Risk report

Risk governance and risk management system

Risk management organisation

Organisational structure

Munich Re has set up a governance system as required under Solvency II. The main elements of this system are the risk management, compliance, audit and actuarial functions. At Group level, risk management is part of the Integrated Risk Management division (IRM) and reports to the Group Chief Risk Officer (Group CRO). In addition to the Group functions, there are risk management units ("mirror functions") in the fields of business.

Risk governance

Our risk governance ensures that an appropriate risk and control culture is in place by clearly assigning roles and responsibilities for all material risks. Risk governance is supported by various committees at Group and field-of-business level. The Board of Management must consult the risk management function on major decisions to be taken.

Defining the risk strategy

The risk strategy, which is aligned with Munich Re's business strategy, defines where, how and to what extent we are prepared to incur risks. The further development of our risk strategy is embedded in the annual planning cycle, and hence in our business planning. The risk strategy is approved by the Board of Management, and discussed with both the Audit Committee of the Supervisory Board and the full Supervisory Board as a material element of the own risk and solvency assessment (ORSA) process.

We determine the risk strategy by defining risk tolerances for a number of risk criteria and limits for risk concentrations that are based on the capital and liquidity available, and on our earnings target, and provide a frame of reference for the Group's operating divisions.

Implementation of strategy and the risk management cycle

The risk appetite defined by the Board of Management is reflected in our business planning and integrated into the management of our operations. If capacity shortages or conflicts with the limit system or regulations arise, defined escalation and decision-making processes are followed. These have been designed to ensure that the interests of the business and risk management considerations are weighed and reconciled with each other as far as possible.

Our implementation of risk management at the operational level embraces the identification, analysis and assessment of all material risks. This provides a basis for risk reporting, the control of limits and monitoring.

Risk identification is performed by means of appropriate processes and indicators, which are complemented by expert opinions. At Munich Re, the early identification of risks is primarily operationalised using the emerging risk process. We define emerging risks as new or changing risks that are characterised by a high degree of uncertainty in terms of occurrence probability, expected loss amount, and possible effects on Munich Re.

As part of the risk analysis, a quantitative and qualitative assessment of all risks at consolidated Group level is made in order to take into account possible interactions between risks across all fields of business. Internal risk reporting provides the Board of Management with regular information on the risk situation, as regards the individual risk categories and the entire Group alike. This ensures that negative trends are identified in sufficient time for countermeasures to be taken. The purpose of our external risk reporting is to provide clients, shareholders and the supervisory authorities with a clear overview of the Group's risk situation. Actual risk limits are derived from the risk strategy: taking the defined risk appetite as a basis, limits, rules and any risk-reducing measures required are approved and implemented. We also have a comprehensive early-warning system that draws our attention to any potential shortages of capacity.

Quantitative risk monitoring based on indicators is carried out both centrally and within units. We monitor risks that cannot be expressed directly as an amount either centrally or in our units, depending on their materiality and allocation. The risk management system is regularly audited by Group Audit.

Internal control system[1]

Our internal control system is an integrated, Group-wide system for managing operational risks. Comprising two key components – the Operational Risk Control System (ORCS) and the Compliance Management System (CMS) – our internal control system addresses both Group management requirements and local regulations.

Operational Risk Control System

The Operational Risk Control System (ORCS) is an essential part of the internal control system. At Group level, the ORCS is overseen by the Integrated Risk Management division (IRM), which reports to the Group Chief Risk Officer (Group CRO). As part of the ORCS, risk and control self-assessments are carried out at least once a year in all fields of business, and the material operational risks, including compliance-related risks, are identified and assessed in the process. Key controls and management measures to mitigate the material operational risks are analysed and assessed. In addition, the risk management function carries out independent

1 The section on the internal control system is part of the combined management report and was not audited.

analyses and cross-comparisons of operational risks and controls (monitoring). Significant control deficiencies are addressed by means of improvement measures and/or close monitoring. The main findings derived from the risk and control self-assessments and from monitoring are reported to the Board of Management.

The identification, management and control of risks arising out of the accounting process is indispensable for the production of reliable annual financial statements at both consolidated and solo-undertaking level. Risks significant for financial reporting from a Group perspective are integrated into the internal control system in accordance with uniform criteria. The risks are checked annually by the process owners to ascertain whether they are up to date, and the controls are amended as necessary.

The standardised methodology has been implemented on the basis of a Group-wide ORCS policy and guidelines specific to the fields of business. The decision about whether to include a Group undertaking in the standardised ORCS is taken on the basis of the principle of proportionality – with due consideration being given to the nature, scale and complexity of the risks inherent in the undertaking's operations, and to compliance with regulatory and legal requirements. The Group undertakings that have not been integrated into the ORCS Group standard control their risks in compliance with the principles of good corporate governance, Group-wide principles of risk management and relevant national laws.

Compared to the previous year, no material changes were made to the ORCS (process, structure or responsibilities) in the reporting period.

