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INSURER INSOLVENCY RISK: SYSTEMATIC LITERATURE REVIEW

Background. ***In the current environment, insurer insolvency risk is considered a key factor in maintaining the stability of the insurance market and the financial system as a whole. Its growth amid crises, macroeconomic instability, and regulatory changes underscores the need for in-depth research and the search for effective approaches to mitigating it.***

Methods. ***The study is based on a systematic literature review conducted in accordance with the PRISMA 2020 standard. Publications from the Scopus and ScienceDirect databases were selected, based on defined inclusion and exclusion criteria. The final sample comprises 54 articles published between 2005 and 2025 that directly address the economic implications of insurer insolvency risk, the factors shaping it, and approaches to its assessment.***

Results. ***The analysis shows that the literature examines insurer insolvency risk through several analytical approaches that focus on different dimensions of the phenomenon, including financial and balance-sheet, risk-sharing (particularly reinsurance), regulatory capital, corporate governance, and systemic approaches. The identified determinants are structured into internal and external factors. At the same time, research evolution has shifted from a narrow regulatory perspective to a more complex view that considers interactions among these factors.***

Conclusions. ***The systematic review indicates that the existing literature lacks a unified framework for analyzing insurer insolvency risk, as studies tend to focus on individual aspects of the phenomenon and its influencing factors. The main contribution of the reviewed research lies in developing different analytical perspectives rather than integrating them. This highlights the need to consider insolvency risk as a complex phenomenon formed by the interaction of multiple factors and to combine different approaches for its comprehensive analysis.***

Keywords: ***reinsurance, reserve and capital requirements, risk-management, default, ESG.***

Background

In today's conditions, the solvency of insurance companies is a key prerequisite for the stability of the entire insurance market, as the insolvency of a single company can undermine consumer trust and trigger chain reactions across the financial system. The statistics on insurance company bankruptcies worldwide are as follows (Kelly, & Peng, 2025):

- during the period 2000-2024, at least 965 cases were recorded across 71 countries, confirming the systemic nature of this risk for the insurance market.
- on average, around 36 insurers go bankrupt globally each year, with a peak of 87 companies in 2000 and a minimum of 20 companies in 2024.
- the largest number of bankruptcies occurs in the non-life segment (606 cases), followed by life insurers (324), while composite insurers (22) and reinsurers (13) fail much less frequently.
- more than half of all bankruptcies (57.5%) occur in North America, primarily in the United States, which accounts for over half of global cases (503), largely due to the scale of the market and high competition.
- according to estimates for OECD countries, the average rate is 2.73 bankruptcies per 1,000 insurers annually, indicating a relatively low but stable frequency of insolvency in the industry.

Such statistics directly justify the need for a systematic literature review on insurers' insolvency risk. Research from the past two decades indicates that the economic significance of insolvency risk extends far beyond simple bankruptcy, encompassing a wide range of internal, external, and regulatory factors – from capital structure and the effectiveness of corporate governance to macroeconomic instability and global crises. For this reason, the analysis of insurers' insolvency risk and the substantiation of the need for its systematic management have become particularly relevant in both the academic sphere and the practice of regulators and market participants.

The main purpose of this article is to clarify the economic meaning of insurers' insolvency risk, identify the key factors shaping it, and substantiate the necessity of its comprehensive management.

Literature review. The systematic literature review on insurer insolvency risk, comprising 54 articles published between 2005 and 2025, has demonstrated the multidimensional nature of this risk. The studies differ in regional coverage, theoretical and methodological approaches, and focal points; however, they all highlight the crucial role of financial stability and regulatory requirements in ensuring solvency.

From a geographical perspective, the reviewed studies encompass a wide range of countries and regions. Considerable attention is devoted to developed markets – the United States and the European Union – where the implementation of the Solvency II Directive and other regulatory regimes has been the main driver of the evolution of approaches to measuring insolvency risk (Dang, 2014; Fernandez-Arjona, 2021; Siopi et al., 2023). At the same time, there is a growing number of works analyzing the specificities of emerging markets, particularly China, South Korea, Ethiopia, and Palestine, where macroeconomic instability, currency fluctuations, and underdeveloped regulatory institutions significantly increase the risk of financial instability among insurance companies (Wu, & Deng, 2021; Park & Shin, 2022; Kebede, Tesfaye, & Erana, 2024; Jawad, & Ayyash, 2019). Comparative studies

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confirm that although global regulatory standards are gradually converging, local market characteristics remain critical for insolvency risk management (Kwon, Kim, & Lee, 2005; Dias, Ismail, & Zhang, 2025).

The dynamics of publications from 2005 to 2025 show a gradual increase in scholarly interest in insurer insolvency risk. While in 2005–2013, only from 0 to 2 papers appeared annually, a steady rise has been observed since 2014, reaching a local peak in 2016 (4 articles). The real surge in research activity occurred in recent years, with the number of publications peaking in 2022 and 2024 (8 publications each year), reflecting the growing relevance of the topic amid global crises and tightening regulatory requirements (Fig. 1).

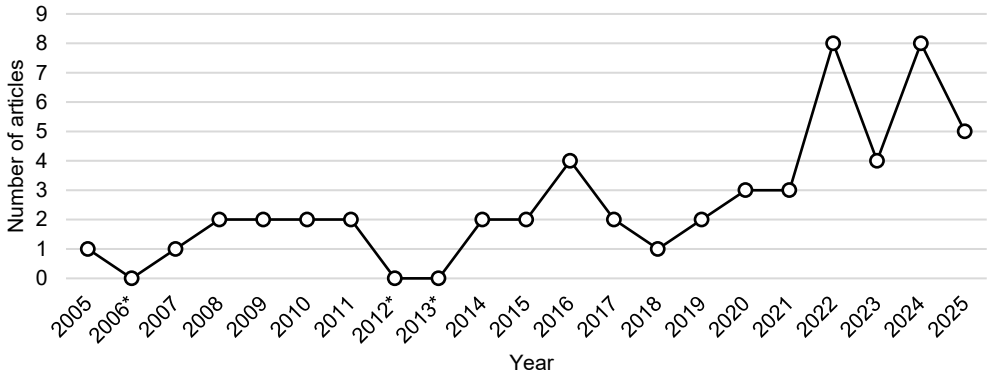


Fig. 1. The number of articles by year included in the systematic review during 2005–2025

** Zero values in some years are explained by the source selection procedure: after analyzing the abstracts and full texts of the articles, only those publications that directly correspond to the research topic and allow answering the research questions were included in the review*

Source: generalization by the authors.

