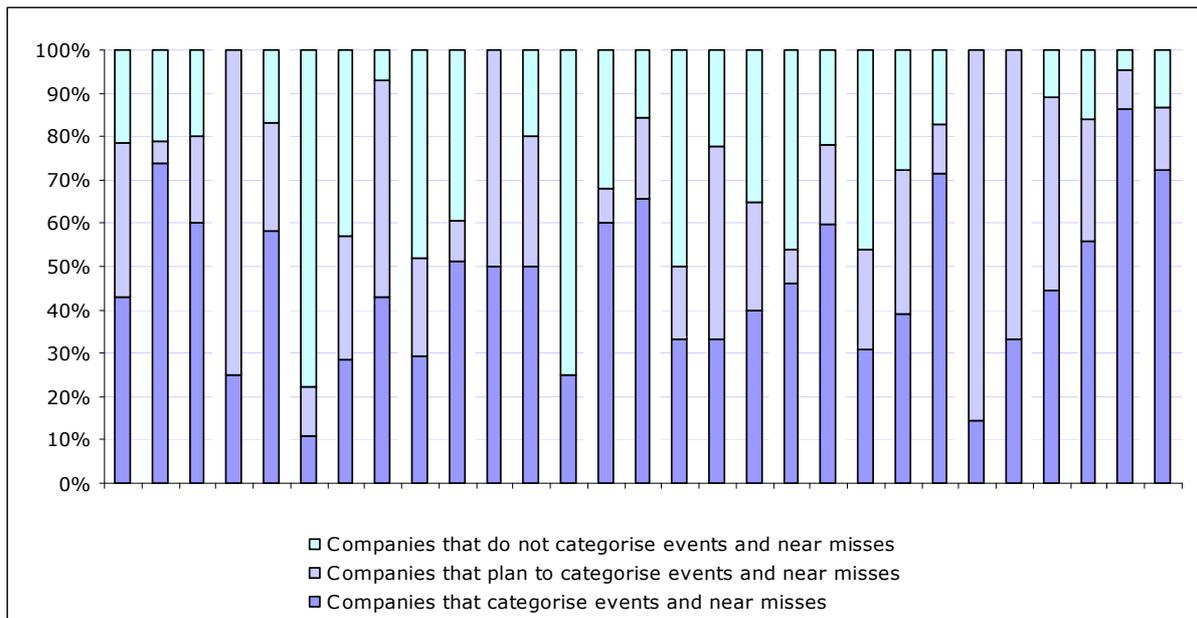
Figure 106: Use of risk mitigation techniques



9.9.4.2 Categorisation of the events

A total of 444 undertakings reported having a risk management system that captures risk events. 442 undertakings stated that they categorise those events (although not all undertakings that answered the first question had answered the second one). From the 300 undertakings that plan to start capturing those events in the day-to-day management only 168 said that they plan to categorise them.

Life insurers (66% of the undertakings) and larger undertakings (68% of the undertakings) are the undertakings that most commonly categorise their operational loss events.

Figure 107: Categorisation of risk events and near misses

The most common categorisation used is the one proposed by the Operational Risk Insurance Consortium (ORIC), or one that can be compared with it. However, some undertakings use fewer categories by merging some of them and others add some categories to suit their needs.

A considerable number of undertakings referred to the categorisation that was established by Basel II, and one country even mentioned that this was the suggestion of the national insurers association. However, since the Level 1 event-type categories proposed by ORIC are based on the Capital Requirements Directive, it can be assumed that the majority of the undertakings is actually using a similar categorisation.

9.9.4.3 Databases

Around 52% of the undertakings that answered that their risk management system capture operational risk events gave information on how long they had been undertaking this process for.

39% of the undertakings that stated that they capture the loss events and that also provided information on how long the database had been established, said they have a register for such events that has been in place for more than 5 years (58% of these also said that they included the near misses on this registry) and 23% of the undertakings stated that they started recording such events last year.

9.10 Risk mitigation effects / adjustment for loss absorbency through profit sharing and deferred taxation

9.10.1 Risk mitigation effects

In many cases, no risk mitigation instruments (other than reinsurance) have been taken into account by undertakings in QIS4.

9.10.1.1 Views of undertakings on the appropriateness of the principles for risk mitigation in the context of a standard formula calculation of the SCR

It was appreciated that QIS4 endorses an **economic approach towards risk mitigation** by laying down certain minimum requirements to the extent that risk mitigation tools can be incorporated into the standard SCR calculation (TS.VII.B). However, there were **some concerns** that the economic approach outlined **does not seem to be adequately captured within the calculation methods** for the various risk types.

In principle, **reinsurance** is included in QIS4 standard formula by using input values net of reinsurance. However, it was questioned whether this approach was sufficiently risk sensitive for risk management purposes.

In one undertaking's view, most **risk mitigation instruments** are not recognised appropriately in QIS4 and the **scope of application is unclear**. In their view, all types of risk mitigation (financial risk mitigation, reinsurance, insurance) should be subject to the same general principles²⁶ both under the SCR standard formula and under internal models.

It was not clear how some **sophisticated risk mitigation tools** would work in the context of these principles.

As part of assessing the effectiveness of the risk mitigation instruments (principle 2) insurers would often consider how to **match the liabilities and any embedded optionality**. In their view, the recognition of risk mitigation and the extent to which there is a reduction in the SCR should then depend on the **quality of the matching**, and the undertaking's consideration of the matching provided by the specific risk mitigation instrument should also be covered by **Pillar 2 review**.

In some undertakings' view, compliance with principles in respect of specific risk mitigation initiatives should be a matter for the undertaking. It should **not**

²⁶ Cf. section TS.VII.B of the Technical Specifications.

require pre-approval by the supervisor although it is expected Pillar 2 would include a demonstration of how the principles are complied with as part of the wider verification of the Pillar 1 calculation.

It was requested by some undertakings that **local 'legacy rules'** regarding risk mitigation should be **discontinued** when Solvency II is implemented.

Some examples of possible structural shortcomings were provided about risk mitigation instruments that are not recognised appropriately in QIS4:

- a) **Changes in the reinsurance program** cannot be appropriately recognised with the QIS4 standard formula as non-life premium risk is modelled using historic premiums and loss ratios. Even worse, although being a reasonable risk management instrument, in case the reinsurance cover was not affected (during the historic years being used for modelling the undertaking-specific standard deviations), non-proportional non-life reinsurance may increase instead of decrease the capital charge for the non-life premium risk as the volatility of the net loss ratios is increased.
- b) Risk mitigation may not be limited to **QIS4 segmentation**. For example reinsurance using umbrella, whole-account and other multi-line covers cannot be incorporated into the lines of business view within non-life premium and reserve risk or into the subdivision of SCR into non-life premium and reserve risk and catastrophe risk respectively. Hence, it cannot be properly reflected in the standard formula SCR. Similar problems arise when considering reinsurance structures in life & health business that combine underwriting and financial market risk elements.
- c) **Reserve risk** is usually also affected by **reinsurance**. Thus, pure market based risk factors may not capture individual risk mitigation techniques. Therefore allowing specific factors for the portfolio assessed was suggested, similar to the approach for premium risk.
- d) **Non-proportional life reinsurance** is not adequately reflected in the catastrophe component of life underwriting risk in QIS4.
- e) Alternative risk transfer instruments such as **catastrophe bonds** are not adequately reflected in QIS4.
- f) Risk mitigation usually affects the **modelling** itself: As risk mitigation can have a significant impact on an insurer's risk profile, assumptions made in QIS4 like e.g. non-life premium and reserve risk being log-normally distributed can become inappropriate. As this assumption might hold true for **loss distributions** before risk mitigation, the distributions after risk mitigation might have a completely different shape. This could however not be solved using simple formulaic approaches.

The reasons for the insufficient recognition of risk mitigation in the standard formula originates from the **variety and complexity of** ways that **risk**

mitigation can and should be used to reduce an insurer's risk. Many undertakings agree that this may never be appropriately reflected by any standard formula. An inappropriate recognition of risk mitigation, however, does not only lead to a SCR not reflecting the insurer's risk situation properly, it may also perversely discourage state of the art risk management practices. In those cases the insurer could use a **partial internal model** for the relevant module or sub-module of the standard formula in order to allow for the risk mitigating effect. However, several undertakings stressed the importance of taking account of risk mitigation adequately under the **standardised approach**.

Several undertakings consider risk mitigation has to be taken into account also within **simplified calculation approaches**; otherwise the real economic picture would not be presented.

Supervisors agree that risk mitigation is an important component for supervisory review. In the view of some supervisors, the responses from undertakings suggest that the **principles** as currently stated may **not always** have the desired impact in providing an **incentive for implementation of effective risk mitigation strategies**, and/or that these principles may not be adequately captured within the concrete calculation methods for the various risk types.

9.10.1.2 Liquidity requirements, including those related to long-term financial risk mitigation instruments

Some undertakings did not agree with the **liquidity principle** for risk mitigation (Principle 3) as they do not believe liquidity to be a key issue for insurance risk mitigation; they believe this principle has more relevance in a banking context.

It was noted that liquidity is recognised in the Directive as one of the risks that insurers should cover through **risk management** (Article 43(2)(d)) rather than through capital. This was understood by a number of undertakings to mean that liquidity risk should be managed in a holistic way and not focus on specific instruments or risk mitigations.

It was then suggested by some undertakings that the liquidity risk of risk mitigating instruments should be dealt with through **Pillar 2 (risk management)** rather than through Pillar 1. They commented that liquidity planning ongoing analysis and liquidity scenario analysis might then be appropriate tools to capture liquidity risk, and that it would not be helpful to impose capital charges for liquidity risk.

Some **supervisors** supported this view; whole others considered that liquidity should nevertheless still be included in the risk mitigation principles.

9.10.1.3 Risk mitigation instruments that do not fulfil the principles in the technical specification for the SCR

A few undertakings mentioned **items that do not fulfil all the principles for risk mitigation** in the specification for the SCR. These items included:

- **Risk of non-payment of premium by policyholders** – unclear whether mitigation by policy cancellation is allowed for in the SCR;
- **Treatment of reinsurance** – one respondent was unclear whether reinsurance could be considered to satisfy the liquidity principle. It was also questioned whether Method 1 for cat risk allows adequately for reinsurance arrangements;
- **Debenture arrangements** – if these can be allowed for as collateral then the SCR would be reduced accordingly;
- **Treatment of tax offsets** – i.e. possibility to offset losses against tax paid in previous periods.

In other countries some undertakings mentioned that the **scope of application is unclear**, so they may have violated it. For example, consider a **dynamic hedge** program: Some undertakings noted that most of the hedging instruments (domestic currency swaps, equity put) used by the undertaking are on a rolling forward basis with a duration of a few months. The effect of these instruments on the SCR according to the QIS4 methodology was then considered to be too low, and in their view, the SCR should acknowledge the possibility of some structured technique of reducing risk. Other undertakings and supervisors observed that hedge effectiveness is a “statistical” feature that can be measured historically but not predicted with absolute certainty.

Some supervisors consider only existing financial risk mitigation instruments should be allowed for in the SCR. In their view, the SCR calculation should not take into account mitigation **techniques** or mere intentions **to limit the risk in the future**, because otherwise it would enable manipulations of the risk assessment. Moreover, these techniques involve high **operational risk** and costs which are not reflected in the SCR.

Some supervisors consider the SCR risk mitigation principles may not cover every possibility. It may be necessary to consider items outside the SCR risk mitigation principles on a **case-by-case** basis.

9.10.2 Adjustment for loss absorbing capacity of technical provisions and deferred taxes

9.10.2.1 Loss absorbency through reduction in profit sharing (and other management actions)

9.10.2.1.1 Main findings

It was observed that the adjustment for loss absorbency through profit sharing appears to be one of the **key elements** in the calculation of the SCR for life and health insurers. Undertakings are likely to need **further and more detailed guidance** on the approach and methodology that should be used to determine the effect of reductions in future profit sharing and how the **assumptions on future management actions** impact on the calculations. Developing some **practical examples** could be very helpful.

Many of the points raised by undertakings and supervisors on the treatment of loss absorbing capacity of technical provisions (discretionary benefits) within the SCR reiterated the conclusions set out in the **Technical Provisions** section of this report.

9.10.2.1.2 General comments

Many supervisors said that there was considerable **inconsistency** between undertakings **in the results** submitted. This can be attributed to various factors, such as **difficulty of calculation**, the need to use **approximations** to arrive at some figures, **simplifications** about the application of possible management actions, and the requirement to carry out **two sets of SCR model runs**. In one country, undertakings particularly appreciated the national guidance on the definition of FDB, allowing for an easier calculation of the adjustment for future profit sharing, whereas in many countries, the absence of definition of the FDB remained an obstacle. In **some** cases there was very **limited discretion** over future bonuses; in **other** cases there was **insufficient clarity** on the **interpretation and valuation of discretionary benefits**, or on how **management actions** might impact on the calculations, so more work may be needed to **clarify the concept** in these cases. It was suggested also that **practical examples** might be helpful.

It was stressed that it was important that **funds used as risk mitigants** should not be double-counted. Guidance could be helpful in this respect.

The important role of **judgement** in determining **realistic management and policyholder actions** during a 99.5% VaR-level stress was noted as an area to consider.

Finally, it was noted that if undertakings increase bonuses during an **interest rate up stress**, this can produce a negative stress, which is not compatible with a risk absorbency test.

In 14 countries with 181 life or composite undertakings that participated in QIS4, there was no significant effect of the loss absorbing properties of future profit sharing on the value of the BSCR of Life undertakings.

However in 15 other countries with 391 life or composite undertakings that participated in QIS4, the effect was material for many undertakings, and varies between 10% to 75% on average, according to the country.

These figures need to be interpreted carefully as many undertakings were unable to calculate a figure for the BSCR ignoring the effect of bonus changes (see paragraph 9.10.2.1.4 below).

9.10.2.1.3 Simplifications

There was a variety of views as to whether **simplifications** would be appropriate. Some undertakings and supervisors felt that simplifications were largely unnecessary, although others disagreed. Some suggestions were made for further work on a simplification for the treatment of future profit sharing. Key aims were:

- To increase the **practicality** of the calculation;
- To produce greater **harmonisation** of the approach used in order to allow increased **comparability** between undertakings;
- Where a prudent simplification was imposed, it should not be so penal that it led to a very large difference **in comparison with** the result from a full **internal model**.

Some supervisors felt that **management actions** should only be included within the assessment when they were supported by **existing documented procedures**. Others felt that it was important that the management actions did **not exaggerate the loss-absorbing effect which could be included in practice**, and should properly take account of any non-linearities.

One respondent suggested a simplification based on principles similar to those used in considering transferability of ring-fenced funds.

9.10.2.1.4 Gross/net of adjustments for future profit sharing

The obligation to provide a calculation of the SCR before application of the risk mitigation **effect of future profit sharing** (gross SCR) is considered burdensome and not necessary by many undertakings. One country noted that the modelling required for measurement of the impact of profit-sharing was

onerous and time-consuming, and within this country the gross test had little meaning.

Many **undertakings** in some markets preferred to just calculate each SCR component **net of** the adjustment for the risk mitigating effect provided by future discretionary benefits (**i.e. the adjustment for profit sharing**) **stresses** as this required **fewer valuation runs**. Undertakings also highlighted that the calculation before the adjustment for profit sharing gross of stress was **artificial** as this does not fit with how they managed their business. Those with internal models stated that they took account of the relevant changes to future discretionary benefits (**i.e. bonus rates**) **used net stresses within** their own **modelling**; these undertakings reported that stochastic projections **ignoring gross** of changes in bonus rates **can give distorted results**. They also expressed concern that the calculation was not appropriate when participating business was sold alongside non-participating business as this may implicitly allow future discretionary benefits to be reduced to meet non-participating business losses. A minority used a gross test for their business.

Supervisors were **more open minded** on the use of both gross and net, or only net results. However, one supervisor considers the calculation of gross results a prerequisite for a useful solvency assessment.

There were some **questions** as to what criteria should be used: for example, there were some questions as to exactly **how the 'gross' calculations, with no adjustment for profit sharing, should operate**, in terms of changes in investment policy, adjustments to premiums (e.g. for health insurance) and policy charges, and other considerations. Some of the concerns on the use of management actions highlighted above were reiterated. It was **suggested** by one supervisor that **only prescriptive management actions** be included here. This area was also highlighted as a useful area for **future simplifications**, though it was noted this would need to take into account differences in profit sharing approaches across Europe.

9.10.2.1.5 Equivalent scenario

The "equivalent scenario method" was **mainly tested in one country** as answering a specific market situation where all other "recognition of the profit sharing" methods are less practicable.

There appeared to be **some preference among undertakings** that expressed a view for the **alternative equivalent scenario method** over the gross/net stress approach. However, it was **not widely used** by undertakings in many member states, potentially due to time constraints or as, unlike many other parts of the SCR calculation; this required an additional valuation calculation. The qualitative feedback suggested:

- Support for this approach in terms of **more realistic treatment of management actions** and avoidance of double-counting of risk mitigation effects. **Some practical benefits** compared with the gross/net runs were also perceived.
- One Member State questioned whether the net SCRs adequately reflect **the relative import of risks and the sensitivities to uncertain management actions**, and queried the exact **definitions for the gross runs**.
- **Doubts** were expressed **if this was the most appropriate scenario test** that could be used by undertakings. Other approaches may work better depending on the nature of the business being assessed – for example a different approach may be more appropriate for non-life business or for different types of profit-sharing. There were **questions** as to whether the equivalent scenario approach allowed appropriately for **non-linearity** between the shock and capital charge (for example where there are embedded options or where there is risk mitigation in place) and for non-linearity in the allocation of diversification effects. Where there may be correlated impacts, the **interpretation of the shocks** was judged not entirely clear (for example, do policyholders die before the policy can be lapsed?).
- **More testing** was required by many undertakings before they were satisfied that this was appropriate for their business. There were also calls for **further documentation**, however, the general position from undertakings was positive.
- The scenario approach was only effective where the undertaking had an **integrated asset/liability model** – without this, the pre and post scenario effects were identical.
- A suggestion was made that a **simplification** could be used in the process for **checking the most onerous stress test has been used in the equivalent scenario** – although it was noted that it is important that such a check is carried out.

One member state strongly supported the use of the equivalent scenario approach. Most **other supervisors** were unable to come to a view based on the **limited evidence**. There was one suggestion that a risk-by-risk approach be used instead.

9.10.2.1.6 Lower boundary SCR

The level of contribution with regard to the quantitative aspects of the lower boundary SCR calculation varied by country, with an average response rate of under 30%. **Few undertakings contributed** to the lower boundary SCR

calculation. In some countries, undertakings who did supply information appeared to have **interpreted** the instructions in an **inconsistent fashion**.

In **one country** the use of the lower boundary SCR resulted in a **reduction of about 50% in the SCR**, with some undertakings able to eliminate all SCR components except for operational risk.

Undertakings in another member state raised concerns that **constraints arising from local conduct of business rules** restricted the extent to which future bonuses could be reduced in response to adverse conditions; these constraints had already been taken into account in calculating the standard SCR, and therefore separate results for the lower boundary SCR had not been submitted. The supervisor agreed this approach was appropriate. However, this is in contrast to some other countries where the managing boards of insurers are unwilling to limit their range of possible actions on future profit sharing under stress by setting down precise rules, or there is only limited discretion in setting bonuses and no concept of “policyholders’ reasonable expectations”.

Comments were received from two countries about the **varying impact of the lower boundary SCR on each of the risk modules**. For the first of these, for life undertakings, the largest impacts arose for equity, lapse and mortality risk, these being significant (order of 20%). The impacts were lower for non-life risk, and were concentrated more in the spread risk module. For the second country responding, the most significant impacts were identified in market risk, counterparty default risk (for life insurers) and health underwriting risk. These were of the order 65-85%.

Many supervisors agreed with the undertakings that the lower boundary SCR was **neither meaningful nor compatible** with the nature of the contracts/legislation in their member state.

One supervisor called for **increased clarity on how judgement**, recognised as a central feature in calculating some aspects of the lower boundary SCR, can be **monitored and controlled by the supervisor**.

9.10.2.2 Loss absorbency through reduction in deferred taxation

In some countries, undertakings generally agreed that the **economic value of taxation payments and their loss absorbing capacity should be included** within the financial requirements. In other countries, however, the allowance for deferred tax liabilities in the solvency balance sheet was rejected on the grounds that they would disappear in crisis situations.

However, there was considerable confusion on the **instructions** given, **how they should be interpreted** given the **taxation basis in each member state** and the practical steps required for this calculation. Undertakings either made an approximate calculation or ignored changes in the tax liabilities.

It was suggested that some **clarification** on this issue would be needed before any **simplifications** can be looked at.

One supervisor set out some suggestions for the treatment of deferred taxes, noting in particular the **importance of achieving consistent treatment** across Europe.

9.11 Supervisory intervention following a breach of the SCR, and link with the risk situation of undertakings

There was a **general welcome** from undertakings for the **principle** that the **overall risk situation should be taken into account** when deciding on the **nature of supervisory intervention** in the event of a breach of the SCR.

It was noted by many undertakings that it is important that a **holistic approach to supervision** should be applied under Solvency II, reflecting the risks facing the regulated entity and the overall economic background, whilst ensuring that policyholder protection remains paramount.

This overall approach would help to **avoid unnecessary forced sales of assets** when these were not warranted by the overall risk situation. It would help undertakings to cope with the **natural balance sheet volatility** that exists for most insurance undertakings given a) the full market consistent approach used in valuation; b) their exposure (where appropriate) to volatile assets; and c) their absorption of risk on behalf of policyholders.

Some undertakings added that the approach would also be **relevant in the event of other market stresses occurring**, and not just when equity market values had fallen. For example, it could be relevant to undertakings holding corporate bonds to cover long-term liabilities in the event of a market wide credit stress event.

Supervisors generally supported the **principle** of a Pillar 2 ladder of intervention based approach for any general market decline that took into account factors such as liquidity management, balanced ALM systems, and appropriate documentation. One supervisor added that the ORSA should ensure that undertakings keep a long-term view, and rely on their own risk management instead of on supervisory lenience.

Comments by individual **undertakings** included the following points:

9.11.1 General comments

- Any intervention should be a **measured response** in proportion to the scale of the breach, the size of the undertaking, the nature of the business written, and the reasons for the breach of the SCR.
- **Different responses** will be required for 'capital' issues arising from large **falls in worldwide stock markets**, or worldwide falls in the value of bonds and other assets, than for issues arising from **poor exposure management**.
- The supervisory response should take account of the **risk position of the undertaking**, and the **duration of liabilities**, including the **proportion of liabilities that might fall due for payment in the near term** (and particularly those payments without any possible reduction to reflect market conditions, such as a market value adjustment for surrenders).
- It is important for the undertaking to **investigate the main reasons and sources of the SCR breach** and try to immediately fix it, or stop doing activities that could intensify deterioration.
- A **minor breach** should at no point lead to significant restrictions e.g. stop writing business etc. as this in turn could also reinforce the negative situation of insurance undertakings. If an undertaking can prove the recovery of its Solvency position in an appropriate timeframe, restrictions should be kept to a minimum.
- The **recovery plan** is likely to contain some self-imposed restrictions on a undertaking's activities. The supervisor should judge, in light of emerging information, whether it needs to impose further constraints on the undertaking. Any restrictions on the activities of the regulated entity should only be to ensure that the position of the policyholder is not prejudiced.
- **Profit sharing** (on both life and non-life policies) mitigates losses and this should be taken into account.
- Some **captives** endorsed this suggestion in view of very volatile markets (e.g. fire damage, third-party liability). In case of extremely rare events arising in an untimely manner, the solvency of an undertaking can be affected without considerable harm for the parent company. Indeed, the occurrence of such an event is often the justification for the captive's creation. In addition, some captives suggested, for start-up captives, a period of 2 years to comply with SCR, where existing captives should be accorded a delay of one year to fulfil the SCR requirements.
- Some quick ways to **de-risk** might be to have **contingency plans** that could be quickly implemented for effecting additional reinsurance

arrangements, matching investments more closely to liabilities, diversifying investments, buying hedges (e.g derivatives), lowering costs, limiting the volume of new business written (especially in more risky lines of business), securitising liabilities, or raising capital.

9.11.2 Supervisory measures

- Sensible **Pillar 2 measures** could include **restrictions on dividends** and **requirements to de-risk** or **restrict new business** where possible or appropriate. The undertaking in question could be prevented from writing new lines of business.
- The **supervisor** should have the **right to impose** any appropriate **restrictions required to limit the risk** of a undertaking breaching the MCR or becoming insolvent.
- **Restrictions** that could be considered are:
 - Restrict management action in the distribution of bonuses and extra-benefits;
 - Increase recognition of risk mitigation (reinsurance, financial hedging);
 - Reallocate the asset portfolio.
- A suggestion by some undertakings was the use of (Pillar 2) measures such as limiting policyholders' right to **surrender** (though some supervisors expressed concerns over this) or by reducing all surrender values in a fair manner.
- An extended analysis of the risk report (including the **ORSA**) of the entity in question could be carried out, indicating the most relevant aspects that affect the SCR, with review and quantitative assessment dates in line with local regulations in this respect. This could be expected to **include an analysis of the matching of assets and liabilities by type and duration**, and of the risks associated with any further new business that was written.
- The supervisors might ask for information **on prescribed stress scenarios and risk exposures** so that they can aggregate the exposure across the local market and across Europe.
- Following an initial breach of the SCR, the **SCR would need to be calculated more frequently** against internal accounts and reserving in order to monitor improvements.
- An **increased frequency** of reporting and of on-site inspections by the supervisor, creation of a **viable recovery plan**, together with increased frequency and intensity of the **dialogue with the supervisor**.

- As part of the **action plan to restore the SCR**, there could be a requirement for the action plan to cover **scenarios** in which conditions worsen or remain the same for a period.
- An acceptable **timetable** and/or **process** should be agreed.
- A reasonable time period should be made available to rectify the breach, and **more time** might be given in **difficult market conditions** if these conditions were expected to be temporary. (Several undertakings and one supervisor added that it would be helpful if the Directive were to allow for some extension of the time, such as doubling of the prescribed time periods, to develop and implement a recover plan in difficult market conditions).
- If supervisory intervention also includes studies to predict long-term basis recovery, and the undertaking has long-tail liabilities, there could be **time-based thresholds** so that the supervisory authority can establish a **milestones** scheme with the undertaking for recovery of the SCR to specific values
- The supervisor could then assess the **feasibility of the action plans** to restore the SCR and **monitor the implementation** of the plans on a regular basis (at least monthly).

9.11.3 Reporting requirements

- **Reporting** could include production of updated balance sheets at least monthly, along with information about the composition and matching by duration of assets held by the undertaking, loss ratios for non-life business, and the nature and volume of new business written.
- Such reporting should be in **private** to avoid the risk of market reaction making the situation worse. The announcement of breaches of the SCR may lead to widespread panic and this could contribute to a significant increase in the default probability. Therefore **public disclosure** needs to be treated with care, particularly for minor breaches.
- Any additional reporting requirements to the supervisor should be **restricted to those which are necessary** for the supervisor to be able to most effectively work with the regulated entity to resolve the breach of the SCR.
- There should be **communication** to supervisors if any **significant increases to risk** are foreseen or if further losses are discovered.

9.11.4 Relationship with MCR

- An important consideration would be **demonstrating** to the supervisor that the insurer still has the **resources** to withstand short-term demands and is unlikely to breach its **MCR**.
- Reducing the likelihood of such a breach could be accomplished through **reducing the risk** of the positions, and **issuing new capital** / debt instruments to enhance the available capital
- A **supervisory scale of action** should be defined between MCR and SCR, to make sure that **progressive restrictions** can be applied, if the situation continues to deteriorate.
- It was important that there should be a **sufficiently wide gap between the SCR and the MCR**, so that there was sufficient time for undertakings and regulators to respond before any breach of the MCR. If the gap is too small (because of an inappropriate calibration) or uncertain (because the MCR is calculated in a way that it does not reflect the SCR) then there is risk of non-compliance with the MCR and the “forced” sale of assets will take place.

9.11.5 Quality of assets, valuation and liquidity issues

- The **transferability** of assets and liabilities should be taken into account
- Undertakings should continue to apply a **market consistent approach** to the valuation of their assets and liabilities.
- In stressed conditions, more attention should be paid to the **quality of assets** when assessing the prospects of recovery, than to a fall in market value, especially if there is little intention of selling. **Liquidity of assets** should also gain increased attention.
- It was suggested that a **liquidity premium** should be taken into account when assessing the balance sheet of insurance undertakings with **long-term liabilities**.

9.11.6 Supervisory co-operation and resources

- There should be **consistency in approach** between regulators (as otherwise a sell off caused by the regulator in one market will affect the solvency in all others), but prescriptive rules would not be able to reflect the full range of possible circumstances, and could exacerbate the problems in stressed market conditions.

- A decision-making process could be introduced by CEIOPS to define **financial distress situations** and issue relevant guidance in order to facilitate a consistent and appropriate response in such situations whereby the focus is on retaining liquidity and the level of technical provisions (instead of the SCR).
- This approach depends on the supervisor having sufficient resources, and these **supervisory resources** may come under strain should a major event cause a large number of undertakings to fall below their SCR simultaneously.

9.11.7 Application of SCR market stresses

- There was a suggestion that the **market risk stress tests are reviewed pro-actively** by the regulator in light of the market conditions; i.e. the regulator should react to the market conditions at that point in time, take account of any short-term effects such as a temporary lack of buyers in the market, and revise capital requirements quickly if they are inappropriate. However, this assumes that the regulator will be able to quickly respond to market conditions.
- It could be **agreed in advance** how much leniency should be applied in times of adverse market stress, although in very extreme scenarios the market may be best protected by further modifications to the supervision approach that are **agreed at the time**.
- It was proposed by some undertakings that stress testing should be subject to a **dampener in adverse conditions** to avoid potential procyclicality. This might be applied either as an indicator of the intensity of the regulatory response, or as a reduction to the SCR. It was seen as important though that there should not be a general reduction in the equity stress in normal conditions, as this would not be prudent.

9.11.8 Application to groups

- For groups operating within the **group support regime**, information on how volatility would be handled within the solo entity was requested
- There was a concern (not shared by all supervisors) that the **group support system** should not be immediately affected by a stress situation on financial markets. In the context of group supervision as foreseen by Art 236, Art 237(3) stipulates the conditions under which the group supervisor will accept a declaration of group support. One of the conditions is that a group meets the group SCR.

- In practice the system of group support only works when the group is capable of meeting the group SCR. In case of **distress on financial markets**, this could result in a situation where large groups that had applied for **group supervision** according to Article 236 fall back to entity supervision and complete supplementary group supervision. At that moment they need more available own funds (declarations of group support do not work anymore) and this increases the gap between the required and available capital.