Compliance Management System

The second key component of the internal control system is the compliance function. At Group level, the compliance function is performed by the Group Compliance & Legal (GCL) division and headed up by the Group Chief Compliance Officer (Group CCO). In addition to the Group function, there are compliance units in the fields of business, each headed up by its own Chief Compliance Officer. The Board of Management has assigned the development, implementation, monitoring and ongoing improvement of the Group-wide compliance management system (CMS) to the Group-level compliance function. GCL manages the compliance activities by means of Group-wide requirements, and monitors their implementation on the basis of the Group-wide CMS. Based on its three pillars of prevention, detection and response, the CMS is designed primarily to help ensure compliance with rules on the part of Munich Re, its management and its staff. The foundation of the CMS comprises an inherent sense of responsibility towards all business activities; a steadfast compliance organisation with clearly defined roles and responsibilities; and independent, suitable and qualified human resources that enable the compliance function to work effectively and efficiently. An intact compliance culture supports each individual CMS pillar.

In the scope of the CMS, compliance risks are systematically identified, analysed and appropriately handled so as to minimise the risks. This process is based on the foundation of the required ORCS methodology. Process results are reported to the Board of Management and the Supervisory Board's Audit Committee.

Compared to the previous year, no material changes to the ORCS were made in the reporting period concerning processes, structure or controls.

You will find a detailed description of the main features of this CMS in the section "Compliance" in the combined non-financial statement.

Statement on the adequacy and effectiveness of the risk management system and the internal control system[1]

In reviewing the adequacy and effectiveness of our risk management systems and internal control systems, we take into consideration many pieces of information in order to, among other things, identify any material internal control deficiencies. The primary pieces of information are as follows:

- the auditor's report on the results of the accounting-related control system,
- the annual report on the results of the ORCS,
- regular risk reporting, in particular by the Group CRO,
- regular (at least semi-annual) compliance reporting by the Group CCO, in particular on key compliance metrics and essential contents of the compliance management system (material compliance cases, focal points of compliance consulting, compliance-related training measures, recent changes in the regulatory environment), and
- confirmation of the maturity level of the CMS by the compliance officers in the individual fields of business.

In addition, the Audit Committee of the Supervisory Board regularly requests reports on the adequacy and effectiveness of the internal control system and on changes to the risk and control landscape compared with the previous year. The audit reports from Group Audit confirm the effectiveness of the accounting-related internal control system.

In light of the information and reports above – and considering the assessments made by experts in the divisions IRM, GCL and Group Audit – we consider our risk management systems and internal control systems to be adequate overall. Based on the fact that no material violations or systematic deficiencies were identified in the reporting period, we consider our risk management and internal control systems to therefore also be effective overall.

1 The statement on the adequacy and effectiveness is part of the combined management report and was not audited.

Significant risks

Our general definition of risk is possible future developments or events that could result in a negative prognosis or a negative deviation from the Group's targets. We consider three criteria when evaluating the materiality of risks. First, the extent to which a risk could influence stakeholder assessments of Munich Re. Second, the ways in which a risk could impact the solvency of Munich Re. And third, the extent to which a risk could exhaust cumulative limits or budgets. We have applied this definition consistently to each business unit and legal entity, taking account of its individual risk-bearing capacity. The assessment of whether a risk is significant or not for a company according to the above definition is performed in the responsible risk management functions. We make a basic distinction between risks included in our internal model and covered by risk-based capital and other risks not quantified in the internal model. The risks included in the internal model are divided into the following risk categories: underwriting risk in property-casualty business, underwriting risk in life and health business, market risk, credit risk and operational risk. Sustainability risks can affect all of these risk categories and are therefore an integral part of the management of these risks.

Risks depicted in the internal model

Munich Re has a comprehensive internal model that determines the capital needed to ensure that the Group is able to meet its commitments even after extreme loss events. We use the model to calculate the capital required under Solvency II (the solvency capital requirement, or SCR).

The SCR is the amount of eligible own funds that Munich Re needs to have available, with a given risk tolerance, to cover unexpected losses in the following year. It corresponds to the value at risk of the economic profit and loss distribution over a one-year time horizon with a confidence level of 99.5%, and thus equates to the economic loss for Munich Re that, given unchanged exposures, will be exceeded each year with a statistical probability of 0.5%. Our internal model is based on specially modelled distributions for the risk categories property-casualty, life and health, market, credit and operational risks. We use primarily historical data for the calibration of these distributions, complemented in some areas by expert judgement. Historical data covers a long period to provide a stable and appropriate estimate of our risk parameters. We continue to take account of diversification effects we achieve through our broad spread across various risk categories and the combination of primary insurance and reinsurance business. We also take into account dependencies between the risks, which can result in higher capital requirements than would be the case if no dependency were assumed. We then determine the effect of the loss absorbency of deferred taxes.

The table shows the solvency capital requirement for Munich Re and its risk categories as at 31 December 2022.