Early works (2005–2010) focused primarily on classical approaches to defining the statutory capital buffer and the role of regulators in preventing mass exits of companies from the market (Kwon, Kim, & Lee, 2005; Zhang, 2008). In subsequent years (2010–2015), the focus shifted toward risk-oriented approaches associated with the implementation of Solvency II, particularly the measurement of Solvency Capital Requirement (SCR) and Minimum Capital Requirement (MCR), the use of risk models, and the development of internal models for a more accurate assessment of financial resilience (Jevtić, & Regis, 2015; Crisafulli, 2024).

Since 2016, the literature has increasingly emphasized the systemic aspects of insolvency risk: the interdependence between the insurance and banking sectors, the threats of catastrophic and pandemic risks, as well as the challenges faced by small and specialized insurers under strict regulatory requirements (Zimmer et al., 2018; Heinrich, Sabuco, & Farmer, 2022; Richter, & Wilson, 2020; Sheehan et al., 2023). Particular attention has been devoted to the role of reinsurance, counterparty risk management, the application of machine learning to forecast solvency indicators, and the integration of ESG factors into supervisory frameworks (Park, & Shin, 2022; Brogi et al., 2022; Calice, 2014; Gal, 2020).

Thus, the contemporary scientific discourse demonstrates a transition from a narrow interpretation of insolvency as actual bankruptcy to understanding it as the probability of losing the ability to meet obligations under the influence of a complex set of financial, macroeconomic, regulatory, and behavioral factors (Siopi et al., 2023; Dias, Ismail, & Zhang, 2025; Di Tommaso, Mazzuca, & Pacelli, 2025).

Methods

The systematic review was conducted in accordance with the international PRISMA 2020 standard, ensuring transparency and reproducibility in the selection and analysis of scientific sources. The review was guided by the following research question:

What is the economic meaning of insurer insolvency risk, what factors determine it, and what is the objective necessity of managing it?

The stages of the systematic literature review are illustrated in Fig. 2.

At the first stage, a search for publications was carried out in leading scientometric databases (Scopus, ScienceDirect). To form the sample, combinations of keywords and Boolean operators were used that corresponded to the research questions related to the economic meaning of insurer insolvency risk and the necessity of its management:

– ScienceDirect: ("insurance company" OR insurer OR "insurance industry") AND ("insolvency" OR "solvency" OR "financial distress" OR "default") AND ("risk" OR "management" OR "factors" OR "determinants" OR "drivers" OR "causes");

– Scopus: TITLE-ABS-KEY (("insurance company" OR "insurer" OR "insurance industry") AND ("insolvency" OR "solvency" OR "financial distress" OR "default") AND ("risk" OR "management" OR "factors" OR "determinants" OR "drivers" OR "causes")) AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (OA, "all")) AND (LIMIT-TO (DOCTYPE, "ar")).

The following inclusion and exclusion criteria were applied to identify the relevant publications (Table 1).

All selected publications were exported into Zotero, where they were systematized. The software was used for bibliography management, duplicate removal, and the creation of a structured database of sources. At the stage of literature cleaning, duplicate articles were automatically removed using Zotero's built-in tool, while metadata (title, authors, year) were manually verified.

In scientific research, alongside Zotero, other reference management systems are also used, particularly Mendeley and EndNote. The advantages of Zotero include open access, a user-friendly interface, simple integration with websites and academic databases, the ability to quickly export and structure sources, and the "one-click" function for generating a reference list in a selected citation style.

Table 1

Inclusion Criteria	Exclusion Criteria
Type of publications – peer-reviewed journal articles published in international scientometric databases (Scopus, ScienceDirect)	Other sources – conference proceedings, books, dissertations, reports, presentations, and unpublished working papers without peer review
Thematic scope – studies directly addressing: • the economic meaning of insurer insolvency risk; • factors influencing insolvency risk; • the objective necessity of managing insolvency risk	Irrelevant topics – studies addressing: • insolvency risks of other financial institutions (banks, corporations) without reference to insurance companies; • general risk issues (e.g., market risk, investment strategies) without connection to insurer insolvency
Field of research – finance, insurance, risk management, and regulatory policy	Duplicate publications – duplicates or reworked versions of the same studies
Language – English	Language – articles published in languages other than English
Chronological scope – 2000–2025 (September)	Chronological scope – before 2000
Data completeness – availability of the full text for analysis	Limited access – studies where the full text was not available for qualitative analysis

Source: generalization by the authors.