9.11.9 Evidence for ability to rebuild capital

- Several undertakings suggested that the **ability to rebuild capital** can be demonstrated through:
 - description of internal and/or external measures that can be taken;
 - evidence of the undertaking's ability to execute each action;
 - expression by the Board of the level of confidence it has in the undertaking's ability to execute each action;
 - business continuity plans;
 - disclosure of guarantees (e.g. from other entities within a cooperative structure).
- **Evidence** might include, for example:
 - stock market listing, and advice from financial advisers as to the amount of equity capital that could be raised;
 - regular access to capital markets in recent years by the undertaking, and current availability of those markets to insurers of a similar credit quality;
 - plans for internal capital restructuring or transfer of assets or risks within the Group;
 - evidence of the ability to reinsure risks;
 - evidence of market capacity for certain asset disposals or derivative protection;
 - stress testing.
- If **internal actions** are proposed, a list of short-term tasks could be delivered, signed by the Risk Management, the Auditing Committee and the Members of the Executive Board, who would then be directly responsible for completing these tasks within the timetable settled with the supervisor.

9.11.10 Alternative approach

It was suggested by some undertakings that certain departures from a market consistent approach may be proposed to support **small and medium sized** regional insurers and to ensure that insurance market retain some diversity.

The concentration risk module could be further developed and include liquidity risk. Markets are not always as deep and liquid as in “normal” circumstances and can hinder an undertaking in realising the expected value of its investment portfolio in stressful situations. An undertaking with a very concentrated portfolio could have a higher SCR, measured by **markets depth and liquidity**. A high concentration in a bear market could result in a higher SCR, forcing undertakings to spread their portfolios over different markets.

10 Internal models

The information request on internal models for solo undertakings and groups followed in principle the same structure.

The information request was divided into three different parts. The first part consisted of a **general questionnaire** directed to all undertakings on the current and future potential use of internal modelling in EU. The second part included a questionnaire to collect **high level qualitative information** from undertakings that use internal models for assessing their capital needs to influence the qualitative aspects of the future implementation measures and the aim of the third part was to collect reliable and comparable **quantitative data** (internal model results and parameterisation) from partial and full internal models that are currently used by undertakings for assessing their capital needs.

One should emphasise that the conclusions drawn from the information on internal models is only representative with respect to the given sample, which in some cases is very small. Extending the outcomes directly to general EU-wide considerations might lead to biased conclusions and hence the observations on internal models should be interpreted cautiously.

The main findings of this chapter can be summarised as follows:

- Many undertakings (13%) consider the standard formula to work reasonable well and will hence not seek internal model approval. (63% of the respondents intend to use either full or partial internal model in the future solvency regime for the purposes of the calculation of the Solvency Capital Requirement, 13% do not intend to use and 24% do not know yet.)
- Replacing the standard formula with a partial or full internal model is nevertheless a **possible route** for many undertakings.
- Equal considerations were given towards **full and partial internal models**.
- Better risk management and governance seems to be the key drivers for seeking internal model approval.
- There is a **wide variety** of partial internal models currently in use.
- Due to the very scarce sample size no meaningful estimates can be made for the expected total EU wide costs related to the potential use of internal models in Solvency II.
- The majority of the respondents expect that SCR will decrease with an internal model compared to the standard formula and slightly less than half of the respondents reported an expected decrease of more than 20%.

- Risk modules where the internal model seems to create **lower capital requirement** than the standard formula include overall SCR, BSCR, market risk, interest rate risk, life underwriting risk, longevity risk, lapse risk, health underwriting risk, health short-term underwriting risk, non-life underwriting risk and premium/reserve risk.
- Risk modules where the internal model seems to create **higher capital requirement** than the standard formula include operational risk, equity risk, property risk and mortality risk.
- The **development** stage of internal models varies significantly by undertaking.
- In order to reach a full compliance with an anticipated Solvency II framework for Solvency II **further work** is required by many undertakings in all areas concerned (use test, statistical quality, calibration, profit and loss attribution and validation etc.).

10.1 Internal models on solo level

In QIS4 710 undertakings (50% of all participating undertakings) provided some kind of information related to internal modelling.

QIS4 undertakings responded to the different parts as follows:

- 710 undertakings from 29 countries provided at least some information on the first part. This includes 182 life, 357 non-life, 126 composite, 25 reinsurance and 20 captive undertakings. The 710 respondents included 132 large, 278 medium and 300 small undertakings.
- 114 undertakings from 17 countries provided at least some information on the second part. This includes 43 life, 52 non-life, 18 composite, 1 reinsurance and 0 captive undertakings. The 114 respondents included 45 large, 54 medium and 15 small undertakings.
- 160 undertakings from 16 countries submitted an SCR calculated with an internal model. This includes 74 life, 63 non-life, 21 composite, 2 reinsurance and 0 captive undertakings. The 160 respondents included 60 large, 74 medium and 23 small undertakings²⁷.

Due to confidentiality arguments within some country reports the internal model responses cannot be consistently segmented by type or size of undertaking. The conclusions will hence focus on aggregated results and where possible disclose observations per type and size of undertaking if an accurate view is obtainable.

²⁷ For some undertakings no size classification was provided.

10.1.1 Current and potential future status

63% of the respondents intend to use either full or partial internal model in the future solvency regime for the purposes of the calculation of the Solvency Capital Requirement, 13% do not intend to use and 24% do not know yet. More than half of the respondents currently use and develop or they are actively developing internal models for some aspects of their business. Concerning these undertakings internal models are used in a wide range of areas and decision making processes. The majority of the respondents use their internal model for asset-liability management (ALM) (79%), reinsurance (67%), investment policy (67%), strategic business decision (66%), asset allocation (59%), risk strategy (59%), capital allocation (59%), risk limit setting (58%), performance analysis (57%), pricing (54%) and market consistent technical provision (53%). A significant amount of respondents also use their internal model for budgeting (48%), assessment of uncertainty in technical provisions (48%), product development (43%) and cost-of-capital (CoC) risk margin (39%). Dividend payments (22%), bonus setting (14%) and management compensation (6%) were the areas that made the least use of internal models.

The main reasons given for not developing internal models for the use of capital requirements were that “standard SCR works well” (90% of the respondents) and “too demanding” (90%) followed closely by “too large administrative burden” (87%) and “too expensive” (80%). Some other reasons mentioned were:

- The quality of the data is not good enough to implement an internal model;
- The catastrophe risk is already undertakings specific under the standard formula.

The main reasons given for seeking an internal model approval (over 90% of the respondents) are “better risk management”, “better capital management” and “more transparent decision making”. About 60% of the respondents stated that “lower regulatory capital” was a reason for seeking an internal model approval. Hence, this was not one of the most important incitements to seek an internal model approval. Some other reasons reported were

- Maintaining consistency with the underwriting control process;
- Value based management (e.g. pricing, controlling, reinsurance, financial analysis, distribution);
- Better asset-liability management;
- Value and risk based management;
- The possibility to use stochastic simulations;
- Improved flexibility in managing ones capital measure;

- Standard formula does not work well for with-profit business for life undertakings and especially for blocks in run-off;
- Aligning regulatory requirements with internal practice where models have been developed regardless of Solvency II;
- Integration throughout the group, or may be requirement from parent company;
- Understanding own credit rating;
- Consistency with peers;
- Supervisors may impose a requirement to use an internal model; and
- The standard formula does not work well for undertakings with very special risk profile.

Slightly over 50% of the respondents that have plans to seek an internal model approval intend to use a full internal model rather than a partial internal model. Furthermore the size of the respondent is quite relevant, because 69% of the large respondents intend to use a full internal model whereas 63% of the small respondents intend to use a partial internal model.

The most likely risk modules that the respondents plan to substitute in a partial internal model are SCR non-life risk, SCR market risk and SCR life risk (over 40% of the respondents) followed closely by SCR operational risk and SCR default risk (nearly 40%). Every module and sub-module is planned to be substituted by at least 10% of the respondents. Concerning type of undertaking one can conclude that:

- Non-life undertakings have plans to substitute non-life premium risk sub-module;
- Life undertakings have plans to substitute interest rate risk sub-module;
- Composite undertakings have plans to substitute non-life premium risk, interest rate risk, equity risk, mortality risk, longevity risk and lapse risk sub-modules;
- Reinsurance undertakings have plans to substitute non-life premium risk and non-life cat risk sub-modules.

Possible partial internal models across business lines included sub-lines such as annuity business, motor business, long-term health care business and third party liability for construction business.

Slightly over 50% of the respondents reported that it will be inappropriate to apply the standard formula for calculating their SCR, because their risk profile deviates from the assumptions underlying the standard formula. The main sources of deviations reported stem from "deviations in terms of volatility" (93%) followed by "non-linear dependency of risks" (83%). Some other reasons

mentioned why it would be inappropriate to apply the standard formula and hence also some possible reasons to convert to an internal model approach were:

- The wide scope of coverage underlying reinsurance portfolios requires a more explicit modelling reflecting the specific loss frequency and loss severity structure;
- Global business model;
- Special reinsurance structure;
- The analysis of alternative investments is not compatible with the standard formula;
- The form of the longevity stress within the SCR standard formula does not appropriately reflect the actual longevity risk, specifically it does not appropriately allow for the risk of increases in future mortality improvements;
- Non-linear interactions are not reflected by the correlation matrix approach and should be adjusted using the results of scenario testing. The appropriate scenarios will depend on the risk profile of each individual company. There is no “one size fits all” calibration;
- The unique characteristics of the business as a third party provider;
- No credit for catastrophe load in premiums for catastrophe exposed business;
- Deviations in the correlation assumptions, particularly between reserving and underwriting risks;
- Categorisation of business and diversification allowance;
- Definition of volatility being around the expected results, rather than in excess of premiums received; and
- Incompatibility of class breakdown.

60% of the respondents expect to have additional costs related to the Solvency II model approval requirements that would not otherwise incur. Furthermore, 35% of the respondents could not yet say if model approval requirement will actually cause additional expenses. The following results should be interpreted very cautiously, because less than 10% of the respondents that have plans to seek internal model approval provided some estimation related to additional costs.

The average cost per respondent in absolute amounts was as follows:

- The average expected total costs related purely (costs that would anyway be incurred in the absence of Solvency II excluded) Solvency II approvals activity of the internal model were EUR 1.3 million.

- The average expected total upfront cost related purely to Solvency II activity of the internal model were EUR 1.6 million.
- The average expected annual costs on a going concern basis of the internal model related purely to Solvency II activity were EUR 1.0 million.

The distribution of internal models costs relative to annual expenses was as follows:

- 84% of the respondents estimated the expected total costs that are related purely to Solvency II approvals activity of the internal model are 5% or less. Furthermore, 44% of the respondents estimated costs that are 0.5% or less.
- 81% of the respondents estimated the expected total upfront costs that are related purely to Solvency II activity of the internal model are 5% or less. Furthermore, 59% of the respondents estimated costs that are 1% or less.
- All of the respondents estimated the expected annual costs on a going concern basis of the internal model that are related purely to Solvency II activity are 3% or less. Furthermore 56% of the respondents estimated costs that are 0.5% or less.

Due to the very scarce sample size no meaningful estimates can be made for the expected total EU-wide costs related to the potential use of internal models in Solvency II.

The distribution of the tentative view of the potential increase or decrease in SCR caused by the application of an internal model as compared to the SCR standard formula was as follows:

- 10% of respondents estimated that SCR would increase more than 20%;
- 5% estimated that SCR would increase between 10 and 20%;
- 2% estimated that SCR would increase no more than 10%;
- 10% estimated that there are no significant change;
- 8% estimated that SCR would decrease but no more than 10%;
- 21% estimated that SCR would decrease between 10 and 20%; and
- 44% estimated that SCR would decrease more than 20%.

Hence, 72% of the respondents indicated that SCR will decrease with an internal model and 18% of the respondents indicated that SCR will increase. Furthermore, more than half of the respondents (65%) indicated that the SCR will decrease more than 10%. It was also recognisable that the larger the respondent the more a 20% decrease in SCR was expected. Slightly fewer than 50% of the respondents provided some estimation related to the potential increase or

decrease in SCR. Many undertakings were unable to provide estimates of the potential impact.

Some undertakings regard the development of their internal model as completed, whereas others consider themselves rather in the early stages of model development. For over half of the respondents it is expected that it will take less than one year to meet the approval standards. On the other hand in some countries and for the majority of the respondents it is expected that it will take some 3-4 years to meet the approval standards.

Many undertakings have developed their internal model in the previous 3-7 years and now undertakings are very often planning to progress the embedding of their internal model into their business to a greater extent than at present. Further development areas and/or goals that undertakings have for their internal models include:

- Gain internal model approval for Solvency II purposes
- Align the internal model to future developments in Solvency II, Market Consistent Embedded Value and IFRS Phase II developments as well as aligning the model to future external disclosure requirements.
- Transform the internal model into a robust model that is being applied as a driver for the decision making process
- Improve the quality of the management information output from the internal model
- Extend the sophistication of the internal model (risk coverage, allowance for non-linearity, tail-dependency etc.)
- Make the internal model more flexible to deal with future changes
- Improve processes surrounding the internal model, including
 - reducing production times
 - enhancing the control environment to bring the model to a full audit standard
 - improving documentation
 - improving internal model governance
 - understanding the analysis of change between time periods
 - running the model more frequently
 - inclusion of sensitivity analysis,
 - improving the robustness of the validation process
- Move the internal model to a different platform to make the model more flexible and powerful (increased use of technology)

- Use the internal model to create a more sophisticated capital allocation process than is currently used

A number of undertakings stated that changing the internal model is part of a continuous review process and that the model evolves, rather than making fundamental changes to the model. Each year the internal model will be improved to incorporate more detailed and accurate modelling of the business.

It was also noted by some undertakings that the long-term goals for the internal model will be dependant on decisions made at group level.

Concerning those undertakings only that have plans to use a full or partial internal model in the future and foreseeable additional steps needed to make the internal model suitable for Solvency II purposes some of the undertakings stated that they need to know the implementing measures of the Directive to be sure to develop their internal model compliant with Solvency II. The understanding of many undertakings is that with respect to the Directive Proposal only, their internal model seems to be in line with the general approach. Further work will depend on Level 2 criteria.

Many of the undertakings indicated that most of the changes required are non-technical. Some responses provided are given below, split out by the approval criteria headings as set out in the Level 1 framework:

10.1.1.1 Use test

There were a number of responses that indicated areas that undertakings are developing further to make greater use of their models. Specific areas mentioned include:

- Embedding use of the model throughout the business;
- Aligning with overall risk and governance process;
- Considerable time and effort to educate employees;
- Continued use of the model for decision making process;
- More explicit link between risk management and capital modelling;
- Full suite of output and use within business;
- Use of output from the model to create management information to be used within the business;
- Implement capital allocation methodology.

10.1.1.2 Statistical quality test

A number of undertakings indicated that they were planning further work on the data used by the internal model, including:

- Organising data into appropriate groupings;
- Reconciliation and collection of data;
- Recasting all relevant data in Solvency II format;
- Resolve data availability issues for credit risk;
- Testing the statistical acceptability of the risk modelling modules;
- Improve robustness of parameterisation.

10.1.1.3 Calibration test

Some undertakings stated that they were planning to change their time horizon currently used in their internal model towards Solvency II standards. A number of undertakings were also planning on changing the structure of their internal model so that it is more comparable to the standard formula.

10.1.1.4 Profit and loss attribution test

Some undertakings stated that they need to develop improved processes for the attribution of profit and loss.

10.1.1.5 Validation test

A number of undertakings highlighted that they were planning to improve the validation of their model. Areas commented on included:

- Putting in place more robust controls and processes such that the internal model produces auditable results
- Mapping of processes to have clarity on responsibilities, key controls and deadlines
- Further checks on results, including:
 - Analysis of movement in capital over the reporting period
 - Back testing
 - Sensibility checking
 - Sensitivity analysis

10.1.1.6 Documentation test

There were many responses on generally improving the documentation of the internal model. Some specific examples of how the documentation could be improved include the following:

- Making documentation more rigorous;

- Step change in documentation;
- Make documentation more formal;
- Improve audit trail.

10.1.1.7 Other areas for internal model improvement

Apart from the specific improvements geared directly towards meeting the approval tests, the following general improvements were mentioned:

- Technical aspects of the internal model, including projection of the model to calculate the risk margin;
- Reducing the run-time of the internal model;
- Some undertakings said that they aim to reduce complexity of the model, while other undertakings stated that they intend to add additional functionality to the model;
- Enhanced new business model-pointing ability;
- Upgrading modelling of operational risk;
- Improvement of IT infrastructure;
- Asset liability modelling and asset risk modelling.

10.1.2 Qualitative information by solos already using internal models for capital assessment

The structure of the questionnaire and this section is aligned with the Directive Proposal as follows:

- Full and partial internal models (article 110);
- Use test (article 118);
- Statistical quality (article 119);
- Calibration (article 120);
- Profit and loss attribution (article 121);
- Validation (article 122); and
- Documentation (article 123).

10.1.2.1 Full and partial internal models

The internal models are generally fairly similar to the standard formula SCR in terms of structure and the risks covered. There are, however, many deviations from the standard formula in individual internal models. These deviations are mainly linked to undertaking-specific activities, and do not represent any systematic differences in terms of structure. Some examples of differences in structure as compared to the SCR standard formula are:

Grouping of risk categories

- Health underwriting risk is assessed together with life underwriting risk or non-life underwriting risk.
- Concentration risk, spread risk and counterparty default risk are combined and modelled as credit risk.
- The segmentation in lines of business in non-life underwriting risk is different from the standard formula.
- Life risk module mortality risk and life catastrophe risk are combined and sometimes also mortality and longevity risk.
- Expense risk and lapse risk are combined in a sub-module referred to as “business risk”.
- Some undertakings have created a dynamic model which combines all risk factors within simulations, such that the internal model is not broken into modules and sub-modules as is done in the standard formula.

More granular approach

- Large claims are assessed separately in non-life underwriting risk.
- Hedge funds and private equity are modelled separately from other equity exposures.
- Mortgages are assessed separately from other credit exposures.

Treatment of risk mitigating effect of future profit sharing

- The effect of future profit sharing is not calculated explicitly, but is included in the effect of relevant scenarios.

Aggregation of risks

- Risks are aggregated in a one step approach without intermediate aggregation to main risk categories.
- Many assume diversification benefits between operational and other risks.

Concerning the question on whether specific risks are included in their internal model or not one can conclude that all respondents (100%) have included market risk, health underwriting risk and non-life underwriting risk in their internal model, where these risks are relevant. A large majority have also included life underwriting risk (96%), counterparty default risk (94%) and operational risk (91%).

For the different subcategories of market risk in the SCR standard formula, internal models generally include interest rate risk (100%), equity risk (98%), property risk (98%), currency risk (93%), concentration risk (77%), and spread risk (71%).

For health underwriting risk most internal models include long-term health risk (77%), short-term health risk (68%) and workers compensation risk (64%).

For non-life underwriting risk the internal models have generally included premium risk (98%) and non-life catastrophe risk (95%).

For life underwriting risk the majority of internal models include mortality risk (99%), longevity risk (97%), lapse risk (95%), expense risk (93%), life catastrophe risk (88%) and disability risk (75%). A minority of internal models cover revision risk (34%), where this risk is relevant (revision risk is considered relevant for 39% of the respondents).

In some cases when the respondents have stated that a specific risk is not covered by the internal model, the model may implicitly allow for this risk, e.g. within the calibration for other risks.

More than 40% of the respondents have included at least one other risk in addition to the risks listed above in their internal model. Almost 30% have included at least three other risks. Some examples of risks or modules included in internal models but not in the SCR standard formula are:

Market risk

- A specific mortgage asset risk module;
- Implied volatility risk for interest rates and equities;
- Additional risk-factors related to the change in shape of the interest rate term structure;
- Currency translation risk for non-Euro capital (the risk of non-Euro surplus holdings losing value);
- Bond fund risk;
- Parametric catastrophe bonds risk;
- Underperformance of investment manager;
- Inflation risk;

Life underwriting risk

- Guaranteed annuity option risk;
- Change in shape of mortality table;
- Mortality risk is split into a mortality, longevity, contagion up and contagion down risk;
- Mortality and longevity risk is split into trend uncertainty, level uncertainty, volatility and calamity risk;
- Option take up risk;

Non-life underwriting risk

- Underwriting cycle risk;
- Non-life premium risk is split into attritional and large claims risk;
- Non-life risk is split into prior, current non-cat and current cat risk;
- Explicit allowance for premium rate volatility risk;

Other risks

- Transfer risk (the risk that a value cannot be transferred from one country to the other);
- Basis risk in a securitisation operation;
- Mutual's marketplace and potential supplementary call risk;
- Liquidity risk;
- Group stress risk;
- Capital shortfall risk or member insolvency risk;
- New business risk;
- Non-linearity risk;
- Scenario testing, which captures non-linearity risk;
- Legislative risk;
- Governance risk; and
- Pension scheme risk.

The internal models are in general developed through a combination of external software and internal development. The model is fully developed in-house for 25% of the respondents, developed in-house but using a purchased modelling platform for 86% of the respondents, partly developed in-house and partly purchased for 53% and purchased without in-house development for only 2% of

the respondents. Many respondents have answered yes to more than one of the alternatives above, either because they find them to be overlapping or because they describe different parts of their internal model.

The respondents have typically included several purchased models or modelling platforms for particular risks in their overall internal model. A number of products and providers have been mentioned, but some products seem to be particularly widely used in the insurance industry.

10.1.2.2 Use test

The internal models are used in a wide range of areas and decision making processes. A large majority of respondents use their internal model for reinsurance (93%), investment policy (90%), risk limit setting (90%), risk strategy (90%), ALM (90%), asset allocation (90%), capital allocation (87%), strategic business decisions (75%), market consistent technical provisions (71%) and pricing (69%). The majority of respondents also use their internal model for product development (64%), cost of capital risk margin (62%), budgeting (61%), performance analysis (57%), dividend payments (57%) and assessment of uncertainty in technical provisions (56%). A minority of respondents also use their internal model for bonus setting (30%) and management compensation (27%). Some other areas mentioned for which the internal model is used were:

- Realistic Disaster Scenarios / Exposure Management;
- Operational Risk;
- Embedded Value reporting (setting of risk discount rates); and
- Mergers and Acquisitions.

Results from the internal models seem generally to be an important factor when the undertakings set their risk management strategy. No respondents answered that the risk management strategy considers the result from the internal models only to a small degree. The risk management strategy considers the result from the internal models to a large degree for 74% of the respondents and to a medium degree for 26% of the respondents. The share of respondents that considers the result of the internal model to a large degree is higher for life undertakings than for non-life undertakings.

The outputs of the internal model are included in the regular reporting for the board of directors for 94% of the respondents, and in the regular reporting for other senior management for 98% of the respondents.

The internal model is approved by the board of directors for 66% of the respondents, and by other senior management for 96% of the respondents. The model is more frequently approved by the board for life undertakings than for non-life undertakings.

10.1.2.3 Statistical quality

10.1.2.3.1 Internal model output

Most respondents (91%) produce output from their internal model in the form of a probability distribution forecast. There is no significant variation of this proportion by either the type or size of the respondents. Of these respondents, almost all respondents (99%) use the probability distribution forecast to indicate the variation of own funds over a 12 month time horizon. Most of the respondents (89%) use methods to calculate the probability distribution forecast that are consistent with the methods that are used to calculate the Solvency II technical provisions.

10.1.2.3.2 Risk ranking

Most respondents (80%) stated that their internal model has the ability to rank risk, with the remaining respondents stating that their internal model is not yet able to rank risks. Methods to rank risk used by respondents include the amount of risk capital held by risk module, either before or after diversification, as well as considering the absolute and marginal impact on risk capital. Other risk ranking measures include comparing the tails of stand-alone distributions and considering the contribution to risk capital within a scenario stressing a number of different risks simultaneously.

10.1.2.3.3 Data²⁸

Overall, 61% of respondents stated that the data used in their internal models is sufficiently accurate, complete and appropriate, with 39% agreeing to some extent and no respondents disagreeing. However, the extent to which respondents viewed the data as accurate, complete and appropriate varies widely by risk type.

Non-life risk

Overall, 91% of respondents agreed that their data is sufficiently accurate, complete and appropriate for non-life risk, but this varies by sub risk module, with only 72% of respondents stating that their data is sufficiently accurate, complete and appropriate for non-life catastrophe risk. The most common

²⁸ The comments provided by respondents regarding the extent to which their data is sufficiently accurate, complete and appropriate do not take into account Level 2 implementing measures as these have not yet been developed. The views are those of the respondents only and no supervisor opinions have been included in this analysis.

frequency (67%) at which non-life data is collected is annual. Almost all (97%) non-life data is entity specific data.

Market risk

For market risk 88% of respondents believed that their data is sufficiently accurate, complete and appropriate, however this does vary by risk sub-module. The proportion of respondents that believed their data is sufficiently accurate, complete and appropriate for each sub-module are 94% for property risk, 92% for interest rate risk, 92% for equity risk, 89% for currency exchange risk, 85% for spread risk and 79% for concentration risk. The majority of market data used by internal models is collected either daily (36%), weekly (26%) or monthly (26%). Most of the market data (90%) used by internal models is publicly available.

Health risk

80% of respondents believed that their data used in internal models for health risk is sufficiently accurate, complete and appropriate. This figure varies by risk sub-module: 91% for workers compensation risk, 89% for short-term risk and 73% for long-term risk.

Counterparty default risk

86% of respondents believed that the default risk data used in their internal model is sufficiently accurate, complete and appropriate. The default risk data used by the respondents is collected either quarterly or annually and the data is either publicly available or entity specific.

Life risk

86% of respondents believed that their data used for life risk within their internal model is sufficiently accurate, complete and appropriate; however this varies widely between risk sub-modules. Most respondents believed their data is sufficiently accurate, complete and appropriate for mortality risk (96%), expense risk (93%), longevity risk (92%), revision risk (88%), lapse risk (77%) and disability risk (75%). However, only 44% of respondents believe that their data is sufficiently accurate, complete and appropriate for life catastrophe risk. Most of the data is collected either quarterly (40%) or annually (50%). The majority of the data (87%) is entity specific.

Operational risk

64% of respondents believed that the data used in their internal model for operational risk is sufficiently accurate, complete and appropriate. The majority (95%) of operational risk data used is collected annually. All respondents use entity specific operational risk data.

10.1.2.3.4 Dependencies

All internal models allow for dependencies within risk categories and almost all internal models (99%) allow for dependencies across risk categories. Almost half (49%) of respondents use expert opinion to determine the dependency measure whereas almost a quarter (23%) of respondents use historic data. The remainder of the respondents defined other methods to derive dependencies, the main one being a combination of expert opinion and historic data. Some respondents also stated that they make use of external benchmarks provided by consultants when either setting or checking their dependency assumptions. Some respondents stated that the dependencies for market risk were more likely to be based on historic data, whereas underwriting dependencies were more likely to be based on expert judgment.

10.1.2.3.5 Risk mitigation

Most respondents (90%) take risk mitigation techniques into account in their internal models. The type of risk mitigation technique taken into account varies by the type of risk they are mitigating:

- For non-life risks, the three most common risk mitigation techniques used are traditional reinsurance alternative risk transfer and securitisation techniques.
- For market risks, the three most common risk mitigation techniques taken into account are asset and liability hedging strategies, loss absorbing technical provisions and loss absorbing other liabilities.
- For health risks, the three most common risk mitigation techniques taken into account are loss absorbing technical provisions, traditional reinsurance and loss absorbing other liabilities.
- For life risks, the three most common risk mitigation techniques taken into account are traditional reinsurance, loss absorbing technical provisions and loss absorbing other liabilities.
- For operational risks, the three most common risk mitigation techniques taken into account are tax issues, traditional reinsurance and alternative risk transfer techniques.

10.1.2.3.6 Management actions

Most respondents (84%) stated that they take account of management actions within their internal models with a further 7% of respondents stating that they take partial account of management actions. For the respondents who stated that they did allow for management actions, the following management actions are modelled:

- Changes in future bonus rates (98%);
- Changes in asset dispositions (75%);
- Changes in expense charges (70%);
- Changes in or use of dynamic option and guarantee charges (70%);
- Changes in risk premium charges (55%);
- Reductions in surrender values (46%); and
- Restrictions in the ability to surrender (26%).

Other management actions allowed for within internal models by respondents include:

- Dynamic hedge program;
- Asset hypothecation - in the event of severe losses the first assets sold will be foreign denominated assets (thus mitigating currency risk)
- Premium increases following a period of severe claims inflation - with a lag (more delayed for liability than motor);
- Changes in staff pension scheme benefits;
- Removal of past miscellaneous surplus;
- Suspension of dividends and sub-debt payments,
- Drawdown of bank facility to use as capital; and
- Allowing for options on callable assets.

10.1.2.4 Calibration

Generally undertakings use only Value at Risk (VaR) as risk measure (90% of the respondents). Some undertakings (10% of the respondents) use a mixed combination of risk measures, which means that in addition to the VaR risk measure they have also adopted a Tail Value at Risk (TVaR) risk measure. Applying only TVaR was not reported by any respondents. All segments (life, non-life, composite) show strong favour for the use of VaR as risk measure.

The use of a so-called modified VaR measure was also reported. The modified VaR consisted of calculating a one-year VaR in each year for a period of 12 years. The worst VaR (based on discounted values) was then taken forward to calculate the capital requirement.

The choice of time horizon shows a strong preference for the one-year (97% of the respondents) time horizon. The choice of the confidence level shows that all undertakings except for one have calibrated their capital need to at least a 99.5% or higher VaR. Undertakings that have rating as target confidence level

mostly calibrate their internal model to a AA rating (91% of the respondents). Other respondents have chosen an A rating.

Hence almost all respondents use a one-year VaR with a confidence level of 99.5% or higher, which is in line with the level of protection set in the Directive Proposal.

Slightly over 50% of the respondents use different risk measures for different risk drivers. It seems that life undertakings tend to apply different risk measure to different risk drivers more often than non-life and that composites are more reluctant to apply different risk measures for different risk drivers.

Other time horizons that were reported by some respondents include quarterly, two-year and the remaining term of the contract. The quarterly time horizon is mostly used for market risks, whereas the remaining term of contract time horizon is used mainly for life and health underwriting risk. For dynamic hedge programs the undertakings often take the hedge effectiveness into account. This commonly implies that a shorter time horizon is taken into account depending on the hedging frequency. The two year time horizon is used by a respondent for the market risk associated with their mortgage business.

Some respondents use the TVaR measure. The risks where TVaR is typically used are extremely fat-tailed risks, which include for instance the mortality catastrophe sub-risk category within the life underwriting risk module, as well as in the health and non-life underwriting risk module. Where the TVaR measure is used, some respondents use the 99% level over a one-year period.

Some respondents stated that they use scenario based analyses or factor-based approaches for operational risk and some respondents stated that they use scenario based approaches for life and health risks.