Solvency capital requirements (SCR)

	Reinsurance		ERGO		Diversification	
	31.12.2022	Prev. year	31.12.2022	Prev. year	31.12.2022	Prev. year
	€m	€m	€m	€m	€m	€m
Property-casualty	12,785	11,014	730	639	–603	–484
Life and health	5,771	6,470	883	1,360	–329	–397
Market	6,191	7,052	3,500	6,496	–1,177	–2,065
Credit	2,357	2,510	947	1,903	–58	–88
Operational risk	1,046	830	746	618	–234	–246
Other[1]	494	459	333	357		
Subtotal	**28,643**	**28,334**	**7,139**	**11,374**		
Diversification effect	–9,982	–10,281	–1,586	–1,594		
Tax	–3,446	–2,958	–965	–1,126		
Total	**15,215**	**15,095**	**4,588**	**8,653**	**–2,110**	**–3,209**

→	Group			Change
	31.12.2022	Prev. year		
	€m	€m	€m	%
Property-casualty	12,911	11,169	1,742	15.6
Life and health	6,325	7,434	–1,109	–14.9
Market	8,514	11,483	–2,969	–25.9
Credit	3,245	4,325	–1,080	–25.0
Operational risk	1,558	1,202	356	29.6
Other[1]	826	816	10	1.2
Subtotal	**33,381**	**36,428**	**–3,047**	**–8.4**
Diversification effect	–11,768	–12,332	564	–4.6
Tax	–3,920	–3,556	–364	10.2
Total	**17,693**	**20,540**	**–2,847**	**–13.9**

1 Capital requirements for other financial sectors, e.g. institutions for occupational retirement provision.

At Group level, the SCR decreased by 13.9% to €17.7bn – compared with €20.5bn as at 31 December of the previous year. This decrease was mainly driven by the substantial rise in interest rates worldwide, which led to lower solvency capital requirements in the categories of market, credit, and life and health. The decline in SCR was slightly mitigated by the growth in property-casualty reinsurance business regarding all natural hazards and in all regions; the growth in life reinsurance business; and the appreciation of the US dollar. Other information about the changes in individual risk categories and details about risk concentrations can be found in the following sections.

Property-casualty underwriting risk

The property-casualty risk category encompasses the underwriting risks in the property, motor, third-party liability, personal accident, marine, aviation and space, and credit classes of insurance, together with special lines also allocated to property-casualty. Further risk-relevant information on property-casualty business can be found in the Notes to the consolidated financial statements under (40) Disclosures on risks from property-casualty insurance business.

Underwriting risk is defined as the risk of insured losses being higher than our expectations. The premium and reserve risks are significant components of the underwriting risk. Premium risk is the risk of future claims payments relating to insured losses that have not yet occurred being higher than expected. Reserve risk is the risk of technical provisions established potentially being insufficient to cover losses that have already been incurred. In measuring loss provisions, we follow a cautious reserving approach and assess uncertainties conservatively. In every quarter, we also compare notified losses with our loss expectancy, in order to sustain a high level of reserves.

We differentiate between large losses involving expenditure that exceeds a certain large-loss limit; losses affecting more than one risk or more than one line of business (accumulation losses); and all other losses (basic losses). For basic losses, we calculate the risk of subsequent reserving being required for existing risks within a year (reserve risk) and the risk of under-rating (premium risk). To achieve this, we use actuarial methods that are based on standard reserving procedures, but take into account the one-year time horizon. The calibration for these methodologies is based on our own historical loss and run-off data. Appropriate homogeneous segments of our property-casualty portfolio are used for the calculation of the reserve and premium risks. To aggregate the risk to whole-portfolio level, we apply correlations that take account of our own historical loss experience.

Our experts develop scientifically sound models for the accumulation scenarios that quantify the probability of occurrence and the damage potential. The models also take risk-limiting elements into consideration, such as cover limits. In addition to natural catastrophes, we include other accumulation risks such as cyber and pandemics, using

special models. Based on these scenarios, the potential effects on our portfolio are determined using stochastic models.

Our internal model considers the resulting accumulation-risk scenarios to be independent events. Munich Re's greatest natural hazard exposure lies in the scenarios "Atlantic Hurricane" and "Earthquake California", for which our estimates of annual loss exposure are €10.0bn (8.2bn) for Atlantic Hurricane and €6.3bn (5.8bn) for Earthquake California (before tax, retained) for a return period of 200 years.

As part of our regular validation, we look in particular at the sensitivity of results produced by the risk model for large and accumulation losses to changes in the return periods or loss amounts for events, or a change in the business volumes written. We also consider the effect of changes of dependency assumptions on the results. We regularly adapt our models on the basis of the findings from our validation.

Another measure for controlling underwriting risks is the targeted cession of a portion of our risks to other carriers via external reinsurance or retrocession. Most of our companies have intra-Group and/or external reinsurance and/or retrocession cover.

In addition to traditional retrocession, we use alternative risk transfer for natural catastrophe risks in particular. Under this process, underwriting risks are transferred to the capital markets via special purpose vehicles.

Solvency capital requirement – Property-casualty

The solvency capital requirement increased by around 15.6% at Group level, reflecting growth in reinsurance business regarding all natural hazards and in all regions. The appreciation of the US dollar further reinforced the increase.