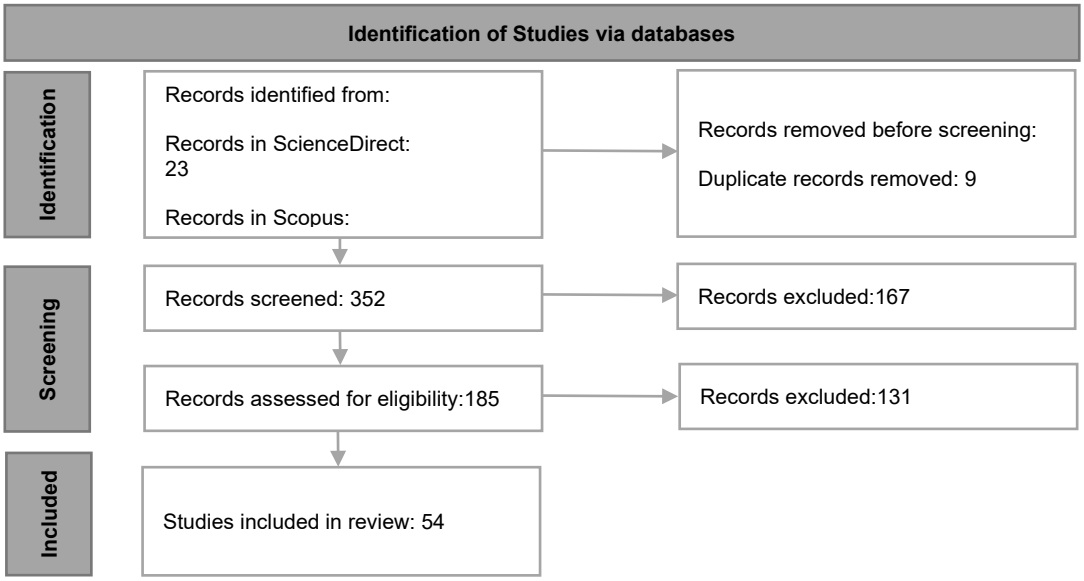


Fig. 2. PRISMA Chart for systematic review

Source: constructed by the authors according to the PRISMA 2020 methodology.

At the same time, certain limitations of this system include a smaller number of tools for automated bibliographic analysis compared with specialized programs (for example, the aforementioned Mendeley and EndNote already incorporate AI-based tools). Considering the objectives of this study, the use of Zotero is appropriate and fully sufficient, as this system allows the efficient organization of selected sources, control over duplicate publications, and the formation of a dataset for further content analysis.

The subsequent selection process was carried out in several stages:

Screening by titles and abstracts – publications unrelated to the topic of insolvency risk in insurance were excluded.

- Full-text analysis – studies were assessed for compliance with the defined inclusion criteria (economic meaning of risk, influencing factors, necessity, and tools of risk management).
- Final sample formation – the final database included 54 articles published between 2005 and September 2025.

After constructing the final sample of publications, the selected scientific sources were systematized. Content analysis was applied to identify the primary research directions in which authors address insurer insolvency risk, including the factors that shape it, approaches to its assessment, and arguments supporting the need for its management.

In summarizing the findings, logical-structural analysis, comparison, and generalization were also used. These methods helped trace the evolution of scholarly approaches to insurer insolvency risk and highlight the main trends in the development of scientific discourse on the topic.

Results

In modern research, insolvency risk is understood as a multidimensional economic construct encompassing financial, investment, market, regulatory, and behavioral factors. It is not limited to actual bankruptcy or default but is viewed as the probability that an insurer will lose the ability to meet its obligations to policyholders, driven by asset-liability mismatches, market shocks, capital inadequacy, or ineffective management. Analysis of the scientific literature reveals several main approaches to the study of insurer insolvency risk.

Within the first approach, the main focus is placed on the financial and balance-sheet perspective, according to which the risk of insolvency is associated with the insufficiency of resources to cover obligations and losses, especially under conditions of catastrophic events or financial crises, and is interpreted as a probabilistic outcome of the dynamic evolution of an insurer's financial condition (Heinrich, Sabuco, & Farmer, 2022; Francesco, & Simonella, 2023; Liu et al., 2023; Goussebaïle, & Louaas, 2024; Aleksieienko, & Kazadaieva, 2024; Bernard, & Chen, 2009; Filipović, Kremslehner, & Muermann, 2011; Smętek, Strzelecka, &

Zawadzka, 2024). It is emphasized that this category has not only a stochastic dimension but also a managerial one, since the financial condition of an insurer directly depends on the quality of planning, reinsurance protection, capital structure, diversification, and investment policy (Sibindi, 2015; Gal, 2020; Wu, & Deng, 2021; Jawad, & Ayyash, 2019; Wu, & Li, 2021).

Some studies focus on the risk-sharing approach, which holds that reinsurance and portfolio diversification are key to reducing default risk. However, inadequate reinsurance coverage conditions or the concentration of catastrophic risks may, conversely, increase the probability of insolvency (Sheehan et al., 2023; Ghafory-Ashtiany, & Motamed, 2024; Constantinescu, et al., 2022; Lo, 2016). In this context, the economic meaning is associated with the distribution of risk across insurance and reinsurance chains, that is, with the potential transfer or return of losses in the event of large shocks.

The next approach identified in the study of this issue is the regulatory capital approach, in which insurer insolvency is considered not merely a financial failure but a gap between the insurer's risk profile and its solvency capital. In this interpretation, particular importance is attached to regulatory standards (Solvency I, Solvency II), capital and reserve requirements, and reinsurance programs that mitigate shock exposures and help prevent collapse. Edita Jurkonytė notes that "Solvency I is the existing system for monitoring insurance risk, but Solvency II evaluates not only security, but also market, credit, and operational risks, as well as risk management across the entire insurer's balance sheet" (Jurkonytė, 2009). The earlier regulatory framework allowed a certain level of "hidden" insolvency risk. In reality, insolvency risk may arise not only from losses but also from errors in asset structure, reserving practices, and underwriting (Chen, & Yang, 2022).

Some authors emphasize that competitive pressure, an imperfect market structure, and poor corporate governance create conditions for the adoption of risky strategies, undercapitalization, and solvency loss (Grochola, & Schlütter, 2025). Thus, it is possible to identify a corporate governance approach within the research on insurer insolvency. Poor governance can amplify crisis phenomena even when the immediate trigger originates from market conditions.