Some undertakings use in certain risk categories a level of confidence that is slightly lower than the 99.5% VaR and then, prior to aggregation, a scaling to the level of 99.5% is performed. However, these undertakings commonly reported that they are planning a change for the selected risk categories to achieve a uniform level of confidence.

The reason why some undertakings may prefer to assess the VaR with a lower confidence level and then scale it up by using for instance a parametric assumption is that their selected methodology include a stochastic calculation where the capital charge for a given risk module or sub-module cannot be precisely estimated at the 99.5% confidence level. The approach does not involve aggregation of risks measured in different ways, since the rescaling is performed on the combined results of stochastic scenarios with implicitly modelled dependencies. Very often there is also the uncertainty in the liabilities included. This is especially used by life insurer and is by principle a “multi-year” approach. The calculations are however done in such a way that they are in line

with a one-year risk horizon. Market risks are then often calculated on a 3-month VaR and doubled to get to a one-year VaR.

Quite often market and credit risks are calculated at a 99% confidence level and then scaled up to 99.5%. However a change to a direct calculation of a 99.5% confidence level is in preparation by many undertakings.

All respondents reported that a recalibration can be done in line with the SCR standards to a calibration of 99.5% VaR over a one-year horizon. Most respondents would perform the recalibration directly from the probability distribution forecast. Some respondents perform the rescaling by a distributional assumption, which is quite often different than the normal distribution assumption.

10.1.2.5 Profit and loss attribution

Just over half of the respondents (54%) stated that they have a process in place that demonstrates how the categorisation of risk chosen in the internal model explains the causes and the sources of profit and losses. There are more life undertakings than non-life undertakings that have stated that they have this process in place. There is also a bigger proportion of medium sized undertakings compared to large undertakings that have stated that they have this process in place.

10.1.2.6 Validation

Almost all of the respondents (99%) have a validation process in place for their internal model. The unit, which is responsible for the validation task, is quite often also responsible for the design (71%), implementation (74%), documentation (76%) and the use (74%) of the internal model.

However, the people responsible for the validation task are commonly independent from the persons who take operational decisions (98%) and independent from the area/departments where risk activities are exercised (80%). It is furthermore rather usual that the validation task is done independently from the design (63%), implementation (63%), testing (62%), documentation (62%) and the use (62%) of the internal model.

The majority of the respondents (75%) have a process in place to monitor the appropriateness of the calibration of their internal model. Concerning the appropriateness of the probability distribution forecasts and their underlying assumptions and to what extent undertakings compare probability distribution forecasts and their underlying assumptions with actually observed and available statistical data 47% of the respondents indicated that they compare forecasts and all underlying assumptions to the extent possible, 47% compare forecasts and only key underlying assumptions and 6% of the respondents do not compare

at all. 68% of the respondents use additional stability analysis regarding changes in key underlying assumptions and/or the impact on the shape of the probability distribution tails, including sensitivity of the results.

Half (50%) of the respondents have a process in place to monitor the rank-ordering ability of their internal model and almost all respondents (99%) are validating how accurate, complete and appropriate the data used by their internal model is.

Nearly all respondents (96%) have a process in place to review what the outputs of their internal model would be under circumstances that are different (e.g. stressed) from those prevailing on the valuation date. However, only half (51%) of the respondents have a process in place to review how volatile the outputs of their internal model are across economic cycles.

10.1.2.7 Documentation

Concerning to what extent the documentation of the internal model gives a detailed outline of the theory, assumptions, and the mathematical and empirical basis underlying the internal model 72% of the respondents indicated that they have a rather complete documentation that constitutes 80-100% of a full documentation. The rest of the respondents typically have 40-60% of the documentation ready.

A rather similar distribution can be observed on the documentation of the design and the operational details of the internal model. 69% of the respondents have 80-100% of the design and the operational details of the internal model documented and 28% of the respondents have 40-60% documented.

However, concerning to what extent the documentation demonstrates the compliance of the internal model with the articles 117 to 121 that is the use test, statistical quality standards, calibration standards, profit and loss attribution and validation standards in the Directive Proposal only 57% of the respondents have a view that their documentation is in an 80-100% compliancy. 28% of the respondents have a 40-60% and 14% have a 20-40% view of the level of compliancy with the Directive Proposal.

Only 38% of the respondents have a documentation that indicates circumstances under which the internal model does not work effectively. The circumstances, where the internal model does not work effectively include for instance:

- Gaps in the systems and controls surrounding the internal model process;
- Improper analysis of movements from previous years' results;
- Assumptions that could be considered conservative and liberal;
- Limited accuracy in the percentiles where the risk is measured due to low number of historical years that the parameter estimation is based on;

- Models that do not describe the risk to be modelled sufficiently enough and effects due to this.

81% of the respondents also document subsequent changes to their internal model and 66% of the respondents have responsibilities and accountabilities documented for each position related to the internal modelling system in place.

Most undertakings do not disclose any information publicly. However, a few of the large undertakings do make some public disclosure, which varies from high level statements to more granular disclosure of risk capital. Furthermore, undertakings that are part of a larger group the public disclosure is done at the group level.

However, quite often the public disclosure for solo undertakings constitutes just a quick overview of the internal model.

10.1.3 General comparison of solo results with the standard formula

In order to be able to perform a comparable benchmark study of internal model results relative to the SCR standard formula the information request followed the same modular approach as the SCR standard formula with additional risk types and classes allowed for separately. It was also requested that the internal model results should be aligned with (recalibrated to) the Solvency II standards, that is a total balance sheet approach (including stress on excess assets), tax-treatment, one-year 99.5 percent VaR-measure etc.

Participants were encouraged to fill in as much internal model information as possible. It was recognised that because internal models can be very different from each other and relative to the SCR standard formula the QIS4 quantitative information request on internal models may not be easily applied by all participants having internal models for assessing their capital needs. The structure was however a necessary requirement in order to be able to benchmark internal model results with QIS4 standard SCR formula.

It was also recognised that in some circumstances certain information will not be available and that in some circumstances not even pragmatic approaches might be possible to perform. Hence participants were asked to use best efforts to complete the fields. Pragmatic and high-level approximations were fully acceptable to the extent they did not significantly distort the reliability and the comparability of the results with QIS4 standard SCR formula.

In the analysis of the internal model results below, the ratio of the risk capital charge calculated by the internal model to the risk capital derived from the standard formula has been considered. It should be noted that the samples for the capital charges exclusive and inclusive the adjustment for loss absorbing

capacity of technical provisions are not necessarily the same and hence any considerations of the effect of the inclusion or exclusion of the adjustment per sub-module in the internal model and in the standard formula should be treated with care. If the ratio is more than 100%, the internal model approach could possibly indicate higher capital than the standard formula. The opposite is true for a ratio less than 100%.

Since undertakings were requested to benchmarking their internal model with respect to the modular structure in the SCR standard formula and because this modular structure was not easily applied by all undertakings on their internal model structure, it should be also be noted that some undertakings made for some sub-modules the conclusions that their internal model approximately produces the same result as the standard formula. This can be observed as a reported ratio equal to 100%.

However, due to the short time given to undertakings to provide the internal model figures in QIS4, it must be noted that some of them were not able to recalibrate or change their internal model in order to ensure an adequate benchmarking against the standard formula.

Some general remarks can be made regarding the figures provided by undertakings and the possible lack of consistency between internal models at this stage and the standard formula:

- In the standard formula, the different risk factors are grouped in modules or sub-modules. There is no certainty that for a certain module or sub-module, the risk factors considered in the internal models are exactly the same compared to the standard formula.
- The standard formula takes into account dependencies between the different risk factors, but some undertakings might not have had the ability to change the dependency structures. Participants model dependencies in different ways (e.g. with copulas, through an integrated simulation or with other correlation matrices) and it is therefore difficult to compare them to the correlation matrix used in the standard formula.
- Some undertakings assess in their internal model the loss-absorbing capacities of deferred taxes or future discretionary benefits in a one-step approach. Conversely the standard formula requires calculations of the SCR both before and after the adjustments for these effects.
- Due to the structure of their internal model, some undertakings may have faced difficulties to provide capital charges for a certain module before diversification: this is often the case where integrated simulations are used.
- Internal models may take into account risks that are not tackled by the standard formula.

The following sections are comparisons between internal models and the standard formula regarding capital charges for stand-alone risk modules as well as for parameters used in the model (in particular dependencies).

However, it should be highlighted that great care should be exercised in a possible comparison between the calibration of internal models and the standard formula.

- Where one risk is covered in a certain module of the internal model, but in another module of the standard formula, there is a bias in the ratios of these two different modules.
- Given the dependency structures, higher capital charges for stand-alone modules in the internal model might not lead to a higher overall SCR.
- Where integrated simulations were used, some undertakings might have provided post-diversification capital charges (e.g. integrated simulation of all market risks). When these figures are compared with pre-diversification capital charges in the standard formula, this introduces a bias in the ratios.

Moreover, it is important to notice that in many Member States, internal models do not have any form of a statutory status. In these countries, it was very difficult to assess the reliability of the figures.

10.1.3.1 Solvency capital requirement (SCR)

The median of the SCR ratios across all undertakings is 81%, with an interquartile range of 60% to 119%. Overall, for 13 of the 16 countries that provided internal model results, the median of the ratio was below 100%, with the other three countries displaying a median of the ratio above 100%.

Table 32: Ratio of the internal model capital to the standard formula capital for SCR across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
After inclusion of loss absorbing TP	59.6%	80.8%	119.5%	(141)

Experience from the development of CRD at a similar stage suggests that the results from internal models may increase with the implementation of Solvency II.

Further insights into the variation between different types of undertakings and where there is scope for convergence of internal model and standard formula results can be drawn from an analysis of the results provided at risk module and sub-module level.

However, the overall SCR is the most comparable figure of the analysis, because it is supposed in both cases to include all risk factors and adjustments.

10.1.3.2 Operational risk

The operational risk capital charge from the internal model tends to be higher than the standard formula with a median ratio of 133% and an interquartile range of 100% to 233%. 13 of the 16 countries that provided details stated that the median of the ratios was at least 100%.

It was also noted that in contrary to the SCR standard formula many respondents allow for diversification benefit between operational risks and other risks within their internal model, which may offset some of the higher modelled operational risk capital.

Table 33: Ratio of the internal model capital to the standard formula capital for operational risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	100.0%	133.4%	232.6%	(136)

10.1.3.3 Basic SCR

The overall Basic SCR risk capital charges from the internal model compared to the SCR standard formula tends to be lower. The Basic SCR risk capital charge has a median ratio of 78% and an interquartile range of 58% to 114%. 10 of the 12 countries that provided details stated that the median of the ratio was below 100%.

Table 34: Ratio of the internal model capital to the standard formula capital for BSCR across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	58.1%	78.4%	114.5%	(107)
After inclusion of loss absorbing TP	60.7%	78.8%	111.6%	(112)

In general, the distribution of the ratios for the Basic SCR risk capital charge does not significantly change after an inclusion of the adjustment for loss absorbing capacity of technical provision.

Compared to the total risk capital charge from the SCR standard formula it seems in general that the lower Basic SCR risk capital charge from the internal model is to some extent off-set in the internal model by a higher risk capital charge for operational risk.

10.1.3.4 Adjustment for loss absorbing capacity of technical provision and deferred taxes

The median of the ratio for the adjustment to profit sharing and deferred taxes in the internal model is 86% and hence there are more respondents where the standard formula produces a higher adjustment, that is, a larger reduction in capital charge than the internal model one. One possible reason for this is that in some cases these adjustments are not modelled in the internal model, despite being considered in the standard formula calculations. The interquartile range for the ratio is 59% to 100%. 8 of the 12 countries that provided details stated that the median of the ratio was below 100%.

Table 35: Ratio of the internal model capital to the standard formula capital for the adjustment for loss absorbing capacity of technical provisions and deferred taxes across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Total adjustments	59.0%	85.7%	100.0%	(49)

10.1.3.5 Market risk

The market risk capital charge from the internal model tends to be lower than the standard formula with an overall median for the ratio equal to 82%, with an interquartile range of 64% to 114%. 10 of the 11 countries that provided details stated that the median of the ratio was below 100%.

It should be noted that for some undertakings, some risks considered in the standard formula market risk module are excluded in the internal model market risk module and incorporated in the counterparty risk module (e.g. spread risks, concentration risks).

Table 36: Ratio of the internal model capital to the standard formula capital for market risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	64.3%	82.2%	114.3%	(101)
After inclusion of loss absorbing TP	64.3%	88.6%	119.0%	(113)

The inclusion of the adjustment for loss absorbing capacity of technical provisions changes the distribution of the ratios for market risk only slightly.

The market risk ratio varies for the different sub-modules of market risk. The largest deviations in the median can be observed for interest rate, property and currency risk.

It should be noted that the overall median ratio for market risk is smaller than any single sub-risk median ratio. The reason for this is most likely different aggregation approach within the internal model and the standard formula.

10.1.3.5.1 Interest rate risk

The interest rate capital charge from the internal model tend to be lower than the standard formula with an overall median for the ratio equal to 83%, with an interquartile range of 45% to 115%. 9 of the 14 countries that provided details stated that the median of the ratio was below 100%.

Table 37: Ratio of the internal model capital to the standard formula capital for interest rate risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	44.6%	83.2%	115.0%	(102)
After inclusion of loss absorbing TP	60.6%	92.5%	123.1%	(113)

The inclusion of the adjustment for loss absorbing capacity of technical provisions shifts the distribution of the ratios upwards.

10.1.3.5.2 Equity risk

The equity risk capital charge from the internal model tend to be higher than the standard formula with an overall median for the ratio equal to 108%, with an interquartile range of 84% to 132%. 5 of the 14 countries that provided details stated that the median of the ratio was below 100%.

Table 38: Ratio of the internal model capital to the standard formula capital for equity risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	83.8%	108.1%	131.9%	(99)
After inclusion of loss absorbing TP	86.8%	107.6%	136.2%	(99)

The inclusion of the adjustment for loss absorbing capacity of technical provisions does not significantly change the distribution of the ratios for equity risk.

All countries that provided the information stated that the average global equity stress test within the internal models was at least 39%. Some respondents pointed out that for life undertakings, higher internal model SCRs than the standard formula SCRs results mainly from the choice of higher parameters for equity shocks.

10.1.3.5.3 Property risk

The property risk capital charge from the internal model tend to be higher than the standard formula with an overall median for the ratio equal to 113%, with an interquartile range of 74% to 121%. 4 of the 13 countries that provided details stated that the median of the ratio was below 100%.

Table 39: Ratio of the internal model capital to the standard formula capital for property risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	73.5%	113.3%	120.6%	(65)
After inclusion of loss absorbing TP	65.7%	106.9%	121.8%	(72)

The inclusion of the adjustment for loss absorbing capacity of technical provisions seems to create slightly more dispersed ratios for property risk.

10.1.3.5.4 Spread risk

In general, the spread risk capital charge from the internal model tends to be for many undertakings almost in line with the standard formula with an overall median for the ratio equal to 98%, with an interquartile range of 47% to 221%. However, the dispersion of the ratios is rather significant. 8 of the 13 countries that provided details stated that the median of the ratio was below 100%.

Table 40: Ratio of the internal model capital to the standard formula capital for spread risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	47.0%	98.4%	220.6%	(79)
After inclusion of loss absorbing TP	55.3%	105.4%	222.9%	(78)

The inclusion of the adjustment for loss absorbing capacity of technical provisions tends to slightly shift the distribution of the ratios for spread risk upwards.

10.1.3.5.5 Concentration risk

Based on a sample size of 7 the concentration risk capital charge from the internal model tends to be for many undertakings almost in line with the standard formula with an overall median for the ratio equal to 100%, with an interquartile range of 69% to 163%. 2 of the 4 countries that provided details stated that the median of the ratio was below 100%.

Based on a sample size of 10 the inclusion of the adjustment for loss absorbing capacity of technical provisions increased the median of the ratios to 111%, with an interquartile range of 90% to 173%.

10.1.3.5.6 Currency risk

The currency risk capital charge from the internal model tends to be lower than the standard formula with an overall median for the ratio equal to 90%, with an interquartile range of 65% to 116%. 7 of the 11 countries that provided details stated that the median of the ratio was below 100%.

Table 41: Ratio of the internal model capital to the standard formula capital for currency risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	65.4%	89.9%	116.3%	(40)
After inclusion of loss absorbing TP	73.1%	100.0%	141.8%	(47)

The inclusion of the adjustment for loss absorbing capacity of technical provisions seems to increase the ratios for currency risk.

10.1.3.6 Counterparty default risk

In general, the counterparty default risk capital charge from the internal model tends to be for many undertakings almost in line with the standard formula with an overall median for the ratio equal to 100% and with an interquartile range of 33% to 246%. However, as for the spread risk the dispersion is rather significant. 8 of the 14 countries that provided details stated that the median of the ratio was below 100%.

It should be noted that for some undertakings, some risks considered in the standard formula market risk module are excluded in the internal model market risk module and incorporated in the counterparty risk module (e.g. spread risks, concentration risks).

Table 42: Ratio of the internal model capital to the standard formula capital for counterparty default risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	33.4%	100.0%	246.3%	(81)
After inclusion of loss absorbing TP	66.5%	100.0%	872.2%	(89)

The inclusion of the adjustment for loss absorbing capacity of technical provisions seems to create for the upper quartile even more dispersed ratios for the counterparty default risk.

10.1.3.7 Life underwriting risk

For overall life underwriting risk, the internal model tends to give a lower risk capital charge than the standard formula. The median of the ratio is 70%, with an interquartile range of 50% to 92%. 7 of the 9 countries that provided details stated that the median of the ratio was below 100%.

It should be noted that for some undertakings, some risks considered in the standard formula health underwriting module are incorporated in the life underwriting module of the internal model (e.g. long-term business, workers compensation disability risks).

Table 43: Ratio of the internal model capital to the standard formula capital for life underwriting risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	49.6%	70.4%	92.4%	(59)
After inclusion of loss absorbing TP	51.7%	71.6%	93.9%	(70)

The inclusion of the adjustment for loss absorbing capacity of technical provision does not significantly change the ratios for life underwriting risk.

The life underwriting risk ratio varies for the different sub-modules of underwriting risk. The largest deviations in the median can be observed for mortality, longevity and lapse risk.

As for market risk, it should be noted that for life underwriting the overall median ratio is, except for the lapse risk, smaller than its single sub-risk median ratios. The reason for this is most likely different aggregation approaches within the internal model and the standard formula.

10.1.3.7.1 Mortality risk

The mortality risk capital charge from the internal model tend to be for many undertakings higher than the standard formula with an overall median for the ratio equal to 140% and with an interquartile range of 53% to 206%. 3 of the 12 countries that provided details stated that the median of the ratio was below 100%.

Table 44: Ratio of the internal model capital to the standard formula capital for mortality risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	52.8%	139.7%	206.2%	(57)
After inclusion of loss absorbing TP	53.1%	130.4%	206.2%	(64)

The inclusion of the adjustment for loss absorbing capacity of technical provision seems to shift the ratios for mortality risk downwards in the middle section.

10.1.3.7.2 Longevity risk

The longevity risk capital charge from the internal model tend to be for many undertakings lower than the standard formula with an overall median for the ratio equal to 81% and with an interquartile range of 78% to 100%. 8 of the 10 countries that provided details stated that the median of the ratio was below 100%.

Table 45: Ratio of the internal model capital to the standard formula capital for longevity risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	77.6%	81.2%	100.0%	(34)
After inclusion of loss absorbing TP	80.0%	90.7%	114.0%	(38)

The inclusion of the adjustment for loss absorbing capacity of technical provision seems to shift the ratios for longevity risk slightly upwards.

10.1.3.7.3 Disability risk

The disability risk capital charge from the internal model tend to be for many undertakings in line with the standard formula with an overall median for the ratio equal to 100% and with an interquartile range of 54% to 117%. 4 of the 8

countries that provided details stated that the median of the ratio was below 100%.

Table 46: Ratio of the internal model capital to the standard formula capital for disability risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	54.0%	100.0%	117.3%	(20)
After inclusion of loss absorbing TP	54.9%	100.0%	109.5%	(26)

The inclusion of the adjustment for loss absorbing capacity of technical provision seems to shift the ratios for disability risk downwards in the upper quartile.

It should be noted that some undertakings, place disability risk within their internal model under morbidity risk.

10.1.3.7.4 Lapse risk

The lapse risk capital charge from the internal model tends to be for many undertakings lower than the standard formula with an overall median for the ratio equal to 67% and with an interquartile range of 42% to 97%. 11 of the 13 countries that provided details stated that the median of the ratio was below 100%.

Table 47: Ratio of the internal model capital to the standard formula capital for lapse risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	42.5%	67.1%	96.8%	(61)
After inclusion of loss absorbing TP	40.0%	67.1%	96.8%	(71)

The inclusion of the adjustment for loss absorbing capacity of technical provision does not seem to have a significant effect on the ratios for lapse risk.

It should be noted that some undertakings, combine within their internal model expense and lapse risk and treat it within a business risk module, which is calculated separately for life, morbidity and non-life risk.

10.1.3.7.5 Expense risk

The expense risk capital charge from the internal model tends to be for many undertakings in line with the standard formula with an overall median for the ratio equal to 100% and with an interquartile range of 85% to 166%. 5 of the 11

countries that provided details stated that the median of the ratio was below 100%.

Table 48: Ratio of the internal model capital to the standard formula capital for expense risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	84.9%	100.0%	166.3%	(60)
After inclusion of loss absorbing TP	77.4%	100.0%	164.8%	(68)

The inclusion of the adjustment for loss absorbing capacity of technical provision does not seem to have a significant effect on the ratios for expense risk.

It should be noted that some undertakings, combine within their internal model expense and lapse risk and treat it within a business risk module, which is calculated separately for life, morbidity and non-life risk.

10.1.3.7.6 Revision risk

No information was provided on the internal model results for revision risk.

10.1.3.7.7 Life catastrophe risk

The life catastrophe risk capital charge from the internal model tend to be for many undertakings in line with the standard formula with an overall median for the ratio equal to 100% and with an interquartile range of 68% to 100%. 6 of the 10 countries that provided details stated that the median of the ratio was below 100%.

Table 49: Ratio of the internal model capital to the standard formula capital for life catastrophe risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	67.8%	100.0%	100.0%	(33)
After inclusion of loss absorbing TP	85.5%	100.0%	109.7%	(45)

The inclusion of the adjustment for loss absorbing capacity of technical provision seems to shift the quartiles upwards.

10.1.3.8 Health underwriting risk

The health underwriting risk capital charge from the internal model tend to be for many undertakings lower than the standard formula with an overall median for the ratio equal to 32% and with an interquartile range of 18% to 51%. All 6 countries that provided details stated that the median of the ratio was below 100%.

It should be noted that for some undertakings, some risks considered in the standard formula health underwriting module are incorporated in the life or non-life underwriting modules of the internal model (e.g. long-term business, disability risks in the life module, short-term business in the non-life module).

Table 50: Ratio of the internal model capital to the standard formula capital for health underwriting risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	18.2%	32.0%	51.1%	(14)
After inclusion of loss absorbing TP	20.5%	35.4%	65.8%	(14)

The inclusion of the adjustment for loss absorbing capacity of technical provision has only a minor impact on the ratios for health underwriting risk.

10.1.3.8.1 Health long-term risk

For health long-term risk there was not enough data provided (only three undertakings submitted some data) to draw firm conclusions. However, the following indications inclusive the adjustment for loss absorbing capacity of technical provisions can be given across all respondents:

- The health long-term risk capital charges from the internal model were all less than 70% of the standard formula
- The expense risk capital charges from the internal model were all less than 5% of the standard formula
- The claims risk capital charges from the internal model were mixed relative to the standard formula
- The accumulation risk capital charges from the internal model were all less than 45% of the standard formula

10.1.3.8.2 Health short-term risk

The health short-term risk capital charge from the internal model tend to be for many undertakings lower than the standard formula with an overall median for

the ratio equal to 54% and with an interquartile range of 34% to 91%. All four countries that provided details stated that the median of the ratio was below 100%.

Table 51: Ratio of the internal model capital to the standard formula capital for health short-term risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	34.0%	54.2%	90.7%	(15)

No information was provided on the internal model results for the sub-modules of health short-term risk.

10.1.3.8.3 Health workers' compensation risk

No information was provided on the internal model results for health workers' compensation risk or its sub-modules.

10.1.3.9 Non-life underwriting risk

The non-life underwriting risk capital charge from the internal model tends to be for many undertakings lower than the standard formula with an overall median for the ratio equal to 81% and with an interquartile range of 63% to 102%. 7 of the 9 countries that provided details stated that the median of the ratio was below 100%.

It should be noted that for some undertakings, some risks considered in the standard formula health underwriting module are incorporated in the non-life underwriting module of the internal model (e.g. short-term business).

Table 52: Ratio of the internal model capital to the standard formula capital for non-life underwriting risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	63.0%	81.0%	101.6%	(44)

10.1.3.9.1 Premium/reserve risk

The premium/reserve risk capital charge from the internal model tends to be for many undertakings lower than the standard formula with an overall median for the ratio equal to 76% and with an interquartile range of 54% to 99%. 10 of the 11 countries that provided details stated that the median of the ratio was below 100%.

Table 53: Ratio of the internal model capital to the standard formula capital for premium/reserve risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	53.5%	75.7%	99.4%	(52)

10.1.3.9.2 Non-life catastrophe risk

The catastrophe risk capital charge from the internal model tend to be for many undertakings in line with the standard formula with an overall median for the ratio equal to 100% and with an interquartile range of 66% to 100%. 5 of the 9 countries that provided details stated that the median of the ratio was below 100%.

Table 54: Ratio of the internal model capital to the standard formula capital for catastrophe risk across all respondents

All segments	25% quartile	Median	75% quartile	Sample size
Before inclusion of loss absorbing TP	66.2%	100.0%	100.0%	(36)

It should be noted that there were many undertakings that used their internal model to calculate the non-life catastrophe risk capital for their standard formula, as allowed under method 3 described in section TS.XIII.C.2 of the QIS4 Technical Specifications.

10.1.4 General comparison of solo parameters with the standard formula

This section on parameters used in internal models is a combination of the qualitative and quantitative data provided by respondents. Where enough data exists, some statistics of these responses has been compared against the corresponding parameter within the standard formula. The analysis below considers the parameters by risk and sub-risk module, followed by an analysis of correlation parameters used in the internal models.

It should be noted that undertakings were asked to use best efforts to complete the fields on internal model parameters. Pragmatic and high-level approximations were fully acceptable to the extent they did not significantly distort the reliability and the comparability with the QIS4 standard SCR formula.

Since undertakings were requested to benchmarking their internal model with respect to the parameterisation of the SCR standard formula and because this was not easily performed by all undertakings on their internal model structure, it

should be also be noted that some undertakings made the assumption for some parameters that their internal model approximately equals the standard formula. This can be observed as reported parameters equal to the standard formula.

However, It should be highlighted that great care needs to be taken when drawing conclusions resulting from the comparison between the internal models results and the internal model parameters as the sample size for the parameters is much smaller and some undertakings found it difficult to adequately benchmark their internal model parameters against the standard formula.

10.1.4.1 Market risk

10.1.4.1.1 Equity risk

13 countries provided data on the global equity stress parameter and 12 countries show a median stress that is higher than the standard formula (32%). Based on a sample size of 33 the overall median stress equals 40%, with an interquartile range equal to the median.

Concerning the equity other stress parameter responses was provided by 9 countries and 8 countries show a median stress that is lower than the standard formula (45%). Based on a sample size of 23 the overall median stress equals 40%, with an interquartile range equal to the median.

One possible reason for having rather similar results for the global equity and the equity other stress is that within internal models these risks could possible be modelled together.

10.1.4.1.2 Interest rate risk

14 countries provided some data on the interest rate stress parameters. It should be noted that the sample sizes for different maturities is heterogeneous. However, relative to the sample sizes the maturities can be grouped into one rather homogenous group (maturities 1 to 12) and another group (maturities 13 to 20+). Due to the fact that the sample sizes are different in the latter group for maturities 15 and 20+ and because these maturities tend show deviant results compared to other maturities in the group, these should be given special attention.

Table 55: Interest rate upward stress parameters from internal models across all respondents

Upward stress for year	Standard formula	25% quartile	Median	75% quartile	Sample size
1	0.94	0.33	0.46	0.92	(64)
2	0.77	0.36	0.65	0.80	(64)
3	0.69	0.35	0.66	0.68	(64)
4	0.62	0.33	0.63	0.63	(64)
5	0.56	0.31	0.57	0.58	(64)
6	0.52	0.29	0.54	0.55	(61)
7	0.49	0.27	0.50	0.53	(61)
8	0.46	0.25	0.48	0.52	(61)
9	0.44	0.23	0.46	0.50	(61)
10	0.42	0.21	0.44	0.48	(64)
11	0.42	0.19	0.43	0.46	(61)
12	0.42	0.17	0.42	0.45	(61)
13	0.42	0.41	0.42	0.43	(42)
14	0.42	0.41	0.41	0.42	(42)
15	0.42	0.13	0.40	0.40	(64)
16	0.41	0.39	0.39	0.39	(42)
17	0.40	0.38	0.39	0.39	(42)
18	0.39	0.37	0.38	0.38	(42)
19	0.38	0.36	0.38	0.38	(45)
20+	0.37	0.09	0.35	0.37	(64)

Concerning the interest rate upward stress parameters and the maturities from 1 to 12 the parameters from the internal model tend to be for many undertakings lower than the standard formula. Analysing the maturities from 13 to 20+ one can conclude that for all other maturities than 15 and 20+ the dispersion of the responses is significantly less and the reported parameters seem to rather similar to the standard formula. Furthermore, since the sample sizes for maturities 15 and 20+ are quite equal to the lower maturities, their levels tend to fit into the descending structure for the lower maturities and since the overall 75% quartile is quite in line with the standard formula one could conclude further that the missing samples in the upper maturities would most likely be quite smaller than the standard formula. Hence one could conclude that across different maturities it is likely that the interest rate upward stress parameters in the standard formula is for many undertakings higher than what is used in their internal models, but for many undertakings the standard formula is also quite in line with the internal models.

Similar conclusions can be drawn for interest rate downward stress parameters from internal models.