Solvency capital requirements (SCR) – Property-casualty

	Reinsurance		ERGO		Diversification	
	31.12.2022	Prev. year	31.12.2022	Prev. year	31.12.2022	Prev. year
	€m	€m	€m	€m	€m	€m
Basic losses	4,790	4,486	630	566	–448	–378
Large and accumulation losses	12,261	10,532	420	360	–312	–299
Subtotal	**17,051**	**15,018**	**1,050**	**926**		
Diversification effect	–4,266	–4,004	–319	–286		
Total	**12,785**	**11,014**	**730**	**639**	**–603**	**–484**

→	Group			
	31.12.2022	Prev. year		Change
	€m	€m	€m	%
Basic losses	4,972	4,674	298	6.4
Large and accumulation losses	12,369	10,593	1,776	16.8
Subtotal	**17,340**	**15,267**	**2,073**	**13.6**
Diversification effect	–4,429	–4,098	–331	8.1
Total	**12,911**	**11,169**	**1,742**	**15.6**

Life and health underwriting risk

We define underwriting risk as the risk of insured benefits payable in life or health insurance business being higher than expected. Of particular relevance are biometric risks and policyholder-behaviour risks, such as lapses and lump-sum options. We differentiate between risks that have a short-term or long-term effect on our portfolio. In addition to the simple risk of random fluctuations resulting in higher claims expenditure in a particular year, the adverse developments with a short-term impact that we model notably include rare – but costly – events such as pandemics. To this end, we model losses and the sum at risk – taking into particular consideration excess mortalities in connection with, for instance, the pandemics of the 20th and 21st centuries.

Further relevant information on the risks in life and health insurance can be found in the Notes to the consolidated financial statements under (39) Disclosures on risks from life and health insurance business.

Life primary insurance products in particular, and a large part of our health primary insurance business, are long-term in nature, and the results they produce are spread over the entire duration of the policies. This can mean that negative developments in risk drivers with long-term effects sustainably reduce the value of the insurance portfolio (trend risks). The risk drivers mortality and disability are dominated by the life and health reinsurance segment, particularly by exposure in North America and the Asia-Pacific region. We also underwrite longevity risk in the life and health

reinsurance segment, especially in the United Kingdom. The longevity risk driver can additionally be found in the products marketed by ERGO in Germany, together with typical risks related to policyholder behaviour, such as the lapse risk. To a lesser extent, we write risks connected with the increase in treatment costs, which arise in the ERGO field of business in particular.

Risk modelling attributes probabilities to potential modified assumptions. We use primarily historical data extracted from our underlying portfolios to calibrate these probabilities, and additionally apply general mortality rates for the population to model the mortality trend risk. To enable us to define appropriate parameters for the modelling of the range of areas in which we operate, portfolios with a homogeneous risk structure are grouped together and individual comprehensive profit and loss distributions determined. We then aggregate these distributions, taking account of the dependency structure to obtain an overall distribution.

Our largest short-term accumulation risk in the life and health risk category is a severe pandemic. We counter this risk by examining our overall exposure in detail using scenario analysis, and by deploying appropriate measures to manage the risks.

In reinsurance, we control the assumption of biometric risks by means of a risk-commensurate underwriting policy. Interest-rate and other market risks are frequently ruled out by depositing the provisions with the cedant, with a guaranteed rate of interest from the deposit. In individual cases, these risks are also hedged by means of suitable capital market instruments. We also limit our exposure to individuals and groups of persons in life insurance.

For primary insurance, substantial risk minimisation is achieved through product design. In case of adverse developments, parts of the provision for premium refunds – which are recognised and reversed in profit or loss – are of great significance for risk-balancing. In health primary insurance, most long-term contracts include the possibility and/or obligation to adjust premiums. Practically, however, there are limits to the resilience of policyholders.

Limits are laid down for the pandemic scenarios, which affect the portfolio in the shorter term, and for the longevity scenarios and their longer-term effects in conformity with the risk strategy. We continue to analyse the sensitivity of the internal model to the input parameters on a regular basis. This relates to the interest rate, the biometric risk drivers and customer behaviour.

Solvency capital requirement – Life and health

The solvency capital requirement decreased by 15% at Group level. In the reinsurance field of business, the SCR fell primarily on account of higher interest rates and the consequently greater discounting of the effect of biometric stresses. This was offset by business growth and the appreciation of the US dollar. The SCR also decreased in the ERGO field of business, mainly due to higher euro interest rates.

Solvency capital requirements (SCR) – Life and health

	Reinsurance		ERGO		Diversification		Group	
	31.12.2022	Prev. year	31.12.2022	Prev. year	31.12.2022	Prev. year	31.12.2022	Prev. year
	€m	€m	€m	€m	€m	€m	€m	€m
Health	343	255	597	833	–82	–55	857	1,033
Mortality	4,343	4,775	176	197	–15	–12	4,504	4,960
Disability	3,111	3,672	175	380	1	–20	3,287	4,031
Longevity	942	1,284	409	636	–17	–30	1,333	1,890
Other	298	446					298	446
Diversification	–3,266	–3,963	–474	–685			–3,955	–4,927
Total	**5,771**	**6,470**	**883**	**1,360**	**–329**	**–397**	**6,325**	**7,434**

Market risk

We define market risk as the risk of economic losses resulting from price changes in the capital markets. It includes equity risk, general interest-rate risk, specific interest-rate risk, property-price risk and currency risk. The general interest-rate risk relates to changes in the basic yield curves, whereas the specific interest-rate risk models changes in credit risk spreads – for example, on euro government bonds from various issuers, or on corporate bonds. We also include in market risk the risk of changes in inflation rates and implicit volatilities (cost of options). Fluctuations in market prices affect not only our investments, but also the underwriting liabilities – especially in life primary insurance. Due to the long-term interest-rate guarantees given in some cases and the variety of options granted to policyholders in traditional life insurance, the amount of the liabilities can be highly dependent on conditions in the capital markets.