The final approach is the systemic approach, in which authors emphasize that insolvency risk is a dynamic process resulting from a combination of insurers' internal decisions and external macroeconomic or industry factors. In this perspective, an insurer's risk is not isolated but interconnected with the overall stability of the financial market (Calice, 2014; Goussebaïle, & Louaas, 2024; Deprez, & Wüthrich, 2016). In this context, the economic content of the risk includes income volatility, interest rate and credit risks, increasing loss ratios, inflation, exchange rate fluctuations, as well as behavioral aspects of consumers and counterparties, particularly reinsurers (Crisafulli, 2024; Lo, 2016). Moreover, insurer insolvency is closely related to banking defaults. Therefore, the trigger for default may arise not only from internal factors but also from financial shocks originating in the banking sector. During crises, PD dependence tends to coincide across time horizons, indicating the risk of a joint collapse (Zhang et al., 2024). Thus, insolvency risk management is considered an economically justified necessity not only for consumer protection but also for maintaining the stability of the insurance market as a whole.

It is also worth noting that the analysed approaches to the study of insurer insolvency risk do not exist in isolation but are closely interconnected, reflecting different aspects of the functioning of insurance companies and the insurance market as a whole. The financial–balance, risk-sharing, regulatory-capital, corporate governance, and systemic approaches within the scientific discourse complement each other, forming a comprehensive understanding of the nature of this risk. In view of this, it is appropriate to formulate a generalized definition. Thus, insurer insolvency risk can be understood as an economic category shaped by both internal managerial decisions and external market, macroeconomic, and regulatory factors. It reflects the probability of a solvency violation arising from imbalances in risk exposure, capital, established reserves, liquidity, and profitability. At the same time, managing this risk is an objective prerequisite for ensuring the financial security of an insurance company as a microeconomic entity, on the one hand, and for maintaining the stability of the insurance market as a whole, on the other hand.

During the systematic literature review, it was found that authors employ various indicators to assess insolvency risk. These can be divided into three groups:

1. *Regulatory-capital indicators (SCR, MCR, Risk-Based Capital (RBC), Solvency Ratio, Solvency Adequacy Ratio):* these determine whether an insurer has a sufficient capital buffer to cover risks and whether it meets regulatory requirements. They reflect regulatory resilience and the ability to withstand external shocks (Fernandez-Arjona, 2021; Crisafulli, 2024; Di Francesco, & Simonella, 2023; Goussebaïle, & Louaas, 2024; Dias, Ismail, & Zhang, 2025; Ghafory-Ashtiany, & Motamed, 2024; Constantinescu et al., 2022; Zariņa-Cīrule, Pettere, & Voronova, 2022; Sheehan et al., 2023; Park, & Shin, 2022; Kwon, Kim, & Lee, 2005; Siopi et al., 2023; Brogi et al., 2022; Grochola, & Schlütter, 2025; Di Tommaso, Mazzuca, & Pacelli, 2025; Chen, & Yang, 2022; Karp, 2007; Szüle, 2017a).

2. *Balance-sheet and financial indicators (Funding Ratio, Default Value, Z-score, Altman Z-score):* these metrics assess the financial equilibrium between assets and liabilities, the risk of default, and the probability of bankruptcy. They demonstrate the extent to which a company can meet its obligations even without external interventions (Jevtić, & Regis, 2015; Zhang, 2008; Siopi et al., 2023; Kebede, Tesfaye, & Erana, 2024; Giráldez-Puig et al., 2025; Szüle, 2017b; Ayinaddis, & Tegegne, 2023; Moreno, Parrado-Martínez, & Trujillo-Ponce, 2022).

3. *Operational-risk indicators (Claim Ratio, Value at risk (VaR)):* these reflect the current level of loss ratio and potential losses that may undermine solvency in the short term or under stress scenarios. They are linked to loss risk, portfolio fluctuations, and unforeseen payouts (Jawad, & Ayyash, 2019; Chen, & Yang, 2022; Heinrich, Sabuco, & Farmer, 2022; Di Francesco, & Simonella, 2023; Constantinescu et al., 2022; Bernard, & Tian, 2010).

The formulas and the economic meaning of the indicators are presented in Table 2.

This confirms that insolvency risk has a multidimensional economic meaning and requires comprehensive monitoring through a combination of different indicators. It should be noted that although the Solvency II Directive requires the calculation of SCR, authors often criticize this measure, arguing that insolvency risk cannot be managed solely through the annual SCR. In contrast, multi-year approaches reduce default probabilities (Diers, 2011; van Bragt, Steehouwer, & Waalwijk, 2010). Other researchers discuss the introduction of a pandemic SCR, reflecting the need for insurance companies to maintain sufficient capital to cover the long-term, gradual financial consequences of a pandemic, including a shrinking client base, reduced premiums, and an increased risk of collapse. This distinguishes such risk from classical sudden catastrophic events (Tamturk, Cortis, & Farrell, 2020).

Table 2

Approaches to assessing insurer insolvency risk

Indicator	Formula	Economic Meaning
Regulatory-capital indicators		
SCR (Solvency Capital Requirement)	SCR = Capital needed to cover unexpected losses with a probability of 99.5%	The amount of capital required to absorb shocks within one year without losing solvency
MCR (Minimum Capital Requirement)	MCR = k × SCR ($k \approx 25–45\%$)	The minimum capital level below which the insurer is considered insolvent
RBC (Risk-Based Capital)	RBC Ratio = Available Capital / Required Capital	Reflects capital adequacy considering risks; below 100% indicates a danger zone
SR (Solvency Ratio)	SR = Own Funds / Solvency Requirement	Demonstrates the ability to meet the solvency requirement
Solvency Adequacy Ratio (SAR)	SAR = Available Capital / Required Solvency Capital	Shows whether actual capital exceeds (or falls short of) the regulatory requirement; a value >1 indicates sufficient capital
Balance-sheet and financial indicators		
Funding Ratio	Funding Ratio = Assets / Liabilities	Indicates the extent to which liabilities are covered by assets; <1 means underfunding
Default Value	Default Value = Assets – Liabilities < 0	Indicates when liabilities exceed assets and default occurs
Z-score	$Z = (ROA + Capital\ Ratio) / \sigma(ROA)$	Probability of bankruptcy: the higher the value, the lower the insolvency risk
Altman Z-score	$Z = 1.2\times(WC/TA) + 1.4\times(RE/TA) + 3.3\times(EBIT/TA) + 0.6\times(MVE/TL) + 1.0\times(S/TA)$	Composite indicator of bankruptcy risk based on five financial ratios
Operational-risk indicators		
Claim Ratio	Claim Ratio = Claims Paid / Premiums Earned	Reflects the loss ratio of insurance operations; high values pose a threat to solvency
VaR (Value at Risk)	VaR = minimum expected losses at a given confidence level	Estimates the maximum potential losses under normal conditions over a specified horizon

Source: generalized by the authors on the basis of the analyzed sources.

