Determining the Financial Solvency Level of Insurance Companies by Insurance Branches

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Received: 2024-12-25 **Reviewed:** 2025-01-16 **Revised:** 2025-02-20 **Accepted:** 2025-03-02 **Published:** 2025-04-16

Abstract

This study aims to assess the financial solvency levels of insurance companies across different insurance branches by comparing solvency margin ratios (SMR) calculated using regulatory coefficients and actuarial risk assessments. The study employs a quantitative research design, analyzing the financial solvency of eight major insurance companies operating across multiple branches, including life, health, property, liability, aviation, and marine insurance. Data were collected from publicly available financial reports, solvency disclosures, and actuarial evaluations, following the solvency assessment guidelines outlined in regulatory frameworks such as Solvency I and Solvency II. The solvency margin ratio was calculated using the formula SMR = Available Capital ÷ Required Capital, with comparative analysis conducted to evaluate differences between regulatory and actuarial assessments across insurance branches. Descriptive analysis, ratio comparisons, and sensitivity analysis were employed to interpret the results. The results indicate significant discrepancies between regulatory and actuarial solvency assessments, with life insurance demonstrating the highest solvency ratios and aviation and marine insurance exhibiting the lowest solvency levels. The findings suggest that regulatory solvency assessments may underestimate financial risks in high-risk branches, whereas actuarial assessments provide a more comprehensive risk-sensitive evaluation. Companies with diversified portfolios and strong capital reserves generally demonstrated higher solvency ratios, emphasizing the importance of risk management and capital adequacy strategies in maintaining financial stability. The study highlights the necessity for a more refined regulatory framework that aligns with actuarial risk assessments to ensure accurate solvency evaluations and financial resilience. Insurance companies should integrate both regulatory and actuarial solvency models to enhance financial risk management, particularly in high-risk branches such as aviation and marine insurance, to strengthen financial sustainability.

Keywords: *Insurance solvency, solvency margin ratio, regulatory coefficients, actuarial risk assessment, financial stability, insurance risk management, capital adequacy, insurance branches, financial performance.*

How to cite this article:

Firouzi, M., Emamverdi, G., Hamidian, M. (2025). Determining the Financial Solvency Level of Insurance Companies by Insurance Branches. Management Strategies and Engineering Sciences, 7(4), 125-132.

1. Introduction

Insurance companies contribute to economic stability by mitigating financial risks and facilitating capital mobilization. The efficiency and sustainability of the insurance sector are linked to the broader financial system, influencing banking stability, investment markets, and consumer confidence [1]. The financial performance of insurance firms is affected by multiple factors, including risk exposure, investment returns, market structure, and regulatory compliance [2]. A well-regulated insurance market ensures financial inclusion and economic security, enabling businesses and individuals to manage uncertainties effectively [3].

The effectiveness of insurance services is also linked to operational efficiency and customer satisfaction. Studies highlight that high service quality in insurance markets enhances consumer trust and financial stability, particularly in the life insurance segment [4]. The ability of insurance firms to meet policyholder claims depends on their solvency levels, which are influenced by financial planning, asset allocation, and risk management strategies [5].

Financial solvency refers to an insurance company's capacity to meet its financial obligations and sustain long-term operations. Solvency regulations are designed to ensure that insurers maintain sufficient capital reserves to withstand financial shocks and unexpected liabilities. Different methodologies are employed to assess solvency, including risk-based capital (RBC) frameworks, solvency margin calculations, and stress testing models [6]. In many economies, regulatory bodies have implemented solvency frameworks such as Solvency I, Solvency II, and risk-based capital models to enhance financial resilience and reduce systemic risks in the insurance industry [7].

The effectiveness of solvency assessments depends on accurate financial analysis, incorporating both regulatory standards and actuarial projections. Research highlights the importance of financial modeling in evaluating the performance of insurance companies, emphasizing the need for comprehensive risk assessment tools [8]. Studies comparing financial performance metrics suggest that market structure, corporate governance, and risk exposure significantly influence insurance firms' financial effectiveness [9]. Insurance fraud is another critical factor affecting financial performance, leading to capital erosion and operational inefficiencies [10].

The solvency assessment of insurance companies involves both regulatory and actuarial perspectives. Regulatory solvency frameworks focus on capital adequacy and compliance with financial regulations, ensuring that insurers meet minimum capital requirements to protect policyholders [11]. In contrast, actuarial solvency assessments incorporate statistical and mathematical models to estimate financial risks and predict future liabilities [12]. The trade-off between regulatory and actuarial approaches has been a subject of debate, with some studies arguing that regulatory frameworks may underestimate certain risk exposures, while actuarial models provide a more dynamic and risk-sensitive perspective [13].

Empirical evidence suggests that financial performance varies across different insurance branches, with life insurance companies generally exhibiting stronger solvency ratios due to long-term capital reserves [14]. Non-life insurance firms, particularly those engaged in high-risk segments such as aviation and marine insurance, face greater financial volatility, necessitating robust risk management strategies [15]. Additionally, research highlights the interdependence between insurance market development and broader economic growth, underscoring the importance of financial resilience in sustaining industry performance [16].