Table 56: Interest rate downward stress parameters from internal models across all respondents

Downward Stress for year	Standard formula	25% quartile	Median	75% quartile	Sample size
1	-0.51	-0.49	-0.36	-0.34	(64)
2	-0.47	-0.44	-0.43	-0.30	(64)
3	-0.44	-0.42	-0.40	-0.27	(64)
4	-0.42	-0.40	-0.38	-0.24	(64)
5	-0.40	-0.39	-0.36	-0.22	(64)
6	-0.38	-0.37	-0.35	-0.20	(61)
7	-0.37	-0.36	-0.34	-0.19	(61)
8	-0.35	-0.35	-0.34	-0.18	(61)
9	-0.34	-0.34	-0.33	-0.17	(61)
10	-0.34	-0.33	-0.32	-0.16	(64)
11	-0.34	-0.33	-0.31	-0.16	(61)
12	-0.34	-0.33	-0.31	-0.15	(61)
13	-0.34	-0.33	-0.33	-0.30	(42)
14	-0.34	-0.32	-0.32	-0.30	(42)
15	-0.34	-0.32	-0.29	-0.14	(64)
16	-0.33	-0.32	-0.32	-0.28	(42)
17	-0.33	-0.31	-0.31	-0.28	(44)
18	-0.32	-0.31	-0.30	-0.27	(42)
19	-0.31	-0.30	-0.30	-0.27	(46)
20+	-0.31	-0.30	-0.26	-0.12	(63)

10.1.4.1.3 Property risk

12 countries provided data on the property stress parameter and 9 countries show a median stress higher than the standard formula (20%). Based on a sample size of 44 the overall median stress equals 24%, with an interquartile range of 23% to 26%.

10.1.4.1.4 Spread risk

Only two countries provided details of the parameters used within the internal model for the credit risk associated with corporate bonds, and these were largely similar to the parameters used in the standard formula. However, the average parameter across the two country averages for CCC rated bonds in internal

models of 4% was significantly lower than the corresponding parameter in the standard formula of 11.2%.

No country provided different parameters used in internal models specifically for the credit risk associated with structured products.

10.1.4.1.5 Currency risk

Only three countries provided details of the currency stress parameter used in internal models and all countries show a median stress that is higher than or equal to the standard formula (20%) Based on a very small sample size equal to 3 this parameter ranged from 20 to 23%.

10.1.4.1.6 Concentration risk

No country provided details of the parameters used by internal models for concentration risk.

10.1.4.2 Counterparty default risk

The default probability parameters used by the internal models compared to the standard formula tend to be higher for AAA to BBB rated counterparties, similar for BB and B rated counterparties and lower for CCC and unrated counterparties. The average parameters across the country averages compared to the standard formula parameters are set out in the table below:

Table 57: Ratio of parameters used for counterparty default risk across the member state averages compared to the standard formula parameters

Rating	Standard formula	Internal model
AAA	0.002%	0.04%
AA	0.01%	0.05%
A	0.05%	0.17%
BBB	0.24%	0.48%
BB	1.20%	1.30%
B	6.04%	6.07%
CCC and unrated	30.41%	22.39%

10.1.4.3 Life underwriting risk

10.1.4.3.1 Mortality risk

10 countries provided details of the mortality stress parameter used in internal models and all countries show a median stress that is higher than the standard formula (10%). Based on a sample size equal to 21 the overall median stress equals 22%, with an interquartile range of 13% to 29%. Some undertakings reported that their internal models use different stresses for different business segments, sex, projection years and also further between different components of the mortality risk.

10.1.4.3.2 Longevity risk

8 countries provided details of the longevity stress parameter used in internal models and 2 countries show a median stress that is lower than the standard formula (25%). Based on a sample size equal to 12 the overall median stress equals 25%, with an interquartile range of 19% to 25%. Some undertakings reported that their internal models use different stresses for different business segments, sex and projection years.

10.1.4.3.3 Disability risk

7 countries provided details of the disability stress parameter at year one used in internal models and all countries show a median stress that is lower than the standard formula (35%). Based on a sample size equal to 20 the overall median stress equals 25%, with an interquartile range equal to the median. Some undertakings reported stresses where the shock varies within a year and between the years.

Concerning the disability stress after year one 7 countries provided details of the parameter used in internal models and 6 countries show a median stress that is in line with the standard formula (25%). Based on a sample size of 20 one can conclude that with an overall median stress equal to 25% and with an interquartile range equal to the median the stress parameters used in internal model tend to be on a rather same level as the standard formula. Furthermore, internal models do not seem to distinguish the year one and after year one shocks.

10.1.4.3.4 Lapse risk

5 countries provided details of the lapse reduction stress parameter used in internal models and 3 countries show a median stress that is similar to the standard formula (50%). Based on a sample size equal to 12 the overall median

stress equals 50%, with an interquartile range of 40% to 50%. Some undertakings reported that the stress depends on the business type in question and for instance a 170% stress for non-profit business and 50% stress for with-profit business were reported.

9 countries provided details of the lapse increase stress parameter used in internal models and 7 countries show a median stress that is similar to the standard formula (50%). Based on a sample size equal to 25 the overall median stress equals 50%, with an interquartile range equal to the median. Some undertakings reported stresses where the shock varies within a year and between the years.

Concerning the lapse mass stress event 5 countries provided details of the parameter used in internal models. Compared with the standard formula (30%) the median stress varies between countries. Based on a sample size equal to 5 the overall median stress equals 18%, with an interquartile range of 17% to 19%.

10.1.4.3.5 Expense risk

14 countries provided details of the expense risk stress parameter at year one used in internal models and 10 countries show a median stress that is similar to the standard formula (10%) Based on a sample size equal to 44 the overall median stress equals 10%, with an interquartile range of 10% to 25%.

Concerning the expense inflation stress parameter 5 countries provided details of the parameter used in internal models and all countries show a median stress that is higher than the standard formula (1%) Based on a sample size equal to 11 the overall median stress equals 3%, with an interquartile range of 2% to 33%.

10.1.4.3.6 Life catastrophe risk

No information was provided by the member states on the life catastrophe parameter used in the internal models.

10.1.4.3.7 Revision risk

No information was provided by the member states on the revision parameter used in the internal models.

10.1.4.4 Non-life underwriting risk

Only one country provided details on the parameters used for premium and reserving risk within internal models for non-life underwriting risk capital. From the information given it was clear that the internal model parameters can vary significantly from the standard formula. Furthermore, the extent to which the

parameters in the internal model differed from the parameters used in the standard formula varied by the line of business.

No country gave information with regard to the parameters used by internal models for the non-life catastrophe risk.

10.1.4.5 Correlations

In general, some countries have observed that respondents consider negative correlation to a larger extent than allowed by the standard formula. Also, many respondents have assumed diversification between operational risk and other risks, which is not present in the standard formula.

The difference in structure between internal models and the standard formula makes it difficult to compare some correlations, especially within the aggregation at the BSCR level. Comparisons may also be complicated by some stresses which can move in different directions, e.g. interest rate stress, affecting the nature of the correlation between this risk and other risks.

A small number of respondents considered full dependency between main risk categories.

Below is a comparison of correlations in the standard formula to the average parameters across countries used in the internal models. Internal model parameter statistics have only been given on those correlations that seem to differ from the standard formula.

10.1.4.5.1 Basic SCR

11 countries provided some details on the correlations within the market risk module. The sample sizes vary from 6 to 69 depending on the correlation. For most risks the responses related to Basic SCR correlations are quite in line with standard formula. However, differences can be observed in some correlations.

Table 58: Basic SCR correlations in the standard formula compared with internal model across all respondents

Correlation	Standard formula	25% quartile	Median	75% quartile	Sample size
Default vs Life	25%	25%	50%	50%	(36)
Default vs Non-life	50%	25%	25%	30%	(49)
Life vs Non-life	0%	13%	13%	13%	(6)

It should be noted that in contrary to the standard formula, some undertakings allow for diversification benefits between operational risk and other risks. Correlation between the operational risk and other risks was not part of the

internal model parameter request and hence no internal model information on these correlations is available.

10.1.4.5.2 Market risk

14 countries provided some details on the correlations within the market risk module. The sample sizes vary from 16 to 63 depending on the correlation. For some risks the responses related to market risk correlations are quite in line with standard formula, but differences can be observed in many correlations.

Table 59: Market risk correlations in the standard formula compared with internal model across all respondents

Correlation	Standard formula	25% quartile	Median	75% quartile	Sample size
Interest rate vs Equity	0%	8%	25%	25%	(47)
Interest rate vs Property	50%	25%	25%	50%	(50)
Interest rate vs Concentration	0%	50%	50%	50%	(17)
Equity vs Property	75%	25%	35%	75%	(63)
Equity vs Concentration	0%	50%	50%	50%	(16)
Property vs Concentration	0%	50%	50%	50%	(16)
Spread vs Concentration	0%	50%	50%	50%	(16)
Concentration vs Currency	0%	50%	50%	50%	(16)

10.1.4.5.3 Life underwriting risk

14 countries provided some details on the correlations within the life underwriting risk module. The sample sizes vary from 16 to 63 depending on the correlation. For some risks the responses related to life underwriting risk correlations are quite in line with standard formula, but differences can be observed in many correlations.

Table 60: Life underwriting risk correlations in the standard formula compared with internal model across all respondents

Correlation	Standard formula	25% quartile	Median	75% quartile	Sample size
Mortality vs Longevity	-25%	8%	25%	25%	(47)
Mortality vs Lapse	0%	25%	25%	34%	(48)
Mortality vs Expense	25%	50%	50%	50%	(16)
Mortality vs Revision	0%	20%	25%	25%	(41)

Mortality vs Catastrophe	0%	25%	35%	75%	(63)
Longevity vs Disability	0%	23%	25%	50%	(59)
Longevity vs Lapse	25%	50%	50%	50%	(16)
Longevity vs Catastrophe	0%	50%	50%	50%	(16)
Disability vs Lapse	0%	25%	25%	25%	(45)
Disability vs Revision	0%	13%	25%	25%	(39)
Disability vs Catastrophe	0%	50%	50%	50%	(16)
Lapse vs Revision	0%	50%	50%	50%	(16)
Lapse vs Catastrophe	0%	50%	50%	50%	(16)
Expense vs Revision	25%	50%	50%	50%	(16)
Expense vs Catastrophe	0%	50%	50%	50%	(16)
Revision vs Catastrophe	0%	50%	50%	50%	(16)

10.1.4.5.4 Health underwriting risk

Seven countries provided some details on the correlations within the health underwriting risk module. The sample size is mostly one, but on some correlation the sample size is slightly larger (6 to 7). In general, the responses related to health underwriting risk correlations from internal models are quite in line with standard formula.

10.1.4.5.5 Non-life underwriting risk

10 countries provided some details on the correlations within the non-life underwriting risk module and different lines of business. The sample sizes vary from 6 to 19 depending on the correlation. In general, the responses related to non-life underwriting risk correlations are quite in line with standard formula. However, some differences can be observed in some correlations.

Table 61: Non-life underwriting risk correlations in the standard formula compared with internal model across all respondents

Correlation	Standard formula	25% quartile	Median	75% quartile	Sample size
NL _{pr} vs NL _{cat}	0%	25%	25%	25%	(16)
Legal expense vs Assistance	25%	28%	100%	100%	(18)
Assistance vs Miscellaneous	50%	50%	100%	100%	(18)

Miscellaneous vs Reinsurance (property)	25%	25%	100%	100%	(19)
Reinsurance (property) vs Reinsurance (casualty)	25%	25%	100%	100%	(19)
Reinsurance (casualty) vs Reinsurance (MAT)	25%	25%	100%	100%	(19)

10.2 Internal models on group level

In the QIS4 15 participants (about 14% of all participants) provided some kind of information related to group internal modelling.

The information request for groups was as for solo insurance undertakings divided into three parts and was with an additional questionnaire part for group specific risks structured in the same way as for solo insurance undertakings (cf. chapter 10.1).

QIS4 group participants responded to the different parts as follows:

- 16 participants from 7 countries provided at least some information on the first part
- 8 participants from 5 countries provided at least some information on the second part and
- 14 participants from 6 countries provided at least some information on internal model results relative to the standard formula.

One should note that the sample size related to any group internal model issue was very small. Hence any firm conclusions cannot be drawn from the responses. Any conclusions drawn from the responses will only reflect the given sample and should be interpreted cautiously.

10.2.1 Current and potential future status

Many of the group respondents intend to use either full or partial internal model in the future solvency regime but there are also some respondents that consider the SCR standard formula to work well. 25% of the respondents do not know yet whether they will use an internal model or not for solvency requirement purposes.

As expected, the stages of internal model development range from “under planning” to “ready to use” and for the majority of the groups it seems that there is still some development to be made. The respondents gave estimates that it will take from zero to four years to develop their internal models until anticipated Solvency II approval standards can be met.

The areas in which internal models are either used or actively developed include reinsurance, risk strategy and strategic business decisions. Dividend payments and management compensation are the areas where internal models are least used.

Every given reason for planning to use an internal model is seen equally important, that is “better risk management”, “better capital management”, “more transparent decision making” and “lower regulatory capital”. Comparing the group responses with the responses from solo insurance undertakings one can conclude that getting a lower regulatory capital was clearly a more important incentive for groups.

In general, the group responses on internal models were rather similar to those received from solo undertakings.

10.2.2 Qualitative information by groups already using internal models for capital assessment

This section for groups is aligned with the Directive Proposal in the same way as in chapter 10.1.2 for solo insurance undertakings.

10.2.2.1 Full and partial internal models

Only a few groups provided information on their internal models, which makes it difficult to draw any firm conclusions. The information received on group internal models does not indicate that the structure and risks covered by group internal models are any different from the solo level internal models.

The group internal models described are fairly similar to the SCR standard formula in terms of structure and risks covered, but with individual adjustments for risks that are linked to undertaking-specific activities.

The majority of group respondents indicated that the relevant risks included in their internal model belong to the main risk categories such as market risk, life underwriting risk, health underwriting risk, non-life underwriting risk, counterparty default risk and operational risk. All risk subcategories are also covered by the majority of respondents, with one exception, which is concentration risk in the market risk module that is included in only a minority of the group internal models.

The group internal models described are in general developed through a combination of external software and internal development. The products and platforms used seem to be generally the same as those used by solo insurance undertakings using internal models.

10.2.2.2 Use test

Little information was provided by the participating groups on the use of their internal model as well. The limited information received does not indicate that the use of internal models on a group level is any different from the use on a solo level.

Based on the limited information provided, the majority of group internal models are used for investment policy, reinsurance, risk limit setting, risk strategy, ALM, asset allocation, capital allocation, strategic business decisions, pricing, market consistent technical provisions, product development, dividend payments, cost of capital risk margin and performance analysis. Similarly, a minority of group internal models are used for assessment of uncertainty in technical provisions, budgeting, bonus setting and management compensation.

The respondents stated that the risk management strategy considers the result from the group internal models to a large degree or to a medium degree.

The outputs of the internal model is mostly included in the regular reporting for the board of directors, and in the regular reporting for other senior management for all group respondents.

The internal model is approved by the board of directors for only a minority of the group respondents. The model is approved by other senior management for a majority of the respondents.

10.2.2.3 Statistical quality

10.2.2.3.1 Internal model output

Most group respondents produce output from their internal model in the form of a probability distribution forecast. The same proportion of respondents use the probability distribution forecast to indicate the variation of own funds over a 12 month horizon. All respondents use methods to calculate the probability distribution forecast that are consistent with the methods that are used to calculate the Solvency II technical provisions.

10.2.2.3.2 Risk ranking

Most respondents stated that their internal model has the ability to rank risk. Methods to rank risk used by groups include listing the top risk factors based on their contribution to total risk, which is measured by their stand-alone TVaR.

10.2.2.3.3 Data

Overall, 33% of respondents agreed that the data used by their internal models is sufficiently accurate, complete and appropriate, with the remaining 67% partially agreeing and no respondents disagreeing. However, the extent to which the data is accurate, complete and appropriate varies by risk type.

Non-Life risk

Overall, all respondents agreed that their data is sufficiently accurate, complete and appropriate for non-life risk, but only 33% of respondents stated that their data is sufficiently accurate, complete and appropriate for non-life catastrophe risk. Data used for non-life risk is annual and entity specific.

Market risk

All respondents believed that their data is sufficiently accurate, complete and appropriate for market risk. However only 33% of respondents believed that their data is sufficiently accurate, complete and appropriate for concentration risk, and 50% of respondents believed that their data is sufficiently accurate, complete and appropriate for property risk. Also, 75% respondents believed that their data is sufficiently accurate, complete and appropriate for currency exchange risk, interest rate risk, equity risk and spread risk. Market risk data used by internal models varies between daily weekly and monthly data and is publicly available.

Health risk

50% of respondents believed that their data used in internal models for health risk is sufficiently accurate, complete and appropriate. This figure varies by risk sub-module: 100% for short-term risk and workers' compensation risk and 50% for long-term risk.

Counterparty default risk

67% of respondents believed that the default risk data used in their internal model is sufficiently accurate, complete and appropriate. The default risk data used by the respondents is monthly data and is publicly available.

Life risk

33% of respondents that believed their data used for life risk within their internal model are sufficiently accurate, complete and appropriate; however this varies widely between risk sub-modules. Most respondents believe their data is sufficiently accurate, complete and appropriate for revision risk (100%), mortality risk (75%), longevity risk (75%), expense risk (67%), disability risk (50%), life catastrophe risk (33%) and lapse risk (25%). Life underwriting risk data is collected quarterly and is entity specific.

Operational risk

Only 25% of respondents believed that the data used in their internal model for operational risk is sufficiently accurate, complete and appropriate. Operational risk data used is collected annually and is entity specific.

Dependencies

All internal models allow for dependencies within risk categories and for dependencies across risk categories. Respondents use a combination of expert opinion and historic data to determine their dependency measures.

Risk mitigation

Most respondents (75%) take risk mitigation techniques into account in their internal models with the remaining 25% partly taking account of risk mitigation. A wide range of risk mitigation techniques are allowed for in the internal models with no clear preference towards any specific technique.

Management actions

Most respondents (75%) take management actions into account in their internal models with the remaining 25% partly taking account of management actions. A wide range of management actions are allowed for in the internal models with no clear preference towards any specific management action.

10.2.2.4 Calibration

Concerning the calibration for group internal models similar observations can be made as for internal models used by solo insurance undertakings. There is a strong preference for a one-year VaR and the level of confidence level is commonly higher or equal to 99.5%. In cases where the rating is set as target confidence level an AA rating seems to have strong preference.

Some groups use different risk confidence levels or time horizons for different risk drivers. Regarding for instance the underwriting risk a time horizon equal to the run-off of the policies was reported. The recalibration to Solvency II standards does not seem to create difficulties and the recalibrating would commonly be done directly from probability distribution forecasts or by some distributional assumption.

10.2.2.5 Profit and loss attribution

Only 25% of respondents stated that they have a process in place that demonstrates how the categorisation of risk chosen in the internal model explains the causes and the sources of profit and losses.

10.2.2.6 Validation

Validation of internal models seems to be common theme for all group respondents. The unit, which is responsible for the validation task, is quite often also responsible for the design, implementation, documentation and the use of the internal model. The people responsible for the validation task are commonly independent from the persons who take operational decisions but not necessary independent from the area/departments where risk activities are exercised. Furthermore, the validation task as well is not necessary done independently from the design, implementation, testing, documentation and the use of the internal model.

The existence of a process to monitor the appropriateness of the calibration of the internal model is not self evident. Concerning the appropriateness of the probability distribution forecasts and their underlying assumptions and to what extent insurance undertakings compare probability distribution forecasts and their underlying assumptions with actually observed and available statistical data all the respondents indicated that forecasts and only key underlying assumptions are compared.

The use of additional stability analysis regarding changes in key underlying assumptions and/or the impact on the shape of the probability distribution tails, including sensitivity of the results might not be the case for all groups. One could also expect that not all groups currently have a process in place to monitor the rank-ordering ability of their internal model.

On the other hand, the validation of how accurate, complete and appropriate the data used by their internal model is and the existence of a process to review what the outputs of their internal model would be under circumstances that are different (e.g. stressed) from those prevailing on the valuation date is a more common praxis.

The existence of a process to review how volatile the outputs of their internal model are across economic cycles was not indicated by any group respondent.

10.2.2.7 Documentation

For groups the documentation seems to be divided between having almost a full documentation and being half way to full documentation.

The documentation of circumstances under which the internal model does not work effectively seems to be an area of future improvement. Group responses paid special attentions to gaps in the systems and controls surrounding the internal model process and improper analysis of movements from previous years' results.

Documentation for group internal models seems to include subjects like subsequent changes to their internal model and responsibilities and accountabilities for each position related to the internal modeling system in place.

Concerning those groups that publicly disclose annual financial statements in accordance with IFRS standards, the annual financial statements include a description of the model consistent with IFRS 7. The public disclosure is done in the risk reporting section in the annual group report. Additional information is also often disclosed at analysts' conferences.

Below is a synopsis of the responses about public disclosure of internal model information:

- General description of the model structure
- Definition and nature of risks covered by the internal model
- Relative exposures to different risk categories
- Risk capital by module and sub-module
- High level qualitative statements regarding capital coverage
- Measure of risk appetite used to manage the business
- Calibration
- Risk aggregation
- Diversification benefits

10.2.3 General comparison of group results with the standard formula

Based on qualitative responses the following observations below can be drawn about internal model results:

Most countries stated that the group internal model SCR is less than the group SCR standard formula. One member state observed that the group internal model SCR is less than the group SCR standard formula for non-life undertakings, whereas for life undertakings the group internal model SCR is greater than the group SCR standard formula.

Very little data was available regarding the comparison of the internal model results against the standard formula at a risk module level, however some comments was given.

10.2.3.1 Market risk

One country stated that most group internal models contain higher capital charges for equity and property risk, with the average stress for equity being 44%, compared to the 32% in the standard formula.

Another country commented that the result for market risk in the group internal model is approximately the same as the SCR standard formula.

10.2.3.2 Life underwriting risk

One country commented that most group internal models contain higher capital charges for mortality risk.

10.2.4 General comparison of group parameters with the standard formula

Very little information was provided regarding the parameters used in group internal models. However, from the commentary given, some observations can be done.

10.2.4.1 Market risk

Higher stresses were used for interest rate risk, equity risk, property risk and currency risk. The equity stress parameter used in group internal models was 40% or higher.

10.2.4.2 Life underwriting risk

A higher parameter was used for the mortality risk sub-module in the group internal model compared to the standard formula.

10.2.4.3 Correlations

On average, the correlation between equity and interest rates in the group internal models was 23%, compared to the 0% parameter used in the standard formula.

Other correlations for which the internal model parameter was higher than the standard formula parameter include the correlations between interest rate risk and spread risk, between spread risk and equity risk, and between life risk and non-life risk. There are also some correlations where the internal model parameter was lower than the standard formula.

10.2.5 Group specific risks

At this stage, it seems that group internal models cover about 90% of the business in terms of life technical provisions, non-life earned premiums or SCRs. Subsidiaries that are not included in the scope of these internal models are often the smallest insurance undertakings, especially in non-EEA countries, services companies or companies with no operational control. Groups also need some time to include subsidiaries that were recently acquired.

Where subsidiaries are not in the scope of the model, there is usually no allowance for diversification. Many different approaches can be observed to assess the capital requirements for the non-covered entities. The two most common treatments for these entities are to set their capital requirements equal to the local regulatory requirements or to consider them as a participation in the equity risk sub-module of the holding company.

Regarding non-regulated entities or entities from another financial sector, participants often use a look-through approach to assess their exposures to risk factors used in their model. Where feasible, groups use to derive a VaR for risks in certain activities and aggregate it with the other SCRs, even if methodologies are rather different.

The participants mentioned some specific group risks which are taken into account in group internal models. For example, the following risk factors have been identified: restrictions on the transferability of capital, dependence on shared services, damage to group brand, mergers and acquisitions, illiquidity, no ability to offset deferred taxes through-out the group or intra-group transactions.

However, participants did not provide much information about quantitative analyses for these risks. It seems that these risk factors are part of the operational risk module and that they are more likely to be considered in a qualitative way and managed by intensive internal control processes. Stress scenarios are sometimes built to assess the impact of these factors on the group solvency position.

11 Assessment of the MCR

11.1 Main findings

- This section provides the results of testing a **combined approach** for the calculation of the MCR in QIS4. This QIS4 combined approach is given by CEIOPS' linear MCR approach combined with a cap of 50% and a floor of 20% of the SCR (whether calculated using the standard formula or an internal model).
- The linear approach **simplifies** the modular approach tested in QIS3. It builds up on the margin over liabilities (percentage of technical provisions) approach, but makes it more **risk-sensitive** by adding other volume measures. However, asset-side volume measures are excluded from the variant of the linear approach specified below.
- Overall, the QIS4 combined approach to calculate the MCR was better received by both undertakings and most supervisors than the previous modular design in QIS3.
- The calculation of the MCR using the QIS4 combined approach caused little or no practical difficulty for most participating undertakings.
- A large number of participating undertakings favoured the compact approach proposed by CEA, whereby the MCR is expressed as a fixed percentage of the SCR. Undertakings criticised the linear calculation for lack of risk sensitivity. However, many undertakings welcomed the addition of the corridor as a step forward.
- The majority of supervisors expressed support for the QIS4 combined approach, or viewed it as an acceptable compromise.
- Some supervisors expressed concerns that the QIS4 combined approach achieved the calibration target and supervisory ladder at the expense of simplicity, auditability and/or safety net.
- By design, the application of the corridor kept all combined MCR to SCR ratios in the **20% to 50% range** (save the absolute floor).
- For non-life business, the underlying linear calculation broadly met the calibration target²⁹.

²⁹ See CEIOPS-DOC-02/2008: QIS4 background document – Calibration of SCR, MCR and proxies. The calibration target was the mid-point of the 80%–90% VaR interval, for which 35% of the SCR was used as a proxy measure.

- For life business, QIS4 results indicate that the underlying linear calculation would need improvement. Although the results were more stable than in the QIS3 modular approach, significant upward and downward deviations from the calibration target were observed, varying between individual business profiles and between country markets.

11.2 Feedback on suitability

Overall, the QIS4 combined approach to calculate the MCR **was better received** by both undertakings and supervisors than the previous modular design in QIS3. Most undertakings and supervisors regarded the QIS4 combined approach as progress. It was also noted that the quantitative behaviour of the QIS4 combined approach showed a marked improvement compared to the QIS3 modular results.

Generally, the calculation of the MCR using the QIS4 combined approach caused little or no practical difficulty for most undertakings.

A large number of undertakings commented that the **compact approach** proposed by CEA (whereby the MCR is expressed as a fixed percentage of the SCR) remained their preferred approach. However, many undertakings welcomed the addition of the corridor as a step forward. A number of undertakings criticised the QIS4 combined approach for not being sufficiently risk sensitive.

The majority of supervisors **expressed support** for the QIS4 combined approach, or viewed it as an **acceptable compromise** with satisfactory functioning. Some supervisors expressed **concerns** that the QIS4 combined approach achieved the calibration target and supervisory ladder at the expense of simplicity, auditability and/or safety net.

Some supervisors considered that the risk sensitivity of the MCR following the QIS4 combined approach would need improvement.

11.3 Feedback regarding the fulfilment of the criteria in the Solvency II Directive Proposal

The Solvency II Framework Directive Proposal sets out a number of criteria for the design and calibration of the MCR. Following Article 126 (1) a–c, these criteria can be described as (a) simplicity and auditability, (b) safety net, (c) calibration and supervisory ladder. In the sub-sections below the QIS4 feedback about the fulfilment of these criteria will be examined.

11.3.1 Simplicity and auditability

Generally, the calculation of the MCR following the QIS4 combined approach caused **little or no practical difficulty** for most undertakings. Reported difficulties mostly related to the breakdown of input data for life classes; splitting capital-at-risk according to outstanding term; splitting technical provisions into guaranteed and discretionary bonuses; calculation of non-life annuities.

Some undertakings however expressed a view that the linear calculation was not simple, and that the **compact approach** would be simpler than the QIS4 combined approach.

Most supervisors consider the QIS4 combined approach to the MCR as **sufficiently simple**. Some supervisors however consider that the need for the prior calculation of the SCR due to the corridor introduced unwelcome **complexity** to the calculation of the MCR. On the other hand, some supervisors agreed with the view that the compact approach would be simpler than the QIS4 combined approach.

For some supervisors, **auditability** of the QIS4 combined approach, where the MCR is linked to the SCR, is **a source of concern**. One supervisor suggested establishing an obligation to have the SCR audited.

11.3.2 Safety net

Undertakings did not comment on the safety net function of the MCR.

Some supervisors believe that the combined approach tested in QIS4 is likely to provide **an adequate safety net**.

However, some other supervisors **do not share this view**. Some of them are concerned that the level of the MCR was too low for certain markets, or market segments, to provide effective policyholder protection. On the other hand, some supervisors expressed **strong concerns** – referring to the lessons of the recent subprime crisis – that the MCR calculated using the combined QIS4 approach would fail to provide an effective safety net for structural reasons: that limiting the MCR by a percentage of the SCR, particularly by company internal models, would undermine policyholder protection; or that such an arrangement would erode solo-level protection under the group support regime.

11.3.3 Calibration and supervisory ladder

Some undertakings considered the MCR calculated using the combined QIS4 approach and the SCR to be sufficiently consistent. On the other hand, a number of undertakings felt that, despite the introduction of the corridor, the QIS4 combined approach still allowed too large fluctuations in the level of the MCR

relative to the SCR, and some undertakings expressed a view that the gap between the MCR and SCR in this approach was still insufficient. These undertakings expressed preference for the **compact approach** that had the advantage of a smooth supervisory ladder.

Most undertakings did not criticise the width of the corridor. In some countries, some undertakings argued that a lower cap would be preferable.

In one country market, a number of undertakings expressed a view that the calibration of non-life (especially long-tail) factors was excessive in absolute terms.

In the opinion of several supervisors, the combined approach tested in QIS4 is likely to **provide a sensible ladder** for potential supervisory action, and the calculations proposed for the MCR using the combined QIS4 approach and SCR are reasonably **consistent**.

In view of the results on their country markets, some supervisors felt that the MCR was **not sufficiently consistent** with the SCR.

Supervisors generally regarded the **non-life calibration** as broadly satisfactory. By contrast, it was also widely recognised that the **life calibration** would need improvement. For some country markets or market segments, the outcome of the linear life MCR was too high, while for other markets or market segments it appeared too low and in some markets it was noted that the linear MCR was not risk sensitive for with-profit life business, leading to a very wide spread of results for the ratio of MCR to SCR. These results will be further examined in the sub-sections below.

11.4 Quantitative results: comparison of the MCR and the SCR by business segment and by size segment

In the combined approach tested in QIS4, the MCR of an undertaking was calculated according to the following steps:

- In the first step, a **linear MCR result** was calculated by applying fixed factors to basic volume measures such as technical provisions, premiums, capital-at-risk and unit-linked administrative expenses. The calibration target for the linear formula was 35% of the SCR, which was regarded as a proxy for the mid-point of the 80% to 90% Value-at-Risk confidence interval.
- In the second step, a **combined MCR result** was calculated by applying a 20% SCR floor and a 50% SCR cap to the linear result. This corridor was

designed to keep the MCR outcome within an acceptable range of the calibration target.