It is also possible to observe a certain correlation between the time of the research and its economic interpretation. Three conditional time periods can be distinguished: 2005–2009, 2010–2015, and 2016–2025.

During the period 2005–2009, the insolvency risk of insurers was primarily interpreted within a regulatory and normative framework. At this stage, the main focus was placed on the legal aspects of market exit, liquidation procedures, and the protection of policyholders' rights. According to Kwon, Kim, & Lee, 2005, insolvency was understood as an institutional event requiring regulatory intervention rather than as an economic process of accumulating risks (Kwon, Kim, & Lee, 2005; Leadbetter, & Dibra, 2008). Only a few studies, such as those conducted by Zhang, have proposed a more economic perspective – assessing risk through the expected default value, the difference between assets and liabilities (Zhang, 2008). Thus, during this period, the Solvency I approach dominated, equating insolvency with violations of capital requirements, and its management focused on controlling liquidity and the adequacy of the solvency margin.

Between 2010 and 2015, the concept of insolvency risk underwent reinterpretation in the wake of the global financial crisis and in preparation for the implementation of Solvency II. Researchers (Dang, 2014; Jevtić, & Regis, 2015; Sibindi, 2015) started to view insolvency as a dynamic financial process shaped by changes in profitability, asset structure, and long-term liabilities. Instead of a static approach, risk-oriented models – such as RBC, SCR, ALM (Asset-Liability Management), and VaR – began to be applied, allowing for the assessment of default probability while accounting for macroeconomic fluctuations and the specific characteristics of the insurance portfolio. Insolvency risk was no longer regarded merely as an accounting category but increasingly interpreted as the outcome of strategic management decisions, capital structure, and corporate governance.

The period 2016–2025 is characterized by a transition to a system-integrated view of insolvency risk. Following the implementation of Solvency II, it has been conceptualized as a complex, multidimensional category encompassing financial, market, catastrophic, climate-related, and non-financial risks. Studies (Heinrich, Sabuco, & Farmer, 2022; Crisafulli, 2024; Siopi et al., 2023; Dias, Ismail, & Zhang, 2025) emphasize that insolvency has a systemic nature and can be transmitted across insurance, banking, and reinsurance sectors. Modern approaches are based on Solvency II internal models, copula and agent-based modeling, machine learning, and the integration of ESG parameters into financial condition assessment. Thus, insolvency risk is no longer perceived as an isolated event but as a continuous systemic process, the management of which is a key prerequisite for an insurance company's financial security.

The literature review presents a multidimensional view of the factors that shape insurer insolvency risk. Authors propose various approaches that have gradually evolved from purely financial to systemic, behavioral, and regulatory perspectives. Huong Dang argues that insolvency risk is not merely a solvent/insolvent dichotomy but a spectrum of possible states (supervision, conservation, rehabilitation, liquidation). The author emphasizes that different insolvency outcomes are driven by distinct processes and factors and therefore cannot be treated as identical (Dang, 2014).

All factors of insolvency risk identified in the literature can be divided into two groups: internal (financial and non-financial (organizational)) and external (macroeconomic and market-related, regulatory, behavioral, ESG) factors:

1. *Internal factors* include both financial and non-financial (organizational). The most frequently cited and empirically confirmed financial factors include insufficient capital adequacy, high leverage, weak liquidity and profitability, problems with reserving and pricing, as well as insufficient portfolio diversification. Empirical evidence shows that a decline in capital or deterioration in ROE/ROA significantly increases the probability of default; conversely, strong capital buffers and cost discipline reduce the risk of financial distress (Dang, 2014; Zhang, 2008; Jawad & Ayyash, 2019; Kebede, Tesfaye, & Erana, 2024; Park, & Shin, 2022; Astuti, Hilman, & Suryajaya, 2025). In addition, pricing errors and an inflated claims ratio in non-life/liability

lines increase pressure on equity (Chen, & Yang, 2022). Non-financial factors include the quality of corporate governance, strategic planning, and risk management (Sibindi, 2015; Gal, 2020). They determine the extent to which an insurer's financial decisions translate into sustainable or risky practices.

2. *External factors* are divided into several subgroups:

• *Macroeconomic and market-related factors*. Inflation, interest rates, devaluation, unemployment, market volatility, and systemic shocks (such as pandemics, banking crises, and geopolitical events) deteriorate solvency indicators by simultaneously pressuring both assets and liabilities (Astuti, Hilman, & Suryajaya, 2025). It has been proven that capital market cycles and crises are strongly correlated with higher insurers' PD; a series of insurer defaults have also been observed after major catastrophes (hurricanes/earthquakes) (Dang, 2014; Calice, 2014; Liu et al., 2022; Richter, & Wilson, 2020; Zhang et al., 2024). Following the COVID-19 pandemic, declines in the Solvency II ratio were observed, prompting the need for enhanced stress tests and recovery plans (Richter, & Wilson, 2020). Poufinas and Siopi argue that Solvency II is effective only if insurers diversify their assets, manage market exposure, and adapt their portfolios to their risk profile (Poufinas, & Siopi, 2024).