Market risks are modelled by means of Monte Carlo simulation of possible future market scenarios. We revalue our assets and liabilities for each simulated market scenario, thus showing the probability distribution for changes to basic own funds.

We use appropriate limit and early-warning systems in our asset-liability management to manage market risks. Derivatives such as equity futures, options and interest-rate swaps – which are used mainly for hedging purposes – also play a role in our management of the risks. The impact of

derivatives is taken into account in the calculation of solvency capital requirements. Further information on derivative financial instruments can be found in the Notes to the consolidated financial statements, (8) Other securities at fair value through profit or loss and insurance-related investments.

Solvency capital requirements (SCR) – Market

	Reinsurance		ERGO		Diversification	
	31.12.2022	Prev. year	31.12.2022	Prev. year	31.12.2022	Prev. year
	€m	€m	€m	€m	€m	€m
Equity risk	2,943	2,997	1,736	2,806	–219	–151
Interest-rate risk	2,654	2,771	1,970	4,349	–968	–1,635
General interest-rate risk	2,002	1,760	1,280	1,540	–459	–684
Specific interest-rate risk	1,145	1,648	1,518	3,114	–432	–777
Diversification interest-rate risk	–492	–638	–828	–305	–77	–173
Property risk	1,724	1,610	767	948	–137	–108
Currency risk	4,234	4,907	211	218	–45	–12
Subtotal	**11,555**	**12,284**	**4,685**	**8,321**		
Diversification effect	–5,363	–5,232	–1,185	–1,826		
Total	**6,191**	**7,052**	**3,500**	**6,496**	**–1,177**	**–2,065**

→

	Group			
	31.12.2022	Prev. year		Change
	€m	€m	€m	%
Equity risk	4,461	5,652	–1,191	–21.1
Interest-rate risk	3,656	5,486	–1,830	–33.4
General interest-rate risk	2,822	2,616	206	7.9
Specific interest-rate risk	2,230	3,985	–1,755	–44.0
Diversification interest-rate risk	–1,397	–1,116	–281	25.2
Property risk	2,354	2,450	–96	–3.9
Currency risk	4,400	5,113	–713	–13.9
Subtotal	**14,870**	**18,701**	**–3,831**	**–20.5**
Diversification effect	–6,356	–7,218	862	–11.9
Total	**8,514**	**11,483**	**–2,969**	**–25.9**

Solvency capital requirement – Market

The solvency capital requirement declined by 25.9% at Group level. Detailed information on the changes in the individual subcategories is available in the following sections.

Equity risk

The reduction in the equity risk was chiefly due to a reduction in equity exposure.

Interest-rate risk

The general interest-rate risk in the reinsurance field of business rose moderately. The specific interest-rate risk fell on account of lower exposure to fixed-interest securities with credit risk exposure, which was attributable, among other things, to the restructuring of portfolios and to lower market values caused by higher interest rates.

The interest-rate risks in the ERGO field of business were down, mainly owing to considerably higher interest-rate levels. As a result, it became easier for German life insurance companies to generate guaranteed minimum interest rates, in turn leaving Munich Re with less risk.

In the reinsurance field of business, the market value of interest-sensitive investments as at 31 December 2022 was €70.1bn (77.1bn). Measured in terms of modified duration, the interest-rate sensitivity of those investments was 4.8 (6.0), while that of the liabilities was 5.0 (6.4). A decrease in interest rates of one basis point led to a change in available own funds amounting to around €6.4m (7.9m).

In the ERGO field of business, the fair value of interest-sensitive investments was €105.9bn (130.0bn). The modified duration was 7.6 (9.6) for interest-sensitive investments and 6.9 (9.3) for liabilities. A decrease in interest rates of one basis point led to a change in available own funds amounting to around €6.0m (0.0m).

Property risk

The property risk decreased slightly, mainly on account of the larger risk buffers available to German life insurance companies.

Currency risk

The currency risk sank due to a reduced position in foreign currencies.

Credit risk

We define credit risk as the financial loss that Munich Re could incur as a result of a change in the financial situation of a counterparty. In addition to credit risks arising out of investments in securities and payment transactions with clients, we actively assume credit risk through the writing of credit and financial reinsurance and in corresponding primary insurance business.

When determining credit risks, Munich Re uses a portfolio model that is calibrated over a longer period (at least one full credit cycle); it also takes account of changes in fair value caused by rating migrations and debtor default. The credit risk arising out of investments (including deposits retained on assumed reinsurance, government bonds and credit default swaps, or CDSs) and reserves ceded is calculated by individual debtor. If the credit risk does not exclusively depend on the debtor's creditworthiness, but also on other factors (such as subordination, guarantees or collateralisation), these are also taken into account. We use historical capital market data to determine the associated migration and default probabilities. Correlation effects between debtors are derived from the sectors and countries in which they operate, and sector and country correlations are based on the interdependencies between the relevant stock indices. The calculation of the credit risk in "Other receivables" is based on internal expert assessments. We also capitalise the credit risk for highly rated government bonds. Information on ratings can be found in the Notes to the consolidated financial statements, (6) Loans ff.