- Finally the absolute floor in the Solvency II Framework Directive Proposal³⁰ was applied to arrive at the **final MCR result**.

Below the comparison of the combined and the linear MCR result and the SCR are examined. The effect of the absolute floor will be analysed further below. The analysis of MCR to SCR ratios is relevant for the assessment of the calibration and supervisory ladder properties of the proposed approach. It is however noted that the MCR to SCR ratio may reflect measurement errors in either the MCR or the SCR or in both. Therefore a “very high MCR to SCR ratio” cannot be automatically interpreted as a “very high MCR”.

11.4.1 Comparison of the combined and linear MCR to the standard formula SCR per business segment

By design, the **application of the corridor** kept all combined MCR to SCR ratios in the 20% to 50% range.

Table 62 shows the percentage of undertakings in each business segment where the MCR using the combined QIS4 approach was equal to the 20% floor or the 50% cap. The behaviour of the underlying linear result for each business segment can be described as outlined below.

Table 62: Percentage of undertakings where the floor or the cap in the combined approach applied

	Standard formula SCR			Internal model SCR		
	floor	cap	inside the corridor	floor	cap	inside the corridor
all segments	27.4%	17.3%	55.3%	16.3%	48.4%	35.3%
life	26.4%	29.4%	44.2%	24.0%	34.7%	41.3%
non-life	21.2%	12.3%	66.5%	1.7%	59.7%	38.6%
composite	27.1%	19.6%	53.3%	20.0%	66.7%	13.3%
reinsurer	36.2%	23.4%	40.4%	n.a.	n.a.	n.a.
captive	68.8%	1.0%	30.2%	n.a.	n.a.	n.a.

³⁰ EUR 1 million for non-life insurance and reinsurance undertakings, EUR 2 million for life insurance undertakings and EUR 3 million for composite (life and non-life) undertakings.

large	12.4%	34.4%	53.2%	15.0%	48.3%	36.7%
medium	17.7%	21.3%	61.0%	17.4%	50.7%	31.9%
small	40.3%	8.2%	51.5%	17.4%	43.5%	39.1%

Table 63: Distribution of the combined MCR (before the absolute floor) to standard SCR ratio per business segment: Number of undertakings falling in each 5% bucket

	life	non-life	composite	reinsurer	captive	total
20% (floor)	89	139	61	17	66	372
20% – 25%	41	69	38	5	7	160
25% – 30%	34	91	18	2	10	155
30% – 35%	16	88	17	3	5	129
35% – 40%	19	70	16	2	5	112
40% – 45%	21	72	14	6	1	114
45% – 50%	18	46	16	1	1	82
50% (cap)	99	81	44	11	1	236

Table 64: Distribution of the combined MCR (before the absolute floor) to standard formula SCR per size segment

	large	medium	small	total
20% (floor)	27	90	255	372
20% – 25%	22	58	80	160
25% – 30%	18	66	71	155
30% – 35%	14	48	67	129
35% – 40%	15	48	49	112
40% – 45%	27	48	39	114
45% – 50%	20	42	19	81
50% (cap)	75	108	52	235

Table 65: Distribution of the linear MCR to standard SCR ratio per business segment: Number of undertakings falling in each 10% bucket

	life	non-life	composite	reinsurer	captive	total
≤ 10%	29	45	30	8	37	149
10% – 20%	62	95	34	10	29	230
20% – 30%	75	161	56	7	17	316
30% – 40%	35	158	33	5	10	241
40% – 50%	39	118	29	7	2	195
50% – 60%	18	43	22	6	0	89
60% – 70%	12	15	9	3	1	40
70% – 80%	11	10	2	0	0	23
80% – 90%	7	5	3	1	0	16
90% – 100%	8	1	2	1	0	12
>100%	42	7	8	0	0	57

Table 66: Distribution of the linear MCR to standard SCR ratio per size segment: Number of undertakings falling in each 10% bucket

	large	medium	small	total
≤ 10%	7	25	118	150
10% – 20%	20	66	143	229
20% – 30%	40	124	152	316
30% – 40%	29	96	116	241
40% – 50%	47	89	58	194
50% – 60%	27	37	25	89
60% – 70%	10	22	8	40
70% – 80%	7	12	3	22
80% – 90%	8	6	2	16
90% – 100%	4	7	1	12
≥100%	19	25	13	57

11.4.1.1 Life undertakings

Although the results for life undertakings were more stable than in the QIS3 modular approach, the linear MCR result did not match the calibration target well. Less than half of the results (44%) fell within the corridor. Depending on each undertaking's business profile, **significant upward and downward deviations** from the calibration target were both observed in a significant number of cases. Instead of being centered around 35%, the distribution of the ratio appeared to show two peaks (one around 25% and another around 45%) and a heavy tail above 100%.

Figure 108: Distribution of the linear and combined MCR (before the absolute floor) to standard formula SCR ratio (life undertakings)

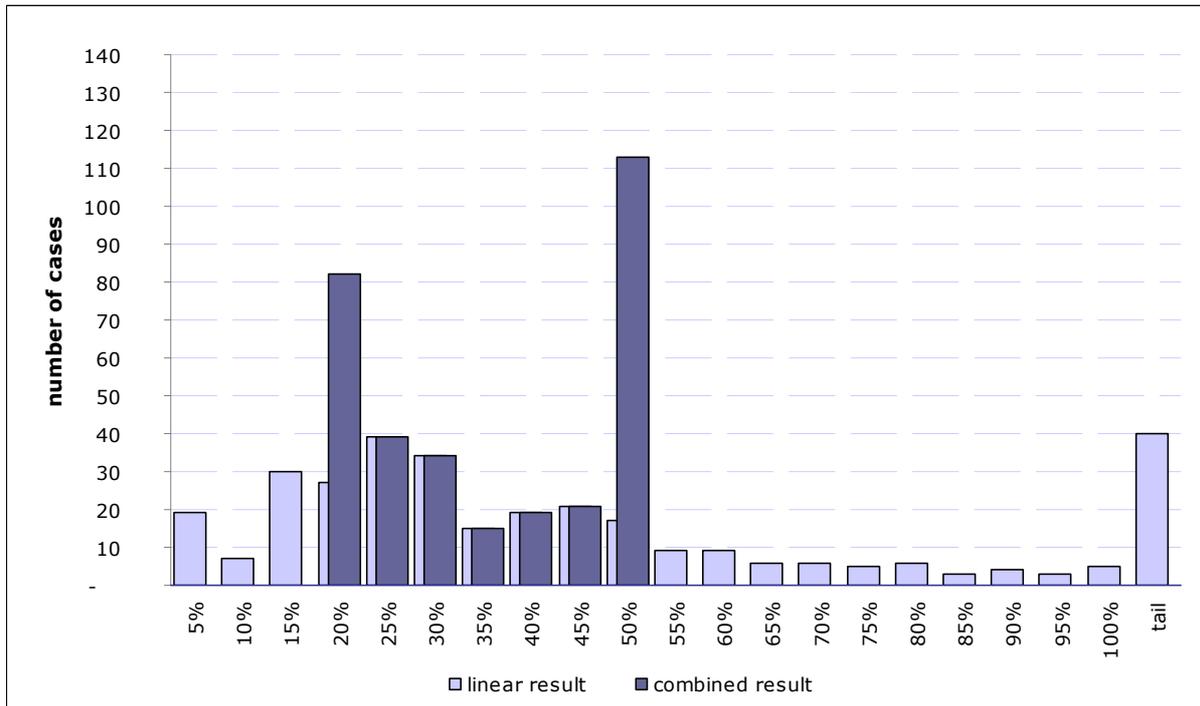
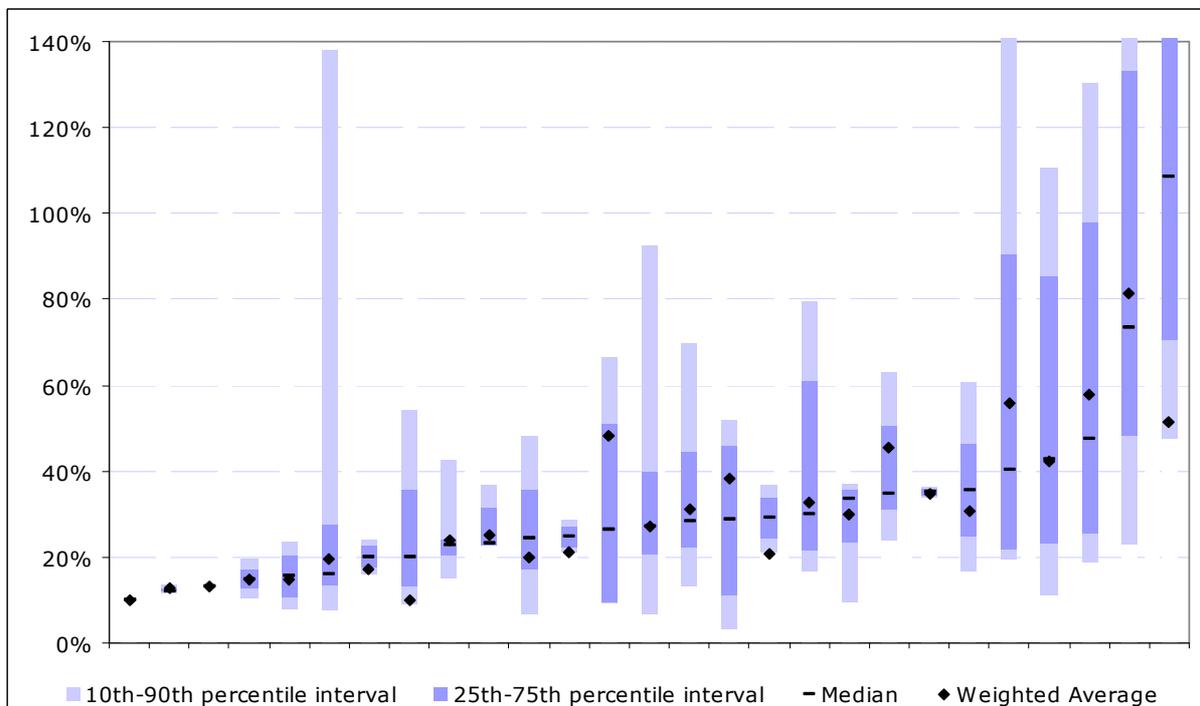


Figure 109: Linear MCR to standard formula SCR by country (life undertakings)



There were also significant **variations between countries** (although less so than in the QIS3 modular approach). The stand-alone linear result would have caused supervisory ladder problems (very high MCR to SCR ratios) in some

countries, while in some other countries the results appeared low relative to the SCR. In a number of countries both very high and very low MCR to SCR ratios were observed. Overall, with 12% of results falling above the SCR, the stand-alone linear formula with the QIS4 factors would not have provided an adequate supervisory ladder across all country markets.

At least the following two reasons can be identified why the life linear formula was a poor match for the calibration target:

1. Adjustment for **profit sharing** caused large variations in the SCR according to business profile and also by country market (it appeared that there were also interpretation differences regarding the meaning of future discretionary bonuses). The MCR linear formula was unable to match the resulting non-linear behaviour. In some countries the linear formula often underestimated the relative weight of future profit sharing, often leading to high MCR to SCR ratios. However, there were also examples of the opposite effect.
2. The linear formula is insensitive to the variations of **market risk** in life business. Some supervisors therefore would seek to better reflect market risk e.g. by introducing additional risk factors on certain asset types.

11.4.1.2 Property & casualty undertakings

The distribution of the linear MCR to SCR ratio was **broadly satisfactory**, with 66% of the results falling within the corridor. The linear result was higher than the SCR in only 1% of all cases. Country-by-country variations of the distribution were limited, with the exception of a few countries where the number of undertakings was very small, and with the exception of a small number of extreme outliers.

Figure 110: Distribution of the linear and combined MCR (before the absolute floor) to standard formula SCR ratio (non-life undertakings)

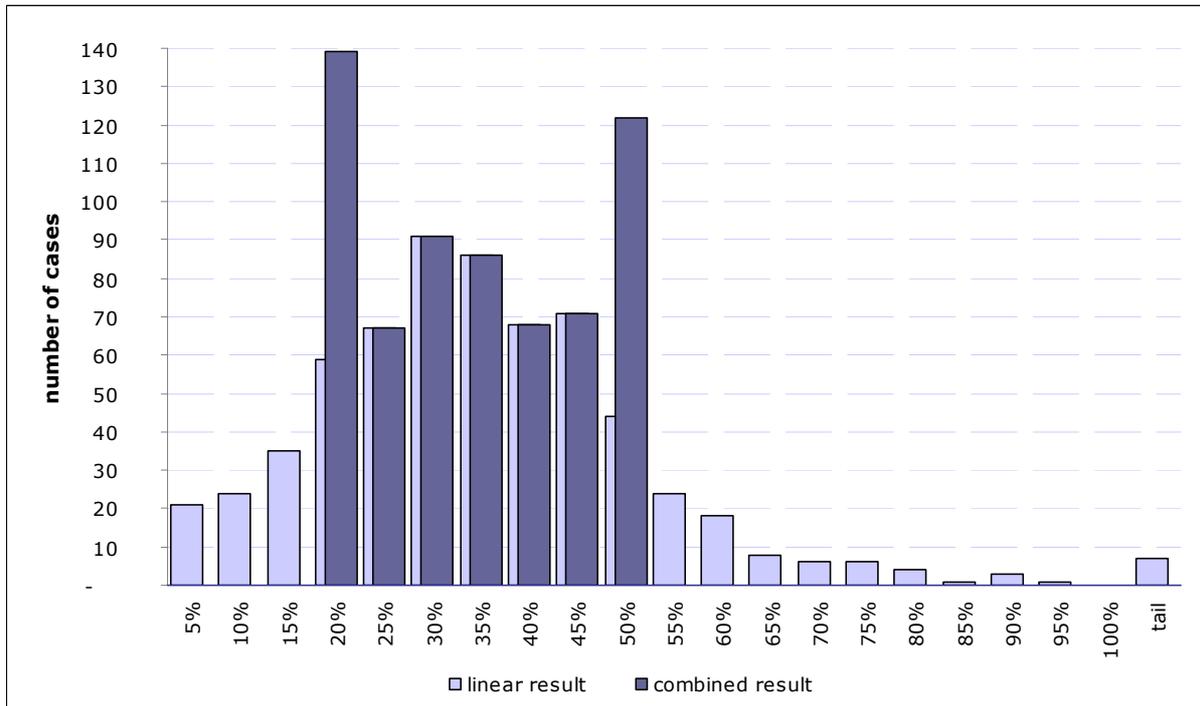
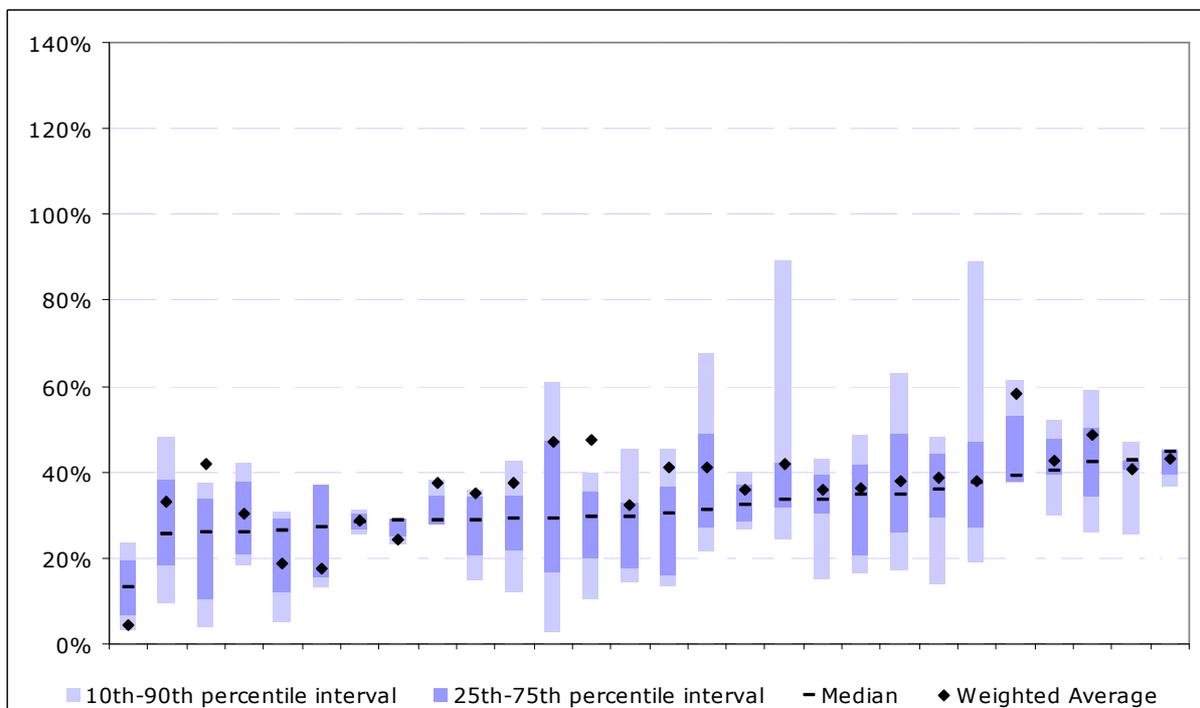


Figure 111: Linear MCR to standard formula SCR by country (non-life undertakings)



11.4.1.3 Composite undertakings

The composite results reflect a mixture of the non-life and life quantitative impact, with slightly more than half (53%) of the results falling within the corridor. The linear MCR result was higher than the SCR in 4% of all cases.

Figure 112: Distribution of the linear and combined MCR (before the absolute floor) to standard formula SCR ratio (composites)

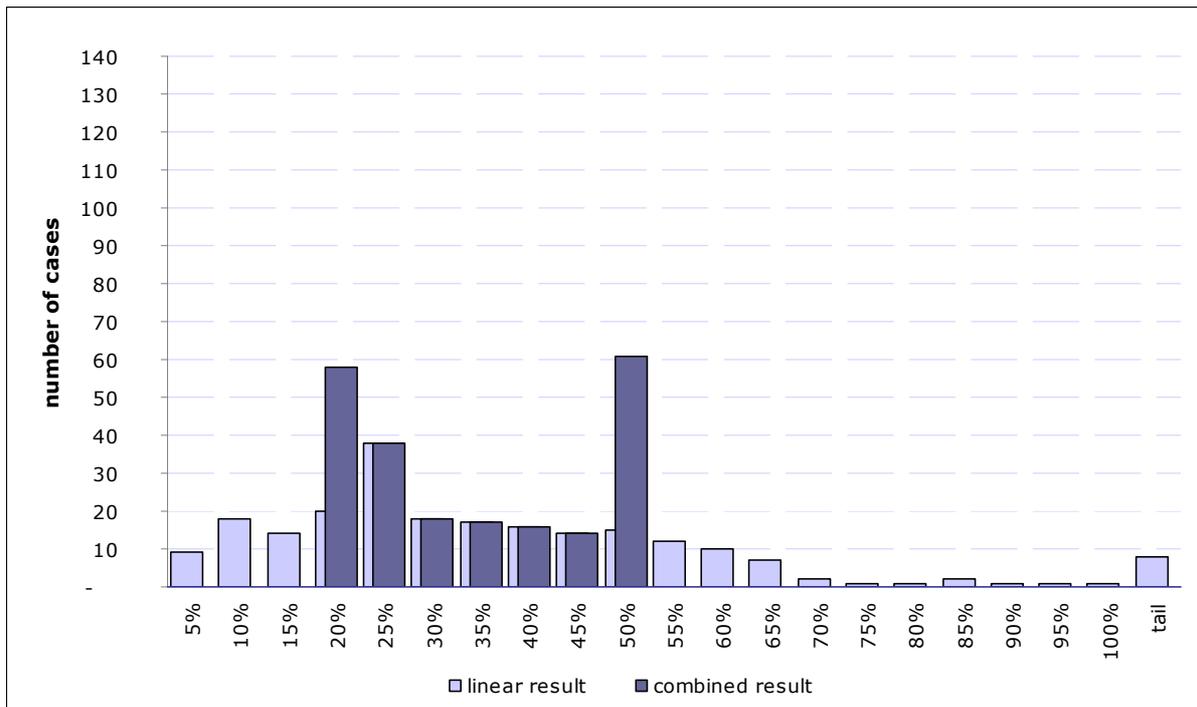
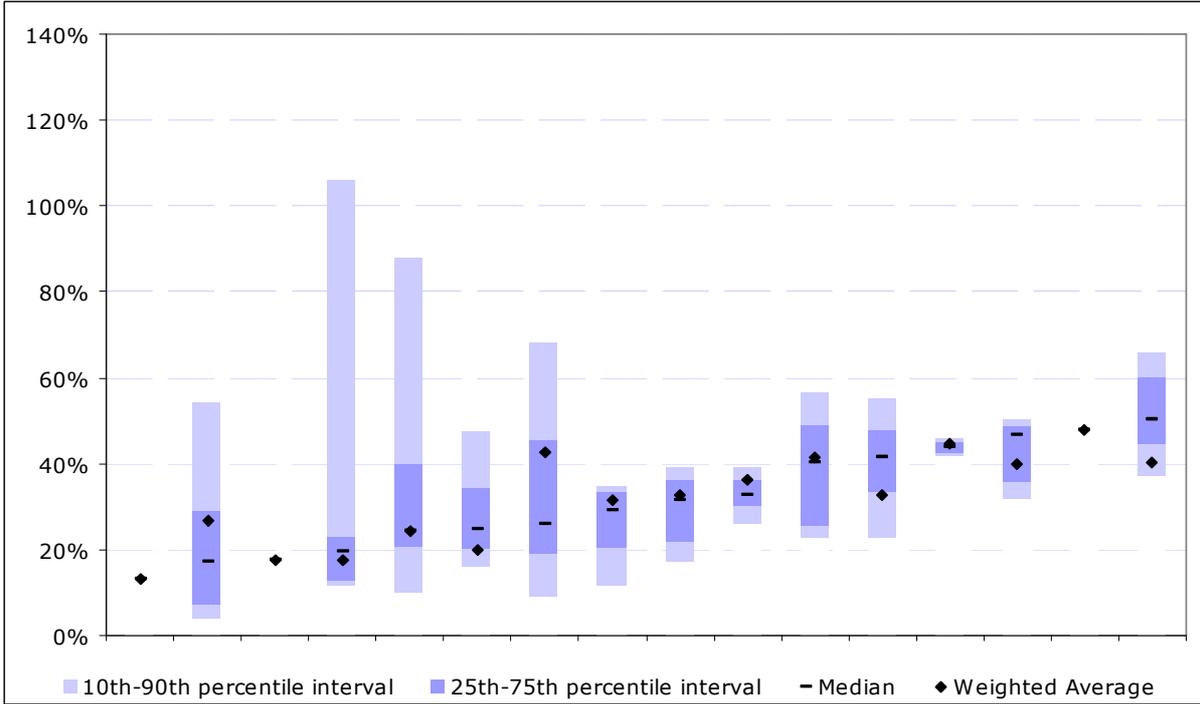


Figure 113: Linear MCR to standard formula SCR by country (composites)



11.4.1.4 Reinsurers

The ratios appeared somewhat more dispersed than the non-life results, with a large portion (36%) falling below the 20% floor.

Figure 114: Distribution of the linear and combined MCR (before the absolute floor) to standard formula SCR ratio (reinsurance undertakings)

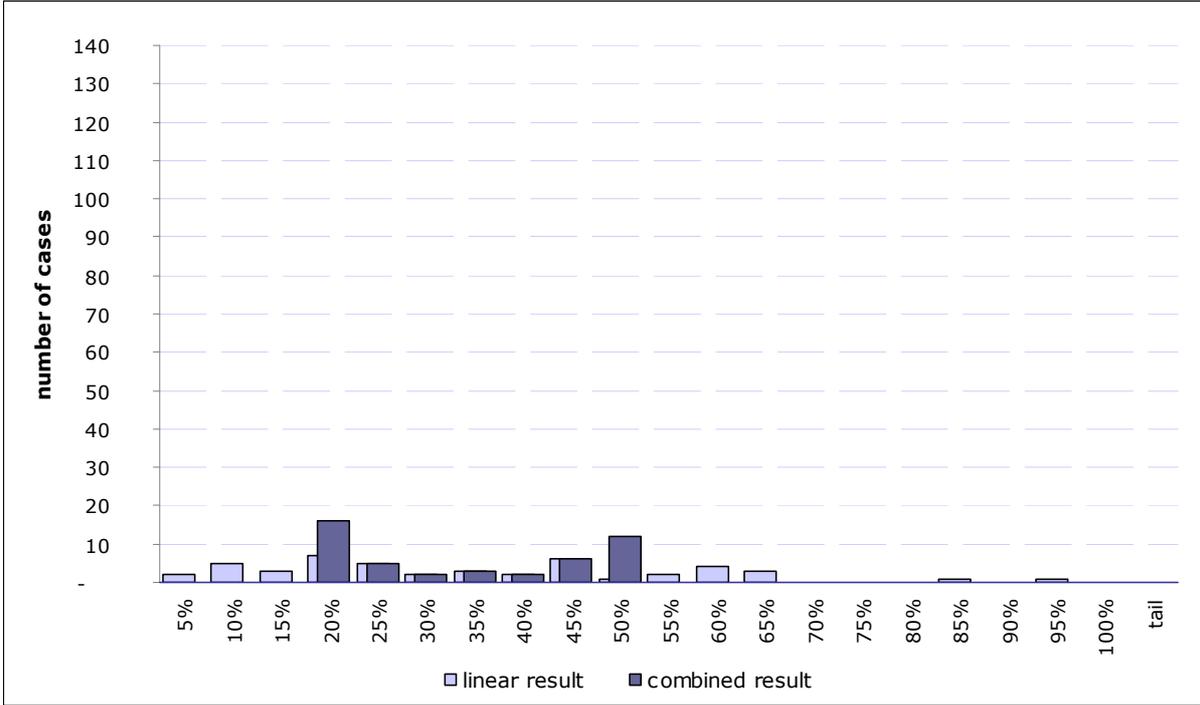
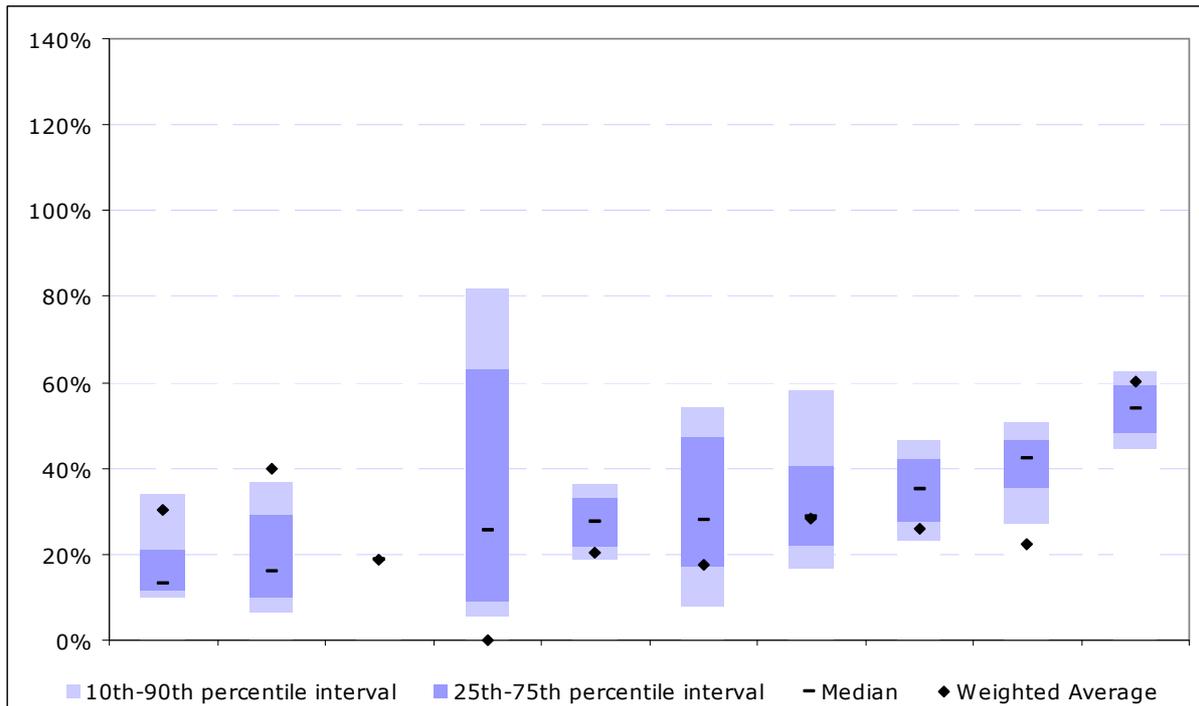


Figure 115: Linear MCR to standard formula SCR by country (reinsurance undertakings)



11.4.1.5 Captives

The outcome for captives was heavily tilted towards low MCR to SCR ratios, with 69% of the linear results falling below the 20% floor. It is noted that more than half of the captive undertakings came from one country. However, for captive undertakings in other countries the ratios also tended to fall on the low side. One reason behind this outcome seems to be that captives are often exposed to a high catastrophe risk SCR charge, which is not reflected in the linear formula.