• *Regulatory factors*. The requirements of Solvency II, SST (Swiss Solvecy Test), and RBC discipline capital and reduce insolvency risk; however, the quality of supervision, transparency, and corporate governance determines whether "formal" compliance translates into genuine resilience. Research findings highlight that: (1) after the introduction of Solvency II, financial stability generally increased, though small and undercapitalized companies require a more flexible approach; (2) weak corporate governance and manipulations with LTG (Long-Term Guarantees) adjustments can create an "illusion" of solvency (Siopi et al., 2023; Kwon, Kim, & Lee, 2005; Gal, 2020; Sibindi, 2015; Grochola, & Schlütter, 2025; Chen, & Hieber, 2016; Jang, Koo, & Park, 2019). In countries with less developed supervision, regulatory gaps amplify systemic risks of insurers exiting the market (Kwon, Kim, & Lee, 2005).

• *Behavioral factors*. Behavioral experiments show that even a 1-3% probability of default sharply decreases consumers' willingness to purchase insurance, making it economically rational to maintain an almost zero PD (Zimmer et al., 2018). Behavioral factors may also include seasonal patterns in losses (Avanzi, Taylor, & Wong, 2016).

ESG factors have a dual dimension, combining internal (organizational) and external aspects. On the one hand, they represent a company's internal policy on sustainable investment, environmental and social responsibility, and transparency in management. On the other hand, they are external pressure from regulators, investors, and public expectations. However, formal ESG compliance without capital backing may reduce the Solvency Ratio ("green arbitrage") (Brogi et al., 2022; Di Tommaso, Mazzuca, & Pacelli, 2025; Giráldez-Puig et al., 2025). Thus, ESG acts as an intersection between organizational culture and the external environment, either increasing or mitigating the insolvency risk. Considering the above information, the factors that influence the risk of insurer insolvency can be represented as follows (Fig. 3).

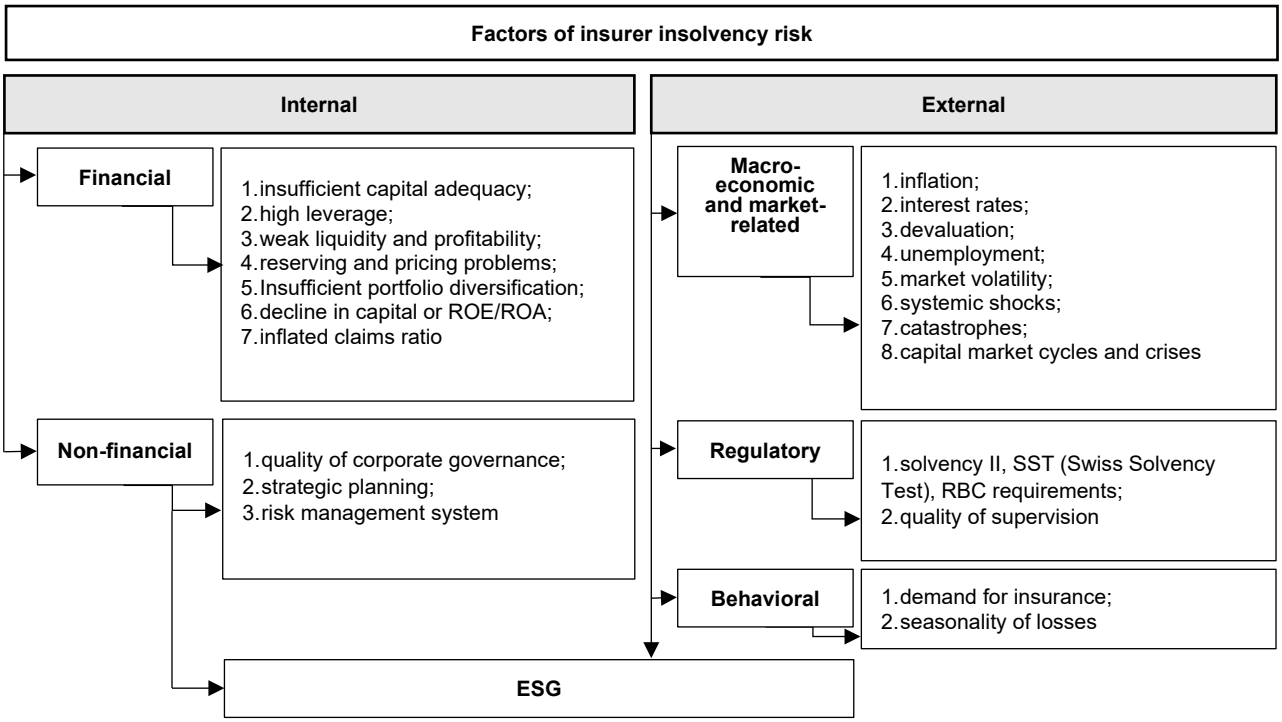


Fig. 3. Factors of insurer insolvency risk

Source: constructed by the authors on the basis of the analyzed sources.

The authors represented in the analyzed studies unanimously emphasize that insolvency risk management is not only an internal need of the insurer but also an externally driven economic, regulatory, and social necessity. It is not a facultative activity, but rather a prerequisite for maintaining the stability of the insurance market, protecting policyholders, and ensuring the overall resilience of the financial system.

On the one hand, the objective necessity of managing insurers' insolvency risk stems from the fact that customer trust, market stability, and the protection of policyholders' interests depend on insurance companies' financial soundness. For instance, studies show that bankruptcy costs in the insurance sector are higher than in the banking sector, and delays in regulatory intervention only exacerbate losses. This is why early detection of problems and effective risk management are key to minimizing negative consequences (Dang, 2014). Moreover, even a very low probability of default sharply reduces demand for insurance services, as consumers are highly sensitive to insurers' financial stability. This suggests that companies must strive for maximum resilience, as even a minor risk can significantly undermine their market position (Zimmer et al., 2018).