Risk concentrations are mainly in government bonds issued by countries inside and outside the European Union. In addition, corporate bonds, pfandbriefe and similar covered bonds account for a large proportion of the investments.

We use a cross-balance-sheet counterparty limit system valid throughout the Group to monitor and control our Group-wide credit risks. The limits for each counterparty (a group of companies or country) are based on its financial situation as determined by the results of our fundamental analyses, ratings and market data, and the risk appetite defined by the Board of Management. The utilisation of limits is calculated on the basis of risk-weighted exposures. There are also volume limits for securities lending and repurchase transactions. Group-wide rules for collateral management – for example, for over-the-counter derivatives and catastrophe bonds issued – reduce the resultant credit risk.

In monitoring the country risks, we do not simply rely on the usual ratings, but perform independent analyses of the political, economic and fiscal situation in the countries issuing bonds in which Munich Re is most heavily invested. On this basis, and taking account of the investment requirements of the fields of business in the respective currency areas and countries, limits or action to be taken are approved. These are mandatory throughout the Group for investments and the insurance of political risks.

With the help of defined stress scenarios, our experts forecast potential consequences for the financial markets, the fair values of our investments, and the present values of our underwriting liabilities. At Group level, we counter any negative effects with the high degree of diversification in our investments and our liability structure, and with our active Group-wide asset-liability management.

The sensitivities in the credit risk model are regularly checked against the most important input parameters. This primarily concerns the recovery rates from insolvent debtors, the probabilities of debtor migration between rating classes, and the parameters for correlations between debtors. All validations demonstrated the appropriateness of the modelling approaches used.

We manage credit default risk in retrocession and external reinsurance with the assistance of limits determined by the Retro Security Committee. Our reserves ceded to reinsurers were assignable to the following rating categories as at 31 December 2022:

Ceded share of technical provisions according to rating

%	31.12.2022	Prev. year
AAA	3.4	4.7
AA	14.8	14.5
A	48.2	49.1
BBB and lower	2.8	5.4
No rating available	30.8	26.2

Less than one-third of the technical provisions covering ceded business came from reinsurers exhibiting sufficient creditworthiness but no official rating, as had been the case in the previous year. Further information on the risks arising out of receivables relating to insurance business can be found in the Notes to the consolidated financial statements, (12) Other receivables.

Solvency capital requirement – Credit

The solvency capital requirement decreased by 25.0% at Group level. The reduction was mainly attributable to higher interest rates, as a result of which the market values of fixed-interest securities fell. In addition, higher interest rates caused the risk buffers available to our life insurance companies to grow, leaving less credit risk with Munich Re.

Operational risk

We define operational risk as the risk of losses resulting from inadequate or failed internal processes, incidents caused by the actions of personnel or system malfunctions, or external events. This includes criminal acts committed by employees or third parties, insider trading, infringements of antitrust law, business interruptions, inaccurate processing of transactions, non-compliance with reporting obligations, and disagreements with business partners.

We use scenario analyses to quantify operational risks. The results are fed into the modelling of the solvency capital requirement for operational risks and are validated using various sources of information, such as the ORCS findings and both internal and external loss data.

The sensitivity in the internal model is regularly checked against the most important input parameters. This mainly relates to the dependence of the result on frequency and loss amounts and the parameters for the correlations between scenarios. The analyses showed no anomalies in the year under review.

Solvency capital requirement – Operational risk

At Group level, the solvency capital requirement for operational risks increased by 29.6%, owing primarily to a model adjustment.

Other risk categories

As is typical throughout the industry and in accordance with regulatory requirements, the risk types specified below are not explicitly capitalised in our internal model. Qualitative risk management is very important for dealing with these risks.

Reputational risk

We define reputational risk as the risk of loss that may result from a deterioration in the Group's public image among clients, shareholders or other parties. Our reputation is affected by our behaviour in a number of areas, such as client relationships, product quality, corporate governance, earnings power, our treatment of employees and corporate responsibility. Reputational risk is closely intertwined with all other risk categories. The assessment of individual business transactions in terms of their reputational risk is performed at field-of-business level by reputational risk committees. Where a reputational risk could potentially have an impact across fields of business, other central divisions may be involved in the assessment if required.

Strategic risk

We define strategic risk as the risk of making wrong business decisions, implementing decisions poorly, or being unable to adapt to changes in the operating environment. Existing and new potential for success in the Group and the fields of business in which it operates creates strategic risks. At Munich Re, strategic risks are identified, assessed and managed in a recurring process comprising the Strategic Dialogue and Annual Planning. The purpose of the Strategic Dialogue is to analyse and assess the risks and opportunities of Munich Re's longer-term strategic alignment. The Group-wide annual (financial) planning process is integrated into the Strategic Dialogue. This annual planning process includes analysing financial sensitivities and risks as well as assessing the capital management and risk strategy. These process steps are mirrored in the primary insurance and reinsurance fields of business and in investment management. In doing so, we put our strategy to the test in close dialogue with the various stakeholders at different levels (Group, primary insurance and reinsurance, investment management). The above processes ensure that the Board of Management addresses the strategic risks in detail and is well placed to control and manage them. The Group CRO is involved in both the strategic and operational business planning as well as in significant company sales, mergers and acquisitions.