Figure 116: Distribution of the linear and combined MCR (before the absolute floor) to standard formula SCR ratio (captives)

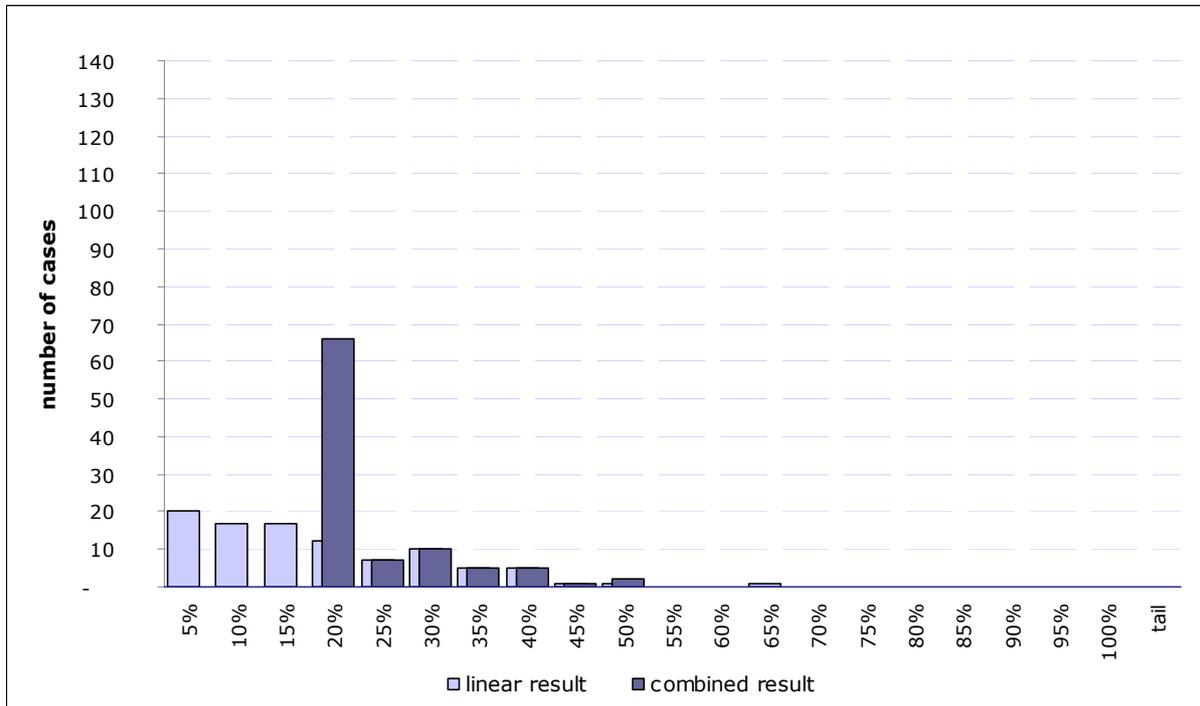
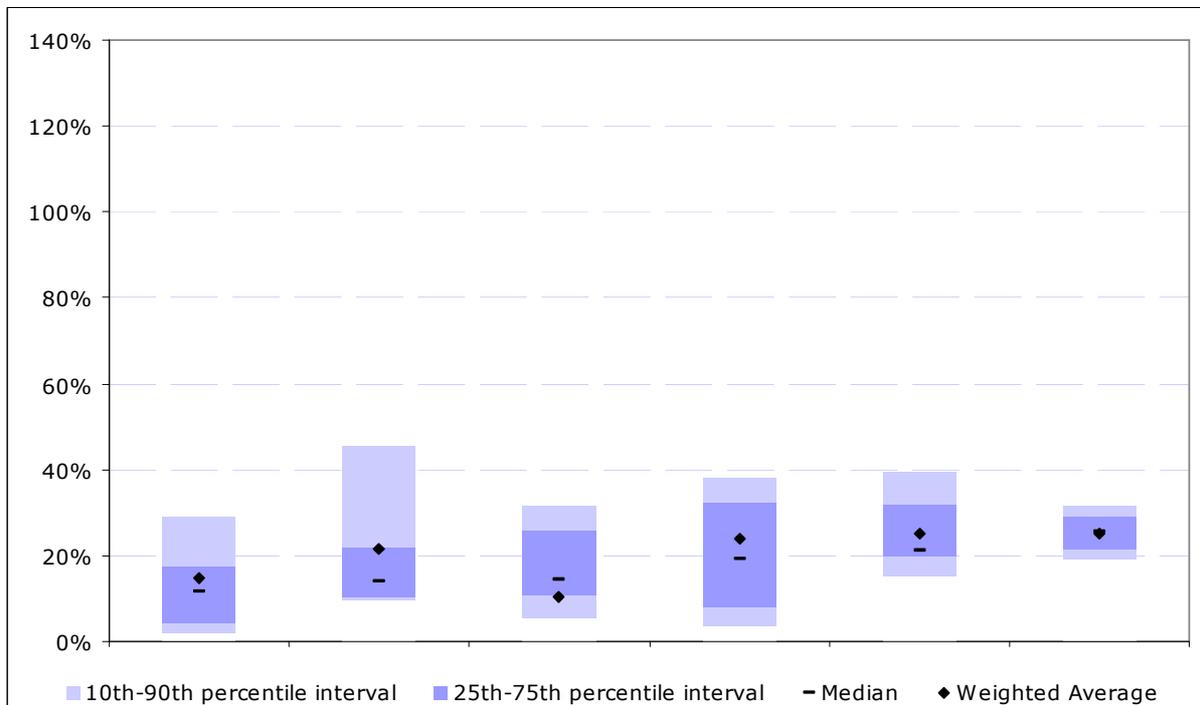


Figure 117: Linear MCR to standard formula SCR by country (captives)



11.4.2 Comparison of the combined and linear MCR to the standard formula SCR per size segment

Both in the combined QIS4 approach to the MCR and in the underlying linear MCR, **smaller undertakings** generally displayed lower MCR to SCR ratios than **larger undertakings**. Accordingly, for small undertakings the MCR using the combined QIS4 approach was more often equal to the 20% floor, whereas for large undertakings it was more often equal to the 50% cap (the distribution for medium undertakings fell in between).

These results may be attributed to the fact that large undertakings can expect larger diversification benefits in the SCR, while the linear MCR formula **does not recognise diversification**. (Specifically in non-life business, the linear formula allows no diversification between lines of business, yet taking the maximum of premium and reserve risk factors within each line reflects more diversification than the 0.5 correlation coefficient between these risks in the standard formula. Therefore specialist non-life undertakings can be expected to show lower MCR to SCR ratios than diversified non-life undertakings, all else being equal.)

It is noted that a number of small undertakings was also affected by the absolute floor (see below).

11.4.3 Comparison of the combined and linear MCR to internal model SCR results

For those undertakings that submitted **internal model SCR** results, a second MCR result using the combined QIS4 approach was calculated in QIS4, starting from the same linear calculation but using 20% and 50% of the internal model SCR to determine the floor and the cap.

In nearly half (48%) of all cases with an internal model result, the MCR using the combined QIS4 approach was equal to the 50% (internal model) cap. Composite and non-life undertakings were more affected by the 50% cap than life undertakings. In 13% of all cases the linear result was higher than the full internal model SCR.

Table 67: Distribution of the combined MCR (before the absolute floor) to standard formula and to internal model SCR ratio for those undertakings that submitted internal model results (all segments): Number of undertakings falling in each 5% bucket

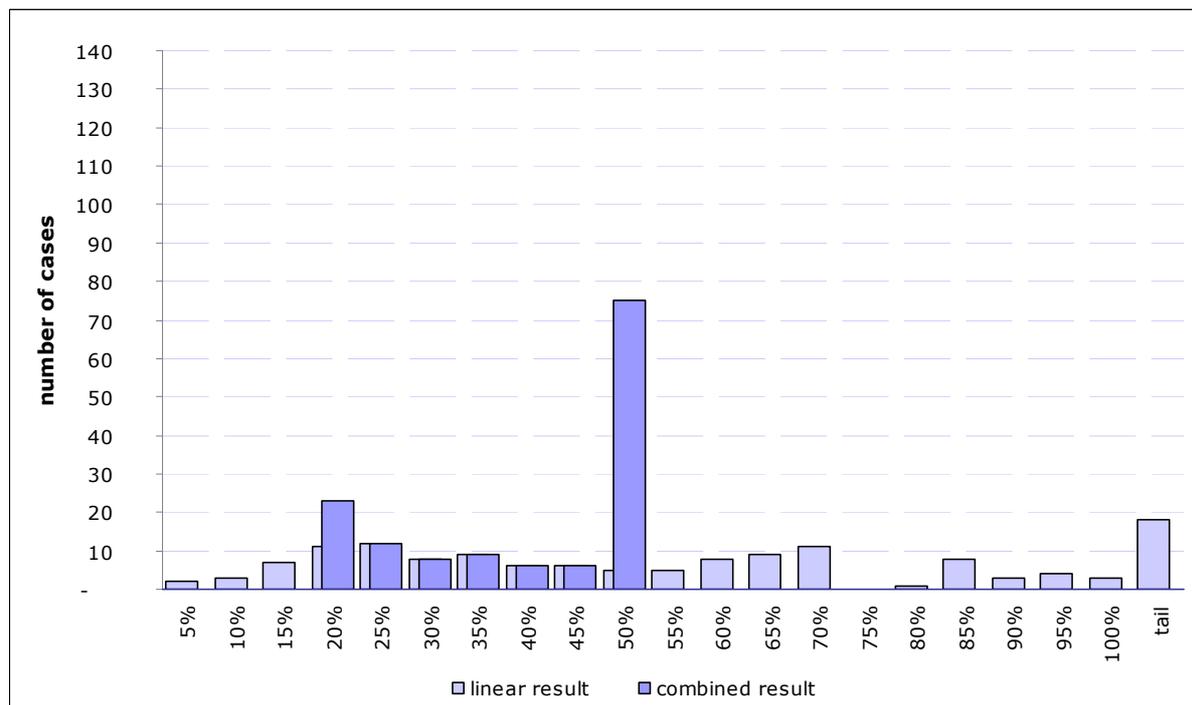
	combined MCR to standard formula SCR	combined MCR to internal model SCR
20% (floor)	23	25
20% – 25%	18	13
25% – 30%	14	9
30% – 35%	11	10
35% – 40%	14	8
40% – 45%	19	7
45% – 50%	17	7
50% (cap)	40	74

Two **underlying effects** can be identified behind this outcome: First, large and medium undertakings were over-represented in the **select subset of undertakings** that submitted internal model results. For this subset of undertakings, ratios relative to the standard formula SCR were already higher than average. Second, the internal model SCR defined, more often than not, a **lower floor and cap** for the MCR than the standard formula.

Table 68: Distribution of the linear MCR to standard formula and to internal model SCR ratio for those undertakings that submitted internal model results (all segments): Number of undertakings falling in each 10% bucket

	linear MCR to standard formula SCR	linear MCR to internal model SCR
≤ 10%	2	6
10% – 20%	21	20
20% – 30%	32	22
30% – 40%	25	18
40% – 50%	36	14
50% – 60%	13	14
60% – 70%	5	20
70% – 80%	6	4
80% – 90%	2	12
90% – 100%	4	8
≥100%	10	18

Figure 118: Distribution of the linear and combined MCR (before the absolute floor) to internal model SCR ratio (all undertakings)



A **caveat** regarding internal model results is that the quality standards of internal models reported in QIS4 varied, and none has yet undergone the Solvency II validation procedure. Validation according to Solvency II standards might see some of those internal model capital requirements' results being raised.

11.4.4 Effect of the absolute floor

Following Article 126(1)d of the Solvency II Framework Directive Proposal, the absolute floor of the MCR tested in QIS4 was EUR 1 million for non-life insurance and reinsurance undertakings, EUR 2 million for life insurance undertakings and EUR 3 million for composite (life and non-life) undertakings.

Of the undertakings participating in QIS4, the absolute floor had an effect for 68 undertakings on the standard formula basis (i.e. when the 20% SCR floor and 50% SCR cap were determined from the standard formula SCR). All of them were small undertakings. On an internal model basis, 3 undertakings (1 large and 2 medium ones) were affected by the absolute floor.

The absolute floor had a minor effect on the overall distribution of MCR to SCR ratios. However, the absolute floor caused a noticeable upward shift in the distribution for small undertakings. It is also noted that those small undertakings that are most likely to be affected by the absolute floor may be more numerous

on the European markets than they were in the QIS4 sample. (Cf. Table 69, Table 70, Table 71)

Table 69: Number of undertakings affected by the absolute floor

	standard formula basis	internal model basis
all segments	68	3
life	18	1
non-life	23	1
composite	2	1
reinsurer	2	-
captive	5	-
large	-	1
medium	-	2
small	68	-

Table 70: Distribution of the final MCR (after the absolute floor) to standard SCR ratio per business segment: Number of undertakings falling in each 5% bucket

	life	non-life	composite	reinsurer	captive	total
20% (floor)	82	127	55	16	63	343
20% – 25%	43	66	34	3	9	155
25% – 30%	33	92	19	4	10	158
30% – 35%	14	87	18	3	4	126
35% – 40%	20	69	18	2	5	114
40% – 45%	22	72	14	6	1	115
45% – 50%	18	47	16	1	1	83
50% (cap)	95	81	43	11	1	231
above cap	10	16	8	1	2	37

Table 71: Distribution of the final MCR (after the absolute floor) to standard SCR ratio per size segment: Number of undertakings falling in each 5% bucket

	large	medium	small	total
20% (floor)	27	90	225	342
20% – 25%	22	58	75	155
25% – 30%	18	66	74	158
30% – 35%	14	48	65	127
35% – 40%	15	48	51	114
40% – 45%	27	48	40	115
45% – 50%	20	42	20	82
50% (cap)	75	108	47	230
above cap	0	0	37	37

11.5 Areas for further improvement

11.5.1 Identification of any particular type of business or undertaking for which the design and/or calibration of MCR may be unsuitable

From the quantitative results and qualitative feedback of QIS4, the following conclusions can be drawn:

- The calibration of the linear formula for **life business** as a whole needs improvement.
 - For **with-profits business** in particular, the linear MCR formula recognises the loss absorbency of technical provisions by applying a negative risk factor on future discretionary benefits. The QIS4 calibration of this factor (–9%) appeared unsuitable for some country markets, or market segments. However, finding a more appropriate factor does not look straightforward given the mixed feedback from supervisors. Some supervisors would suggest less reduction for profit sharing, while others would favour an even smaller negative factor. Some supervisors commented that the high MCR to SCR ratio among their life insurance undertakings may result from an insufficient recognition of the risk mitigating effect of future profit sharing in the MCR (the relatively large bonus reserves reduced the SCR for some of these undertakings). However, another supervisor considered that

future discretionary benefits of uncertain valuation overly reduced the MCR.

- In a number of country markets the **overall calibration** of linear MCR for life undertakings appeared too low, possibly due to insufficient sensitivity to market risk. Supervisors from these countries suggested an upward recalibration of the factors. On the basis of the results in its country market, one supervisor commented that a scaling-up of the life linear MCR by a factor of 2.2 would be appropriate. Some supervisors noted that low MCR to SCR ratios were observed specifically among traditional life undertakings.
- One supervisor commented that it is **unlikely** that any calibration will result in a **sufficiently risk sensitive calculation for the linear MCR** (and hence a sensible interplay with the SCR) for all undertakings. Therefore they emphasised the necessity of combining a corridor with any linear approach **to improve the efficacy of the calibration**.
- For **captives**, low MCR to SCR ratios were observed in some countries. An underlying reason seems to be the high catastrophe risk charge in the SCR that is not reflected in the linear MCR calculation. It is noted however that the application of the 20% floor in the QIS4 combined approach leads to a more appropriate outcome.
- In one country the MCR for **health insurance** undertakings hovered around the 20% floor. This resulted from the high SCR charge, particularly with respect to the treatment of the counterparty default risk for unrated names and the high method 1 catastrophe risk results. The MCR to SCR ratios of these undertakings would be even lower if the national risk mitigation scheme for basic health insurance policies was fully taken into account in the QIS4 calculations for the MCR.

11.5.2 Suggestions for improvement of the methodology

Undertakings in many countries criticised the MCR calculation (and the linear formula in particular) for not being sufficiently risk sensitive. They also drew attention to the lack of recognition of the risk mitigation techniques and lack of allowance for diversification in the linear calculation. In these undertakings' view, the **compact approach** would be the most appropriate MCR methodology.

A number of supervisors, on the other hand, felt that the auditability of the calculation and the safety net function should be strengthened. These supervisors suggested **reducing the dependence of the MCR on the SCR**:

- some supervisors preferred a move to a **fully stand-alone** approach;
- some supervisors suggested a **floor-only combined** approach;

- some supervisors raised the possibility of using **different methodologies for life and for non-life business**. They observed that the linear formula appeared more satisfactory for non-life business, therefore the cap, or the whole corridor, could be removed separately for non-life business.

To address the issue of risk-sensitivity, some supervisors suggested **refining the stand-alone component** of the QIS4 combined approach. Their proposals included:

- addition of **market risk** factors (e.g. on certain asset classes) to better reflect market risk;
- allowance for **diversification** (e.g. similar techniques as in the modular approach);
- allowance for the loss absorbency of **deferred taxes**.

On the other hand, some supervisors expressed support for the **compact approach**.

12 Proportionality – Simplifications and Proxies

12.1 QIS4 testing proposals

The principle of proportionality applies to all the provisions in the Directive Proposal and, as a consequence, to all future implementing measures.

In order to implement the proportionality principle, the QIS4 Technical Specifications proposed to participants a number of simplifications and proxies. The scope of the application of simplified methods is, in line with the proportionality principle, restricted to portfolios with relatively simple risk profiles. This simple risk profile is defined by a combination of nature, scale and complexity of the risks inherent in the insurer's business.

Proxies have been developed in case there is insufficient undertaking-specific data of appropriate quality to apply a reliable statistical actuarial method.

Therefore proxies can be regarded as special types of simplified methods which are positioned at the "lower end" of continuum of methods that could be applied. The use of proxy methods should also be subject to clear admissibility criteria in order to encourage insurers to use – whenever this is possible – appropriate actuarial methods for the valuation of liabilities as foreseen in the Framework Directive Proposal. A decision tree has been designed to help undertakings decide when they should be allowed to use a proxy and which proxy would be most suitable.

Over 30 simplifications and proxies were included in the specifications, which covered various aspects of valuation and calculation:

- The valuation of the best estimate technical provisions, including the valuation of reinsurance recoverables;
- The calculation of the risk margin;
- The determination of the SCR using the standardised formula, with regard to the modelling of market risk, counterparty default risk, life and non-life underwriting risk, including some specific cases (with-profit insurance products and risk borne by captives).

In order to ensure the appropriate use of simplifications, specific criteria were proposed in QIS4 which took into account the nature and complexity of the underlying risks and the materiality of using simplifications based on absolute thresholds linked to premiums and provisions, or the overall impact of the simplified calculation on the SCR.

Additionally, the implementation package (a set of excel spreadsheets) proposed some IT tools (named “helper tabs”) that proposed some practical guidance to fill out the spreadsheets for undertakings without access to more sophisticated IT tools. Among them was a tool designed in cooperation with the Group Consultatif to help valuating the non-life best estimates.

12.2 Application criteria

The **proportionality principle** and its transposition in the Technical Specifications were in general **well received**.

Some requests for clarification and further guidance were reported regarding the application criteria. The comments related to the cumulative application of the criteria of nature scale and complexity, and the conditions for the use of simplifications. Further questions were raised on the appropriate granularity to evaluate the conditions (for example, conditions could be fulfilled at a subset of the business but not as the whole, or the opposite).

Some undertakings took the view that undertakings – and especially small undertakings – should be allowed to use proxies and simplifications based on prudent assumptions without any restrictions.

Some undertakings remarked that simplified approaches should generally be allowed for immaterial risks rather than on the basis of the undertaking’s size or legal form.

A number of undertakings remarked that the criteria described in the specifications were not sufficiently clear, especially in cases where the specifications included several proxies for the same purpose in parallel. It was also noted that where several simplifications and proxies were described for the same purpose, these sometimes yielded materially divergent results. In this context, “cherry picking” should be prevented.

Undertakings gave very little feedback to the qualitative questions contained in the Technical Specifications referring to the materiality threshold. Therefore, feedback on the absolute level tested was too scarce to draw any conclusions.

Supervisors pointed out that further guidance could be developed on the range of available actuarial methods including both more advanced techniques and also simplifications which in their degree of sophistication range between such advanced techniques and simple proxy approaches. More accurate but still simplified methods should be developed, excluding those simplifications that could introduce relevant distortions.

At the same time, more stringent application criteria are needed for very simple proxy techniques where there is the increased risk that their usage may lead to unsuitable results.

12.3 Use of simplifications and proxies

Reported usage³¹ of the proposed simplification was on average low but with substantial variation among countries and undertakings. They were mostly used by undertakings with specific risk profiles (see Annex B for a focused analysis for captives), to address the new valuation principles for reinsurance assets (see chapter 6 on valuation) and as a practical way to derive the risk margin (see chapter 7 on technical provisions).

A number of useful comments were received regarding the concrete proposal for simplified underwriting risk modelling and provision valuations. They will provide valuable inputs for the further work in preparing Level 2 implementation measures.

³¹ Some undertakings did use simplifications and proxies, without indicating their use in their submissions.

13 Groups solvency

13.1 Main findings

Participation:

111 groups from 16 home countries participated in the group part of the QIS4 study. This figure includes more than 60% of cross-border groups as well as a significant number of mutual groups. 106 groups submitted their results to the centralized database. CEIOPS acknowledges the great efforts of groups in participating in QIS4. This is the first impact study in which the sample size is large enough to have a global view on the potential quantitative and qualitative impact of Solvency II on European groups. However, it should be noted that the data is less reliable than at solo level. Therefore, only general conclusions on the main trends can be drawn.

Group SCR:

The level of group diversification effect is equal to 26% on average where it is measured as the ratio between the group SCR, calculated using the standard formula, and the sum of the solo SCRs. Once the capital charges related to intra-group transactions have been neutralized, this diversification is equal to 21% on average. The latter measure represents, *ceteris paribus*, the real level of “pure” group diversification benefits. By their nature, diversification effects vary considerably from one group to another, depending on the diversity of their businesses in combination with the inherent correlations in the standard formula.

Results with respect to the treatment of third country entities on the group SCR are also interesting although data is available for only a few groups. Diversification effects including third country undertakings compared to the group SCR where it is not considered can be as high as 36% for some groups. It is 19% on average.

The diversification effects related to with-profit business compared to the results where it is not considered have also a major impact on the group diversification effects, 16% on average at the EEA level for groups that tested it. With respect to both third country entities and with-profit issues, supervisors highlighted the importance of analysing the transferability of capital within a group, as obstacles to that transferability may impact the realisation of diversification effects.

In any case, these estimates of capital requirements and diversification effects provided above should be considered as illustrative of the order of magnitude rather than exact numbers, since modelling at group level is extremely complex and was done within a very short time-frame. In addition, uncertainties in the

calculations at solo level were amplified at group level (in particular, the treatment of deferred taxes and limits to the offsets of risks).

The level of diversification effects can be explained by three main driving factors:

1. the elimination of the capital charge related to intra-group transactions (internal reinsurance, loans, participations, etc);
2. specific group effects that offset risks that have a negative effect in some solo undertakings and a positive effect in others (e.g. interest rate risk) or cause a “dilution” of some risks at group level (concentration risk);
3. more diversified risk profiles at group level than for each of the solo undertakings.

On the suitability and appropriateness of the QIS4 methodology for the calculation of group SCR and group own funds, groups generally expressed a clear preference for a fully consolidated method that treats a group as if it were a single economic entity, recognising diversification from third country entities and with-profit business (i.e. the default method).

Some groups commented that adding the solo operational risk capital charges does not reflect the effectiveness in managing those risks centrally. Supervisors pointed out that the group-specific risks are not reflected in the current calibration of the operational risk and that it is difficult to tell whether their effects are higher or lower than the diversification effects on operational risk at group level.

Both groups and supervisors noted the group calculations and the use of variation methods made the process very complex, particularly for the SCR calculation. The need to further refine the standard formula was a common message from both groups and supervisors.

For the seven groups, which provided complete data for internal models, the internal model group SCR is on average very similar to the group SCR calculated with the standard formula.

Group technical provisions:

Some groups asked for the recognition of diversification in the calculation of the risk margin. Supervisors noted this is inappropriate since the risk margin is a part of technical provisions and that these should equal the sum of solo technical provisions (with elimination of internal reinsurance) in the consolidated accounts.

Group own funds:

It is important to note that the elimination of the double use of own funds in the calculation of group own funds is a fundamental principle of group supervision. For this reason, under Solvency I and QIS4, group own funds do not always equal the sum of solo own funds.

The calculations for group own funds were consistent with the own funds calculations at solo level. Most of the group own funds have been classified as Tier 1 capital (91%). A characteristic specific to groups is a higher proportion of hybrid capital (13%) such as subordinated debts at group level, which comes mostly from the inclusion of holding companies.

Further work is needed on the assessment of non-transferable assets at group level. Both groups and supervisors asked for more clarification in this regard as it can have a very significant impact. Some supervisors consider that this assessment should be done individually by groups and included in the Pillar 2 review.

Group surplus:

There is a slight general increase of group surpluses that means that on average groups would see the excess of available capital over the standard formula SCR increase as compared to their current Solvency I position. However, it should be noted that results vary largely from one group to another

Group support:

There is broad support from groups, in particular the largest groups, for the group support regime. Very few supervisors provided comments on group support, principally due to the fact that it is a subject of on-going debate in the Council and Parliament. There is almost no quantitative data from QIS4 on the issue. This may reflect that nothing comparable to the group support regime exists today.

13.2 Methods tested for assessing the group SCR

CEIOPS acknowledges the great efforts of groups in participating in QIS4. Their participation and the calculations of the different methods of the Technical Specifications were essential for assessing the impact on group surpluses and the different sources of diversification. 111 groups from 16 home countries participated in the group part of the QIS4 study, including more than 60% of cross-border groups and a significant number of mutual groups. 106 submitted their results to the centralised database.

Groups were specifically asked to test:

- the default method that applies the solo standard SCR formula to the group as if it were a single entity and recognises diversification benefits between different group undertakings, including between EEA (European Economic Area) and non-EEA (re)insurance undertakings and with-profit business (default method);

- the default method without diversification arising from non-EEA undertakings (Variation 1);
- the default method without diversification arising from non-EEA undertakings and from with-profit business for EEA undertakings (Variation 2);
- the deduction and aggregation method. No diversification across group undertakings is recognised but the double capital charge on intra-group transactions is eliminated.

The following table summarises for which kind of undertakings diversification is recognised in each method:

Table 72: Different methods of calculations of group SCR and group own funds

Diversification recognised	EEA undertakings	EEA with-profits business	Non-EEA undertakings
Worldwide consolidated (default method)	Yes	Yes	Yes
EEA consolidated (Variation 1)	Yes	Yes	No
EEA consolidated excluding with-profit (Variation 2)	Yes	No	No
Deduction & aggregation	No	No	No

In general, groups expressed a clear preference for the default method.

13.3 Quality of data

In general, group calculations are less reliable than solo results. Quality checks of the results were more difficult due to the perimeters of consolidation that may have been different from the ones currently used for supplementary supervision, e.g. when some entities of the group were not modelled. Furthermore, some of the group undertakings were not always modelled, which impaired the analysis of the group versus solo effects. There was also evidence that groups made certain adjustments, deductions and simplifications in their solvency calculations³², which has made it difficult to compare groups on an equal basis.

³² This may be due the short timeframe in which QIS4 was conducted.

As a consequence, the amount of surplus is subject to reservations due to the heterogeneity in the estimation of non-transferable assets and of the impact of deferred taxes and future discretionary benefits on the assessment of own funds.

It has also to be highlighted that some groups found it difficult and onerous to calculate the two variations of the default method given the limited number of dedicated resources and the short deadline. Moreover, for some of the groups Variation 1 is not applicable due to the fact that they have all their business within the European Economic Area. For these reasons, the samples of groups included in the following tables differ.

13.4 Comparisons of the various methods and principal results

The results exposed in chapter 13.4 cannot be considered independently of the detailed results on the analysis of diversification and the eligible elements of own funds of chapters 13.5 and 13.6.

It should be highlighted as well that it was only possible to assess diversification for groups that provided complete data (e.g. all the solo SCRs and the worldwide consolidated calculation group SCR for assessing the overall diversification). As a consequence, the samples for assessing diversification are smaller than the number of groups that provided at least one group SCR calculation.

13.4.1 Total evolution of the surpluses between Solvency I and II

The following table shows the evolution of the surplus in QIS4 (i.e. the excess of eligible elements of own funds to the group SCR as calculated with the default method) to the surplus under Solvency I.

Table 73: Surplus under QIS4 to surplus under Solvency I

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
QIS4 surplus to SI surplus	44.7%	76.2%	113.4%	231.9%	326.8%	108.7%	137.1%	(44)

The surplus would slightly increase for a majority of the groups that did provide sufficient data to assess the ratio. The weighted average is equal to 108.7%.

13.4.2 General results

The group diversification effect is measured as the ratio between the group SCR, calculated by using the standard formula, and the sum of the solo SCRs.

It should be noted that some groups did not provide solo answers for all the solo undertakings that have been included in the scope of consolidation. Other groups did not model the material risk borne by the holdings, for which there would be a capital charge in a “total balance sheet” system.

Both groups and supervisors noted the group calculations and the use of variation methods made the process very complex, particularly for the SCR calculation. Some supervisors observed that some groups made adjustments to the specifications, which means the results may overestimate or underestimate a group’s true position. The need to further refine the standard formula was a common message from both groups and supervisors.

Table 74: Group SCR to sum of solo SCRs

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
Group SCR to sum of solo SCR	60.3%	69.0%	80.5%	89.9%	98.1%	73.7%	26.1%	(48)
Diversification	39.7%	31.0%	19.5%	10.1%	1.9%	26.3%		(48)

The table above shows that the median of the diversification is equal to 19.5% and the weighted average is equal to 26.3%, which implies that the diversification is higher for the largest groups.

This diversification includes both the release of the double capital charge on intra-group transactions and “real” diversification.

The separate analysis of those two effects is set out in the following paragraphs.

13.4.2.1 SCR using the standard formula

13.4.2.1.1 Impact of intra-group transactions

In addition to the application of the solo formula, groups were asked to calculate the solo SCR with no capital charge on intra-group transactions. A comparison of the sum of the solo SCR and the adjusted solo SCR demonstrates the impact of the capital charge on intra-group transactions in the solo capital requirements.

Table 75: Sum of solo SCRs adjusted for intra-group transactions to sum of solo SCRs

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
Sum of solo SCR adjusted to sum of solo SCR	64.4%	79.0%	89.9%	97.5%	100.0%	91.4%	16.3%	(54)

Table 75 shows that the impact of the intra-group transactions capital charge can be very high for a significant number of groups. The charges are mainly in relation to participations, loans and internal reinsurance.

On average, capital charges on intra-group transactions represents 10% of the solo SCRs. The figure is lower for the larger groups as the weighted average (8.6%) is lower than the median (10.1%).

13.4.2.1.2 "Real" diversification

Once double-counting for the capital charge on intra-group transactions is neutralised, that volume measure represents, *ceteris paribus*, the "real" measure of the group worldwide diversification effect (i.e. "pure" diversification effects neutralising the impact of intra-group transactions on the SCR). By its very nature, diversification effects vary considerably from one group to another, mainly according to the diversity of their businesses. Consequently, the average diversification effect is a result that should be interpreted with care.

Table 76: Group SCR over sum of solo SCRs adjusted for intra-group transactions

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
Ratio of SCR Conso to SCR sum of solo adjusted	77.2%	83.5%	88.7%	93.7%	96.2%	78.7%	8.7%	(24)

The reduced size of the sample is due to the fact that some groups did not perform solo calculations for the non-EEA undertakings.

The above table shows a median of the real diversification for groups that provided adjusted solo SCRs and a group SCR based on the consolidated accounts of 11.3% and a weighted average of 21.3%. Therefore the real diversification is quite significantly higher for the larger groups than for the smaller ones. It also shows that more than 25% of groups have a real

diversification higher than 16.5%. For at least 10% of groups, the diversification is lower than 3.8%.