On the other hand, the regulatory dimension is no less important. Within Solvency II and the Swiss Solvency Test, insurers are required to continuously monitor capital, since inaccurate or untimely assessments may lead to underfunding and increase insolvency risk (Fernandez-Arjona, 2021). In addition, research demonstrates that systemic factors, such as the widespread use of identical risk models by many companies, can create the threat of simultaneous bankruptcies within the sector. This makes diversification of models and approaches to risk management particularly essential (Heinrich, Sabuco, & Farmer, 2022).

Financial control and planning are also crucial. The absence of effective asset-liability management can lead to cash flow gaps and defaults, exposing both shareholders and policyholders to significant risk (Di Francesco, & Simonella, 2023). Added to this is the risk posed by unreliable reinsurers: selecting counterparties solely on price, without considering their creditworthiness, increases an insurer's vulnerability. Within the framework of Solvency II, managing this risk becomes not only desirable but mandatory (Crisafulli, 2024).

On a broader scale, the insolvency of individual insurers can generate serious socio-economic consequences. It threatens not only the welfare of policyholders but can also create imbalances in the wider economy, underscoring the need for strict supervision (Kwon, Kim, & Lee, 2005). In the case of catastrophic risks, the issue extends to the potential collapse of entire market segments, making insolvency management a matter of systemic stability (Goussebaïle, & Louaas, 2024). Finally, the insolvency risk of a single insurer has a global dimension: it can impact financial markets by widening CDS (Credit Default Swap) spreads and declining company capitalization, underscoring the need for enhanced supervision of systemically important insurers (Calice, 2014).

Discussion and conclusions

The results of the systematic review show that the academic literature on insurer insolvency risk reflects a variety of conceptual perspectives, each emphasizing different aspects of this complex phenomenon. A significant body of research adopts a financial and balance-sheet perspective, viewing insolvency risk primarily as a consequence of insufficient capital, asset–liability mismatches, and the overall deterioration of insurer financial stability. Within this approach, particular attention is given to the role of capital structure, liquidity management, and investment strategies in maintaining solvency (Francesco, & Simonella, 2023; Filipović, Kremslehner, & Muermann, 2011). At the same time, other studies focus on mechanisms of risk distribution, arguing that reinsurance and portfolio diversification play a crucial role in reducing the probability of default (Sheehan et al., 2023; Constantinescu et al., 2022; Lo, 2016). Taken together, these findings suggest that insolvency risk cannot be understood solely through internal financial indicators but should also be examined in relation to risk-transfer mechanisms and broader risk management strategies within insurance companies.

Another important line of research highlights the roles of regulatory frameworks, corporate governance, and systemic interconnections in shaping insolvency risk. From this perspective, regulatory capital approaches highlight the importance of solvency requirements and supervisory regimes such as Solvency II in strengthening insurers' financial resilience and ensuring adequate capital buffers (Fernandez-Arjona, 2021; Siopi et al., 2023). At the same time, several authors argue that formal compliance with regulatory standards does not automatically translate into genuine financial stability, especially when corporate governance is weak or when companies pursue excessively risky strategies (Grochola & Schlütter, 2025; Sibindi, 2015; Gal, 2020). It is interesting to note that Grochola and Schlütter (2025) show that companies with lower solvency ratios actively use LTG-mechanisms which can increase the reported solvency ratio by up to 29 percentage points, that raises questions about the true financial resilience of such firms. Moreover, systemic approaches underline the growing interconnectedness between insurance markets and the wider financial system, including banking and capital markets, and emphasize the impact of macroeconomic shocks and financial crises on insurers' solvency (Calice, 2014; Zhang et al., 2024; Heinrich, Sabuco, & Farmer, 2022). In this context, insolvency risk should be viewed as a dynamic and multifaceted phenomenon that arises from the interaction of financial, institutional, and macroeconomic factors rather than from isolated internal conditions.

The results indicate that there is no single, unified approach in the academic literature for defining the key determinants of insurer insolvency risk. On the one hand, a substantial body of research focuses on internal financial indicators – such as capital adequacy, liquidity, and the balance between assets and liabilities – as the primary basis for assessing solvency. This approach is both logical and practical, as these indicators are easily measurable and serve as the foundation for regulatory requirements.

At the same time, an increasing number of studies emphasize that this is insufficient. Financial indicators alone do not explain how risks are distributed, transferred, or accumulated within the system. In this context, particular importance is attached to risk transfer mechanisms, especially reinsurance, as well as broader risk management approaches. These mechanisms can either mitigate or, conversely, amplify an insurer's vulnerability.

This creates an important area of debate: on the one hand, financial indicators provide a standardized and quantifiable basis for solvency assessment but may underestimate systemic risks and cross-sectoral interconnections. On the other hand, approaches that incorporate risk transfer and systemic effects offer a more comprehensive perspective, yet they are more difficult to formalize and implement in practice.

This, in turn, calls into question the sufficiency of traditional solvency assessment models based solely on financial indicators.

Therefore, it can be argued that none of these approaches is self-sufficient. A more robust solution lies in an integrated approach that treats insolvency risk as a dynamic, multidimensional phenomenon.

In our view, the main contribution of this article lies in the systematization of approaches, specifically in identifying the

perspectives from which authors analyze insurers' insolvency risk. At the same time, this very systematization reveals that the literature remains highly fragmented. There are separate strands of research focusing on capital adequacy, others on reinsurance, and still others on systemic linkages, yet far fewer studies attempt to integrate these dimensions. Therefore, the most productive next step is to move beyond a typology of factors toward an understanding of how they interact dynamically over time.

Importantly, the current regulatory context is particularly conducive to such research. Within the framework of the Solvency II review, the integration of a macroprudential dimension into insurers' activities has been explicitly formalized. As noted, "Directive (EU) 2025/2 introduces new requirements … regarding the inclusion of macroprudential analyses in the own risk and solvency assessment (ORSA) and as part of the prudent person principle (PPP) (EIOPA, 2025)." Moreover, supervisory authorities not only assess these aspects but also actively shape insurers' risk management approaches, as they "should analyse the ORSA report … and provide input … particularly as regards macroprudential risks (EIOPA, 2025)."