Security risk

We define security risks as risks resulting from threats to the security of our employees, data, information, and property. We are intensifying our analysis of cyber risks in recognition of the increasing importance of information technology for Munich Re's core processes and the dynamic environment of cyber crime.

The Group Chief Information Security Officer (CISO), a function that is assigned to risk management, is responsible for the central and Group-wide coordination and control of all activities involving information security risks. Security risk committees have also been set up in the fields of business to assess and manage security risks. The members of the security risk committees are managers from operational units (e.g. IT Security), the control functions (e.g. Risk Management, Information Security, Data Protection) and other representatives.

To further improve cyber security, we are working on initiatives both specific to and across the fields of business to ensure a level of protection in line with our information security strategy.

Further information can be found in the combined non-financial statement, in the section "Responsible digital transformation, data protection and cyber security".

Liquidity risk

Our objective in managing liquidity risk is to ensure that we are in a position to meet our payment obligations at all times. To guarantee this, the liquidity position is continuously monitored and subject to stringent requirements for the availability of liquidity. The short-term and medium-term liquidity planning is submitted to the Board of Management on a regular basis.

The liquidity risk is managed within the framework of our holistic risk strategy, with the Board of Management defining limits on which minimum liquidity requirements for our operations are based. These risk limits are reviewed annually, and compliance with the minimum requirements is continuously monitored. Using quantitative risk criteria, we ensure that Munich Re has sufficient liquidity available to meet its payment obligations even under adverse scenarios, with the liquidity position being assessed both for extreme insurance scenarios and for adverse situations in the capital markets.

Further information on liquidity risks in life and health and property-casualty insurance business can be found in the Notes to the consolidated financial statements, (39) Disclosures on risks from life and health insurance business, and (40) Disclosures on risks from property-casualty insurance business.

Solvency ratio under Solvency II

The solvency ratio under Solvency II is the ratio of the eligible own funds to the solvency capital requirement.

Solvency II ratio[1]

		31.12.2022	Prev. year	Change
Eligible own funds[2]	€m	46,019	46,626	-607
Solvency capital requirement	€m	17,693	20,540	-2,847
Solvency II ratio	%	260	227	

1 Eligible own funds excluding the application of transitional measures for technical provisions; including the application of transitional measures for technical provisions, the own funds amounted to €51.1bn (52.2bn); Solvency II ratio: 289% (254%).

2 Despite positive economic earnings of €2.8bn, the eligible own funds decreased as at the reporting date on account of the following: the dividend of €1.6bn, agreed by the Board of Management and to be proposed to the Annual General Meeting for the 2022 financial year; the planned share buy-back programme with a volume of €1.0bn; the adjustment to the opening balance amounting to €0.2bn; and other measures totalling €0.4bn. The repayment and issue of a subordinated bond similarly led to a slight overall reduction in the eligible own funds.

The eligible own funds as at the balance sheet date take into account deductions for the dividend of €1.6bn agreed by the Board of Management and proposed to the Annual General Meeting for the 2022 financial year.

Other risks

Economic and financial-market developments and regulatory risks

Munich Re is heavily invested in the eurozone, and in reinsurance in particular in the US dollar currency area, a consequence of our global business activities in these currency areas. We prioritise maintaining a correspondingly broad diversification of investments to cover our technical provisions and liabilities. We take various risk management measures to counter fluctuations in the capital markets that can lead to volatilities in the Group's own funds.

The recovery of the global economy from the recession triggered by the coronavirus pandemic faltered substantially over the course of 2022 – with the economic recovery nearly stagnating altogether at the end of the year, particularly in Europe. One reason for this stagnation was the Russia/Ukraine war and the consequently much higher prices, especially of energy, which in turn impacted real income. A second reason lay in the significant tightening of monetary policy, which dampened the propensity to invest. In addition, the rapidly rising key interest rates led to substantial losses in the bond and equities markets.

Against the backdrop of a recently weak economy and higher interest rates, refinancing has become more expensive for businesses, private households and governments alike – and the general risk of insolvencies has increased. The global tightening of monetary policy could hamper economic activity even more severely than expected. This would likely occur if the recent above-average inflation rates were to become entrenched – on account of higher collective wage agreements, for example. Moreover, rising prices could contribute to social upheavals and political instability. Over the course of 2023, polarised politics in the United States Congress could lead to a failure to raise the debt ceiling in time, which would make it impossible to rule out a temporary payment default.

For Munich Re, above-average inflation rates can have a particularly adverse effect on its provision for outstanding claims. Despite this, we consider our stance on anticipated inflation to be adequate in light of both our conservative reserving approach and the standard actuarial methods that we use, which address the effects of inflation. Nevertheless, there is a risk that inflation exceeds forecasts and remains high for longer than anticipated, in turn impacting the business operations, financial position and financial performance of the Group. Although Munich Re protects itself against accelerated inflation by holding inflation-linked bonds and inflation-linked assets such as property, commodities and infrastructure, these measures would not be sufficient to fully mitigate the repercussions of inflation. Conversely, the strong increase in interest rates in the eurozone associated with high inflation has been a significant relief for life insurance companies with guaranteed minimum interest rates. Although the number of lapses could increase as soon as interest rates rise significantly above the guaranteed interest rate, Munich Re life insurance companies have not on the whole observed such a trend. Thus far, both the positive impact on earnings capacity and the solvency ratio of life insurance companies significantly outweigh the lapse risk.