The table below shows the real diversification at EEA level. In this case the group sample is significantly higher than in the table "group SCR over sum of solo SCRs adjusted for intra-group transactions".

Table 77: Group insurance EEA SCR over sum of solo EEA insurance undertakings SCRs adjusted for intra-group transactions

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
Group EEA SCR to sum of EEA solo adjusted	64.5%	71.3%	82.0%	92.7%	97.1%	79.1%	14.8%	(42)

When only considering the EEA insurance undertakings of the groups, the diversification is on average equal to 18% and the weighted average is equal to 20.9%.

A comparison with figures in the table "group SCR over sum of solo SCRs adjusted for intra-group transactions" shows that the median of diversification may be higher at EEA level than at a worldwide level. It is difficult to interpret this result given that the two samples are not fully comparable and the sample taken into account in this table is significantly higher than in the previous.

Some reasons may be that:

- In the worldwide calculation, other financial services and non-controlled participations are included, for which diversification is not recognised, while in the table above, only the controlled EEA (re)insurance undertakings are included, for which diversification is recognised;
- SCR or local capital requirements for some non-EEA entities may not have been included in the groups answers, which leads to an underestimation of the diversification at a worldwide level.

13.4.2.1.3 Diversification from third countries

The ratio of the SCR with diversification from third countries on the SCR without diversification from third countries has a weighted average of 81%, which means a diversification of 19%. The results indicate that internationally active groups can account for a significant amount of diversification from non-EEA business, but the figures are limited because of the sample size. Generally, groups noted that diversification benefits between non-EEA and EEA undertakings should be recognised. Some supervisors considered that transferability is an important

issue when assessing diversification and its impact should be properly taken into account when assessing the surplus.

13.4.2.1.4 Diversification from with-profit business

The results show that the inclusion of with-profit business under Variation 2 generated a higher group SCR than the default method of QIS4. Groups noted that diversification benefits between with-profit business and other business should be permitted. However, some supervisors expressed concerns over the inclusion of this diversification to meet the SCR of other business as these funds may not be transferable. Therefore, in their opinion, they should not be attributable to the group surplus. Other supervisors highlighted that with-profit business is not the same in the European countries and that such differences have to be taken into account properly³³.

Table 78: EEA group SCR with diversification from with-profit business to EEA SCR without diversification from with-profit business

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
EEA Variation 1 to EEA Variation 2	72.7%	79.4%	86.8%	94.2%	96.9%	84.1%	12.0%	(35)

For half of the groups in the sample (18 groups), the SCR for the EEA part of the group when recognising diversification for with-profit business will be lower by more than 13% compared to the calculation that does not recognise diversification for with-profit business.

13.4.2.2 Comparison of capital requirement of standard formula and internal model

Groups using full or partial internal models were asked to present their own calculation of the group SCR.

Only seven groups provided complete data on a group SCR calculated with internal models. As indicated in the following table, the standard deviation of the ratio of the SCR calculated with the internal model on the SCR calculated with the standard formula (default method) is very high since it is equal to 28% and the median is equal to 88%, which means that for half of the groups the internal

³³ See "Background paper for cross-border insurance groups on the treatment of with-profit business in QIS4", CEIOPS-SEC.35/08, 24 April 2008, available on CEIOPS website

model group SCR will be lower than the group SCR calculated with the standard formula by more than 12%.

Table 79: Ratio of internal model SCR to standard formula SCR (default method)

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
Internal model SCR to standard formula SCR	75.6%	79.6%	87.6%	109.6%	132.5%	99.5%	28.1%	(7)

As a result, no general trend at European level can be drawn due to size of the sample and due to the fact that a number of groups reported a higher SCR calculated with their internal model. The explanations given were that some of the assumptions in the standard formula (e.g. equity risk) were insufficiently prudent compared with the groups' own risk assumptions or that groups applied in their internal model a prudent approach to the treatment of diversification from non-EEA undertakings (to reflect the likely limits on the transferability of capital arising from local regulatory restrictions or other limits). On the other hand, groups also noted that some parts of the standard formula were overly prudent (e.g. operational risk) and restricted the recognition of diversification. These factors may explain some of the variations when comparing the group SCR using the standard formula and internal model.

It should also be noted that comparing internal models and the standard formula on specific risks is difficult. For example, a higher calibration and a lower correlation can lead to the same result as a lower calibration and a higher correlation. Comparing diversification from two models that do not have the same structures is not always possible.

Eventually, some supervisors expressed some reservations on the figures derived from models that are still under development.

The figures in the remaining part of the group section are derived from the application of the standard formula. More detailed figures from internal models can be found in chapter 10.2.

13.4.3 Composition of the capital requirement

Unless specified otherwise, the figures in this sub-section are derived from the default method of the group QIS4 Technical Specifications by module (health, life, non-life, counterparty, market).

The following table shows the average composition of the net basic SCR (nBSCR) calculated with the worldwide consolidated method (default method). The

components of the nBSCR are counterparty default risk, market risk, non-life underwriting, health underwriting and life underwriting risk modules.

Table 80: Composition of net basic SCR as a percentage of the net basic SCR

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
Market risk	31.4%	41.9%	59.6%	75.8%	88.0%	63.0%	30.3%	(90)
Counter-party default risk	0.0%	0.1%	1.2%	5.2%	9.6%	4.3%	8.2%	(88)
Life underwriting risk	0.0%	2.8%	15.1%	33.4%	47.9%	24.8%	20.6%	(90)
Health underwriting risk	0.0%	1.1%	4.3%	12.5%	37.2%	7.0%	16.6%	(90)
Non-Life underwriting risk	0.0%	2.2%	34.4%	64.7%	78.2%	29.9%	30.9%	(90)
Reduction for profit sharing	0.0%	0.0%	5.2%	57.7%	157.2%	46.4%	187.2%	(90)
BSCR/nBSCR	100.0%	100.0%	106.4%	162.1%	260.2%	146.7%	187.7%	(90)
Diversification: sum risk modules/nBSCR	114.4%	123.3%	134.1%	141.1%	147.1%	134.4%	27.5%	(83)

Table 80 shows for each risk (counterparty default risk, market risk, non-life underwriting, health underwriting and life underwriting risk modules) the percentage of the net basic SCR it represents for groups. The row showing RPS gives the reduction of the group SCR due to the absorbing capacity of the future discretionary benefits (FDB) as a percentage of the nBSCR. The last line of the tables gives the results of the sum of each components of the net basic SCR (counterparty default risk, market risk, non-life underwriting, health underwriting and life underwriting risk modules) to the net basic SCR.

The main risk at solo level is market risk, followed by non-life underwriting risk, life underwriting risk and health risk.

On average the reduction for profit sharing (RPS) due to the absorbing capacity of future discretionary benefits (FDB) will lower the SCR by circa 53% (it has no impact on at least 25% of the groups but an extremely high impact on 10% of them).

On average, the application of the correlation matrix between market risk, counterparty default risk and underwriting risks (life, health and non-life) leads to reduction in the capital charge for those risks on average from 134 (the sum of the solo capital charge for the different risk modules) to 100 (the net basic SCR calculating by taking into account the diversification between the different risks).

As there will be a significant number of groups in the sample with life, health and non-life, they will benefit from a greater diversification effect via the correlation matrix of the standard formula than most of the solo entities that do not include those three risks.

13.4.3.1 Absorbing capacity of future discretionary benefits

The figures mentioned in the previous section take into account the absorbing capacity of future discretionary benefits (FDB). The following table shows the reduction of the group SCR due to the absorbing capacity of future discretionary benefits. The very high volatility of the ratio should be noted.

Table 81: Ratio of future discretionary benefits to group SCR

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
FDB to group SCR	1.4%	7.0%	36.1%	117.3%	219.9%	52.6%	166.8%	(58)

The absorbing capacity of FDB can be significant as it is at solo level. The impact of diversification can lead to a lower adjustment at group level because of diversification since, in general, the contribution of a solo undertaking to the group SCR is lower than to the solo SCR of the undertaking.

The following table indicates the percentage that reduction for profit sharing represents as a percentage of the amounts of the FDB in the groups’ accounts.

Table 82: Ratio of reduction for profit sharing to future discretionary benefits

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
RPS/ FDB	3.9%	14.1%	27.3%	61.9%	80.7%	30.4%	30.6%	(57)

The limitation on the amount of reduction for profit sharing to the amount of future discretionary benefits in the technical provisions (i.e. the fact that the adjustments for the loss absorbing capacity of future discretionary benefits itself can never exceed the excess of the total value of FDB) does not have any impact for most of the groups of the sample.

However, one issue for further work and consideration is to ensure that the absorbing capacity in one undertaking is not used to cover losses in another when calculating the group SCR on consolidated accounts, if this does not correspond with an economic reality.

13.4.3.2 Deferred taxes

As at solo level, this issue is treated differently by various groups. The issue was even more difficult to deal with for groups due to the different tax regimes that affect cross-border groups.

The table below shows the impact of the deferred taxes adjustment on the group SCR as a percentage of the SCR. Some groups have not been included in the table since not all groups modelled the effect in their calculations or it was already included within the various sub-modules when calculating the impact of shocks on the net asset value of the group.

Table 83: Ratio of the adjustment of deferred taxes to SCR

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
Adj DT to group SCR	2.2%	7.5%	18.7%	33.6%	50.5%	18.8%	22.0%	(48)

The table illustrates the significant impact of that adjustment on the level of the group SCR calculated with the worldwide consolidated method and with the consequences on the amount of available surplus. That adjustment is on average of 18.8% and can represent up to 50% of the final SCR for the most impacted groups. Only half of the sample of answering groups provided the calculation.

Whereas groups consider the calculation needs to be refined, a majority were in favour of taking into account the absorbing effect of deferred taxes in the case of shocks in the calculation of the SCR.

13.4.3.3 Operational risk

No diversification was allowed between the various entities of groups for QIS4. However, groups considered that diversification within the group should be allowed for operational risk. The application of the operational risk on the consolidated or combined accounts was tested for information purposes. The amounts as a percentage of the SCR are reflected in the table below.

Table 84: Ratio of operational risk to SCR

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
OpRisk to SCR	4.0%	5.2%	7.2%	10.6%	15.9%	7.7%	5.1%	(89)

On average, operational risk represents 7.7% of the group SCR (around 6% on average at solo level). The difference with solo level might be due to a better diversification of the different modules of the nBSR.

Two comments can be made on this issue. First, the calculation of operational risk at solo level is still not very satisfactory from a group’ perspective. Secondly, the diversification of operational risk depends on which of the following two effects is the greatest:

- the positive impact of being in a group (more means allocated to the management of those risks, a supplementary level of control, etc.);
- the group-specific risks such as contagion.

There was no empirical evidence that the operational risk for a group is lower or higher than the sum of solo operational risk. It should also be highlighted that the current standard calibration does not take into account group-specific risks.

Regarding internal models, the participants noted that some group-specific risks are taken into account. For example, restrictions on the transferability of capital, dependence on shared services, damage to group brand, M&As, illiquidity, no ability to offset deferred taxes throughout the group and intra-group transactions.

However, participants did not provide much quantitative analysis on these risks. It seems that these risk factors are more likely to be considered in a qualitative way and managed by intensive internal control processes. Stress scenarios are sometimes built to assess the impact of these factors on the group solvency position.

13.5 Analysis of diversification within the SCR

13.5.1 Effect of capital charge on intra-group transactions in solo SCRs

This sub-section deals with the assessment of the capital charges on intra-group transactions at solo level. In order to assess the impact and to be able to distinguish between the elimination of those effects and the real diversification

effects, groups were asked to calculate an adjusted solo SCR for capital charges on intra-group transactions.

13.5.1.1 Market risk

The following table shows the overall impact of capital charge on intra-group transactions on the sum of solo market risk.

Table 85: Ratio of sum of solo adjusted market risk to sum of solo market risk

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
Sum of solo adjusted market risk to sum of solo market risk	14.3%	53.5%	74.0%	96.1%	99.8%	50.6%	30.9%	(60)

Overall, capital charge on intra-group transactions will represent 26% at the 50th quartile and 50% as a weighted average of the overall market risk and only 4% for the 75th quartile. This implies that the capital charge on intra-group transactions is higher for larger groups.

The following paragraphs give the impact of intra-group transactions on the three main components of the market risk at group level: equity risk, property risk and spread risk.

13.5.1.1.1 Property risk

Property risk on intra-group transactions has a significant impact especially for some large groups, while it has almost no impact for half the groups in the sub-sample.

Table 86: Ratio of sum of solo adjusted property risk to sum of solo property risk

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
Sum of solo adjusted property risk to sum of solo property risk	21.4%	89.8%	99.1%	100.0%	100.0%	44.5%	31.4%	(20)

13.5.1.1.2 Capital charge for participation and subsidiaries

As for concentration risk, the capital charge on participations in the equity risk module can be quite significant in some groups. The qualitative comments on the treatment of participations are included in the SCR part of this report. The following table shows the quantitative impact for groups of those capital charges.

Table 87: Ratio of sum of solo adjusted equity risk to sum of solo equity risk

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
Sum of solo adjusted equity risk to sum of solo equity risk	18.5%	41.3%	69.2%	93.0%	97.3%	46.3%	30.5%	(52)

For 25% of the groups, intra-group capital charge represents more than 58% of the solo equity risk, while it has almost no impact for 25% of the groups in the sample. The impact is higher for the largest groups.

13.5.1.1.3 Spread risk

There is also spread risk on intra-group transactions, again mainly loans. The effect is generally negligible.

Table 88: Ratio of sum of solo adjusted spread risk to sum of solo spread risk

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	Percentile							
Sum of solo adjusted spread risk to sum of solo spread risk	12.9%	62.8%	96.9%	99.8%	100.0%	54.7%	33.7%	(35)

Spread risk on intra-group transactions can have a significant impact for some groups, while it has almost no impact for half of them. The impact is higher for the largest groups.

13.5.1.2 Counterparty default risk (internal reinsurance)

Counterparty default risk can be significant at solo level for groups where all the entities are reinsured by one entity in the group that is in charge of negotiating the reinsurance for the entire group. Some groups have also put such mechanisms in place to pool risks across the different entities of the group.

Table 89: Ratio of sum of solo adjusted counterparty default risk to sum of solo counterparty default risk

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
Sum of solo adjusted counterparty default risk to sum of solo counterparty default risk	3.8%	46.1%	91.5%	100.0%	100.0%	69.9%	36.3%	(45)

Counterparty default risk on intra-group transactions can have a significant impact for some groups, while it has almost no impact for half of them. The impact is higher for the largest groups since on average it represents 30.1% of the sum of the solo counterparty default risk while the median is equal to 8.5%.

13.5.2 Risk factors which are lower at group level

13.5.2.1 Concentration risk (widened assets basis)

If there is a concentration risk in one solo undertaking, the fact that the assets are mixed with those of other undertakings can lead to much lower concentration risk at group level than the sum of the solo adjusted SCR.

A specific case should be mentioned here. When there is a non-OECD or non-EEA undertaking in a group, governments bonds are charged at solo level and group level within concentration and spread risk while they are “non-risky” assets when covering the liabilities of the subsidiary. For an undertaking in a non-OECD country investing mainly in the government bonds of that country, the concentration risk on those bonds can represent up to 75% of the solo SCR.

13.5.2.2 Non-life cat underwriting risk (impact of the materiality threshold)

In the non-life cat module, there is a materiality threshold equal to 25% of the highest exposure to cat risk of the concerned entity or group. Therefore, when calculating cat risk at group level, only the main exposures will be taken into account. The effect is illustrated in the following table.

Table 90: Illustration: Materiality threshold in non-life cat underwriting

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	NL _{cat}
Entity 1	100	30	30	20	0	109
Entity 2	30	0	0	5	20	36
Group	130	30	30	25	20	130 (145)

13.5.2.3 Offsets of the positive and negative effects in the modules with scenario

13.5.2.3.1 Interest rate risk

If there are undertakings for which the net asset value will decrease where there is an increase in interest rates and others for which the net asset value will increase, the impact for the group will be offset by those two effects. Therefore, interest rate risk can be lower when applying the standard formula to the group than when considering only the sum of interest rate risk for the undertakings for which the net asset value diminishes (i.e. when interest rates increase).

This effect can lead in some cases to a 60% reduction in the interest rate risk charge at group level and in some cases to no capital charge for interest rate risk. Therefore, from a supervisory perspective it is essential to be sure that those offsets are justified.

Table 91: Ratio of sum of solo adjusted interest rate risk to sum of solo interest rate risk

	10th	25th	50th	75th	90th	Weighted average	Standard deviation	Sample size
	percentile							
Sum of adjusted interest rate risk to sum of unadjusted interest rate risk	29.9%	52.4%	75.1%	87.4%	96.1%	71.5%	24.9%	(43)

The weighted average of the reduction of interest rate risk, when comparing solo results to the group one, is equal to 28.5% and the median to 24.9%, which is very significant.

13.5.2.3.2 Other market risks and life risks

As for interest rate risks, there can be offsets for longevity and mortality risks, since there might be group entities for which the net asset value will increase in case of a decrease of mortality and others for which it will decrease.

Those offsets can happen any time a scenario is considered to calculate the capital charge for a risk (i.e. for other sub-modules of market risk). However, the effects are less material for other sub-risks than for interest rate risk.

13.5.3 Diversification effects amplified at group level

13.5.3.1 Non-life underwriting risk

13.5.3.1.1 Geographical diversification

One of the aims of QIS4 was to test the usability of the geographical diversification factor in the group SCR calculations. It can be tested in two ways: either by the use of a diversification index between geographical areas based on the locations of the risks borne by groups, or by the use of deviation parameters specific to groups. Recognising geographical diversification is discussed in the SCR part of this report.

The following table shows for the different lines of business, the number of groups for which geographical diversification reduced the non-life premiums and the reserves capital charge.

Table 92: Non-life premium and reserve risk with the geographical diversification on the non-life premium and reserves risk without geographical diversification

	10th	25th	50th	75th	90th	Standard deviation	Sample size
	percentile						
Workers' compensation	80.3%	83.7%	89.7%	95.5%	97.9%	6.8%	(26)
Health short-term	80.1%	87.5%	92.7%	96.2%	99.0%	6.8%	(27)
Health (other)	79.3%	80.6%	87.4%	95.3%	99.4%	7.6%	(29)
Motor, third party liability	79.9%	84.5%	89.7%	97.5%	99.8%	7.5%	(32)
Motor, other classes	82.8%	86.0%	90.1%	97.0%	99.6%	6.7%	(28)
Marine, aviation	78.3%	82.5%	88.4%	94.3%	98.0%	7.2%	(22)

and transport							
Fire and other damage to property	84.0%	86.7%	93.9%	99.0%	99.4%	7.4%	(11)
Third-party liability	86.8%	87.5%	93.2%	99.1%	99.8%	7.1%	(13)
Credit and suretyship	79.1%	81.2%	87.6%	97.3%	99.7%	8.1%	(26)
Legal expenses	78.0%	78.5%	81.2%	87.6%	88.3%	6.5%	(12)
Assistance	79.8%	80.4%	82.3%	85.5%	92.2%	6.1%	(12)
Miscellaneous non-life insurance	78.3%	78.7%	80.3%	83.9%	86.3%	3.5%	(11)
Non-proportional reinsurance property	85.1%	88.0%	89.3%	98.0%	99.8%	6.1%	(12)
Non-proportional reinsurance casualty	83.3%	86.5%	94.8%	98.1%	99.9%	6.7%	(25)
Non-proportional reinsurance MAT	82.4%	87.6%	89.5%	98.0%	99.0%	6.7%	(24)

The ratio is always between 75% and 100% since geographical diversification was limited in QIS4 to 25%. It can be noted from the above table using the standard formula that diversification across countries can have an impact in all lines of business and for a significant share of the groups that have responded to QIS4. It should be noted that some groups did not provide the data to assess geographic diversification.

13.5.3.1.2 Diversification between lines of business

Usually, a group will have a more diversified business mix than a solo undertaking. Therefore, it will benefit more than solo entities from the fact that the correlations between the non-life premium and reserves risk between the different lines of business is lower than 100%.

13.5.3.2 More diversified risks lead to more diversification benefits via the correlation matrixes

In general, the results indicate that having a more diversified business mix leads to a reduction of the capital requirement when applying the standard formula. Indeed most of the risks within the standard formula are considered to be not fully correlated and, therefore, the effect can be quite significant. For example, if a non-life entity is added to a group that has mainly a life activity, the additional capital charge for the group will be much lower than the solo SCR of that entity (up to 50% depending on the size of the entity compared to the size of the group).

13.6 Own funds

13.6.1 Composition by category

According to the default method, group own funds have been calculated by applying the solo standard formula to the consolidated accounts, with some adjustments related to the non-transferability of certain items (see next paragraph).

The composition of group capital reflects the same classification and limits applied at solo level and, to some extent, provides the same picture (see chapter on Own Funds).

Table 93: Detailed breakdown of eligible elements under QIS4 regime and Solvency I regime

All business segments	Detailed breakdown of eligible elements						Sample size
	Solvency I	QIS4 Total	QIS4 Tier 1	QIS4 Tier 2	QIS4 Tier 3	QIS4 Total ratio to All own funds	
Groups <i>Worldwide consolidated</i>	EUR mill.	EUR mill.	EUR mill.	EUR mill.	EUR mill.		
All own funds	348,225	446,012	402,456	36,688	6,868		(76)
Basic Own Fund Items	310,621	438,184	402,456	32,014	3,714	98.2%	(76)
Common equity capital (net of own shares)	75,665	102,922	102,922			23.1%	(76)

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Profit/loss carried forward (i.e. retained earnings)	70,300	92,713	92,713	0	0	20.8%	(76)
Valuation adjustments to assets		-6,064	-6,064			-1.4%	(76)
Valuation adjustments to liabilities		67,779	67,779			15.2%	(76)
Share premium account	20,505	23,537	23,537			5.3%	(76)
Surplus funds		9,212	9,212			2.1%	(76)
Profit reserves	10,176						(76)
Revaluation reserves	14,085						(76)
Other reserves (loss-absorbent for all policyholders)	35,072	37,715	37,715			8.5%	(76)
Other reserves (with restricted loss-absorbency)	22,559	24,782	24,491	290	0	5.6%	(76)
Members account (subordinated)	-2	-17	-17	0	0	0.0%	(76)
Budgeted supplementary calls	17	882	17	346	519	0.2%	(76)
Cumulative preference shares - perpetual	170	754	344	409	0	0.2%	(76)
Cumulative preference shares - dated	0	1,014	0	1,014	0	0.2%	(76)
Non-cumulative preference shares - perpetual	4,464	4,191	4,191			0.9%	(76)
Non-cumulative preference shares - dated	0	0	0			0.0%	(76)
Subordinated loans - perpetual	24,247	26,220	16,164	9,315	741	5.9%	(76)
Subordinated loans - dated	12,579	25,180	6,711	16,331	2,138	5.6%	(76)
Other hybrid capital - perpetual	3,241	5,572	2,089	3,483	0	1.2%	(76)
Other hybrid capital - dated	1,103	1,141	0	825	316	0.3%	(76)
Other	16,439	20,651	20,651	0	0	4.6%	(76)
Ancillary Own Fund Items	1,155	7,828		4,674	3,154	1.8%	(76)

Callable common equity capital	56	136		136		0.0%	(76)
Unpaid cumulative preference shares - perpetual	65	65			65	0.0%	(76)
Unpaid cumulative preference shares - dated	0	0			0	0.0%	(76)
Unpaid non-cumulative preference shares - perpetual	0	0		0	0	0.0%	(76)
Unpaid non-cumulative preference shares - dated	0	0		0	0	0.0%	(76)
Unpaid subordinated loans - perpetual	575	575		575	0	0.1%	(76)
Unpaid subordinated loans - dated	0	0		0	0	0.0%	(76)
Unpaid other hybrid capital - perpetual	0	0		0	0	0.0%	(76)
Unpaid other hybrid capital - dated	0	0		0	0	0.0%	(76)
Letters of credit & guarantees (Art. 96)		0		0	0	0.0%	(76)
Other letter of credit and guarantees		0			0	0.0%	(76)
Supplementary member calls for PIA		400		400		0.1%	(76)
Supplementary member calls (other)	459	6,551		3,463	3,089	1.5%	(76)
Group support		101		101	0	0.0%	(76)
Other		0		0	0	0.0%	(76)
Solvency I specific items	12,509						(76)
Future profits	721						(76)
Zillmerisation	-2						(76)
Hidden reserves	11,790						(76)

Basic own funds in the QIS4 regime are about 98.2% of the total own funds. The main categories are: common equity capital (net of own shares), profit/loss carried forward (i.e. retained earnings), valuation adjustments to liabilities and subordinated loans (perpetual and dated). It is important to note that the

proportion of hybrid capital instruments and subordinated liabilities (average 13%) is higher than at solo level (average 2%).

This was expected, as often undertakings raise capital at the parent or holding company level and then down-stream and/or lend it to subsidiaries in the form of higher quality capital. Although most hybrid capital has been classified as Tier 1, this classification may not be correct in all cases, as instruments may not have the required loss absorbency features.

Ancillary own funds are about 1.8% of the total own funds. There is a very high percentage of supplementary calls (other), about 1.5% of the total own funds, stemming from small mutual groups. Most of the other ancillary own funds form a small proportion of total own funds (similar to QIS3).

In terms of quantitative impact, group own funds would increase under QIS4 by approximately 39% compared to their current Solvency I position (as shown in the table below which includes 85 groups). This increase is largely due to: Solvency II valuation adjustments, reclassification of equalisation provisions into own funds, 100% inclusion in own funds of hybrid capital instruments, subordinated liabilities and ancillary own funds.

The vast majority of own funds has been classified as Tier 1. A similar situation was observed in QIS3.

Table 94: Detailed breakdown by tiers of eligible elements under QIS4 regime (EUR million)

	Solvency I	QIS4 total	Tier 1	Tier 2	Tier 3	Sample size
Total own funds	370,272	515,308	467,804 (90.8%)	38,636 (7.5%)	8,868 (1.7%)	(85)

More specifically, as indicated in the table:

- on average 90.8% of capital has been classified as Tier 1. In some groups Tier 1 is 100 percent;
- on average 7.5% of capital has been classified as Tier 2;
- only the remaining 1.7% are attributable to Tier 3.

Most respondents did not raise any issues in their qualitative responses relating to the adequacy, suitability and practicability of the proposed classification of own funds. In some cases, groups made the same remarks they had made in the solo responses. Some groups asked for more guidance on the tiering of capital when calculating the solo and groups own funds.

13.6.2 Transferability

In order to assess the impact on the solvency margin position of the group of specific undertakings or business segments which might be significantly affected by capital transferability issues, groups were asked to apply some adjustments to the amount of own funds. As a matter of fact, where some eligible own fund items of one entity in a group cannot effectively be made available to cover the losses (and thus the SCRs) of other group undertakings, this has a (negative) impact on the solvency position of the group, as not all own funds are fully available at group level. These adjustments related mainly to: the surplus of with-profits business, the surplus in non-EEA undertakings, the treatment of minority interests and non-transferable assets. Groups were required to indicate the amounts of these adjustments according to their own estimations and then to calculate their contribution to the eligible group own funds with a specific reduction of these amounts to take account of diversification effects on the consolidated group SCR (see TS.XVI.B.24 and TS.XVI.B.34).

This evaluation was found difficult. The Technical Specifications were considered insufficiently clear by several groups, irrespective of their size. As a result, the figures provided are not always consistent across groups. This problem arises from the fact that:

- groups have not included exactly the same elements in their calculations;
- some groups have made certain adjustments in order to calculate their contribution to the eligible own funds and other groups have not;
- some groups have not provided any data in the group spreadsheet.

Some groups have taken into account some limitations to the transferability of the “value in force” (i.e. discounted value of future profits) from one undertaking to the rest of the group. In contrast, others did not take into account and do not agree with such a restriction.

For this reason, as noted by the vast majority of supervisors, it is not possible to draw any general conclusion on the amount of non-transferable elements and their impact on groups own funds. However, it seems that the limitations to transferability have not been fully taken into account by some groups and, consequently, group own funds may have been overestimated. As noted both by groups and supervisors the issue of transferability would need further clarifications and guidance at the European level.

13.7 Group support & Group Membership

13.7.1 Group Support

Very few groups provided quantitative information on the amount of any “group support” that undertakings have used as part of own funds and how this relates to total own funds. Groups were asked to show the amount of any “group support” that they may seek regulatory approval for under the group support proposal as Tier 2 or Tier 3 capital.

Supervisors can only speculate on the reasons for the limited response. However, it may be because groups have focussed more on the core group calculations than on the assessment of quantitative amounts of group support. Moreover, QIS4 was based on the group accounts as at the end of 2007 in a regulatory framework without a group support regime. This may have made it difficult for groups to calculate a group support figure for subsidiaries. Comments on group support were more qualitative than quantitative.

All groups that have answered have classified the group support as Tier 2 (see the detailed breakdown of eligible elements under QIS4 regime and Solvency I regime).

It is not possible to test how group support relates to the minimum (the sum of any deficits in the solo SCR of any EEA group member) and maximum (the sum of the difference between the solo SCR and the solo MCR for all EEA members of the groups) from the QIS4 data, due to the lack of information.

From the results, it is estimated that the maximum amount of group support is equal to more than half of the sum of solo SCRs on average. However, it is doubtful whether groups would have used the theoretically “maximum” amount of group support permitted under the Solvency II Framework Directive Proposal. One group noted that it would never use group support to meet the entire difference between the SCR and MCR as it would leave a subsidiary too vulnerable to a solvency breach in the event of losses or fluctuations on the balance sheet.

Very few supervisors provided comments on group support, principally due to the fact that it is a subject of on-going debate in the EU Council and Parliament. Supervisors noted that they are aware that large groups are in favour of such an approach for the reasons summarised above and expressed in several CRO papers and documents. It was also noted that several responses concerning the mechanisms for the movement of capital are consistent with CEIOPS Advice to the European Commission on aspects of the Framework Directive Proposal related to Insurance Groups (CEIOPS-DOC/25/08) of May 2008 (e.g. the dividend-subscription method).

Groups that expressed their opinion in the groups questionnaire (generally the largest groups) were strongly in favour of the group support regime. In their responses, they often made reference to the CRO Forum's position and statements.

More specifically, the following comments were provided:

Potential barriers for the transfer of assets

The potential barriers mentioned by groups relate to whether the group will have appropriate funds in a time of stress and whether the group will be able to deliver value to the subsidiary in the appropriate timeframes. It was also mentioned that there could be legal barriers if own funds of life insurance subsidiaries should be transferred.