This indicates that macroprudential analysis is gradually moving from a declarative concept to a practical component of risk management and investment decision-making, as insurers "need to take account of macroprudential concerns when they decide on their investment strategy. (EIOPA, 2025)" At the same time, this approach is based on a combination of quantitative and qualitative criteria (including asset size, interconnectedness with the financial system, and liquidity), which points to the emergence of a comprehensive macroprudential toolkit and the institutionalization of a systemic approach to financial stability in the insurance sector (EIOPA, 2025).

Also, the findings allow for several key generalizations. First, in the temporal dimension, there is a clear transformation in the interpretation of insolvency risk: from a regulatory-legal approach (2005–2009), through a financial-dynamic view with emphasis on managerial decisions (2010–2015), to an integrated systemic concept (2016–2025) encompassing financial, market, climate, and non-financial factors. This indicates a growing complexity in the economic meaning of the category and an increasing role of systemic risk management.

Second, the use of different groups of indicators (regulatory capital, balance sheet, and financial and operational risk) reflects the multifaceted nature of the problem. At the same time, authors stress that no single indicator – even the SCR under Solvency II can provide a comprehensive picture. This underscores the need for combined, multi-year approaches that better account for the long-term consequences of crisis events, including pandemics.

Third, a key conclusion is that insolvency risk management is objective and unavoidable. Its economic necessity arises not only from protecting the interests of owners and policyholders but also from maintaining the stability of the financial market as a whole. Evidence shows that even a low probability of insolvency significantly reduces demand for insurance services, while insurer bankruptcies create broader socio-economic imbalances.

Insolvency risk management, therefore, requires a systemic approach that combines:

- maintaining adequate levels of capital and liquidity,
- strategic asset-liability planning,
- diversification and reliable reinsurance protection,
- strengthening corporate governance and regulatory oversight,
- integrating new risks (ESG, climate, pandemic-related) into risk management.
- In addition, the systematic literature review suggests several promising directions for future research:
- Deepening the behavioral dimension of insurer insolvency risk. Existing studies indicate that even a slight increase in the probability of default significantly affects the demand for insurance services. However, the mechanisms underlying these reactions require further analysis. In particular, the effects of "panic" and informational signals remain underexplored. This would make it possible to consider insolvency risk not only as a purely financial category, but also as a socio-economic phenomenon shaped by expectations and trust.
- The dual effect of reinsurance remains an open question. While reinsurance is traditionally viewed as a key risk-sharing instrument, excessive reliance on it and risk concentration may, conversely, increase an insurer's vulnerability. In this regard, further research could focus on optimal reinsurance models and the role of counterparty risk in managing insurers' insolvency risk.
- Further research should focus on a deeper understanding of the role of ESG factors in shaping insolvency risk. Despite the growing attention to sustainability, an important question remains unresolved: does the implementation of ESG approaches genuinely improve financial performance, or does it primarily enhance insurers' reputation?
- Future studies should also account for regional and institutional differences in the formation of insolvency risk. Although regulatory standards aim at harmonization (particularly through Solvency II), national market specifics, the level of institutional development, supervisory quality, and macroeconomic conditions remain significant factors. A comparative analysis between developed and developing countries would be particularly valuable in assessing the effectiveness of regulation and insurers' solvency. Such an approach would help better understand how institutional quality influences the effectiveness of insolvency risk management.
- Another relevant research direction concerns the impact of new types of crisis scenarios on insurers' insolvency risk. These include complex, prolonged, and often nonlinear events such as climate change, geopolitical conflicts, and war-related risks.

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РИЗИК НЕПЛАТОСПРОМОЖНОСТІ СТРАХОВИКА: СИСТЕМАТИЧНИЙ ОГЛЯД ЛІТЕРАТУРИ

В с т у п . ***В сучасних умовах ризик неплатоспроможності страховиків розглядають як ключовий чинник стабільності страхового ринку та фінансової системи загалом. Його зростання під впливом кризових явищ, макроекономічної нестабільності та регуляторних змін актуалізує потребу в поглибленому дослідженні та пошуку ефективних підходів до його зниження.***

М е т о д и . ***Дослідження побудоване на систематичному огляді наукової літератури за стандартом PRISMA 2020. Використано публікації з баз Scopus і ScienceDirect, відібрані за визначеними критеріями включення та виключення. Остаточна вибірка охоплює 54 статті, опубліковані у 2005–2025 рр., що безпосередньо висвітлюють економічний зміст ризику неплатоспроможності страховиків, чинники його формування та підходи до оцінювання.***

Р е з у л ь т а т и . ***Економічний зміст ризику неплатоспроможності трактується як імовірність втрати страховиком здатності виконувати зобов'язання перед страхувальниками. Усі фактори ризику неплатоспроможності можна розділити на дві групи: внутрішні (фінансові та нефінансові (організаційні)) та зовнішні (макроекономічні та ринкові, регуляторні, поведінкові, ESG). Визначено, що об'єктивна необхідність управління цим ризиком зумовлена не лише захистом інтересів страхувальників, а й забезпеченням стабільності страхового ринку, підтримкою довіри та запобіганням поширенню кризових явищ у фінансовій системі.***

В и с н о в к и . ***Ризик неплатоспроможності є багатовимірною економічною категорією, управління яким є обов'язковою умовою функціонування страхової компанії та гарантією стабільності ринку. Подальші дослідження повинні спрямовуватися на розроблення інтегрованих моделей оцінювання та багаторівневих підходів до управління, що дасть змогу підвищити фінансову безпеку страховиків і зміцнити довіру до страхового сектору.***

К л ю ч о в і с л о в а : ***перестрахування, вимоги до резервів та капіталу, управління ризиками, дефолт, ESG.***

Автори заявляють про відсутність конфлікту інтересів. Спонсори не брали участі в розробленні дослідження; у зборі, аналізі чи інтерпретації даних; у написанні рукопису; в рішенні про публікацію результатів.

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