The focal point of geopolitics remains the war between Russia and Ukraine. In this context, we posted provisions in various lines of business and posted write-downs, particularly of Russian and Ukrainian bonds, in the reporting year. In addition, we cancelled all new business in Russia and Belarus shortly after war broke out, and existing contracts have not been renewed. We consequently regard the remaining risks directly associated with the war of aggression as largely mitigated with respect to both investment risks and underwriting risks. However, further escalation of the war cannot be ruled out. In addition, geopolitical conflicts (especially between China and the USA) and a large number of other major conflicts and trouble spots – including a possible deterioration in the confrontation between the USA and Iran – could, if they escalate, have perceptible regional and global consequences, and make capital markets more volatile, at least in the short term. Against the backdrop of the above-mentioned fault lines, there remains a risk of a deepening division of the global economy and of access to technology into two spheres of influence.

And the eurozone remains home to stability risks. It is in the shadow of the war between Russia and Ukraine that the EU has sent strong signals of cohesion. In connection with the ECB's tightening of monetary policy, refinancing costs remain high, as does the consequently greater risk of potential falls in ratings and declines in market values – especially in countries with high sovereign debt. But the ECB has already implemented the transmission protection instrument (TPI), a new programme for limiting distortions in the bond markets. Political risks nevertheless remain, with the disputes related to the rule-of-law mechanisms similarly exacerbating disintegration risks. Conversely, the "communitisation" of sovereign debt, already underway, could lead to German government bonds losing their safe-haven status in the medium term, which would also involve falls in market values. The risk of power outages and energy supply failures could return as a threat for the winter of 2023/2024, in turn impacting European investments in particular. Moreover, there remains a risk that the bilateral trade agreement between the European Union and the United Kingdom could be terminated as part of the renegotiation of the Northern Ireland Protocol.

Global players such as Munich Re are subject to increased fiscal pressure nationally and internationally, as well as a higher audit intensity. Given the current political emphasis on an appropriate taxation of international companies and the implementation of a global minimum tax rate, which has already been approved by the EU, this trend will continue and intensify.

Climate change

With respect to the ecological dimension of sustainability, climate change represents the central sustainability risk. Climate-related risks arise in the form of physical risks and transition risks, with interdependencies between both risk types. Physical risks arise as a consequence of extreme weather events (heat, drought, windstorms, hail, etc.) resulting from climate change. Transition risks arise as a consequence of political or economic measures taken for the purpose of conversion to a more low-carbon economy or reactions to changing living conditions in certain regions. Both risks not only have long-term effects, but can also have disruptive short-term consequences. The occurrence of natural catastrophes with greater frequency or of greater severity than expected could have a substantial adverse impact on Munich Re's results and financial situation.

Munich Re is working intensively on the impact of climate change. Our risk management competence built up over many years allows us to professionally assess changes in natural hazard risks and to adequately account for these risks in the pricing of hedging products as well as in contract wording and in calculating solvency capital requirements.

We take short-term (physical) impacts of climate change on our insurance business into account, particularly in the risk assessment of natural hazards. The validation activities for modelling accumulation risks also take climate change risks into account. Munich Re regularly analyses how resilient the Company is against various climate change scenarios to derive potential action requirements. We generally assess the risks resulting from climate change as material risks for the Company. We currently regard the impacts on our risk exposures as immaterial on the whole. This is, in particular, thanks to our ability to regularly adjust risk exposures.

We see relevant, long-term risks in long-term, illiquid investments; in possible exposures to litigation risks in our insurance portfolio; and in the risk of litigation against Munich Re itself. We address these risks with suitable mitigation measures such as employee training, appropriate guidelines for writing business and making investments, and through the diversification of investments.

Further information, in particular on the probable maximum loss (PML) to our insurance portfolio from climate-related natural catastrophes for a 200-year return period, is available in the section “Insurance” of our combined non-financial statement.

Legal risks

As part of the normal course of business, Munich Re companies are involved in court, regulatory and arbitration proceedings in various countries. The outcome of those or possibly imminent proceedings is neither certain nor predictable. However, we believe that none of these proceedings will have a significant negative effect on the financial position of Munich Re. Such proceedings are dealt with using combined expertise within the individual departments and units.

Summary

In accordance with the prescribed processes, our Board committees explicitly defined the risk appetite for significant risk categories in the year under review, and quantified it with key figures. We determined and documented the risk appetite across the Group hierarchy and communicated it throughout the Group. In 2022 risk exposures were regularly quantified and compared with the risk appetite. They were reported on and discussed in the relevant committees.
At 260%, the Solvency II ratio is at a very comfortable level above our communicated optimal range of 175–220% (without application of transitional measures).

Munich Re thus continues to have a very solid capital base. Based on up-to-date findings and on our internal model, Munich Re’s Solvency II ratio (without application of transitional measures) would be at least within or above the optimal range even in the event of major loss events and negative capital market effects. We therefore assess Munich Re’s risk situation to be manageable and under control.