

To: Solvency II WG
From: Prudential Team
Date: 07-02-2024
Reference: ECO-SLV-24-034

Subject: Summary of EIOPA study on Diversification in Internal Models

Comments

The secretariat has prepared a high-level summary of EIOPA's report "Study on Diversification in Internal Models" ([here](#)). The study aims to provide a comprehensive overview of risk diversification practices within the internal model users. The report is part of an ongoing process of monitoring and comparing internal models (IM).

Summary

In 2020, the EIOPA undertook the first study on Diversification in Internal Models (DivIM). EIOPA shared the study results with National Competent Authorities (NCAs) to provide them with a better understanding of the diversification landscape. Some NCAs have replicated part of this study into their regular model supervision.

- **Date:** This study is based on 2019 data.
- **Study phases:** There are two main phases. The first phase focused on top risk levels (market, credit, life, etc.), and the second phase focused on sub-risk levels (interest rate, equity, longevity, etc).
- **Undertakings in scope:** For the first phase, there is data from 88 solo undertakings and 8 groups. For the second phase, there is data from 99 solo undertakings and 10 groups.
- **Key findings:**
 - Life and reinsurance undertakings present the highest diversification scores.
 - Compared to other risks, health, life, and other risks are the risks more reduced due to diversification.
 - The most relevant sub-risks within the market risk module are spread, equity and interest rates sub-risks.
 - Finally, compared to their peers, the life insurers and insurance groups have a higher dispersion.

Internal model heterogeneity

The SII framework provides undertakings with the freedom to create internal models, as long as these internal models are aligned with the SII's tests and standards.

The European landscape comprises a broad spectrum of internal models. The study highlights the following key differences in how internal models diversify risks.

- **Aggregation approaches.**
 - Bottom-up integration with a simultaneous simulation of all different risks.
 - Modular approach with a dependence structure based on the aggregation of solvency capital requirements (SCRs) or profit and loss (P&Ls) of different risks (similar to the Standard Formula (SF))
 - Sideways integration with a dependence structure based on the aggregation of different risk factors and P&Ls based on multiple partial dependencies.

- **Dependency methodology.** Internal model users could include the VaR-CoVaR approach (as in SF), a Copula approach (eg. Gaussian, student or Clayton) or common risk drivers.
- **Risk taxonomy.** Different sub-risks may be categorized differently or excluded based on the undertaking's materiality, e.g. credit risk, premium risk of the credit and suretyship, expense risk, health underwriting risk, and inflation risks.

Key findings

The DivIM Study seeks to provide NSAs with a sector-wide comparison and tools to assess the appropriateness of diversification within users of the internal model.

Based on the type of participant, there is a high diversification in reinsurers; the dispersion is similar for composites, life and non-life participants and smaller for groups. Inside specific risks, the largest dispersion is observed in life and health, followed by market risks.

In addition, the study includes three analyses:

- **Explorative analysis:** the objective is to understand the importance of correlation or (sub-)risk capital levels in the overall diversified capital requirements.
 - Risk and correlation multipliers: This provides an indication of the materiality of individual risk (a higher multiplier indicates a risk of major importance) or pairwise dependencies (a high value of correlation multiplier indicates an important pairwise dependency).
 - The results outline the different risk profiles of the undertakings in the scope. Within the market risk, the most relevant sub-risks are spread, equity and interest rates.
 - Extreme quantile analysis: This provides an indicator of the distribution behaviour over the 99.5% percentile.
 - The results show a disparity; non-life businesses show a rapid slope in the increase in the SCR when the 99.5% threshold is reached (due to a catastrophic event).
- **Measurement of dependencies:** the objective is to understand the relationship between profits and losses of (sub-)risk, the contribution of each (sub-risk) diversified capital requirement to the total diversified capital requirement and how the (sub-)risk diversified capital requirements translate into other of the percentiles of its underlying profits and losses distribution.
 - Spearman rank correlation: This exercise provides an overall view of dependencies in profits and loss without focusing on the tails.
 - The results indicate a higher correlation for a pair of risks that include health, life and non-life underwriting risk.
 - The analysis included the Spearman rank correlation for selected pairs of risk; under this analysis, there is a higher dispersion between equity-spread and equity-Non-life aggregate pairs.
 - Landing quantile: This exercise identifies potential drivers of diversification. A low landing quantile may indicate a significant reduction in risk due to diversification.
 - The results indicate that health, life, and other risks have a significant reduction in risk due to diversification.
 - Additional analyses have been undertaken based on tail dependence, risk composition at varying quantiles (to understand the modelling of extreme events), and contribution to total diversification benefit.
- **Impact of dependencies on capital requirement:** the objective is to assess the relationship between diversification and concentration risk, compare the total risk diversification with the diversification under the assumption of independent variables and assess capital requirements in case of changes in the dependency structure and assumptions.

- **Diversification and concentration.** This exercise compares the diversification of the risks with the concentration level (Gini).
 - The results spot outliers for further analysis due to similar concentration but different levels of diversification.
- **Diversification score.** This exercise compares the current risk diversification with a scenario of full independence among risks.
 - Life and reinsurance undertakings had the highest diversification scores.
- **Dependency structure switch.** This exercise uses copulas to understand the position of an undertaking compared to its peers in terms of how prudent the internal model is. Outliers led to further analysis. The individual results were used to obtain information on the SCR outcomes over the whole sector.
 - The results indicate that Life insurers and insurance groups have quite significant dispersion.