Intra-group support arrangements

Groups noted that group support is akin to some of the intra-group funding arrangements they currently have in place: assets are typically down-streamed from the parent to the subsidiary. Several groups noted that excess assets are often moved by means of a dividend followed by share capital injection or intra-group loan to the subsidiary. In some groups, profit and loss transfer agreements or loss assumption contracts are in place. This ensures that the subsidiaries' losses will be borne by the parent company at the end of the year.

Other groups noted that the effect of group support can also be achieved in stress conditions by moving the relevant risk to the parent using internal reinsurance.

The type of instruments potentially used in group support

Groups noted that the precise legal form is to some extent secondary, though what matters is that the legal issues are appropriately addressed.

A majority of groups mentioned a "first demand guarantee" as a key example of the type of instrument that could be used for group support. Other instruments referred to include loans, contingent loans, contractual guarantees, letters of credit and collateral deposits. Some groups also noted that Level 2 measures should not prescribe the legal instruments which count as group support.

Factor that may influence the decision to mobilise group support

Groups noted that group support will only be used if the result of a cost-benefit analysis is positive. In their opinion, the issuance of group support may be complicated by factors such as the role of the solo supervisor, the imposed capital add-ons and the extent to which group support can be used.

They also noted that there are alternative tools to group support allowed within Solvency II such as internal reinsurance and unpaid own funds. However, these are not perfect substitutes.

Other factors that may influence a transfer of assets within a group include regulation (i.e. third country requirements), credit ratings and the location of transferable funds.

The link between group support and capital management

Groups noted that the group support regime may provide an incentive to restructure the group to maximise the return on capital. The key advantage of group support is to capture some of the diversification effects within a group, reduce the encumbrances on capital and improve the robustness of the group's solvency capital. However, capital that is not transferable within the group should not be permitted to be used for group support.

Some participants mentioned that capital management was viewed from an overall perspective instead of an individual unit perspective to ensure a better overall risk management in this case. Other groups noted that they hold surplus capital at group level to maintain maximum flexibility.

13.7.2 Group Membership

13.7.2.1 Distribution of diversification benefits over individual group entities

Groups noted that there are many ways to attribute diversification benefits, such as hybrid capital injections into the subsidiary, assets transfer, and equity injections.

Some groups noted also that one of the key aspects of group diversification is that they are allowed in the solvency calculation. A separate issue is the mechanism used to give credit to local entities in a supervisory context. The proposal for group support represents an approach to do so but Solvency II generally aims to facilitate capital mobility within a group.

13.7.2.2 Positive and negative effects of group membership

Some of the benefits of being in a group mentioned by groups include a more balanced risk profile, better use of scarce resources, access to capital (internal/external), access to markets and skills, common risk management systems and shared brand recognition. In the groups' view another positive effect is the ability to enlarge the pool of risks with the benefits of spreading risk more effectively, which should make a solo entity more resilient than a similar entity which is not part of a group.

Some of the negative aspects of being in a group include the regulatory burden of reporting under various regimes, reduced autonomy, reputation risk, liquidity risk, insufficient group own funds to support subsidiaries and maintaining appropriate systems and controls of groups with diverse lines of business in different geographical areas.

13.8 Other topics

13.8.1 Floor of the SCR

The minimum consolidated group SCR has a floor equal to the sum of the solo MCR. This floor results from the fact that if the minimum group SCR is below the sum of the solo MCR, then it means that one of the entities of the group will not cover its minimum capital requirement.

The following table gives the ratio of the sum of the MCR (calculated with a linear MCR capped by 50% of the solo SCR and floored by 20% of the solo SCR) over the group SCR calculated with the standard formula.

Table 95: Ratio of sum of the “corridor” MCR to the group SCR (default method)

	10th	25th	50th	75th	90th	Weighted Average	Standard deviation	Sample size
	percentile							
Ratio MCR corridor/ SCR _{wwconso}	24.0%	36.0%	46.6%	57.9%	63.0%	45.6%	15.0%	(54)

The floor equal to the sum of the solo MCR for the SCR has no impact in the QIS4 exercise.

13.8.2 Technical provisions: risk margin

Some groups asked for the recognition of diversification in the calculation of the risk margin. Supervisors consider this is not appropriate since risk margin is a part of technical provisions and that technical provisions in the consolidated accounts are equal to the sum of solo technical provisions (with elimination of internal reinsurance).

13.8.3 Clarification on the deduction and aggregation method

Some supervisors and groups consider that some clarification on the calculation of the group solvency capital requirement for the deduction & aggregation method are required in Level 2 or 3 measures, particularly on two issues:

- material risks borne by non-regulated entities; and
- elimination of intra-group transactions and the methods to do it.

On the first point, some supervisors consider that the material risks borne by the non-regulated entities, such as the currency risk at the holding level, should be taken into account in the assessment of the SCR with the deduction & aggregation method. It was requested in QIS3 and QIS4, but that calculation was not performed by all the groups.

On the second point, the method used in QIS4 to avoid a double capital charge on intra-group transactions (i.e. the elimination of market and counterparty risk charges on all intra-group transactions) seems suitable for most of the groups.

However, some groups asked for more guidance, for example, further guidance should be given on the entity to which internal loans should be allocated. In addition, some supervisors noted that loans should be located where the cash is located.

Some groups also noted that the deduction and aggregation method (that is the alternative method for the calculation of the group SCR envisaged in the Directive Proposal) is good and practical. According to the relevant supervisors, some of the reasons behind this standpoint may be that the group level diversification strategy is sometimes quite negligible, that the selected capitalisation strategy is sometimes quite prudent and that the adding up of the solo SCR is technical, fast and simple to carry through.

13.8.4 Valuation of participation issue

The treatment of participations and subsidiaries raised some comments from groups and supervisors.

One supervisor noted that the calculations required for all subsidiaries/participations were considerably more complex in QIS4 and there were dangers of mixing solo and group perspectives of solvency.

On the difference between economic value and accounting, one supervisor mentioned that there should be a clarification on the valuation of subsidiaries in Solvency II accounts since according to the accounting practice the holdings of subsidiaries cannot be valued over acquisition value in the accounts. The difference between the economic valuation to market value and the acquisition

value is an eligible element in the own funds in Solvency I and forms a part in own funds. In the QIS4 solo sheet, the treatment of that item was unclear.

There is another issue regarding the method of consolidation and the calculation of the group capital requirement. Some groups noted that their consolidated balance sheet are based on IFRS principles, and, as a result, they found it difficult and non-IFRS consistent to calculate the sub-consolidated areas as requested in the Technical Specifications because the sub-consolidated figures do not stem from a balance sheet. In particular, groups made reference to other financial sectors (OFS) and other group business (OT) that, according to the Technical Specifications, are not included in the consolidated perimeter and, consequently, are not taken into account in the calculation of diversification effects.

Other groups mentioned that they have a preference for the use of principles over rules in the Solvency II Framework Directive Proposal and stressed that possible upcoming Level 2 measures related to the scope of consolidation should be principle-based and not rule-based. They also noted that, once diversification is recognised in the calculation of the group capital requirement, it is essential to have a consistent method of consolidation across groups to avoid regulatory arbitrage due to the use of one method or another. This might have consequences as well for the implementation of internal models.

In particular groups made reference to Article 226 of the Solvency II Framework Directive Proposal that states that when an insurance undertaking is participating in a credit institution, an investment firm or a financial institution, Member States shall allow their participating insurance undertaking to apply the consolidation method as set out in the Financial Conglomerates Directive (2002/87/EC). According to Article 226, this is only allowed when the group supervisor is satisfied with the level of integrated management and internal control regarding the entities that would be included in the scope of consolidation. In their opinion this option is important, because the internal model will apply to all subsidiaries, not only the (re)insurance companies within the group. Moreover, allowing exclusions of non-(re)insurance participations may encourage regulatory arbitrage in that some companies may seek to classify certain risks as “banking” or “pensions” to circumvent market consistent valuation when it is to their detriment.

The group internal model results indicate models cover about 90% of the business in terms of life technical provisions, non-life earned premiums and SCRs. Subsidiaries that were not included in the scope of internal models are often the smallest insurance undertakings, especially in non-EEA countries, services companies or companies with no operational control. Groups also noted that they need some time to include subsidiaries that were recently acquired.

There is usually no allowance for diversification from subsidiaries outside the scope of an internal model. Many different approaches can be observed to assess the capital requirements for the non-covered entities. The two most common treatments for these entities are to set their capital requirements equal to the local regulatory requirements or to consider them as a participation in the equity risk sub-module of the holding company.

Regarding non-regulated entities or entities from another financial sector, participants often use a look-through approach to assess their exposures to risk factors used in their model. Where feasible, groups derive a VaR for risks in certain activities and aggregate it with the other SCRs, even if methodologies are rather different.

14 Key lessons learned and challenges ahead

In addition to the areas identified in the report where further guidance is needed or approaches need to be clarified or simplified, some challenges have arisen during the exercise, which will need to be tackled in the coming months and years when implementing Solvency II.

The challenges include:

1. The **auditability** of the Solvency II balance sheet is a crucial element for the practical implementation of Solvency II. Some concerns arise with regard to the differences between Solvency II and IFRS valuation. CEIOPS participates in the ongoing discussion on how the current financial crisis will affect fair value measurement.
2. CEIOPS will carefully consider ways to render the new regulation appropriately risk sensitive, whilst taking into account the need to avoid **procyclical behaviour**. One issue that warrants further investigation here relates to optimal recovery periods under severe market stress.
3. Whilst QIS4 has already taken steps in improving the proposals taking into account the impact of **correlations** between risks, the treatment of structured products and the volatility of equities, further work on these issues will need to be carried out at Level 2.
4. Taking into account the possibility for including hybrid capital as eligible capital, careful consideration should be given to ways of reinforcing the highest **quality of capital** for covering the capital requirements.

15 Annex A: Suitability – A participants’ feedback analysis

One question in the QIS4 solo qualitative questionnaire asked participating undertakings to give an input on their expectations regarding CEIOPS future work. Concretely, undertakings were asked to state on a scale of 5 (more) to 1 (less) whether they deem appropriate more or less prescriptive rules, guidance for calculation, or simplifications to the methodology proposed in the QIS4 Technical Specifications.

The overall results of this analysis are presented in Chapter 4.1 of the main report.

15.1 Average results

The simple average of the national results is presented below:

Table 96: Average country grades

<i>Average country grade</i>	Technical provisions	Value of assets	Assessment of eligible capital	Calculation of SCR	Calculation of MCR
Prescriptive rules	3.1	3.1	3.3	3.2	3.2
Guidance for calculation	3.5	3.1	3.4	3.5	3.3
Simplification for methodology	3.3	3.1	3.3	3.3	3.3

For no item the balance fell towards “less” (that is under 3) which means that undertakings actually expect more of everything. Some prioritisation of the most relevant topics however seems to be useful in order to use CEIOPS resources efficiently when preparing the advice on implementing measures to the European Commission.

In the next table the ranks of these simple averages are presented, where the top five averages are flagged with a light background (high priority expectations toward CEIOPS regarding future work), the bottom five are flagged with a dark background (lower priority expectations toward CEIOPS). Average replies ranked

from 6 to 10 are presented with a white background (medium priority expectations).

Table 97: Global ranks (simple averages)

<i>Average country grade</i>	Technical provisions	Value of assets	Assessment of eligible capital	Calculation of SCR	Calculation of MCR
Prescriptive rules	13	15	9	11	10
Guidance for calculation	1	14	3	2	7
Simplification for methodology	8	12	6	4	5

15.1.1 Country bias

In order to address the issue that some countries may display a different level of overall satisfaction regarding the whole Solvency II process, which would distort the simple average results presented above, a second step of analysis has been performed:

In each country report, notes given by participants have been ranked. This replaces the country average reported by an order of importance from 1 (highest priority) to 15 (lowest priority).

Table 98: Global ranks (average priority ranks)

<i>Average country grade</i>	Technical provisions	Value of assets	Assessment of eligible capital	Calculation of SCR	Calculation of MCR
Prescriptive rules	14	15	8	13	12
Guidance for calculation	1	7	3	2	4
Simplification for methodology	6	11	9	5	10

The rank analysis presents only slight differences with the simple average presented in the previous section. Some general patterns seem to emerge:

- The calculation of the SCR and the assessment of eligible capital are in general the items that raise the highest priority expectations. They are followed by the MCR and the technical provisions. Valuation of assets is, on average, well behind.
- Guidance is more expected than prescriptive rules. Expectations for simplifications in the underlying methodologies generally lie in between.

15.1.2 Country diversity

In order to assess the diversity in the prioritisation of items between countries, a standard error of the ranking has been computed. In a second step these standard errors were ranked from 1 (lowest diversity between countries in the market participants based prioritisation) to 15 (highest).

In the following table, the items with the lowest country diversity in the ranking are flagged with a light background. Those with the highest are flagged with a dark background.

The lowest average country diversity is found for the calculation of the SCR, while the highest value was found for the valuation of assets and technical provisions.

Table 99: Standard error of ranks

<i>Average country grade</i>	Technical provisions	Value of assets	Assessment of eligible capital	Calculation of SCR	Calculation of MCR
Prescriptive rules	11	15	10	5	9
Guidance for calculation	2	6	4	1	3
Simplification for methodology	14	13	8	7	12

16 Annex B - Outcome of the national guidance for captives on the Luxembourg market³⁴

16.1 Introduction

Due to the particular business model and structure of captives, Luxembourg, Malta and Ireland issued national guidance for captives in order to facilitate participation of as many participants as possible in the QIS4 study.

The possibility for captives to apply this **national guidance** (in addition to the QIS4 standard model) **proved to be a major incentive** for this type of companies to participate in the QIS4 study. The increase of the participation rate for captives from QIS3 (3 participants) to QIS4 (65 participants) shows the increased interest and awareness of captives to the changes Solvency II will have on their business. This report analyzes the outcome of the different simplifications / alternatives proposed to captives. For a better reading of the report the grey-shaded boxes reproduce the text of the simplification/alternative proposed in the National Guidance paper.

It is important to note that the figures provided by the captives in this QIS4 exercise as well as the results and conclusions drawn below need to be analysed with caution. Actually the QIS4 study presented for the Luxembourg captives an increased level of complexity as

- for most of them QIS4 was the first QIS exercise they took part in, thus they had to deal with the Technical Specifications from scratch.
- in addition to the standard model they had to provide a second set of simulations for the National Guidance (NG).

16.1 Market risk alternatives

16.1.1 Spread risk

Captives should consider their whole non-government bond portfolio and then apply the following factors on the total asset market value depending on the maturity bonds assuming that the stressed assets are all BBB rated:

³⁴ Provided by Commissariat aux Assurances, Luxembourg

Maturity less than a year:	1.3%
Maturity between 1 and 3 years:	2.3%
Maturity between 3 and 5 years:	4.5%
Maturity between 5 and 10 years:	7.3%
Maturity above 10 years:	11.2%

23 companies provided a figure for this alternative different than the figure they provided in the standard module. The alternative has been tested by more than 23 companies, but for some of them no significant change could be observed so that the participants did not deliver an alternative number for this module.

Table 100: Spread Risk: Ratio of national guidance result to standard formula

Minimum	25th Percentile	Median	75th Percentile	Maximum	Average	Sample size
37%	127%	145%	371%	900%	267%	(23)

As can be seen from Table 100 above, the **SCR_{mkt} spread charge is on average multiplied by 2.6 if the simplification is applied**. This is due to the fact that most of the participants have counterparties with a rating exceeding BBB (to be tested by participants in the national guidance), and thus the simplification is very penalising for them from a capital requirement point of view.

For some companies however, this module proved to be more expensive than the standard formula since their bonds have ratings exceeding BBB exceeding the national guidance.

16.1.2 Concentration risk

Due to their size and business model, it is highly inefficient for captives to spread their assets on numerous banks or issuers. Indeed captives are usually part of the banking arrangements of their parent group who tend to centralize all funds with a limited number of banks. Therefore, the following alternative for captives should be tested, in addition to the guidelines foreseen in the market concentration risk module foreseen in the Technical Specifications:

Captives may be exempted from the application of the market concentration risk module on assets provided that they use custodians or issuers that are at least A rated or equivalent.

13 companies submitted usable results for the concentration risk module. More results have been received, but some companies seem to have misunderstood

the national guidance of this module. **Most of these captives see their concentration risk charge completely disappear under the alternative method** due to the favourite rating of their custodians or issuers (A rated or above).

This simplification has a huge impact on the overall SCR_{mkt} risk for the affected companies. The industry largely welcomed this simplification.

16.1.3 Interest rate risk

Reason for proposing an alternative/ simplification: instead of investigating maturities and/or durations of every asset and every liability line by line, assets are grouped by maturity-intervals and best estimates of technical liabilities are evaluated along the lines of the proxy developed in TS.IV.I.6. with the discounting factors as proposed hereafter taking into account of the risk free term structure as of 31.12.2007.

In TS.IX.B.5, QIS4 foresees different interest rate shocks (upwards and downwards) for individual maturities on assets as well as on liabilities. To simplify, these shocks have been translated into a percentage to be deducted from the market value of the assets, and a percentage to be deducted from the undiscounted best estimate of the technical provisions.

16.1.3.1 Interest rate risk - Alternative 1

Shocks on market asset values:

- | | |
|---------------------------------------|-------------|
| • Maturity less than 1 year: | -2% / +1% |
| • Maturity between 1 and 3 years: | -6% / +4% |
| • Maturity between 3 and 5 years: | -10% / +7% |
| • Maturity above 5 years: | -13% / +11% |
| • Eventually maturity above 10 years: | -17% / +16% |

Shocks on best estimate of technical provision, considering the durations in TS.IV.I.6 and shocks in TS.IX.B5:

Line of business	based on Dur_{mod}	Discounting factor	Discounting factor up	Discounting factor down
Accident and health	1.8	7.66%	12.95%	4.18%
Motor, third party liability	5.8	22.87%	32.32%	14.99%
Motor, other classes	0.8	3.60%	6.74%	1.80%
Fire and other damage to property	1.1	4.92%	9.15%	2.47%
Third-party liability (private)	2	8.47%	14.28%	4.63%
Third-party liability (other)	5	19.96%	29.04%	12.61%
Marine, aviation and transport	1.5	6.42%	10.92%	3.49%
Credit and suretyship	2	8.47%	14.28%	4.63%
Legal expenses	2.5	10.44%	16.78%	6.05%
Assistance	0.7	3.16%	5.92%	1.58%
Miscellaneous non-life insurance	1.7	7.25%	12.28%	3.95%

35 companies applied interest rate alternative 1 as foreseen in national guidance. On average, **this alternative produced an average ratio SCR_{mkt} alt 1 / SCR_{mkt} standard of 90%**, with extremes ranging from 0% to 439%.

This simplification was largely welcomed by the industry and qualified as appropriate for the average captive.

Table 101: Ratio SCR_{mkt} with interest rate risk alternative 1 to standard formula SCR_{mkt}

Minimum	25th Percentile	Median	75th Percentile	Maximum	Average	Sample size
0%	43%	94%	108%	439%	90%	(35)

Captives should also test the following conservative approach. The market interest rate charge can be obtained by applying the upward shock scenario on assets only, without taking into account the downward shocks (as the value of the assets increases under

such a scenario) and without 'netting' the impact on assets by the corresponding impact on liabilities. Market interest rate risk is thus reduced to the following scenario:

Shocks on market asset values:

Maturity less than 1 year:	2%
Maturity between 1 and 3 years:	6%
Maturity between 3 and 5 years:	10%
Maturity above 5 years:	13%
Eventually maturity above 10 years:	17%

16.1.3.2 Interest rate risk - Alternative 2

35 companies applied interest rate alternative 2 as foreseen in national guidance. On average, **this alternative produced a ratio SCR_{mkt} alt 2 / SCR_{mkt} standard of 168%**, with extremes ranging from 0% to 1,236%.

The calibration of the proposed simplification seems inadequate for the average captive.

Table 102: Ratio SCR_{mkt} with interest rate risk alternative 2 to standard formula SCR_{mkt}

Minimum	25th Percentile	Median	75th Percentile	Maximum	Average	Sample size
0%	0%	100%	180%	1,236%	168%	(35)

16.1.4 Non-life underwriting risk

Reason for proposing an alternative / a simplification: The proposed formula in TS.XIII.B.18, whilst fully correct for reserve risk, does not take into account the fact that captives typically have a combined ratio lower than 100% and very often have an annual aggregate limit in the contract.

In addition to the SCR non-life underwriting risk module as foreseen in the Technical Specifications, captives should test the following alternative, based on the formulae for $\rho(\sigma)$, premium risk and reserve risk as defined in the TS, as well as considering the market-wide standard deviations shown in TS.XIII.B.25-27, and the matrix CorrLob defined in TS.XIII.B.36.

$$\sigma_{res,lob} = \sigma_{prem,lob} = 15\%$$

$$corr_{prem,lob} = corr_{res,lob} = 0,25$$

$$corr_{prem,res} = 0$$

then

$$NL_{prem,lob} = 45\% \cdot V_{prem,lob}$$

$$NL_{pr} = \sqrt{\sum_{lob} NL_{prem,lob}^2 + 50\% \left(\sum_{\substack{r,c \\ r \neq c}} NL_{premr} \cdot NL_{premc} \right) + [45\%]^2 \left[\sum_{lob} V_{res,lob}^2 + 50\% \left(\sum_{\substack{r,c \\ r \neq c}} V_{res,r} \cdot V_{res,c} \right) \right]}$$

Assuming 15% standard deviation for $\sigma_{res,lob}$ and $\sigma_{prem,lob}$ is a conservative assumption, since it is the maximum shown in TS.XIII.B.25 and TS.XIII.B.27. The term $corr_{prem,res}$ has been set to 0 considering that there exists no correlation between premium risk and reserve risk. The factors $corr_{prem,lob}$ and $corr_{res,lob}$ represent the correlation factors between LoBs of premium risk and reserve risk. These factors have been set to 0.25 since some correlation exists for premium risk between Lob's and reserve risk between LoBs.

Please note that this alternative formula yields exactly the same result as the NL_{pr} formula defined in TS.XIII.B.17 and following of the Technical Specifications if in these formulae the three assumptions mentioned here above are used and no geographical diversification is applied.

Furthermore, taking into account the combined ratio assumption the integration of aggregate limits in premium risk, captives should test a generalized version of the above alternative can be generalized by replacing the formulae for $NL_{prem,lob}$ and NL_{pr} by the following:

$$NL_{prem,lob} = \text{Min}[(Agg_{lob} - V_{prem,lob}); \text{Max}[45\% + \mu_{prem,lob} - 1; 0] \cdot V_{prem,lob}]$$

To integrate comments on time diversification of reserve risk in this alternative for captives, it is proposed to simplify by using the number of underwriting years on which the total V_{res} all Lob combined on which outstanding claims are still open (n_{res}) and the maximum amount of total V_{res} concentrated on one single underwriting year ($Max_{res,UY}$). Then by assuming that the underwriting years are independent, the simplified formula to estimate the overall σ_{res} all Lob combined would be:

$$\sigma_{res} = 15\% \times \sqrt{(Max_{res,UY})^2 + \frac{(1 - Max_{res,UY})^2}{n_{res} - 1}}$$

$$\text{where } Max_{res,UY} = \frac{Max(V_{res,UY})}{V_{res}}$$

and then the alternative formula for NL_{pr} becomes:

$$NL_{pr} = \sqrt{\sum_{lob} NL_{prem,lob}^2 + 50\% \left(\sum_{\substack{r,c \\ r \neq c}} NL_{prem,r} \cdot NL_{prem,c} \right)} + [3\sigma_{res}] \sqrt{\sum_{lob} V_{res,lob}^2 + 50\% \left(\sum_{\substack{r,c \\ r \neq c}} V_{res,r} \cdot V_{res,c} \right)}$$

Most of the companies used the alternative including the combined ratio and the annual aggregate if possible.

The diversification between underwriting years has only been considered by 21 companies.

First, the outcome of the alternative is presented where companies used their own combined ratio in the reserve risk as well as in the premium risk, and where annual aggregates in treaties have been used if available. For 43 companies out of 65, the standard SCR_{nl} can be compared to the alternative stated above. For the other 22 companies, the results are not compared since either they did not test the national guidance at all, or this specific module has not been tested.

For SCR_{nl} excluding CAT risk, an average ratio SCR_{nl} alternative / SCR_{nl} standard of 70% is observed. The percentiles can be found in the table below.

This alternative was considered by the industry to be perfectly adequate to reflect the characteristics of the captive business.

Table 103: Ratio SCR_{nl} with combined ratio and annual aggregate risk / standard SCR_{nl}

Minimum	25th Percentile	Median	75th Percentile	Maximum	Average	Sample size
0%	25%	58%	99%	303%	70%	(43)

Secondly, the alternative for using diversification between underwriting years in the SCR_{nl} module is presented. This alternative has been tested by 21 captives. On average, the SCR_{nl} is reduced by 56% if this hypothesis is added to the set of hypothesis stated above. For the same 21 companies (also included in the analysis above), the reduction was 41% if no diversification benefits are considered between underwriting years.

16.1.5 Remark on CAT risk

National guidance did not propose any simplification/alternative for the CAT Risk.

As already stated in the country report, the SCR_{nl} module is really sensitive to the catastrophic method chosen. Out of the 15 captives with insufficient own

funds, 8 would have sufficient own funds if method 1 instead of method 3 had been chosen.

The QIS4 analysis revealed that the default CAT risk method 1 stated in the TS is completely inappropriate for captives. The ratio of CAT risk 3 to CAT risk 1 was calculated for 34 companies for which this comparison was possible. On average, CAT risk 3 method produced a capital charge 15 times higher than CAT risk 1 method. Clearly the CAT risk sub-module in the SCR_{nl} module needs to be better calibrated and more guidance needs to be given to captives on the treatment of CAT risk.

Table 104: Ratio of CAT risk method 3 to CAT risk method 1

Minimum	25th Percentile	Median	75th Percentile	Maximum	Average	Sample size
66%	591%	845%	1,977%	6,000%	1,518%	(34)

16.1.6 Currency risk

Reason for proposing an alternative / a simplification: The proposed TS for currency risk are not in line with common practice in captive business. Captives typically book their technical provisions in the currency of the reinsurance contracts.

Captives should also test the following alternative: On technical liabilities, should be retained only the currencies in which the technical provisions are kept, or if not defined, the currency in which the policy has been established. This is in line with common practice by which captives typically use the policy currency and post their liabilities in that currency.

This module has not been tested by the participants. However, it is referred to the comments of the QIS4 Luxembourg country report where this issue has been discussed by reinsurers indicating that this module should not be neglected.

16.1.7 Counterparty risk module

Reason for proposing an alternative / a simplification: Applying a flat rating of BBB to unrated captives subject to Solvency II is not a risk-based approach.

The following two alternative scenarios should be tested by captives:

I. Alternative scenario nr 1 to be tested by captives:

Unrated captives would be treated according to the rating class of the group to whom the captive belongs. In case the group is not rated and the captive is subject to Solvency II regulation, the captive would be treated as rating class 3 (BBB).

II. Alternative scenario nr 2 to be tested by captives:

For unrated captives subject to Solvency II regulation the probability of default of the captive will be determined according to a regulatory rating depending on the solvency ratio (as at 31.12.2007 calculated according either to QIS4 or to the provisions of the Reinsurance Directive 2005/68 when the former is not available) as follows:

Solvency ratio	PD*
>200%	0.002%
>160%	0.010%
>130%	0.050%
>100%	0.240%
>70%	1.200%
>50%	6.400%
<=50%	30.410%

Among the reinsurance captives participating in QIS4, no undertaking was eligible for this alternative as no undertaking was reinsuring its risks to a captive undertaking. In addition, no figures were provided for this alternative model by the direct writing companies.

Furthermore, it has to be noted that most captives had difficulties assessing the standard SCR_{def} module, in the same way as most non-captive companies experienced problems with this module. Additionally, some companies did not understand how to apply correctly the alternatives stated in the national guidance document.

As a consequence, no conclusion can be drawn on the alternatives. It is suggested that these alternatives should be tested (again) once the standard module for the counterparty default risk has been revisited.

16.1.8 Overall alternative SCR

16.1.8.1 Combined scenario 1

- 1. interest rate risk alt 1
- 2. spread risk
- 3. concentration risk
- 4. non-life underwriting risk
- 5. combined ratio and annual aggregate

This alternative has been tested by 55 captives. On average, the ratio SCR alt 1 / SCR standard is 92%, with values ranging from 7% to 129%. As a conclusion on this alternative, which is considered to be most representative in terms of results obtained and undertakings involved, it can be said that on average this alternative SCR is close to the standard SCR, whilst being easier to apply for some module and more adapted to captives mainly for the non-life underwriting risk.

Table 105: Ratio of SCR combined scenario 1 to standard formula SCR

Minimum	25th Percentile	Median	75th Percentile	Maximum	Average	Sample size
7%	88%	98%	100%	129%	92%	(55)

16.1.8.2 Combined scenario 2

- 1. interest rate risk alt 2
- 2. spread risk
- 3. concentration risk
- 4. non-life underwriting risk
- 5. combined ratio and annual aggregate
- 6. diversification between underwriting years

21 participants applied this combined scenario. The average ratio SCR alt 2 / SCR standard is 87%, with values ranging from 7% to 101%. The lowest value of 7% has been obtained for a captive with a heavy concentration risk in the standard model, which has been omitted as stated in national guidance.

Table 106: Ratio of SCR combined scenario 2 to standard formula SCR

Minimum	25th Percentile	Median	75th Percentile	Maximum	Average	Sample size
7%	83%	98%	100%	101%	87%	(21)

16.1.9 Conclusions

- Most captives confirmed that the proposed alternatives were simplifications better reflecting the characteristics of captives' business than the standard modules.
- The calibration for some simplifications proposed in the National Guidance needs to be revisited as it provided on average for an overall SCR lower than the SCR Standard Model (e.g. interest rate risk).
- The industry welcomed the simplification exempting captives from the application of the market concentration risk module on assets provided that they use custodians or issuers that are at least A rated or equivalent.
- The proposed alternative for the underwriting module provides for both a sophistication and a simplification compared to the standard model. The sophistication achieved via an undertaking specific combined ratio (instead of a fixed ratio of 100%) produced a lower solvency requirement as captives typically have a combined ratio of less than 100%. The simplification achieved by assuming conservatively the standard deviation for $\sigma_{res,lob}$ and $\sigma_{prem,lob}$ at 15% has partially diluted the effect of the above mentioned sophistication. Though it is not possible to precisely distinguish the effect of both movements, the overall effect of both the sophistication and the simplification produces a decrease in the capital charge according to the national guidance compared to the standard model.
- The national guidance did not propose any simplification/alternative for the CAT risk. The results show that the current scenario 1 is not appropriate for captives or reinsurance in general. The CAT1 results were far below the estimations the captive managers provided of their undertaking CAT risk exposure. For scenario 3 most companies simulated their overall exposure gross or net of premium income. On average the CAT3 figures were 15 times higher than the CAT1 figures.