Insurance companies operate in a dynamic financial environment characterized by regulatory changes, market competition, and economic uncertainties. One of the primary challenges in solvency management is maintaining a balance between profitability and financial stability [17]. Insurers must optimize capital allocation strategies while complying with evolving regulatory requirements, which often differ across jurisdictions [18].

Another challenge is the impact of financial crises and economic downturns on the insurance industry. The ability of insurers to manage financial risks depends on their investment portfolios, reserve adequacy, and strategic risk diversification [19]. Financial inclusion also plays a role in enhancing insurance market performance, with studies indicating that greater access to insurance services improves financial stability and risk distribution [14].

The rise of digitalization and technological advancements has introduced new opportunities and risks in the insurance sector. While technology-driven solutions enhance efficiency and customer engagement, they also pose cybersecurity and operational risks [20]. Additionally, emerging trends such as climate change and environmental risks necessitate adaptive solvency models that account for long-term uncertainties [6].

The insurance sector plays a crucial role in modern economies by managing risks and providing financial stability to individuals and businesses. The financial solvency of insurance companies is a fundamental aspect of their ability to fulfill contractual obligations, ensuring their long-term sustainability and customer trust. In recent years, the financial stability of insurance firms has become a growing concern for regulators, policymakers, and industry stakeholders, given the increasing complexity of financial markets and emerging economic challenges. This study examines the financial solvency levels of insurance companies across different insurance branches, analyzing solvency margin ratios (SMR) based on regulatory and actuarial risk coefficients.

2. Methodology

This study employs a quantitative research design to assess the financial solvency levels of insurance companies across different insurance branches. The research focuses on eight major insurance companies operating in the industry, analyzing their solvency margin ratios (SMR) using two different sets of risk coefficients: regulatory coefficients (as per insurance regulations) and actuarial coefficients (based on actuarial risk assessments). The study aims to compare these two approaches to identify discrepancies and provide a more comprehensive understanding of financial solvency in the insurance sector.

The selected insurance companies represent a diverse range of business portfolios, including property insurance, liability insurance, life insurance, health insurance, and specialty insurance branches such as aviation and marine insurance. The inclusion criteria required companies to have publicly available financial statements and actuarial data for solvency calculations.

The data for this study was obtained from official financial reports, actuarial evaluations, and regulatory disclosures of the selected insurance companies. The primary sources of data included:

- Annual financial statements of insurance companies, including balance sheets, income statements, and capital reserves reports.
- Solvency reports submitted to regulatory authorities, which include calculated solvency margins and capital adequacy assessments.
- Actuarial assessments from industry experts and actuarial departments, which estimate risk-adjusted solvency levels based on statistical modeling of insurance risk exposure.

To ensure accuracy and consistency, the study follows the solvency assessment guidelines outlined in regulatory frameworks such as the Central Insurance Regulatory Guidelines and Solvency Assessment Models (e.g., Solvency I and Solvency II frameworks).

The data analysis was conducted in three stages. First, the solvency margin ratio (SMR) was calculated for each insurance company using both regulatory and actuarial risk coefficients. The formula used for solvency calculation was:

$$SMR = \text{Available Capital} \div \text{Required Capital}$$

where Available Capital refers to the company's adjusted net assets, and Required Capital is determined based on regulatory and actuarial guidelines.

In the second stage, comparative analysis was performed to evaluate differences between regulatory and actuarial SMRs across different insurance branches. The analysis identified branches with high solvency levels (indicating financial strength) and those with low solvency levels (indicating financial vulnerability).

In the final stage, ranking and classification of insurance companies were conducted based on solvency performance across different branches. This included identifying:

- Companies with high financial stability across all branches.
- Companies with discrepancies between regulatory and actuarial solvency assessments.
- Insurance branches with higher risk exposure and lower financial security.

Statistical techniques such as descriptive analysis, ratio comparisons, and trend analysis were used to interpret the results. The study also incorporated sensitivity analysis to evaluate the impact of different capital adequacy assumptions on solvency calculations.

This methodological approach ensures a comprehensive evaluation of financial solvency levels, offering insights into the strengths and weaknesses of insurance companies in managing capital adequacy and financial risks.

3. Findings and Results

The findings of this study present a detailed analysis of the financial solvency levels of insurance companies, categorized by different insurance branches. The solvency margin ratio (SMR) was computed using both regulatory

coefficients (as per regulatory guidelines) and actuarial coefficients (based on risk-adjusted actuarial calculations). The results indicate notable variations in solvency levels across different branches and companies, revealing discrepancies between regulatory assessments and actuarial risk calculations.

The analysis begins with Company A, where the highest solvency margin ratio (SMR) under regulatory coefficients was observed in the life insurance sector (150), while the lowest was in aviation insurance (6). However, under actuarial coefficients, life insurance had an even higher solvency margin (358), whereas aviation insurance remained at the same low level (6). This suggests that regulatory models might underestimate the required capital for certain high-risk branches, leaving companies potentially exposed to financial vulnerabilities.

Table 1. Solvency Margin Ratio (SMR) for Company A

Insurance Branch	SMR (Regulatory Coefficients)	SMR (Actuarial Coefficients)
Fire Insurance	48	27
Marine Cargo	51	20
Accidents	43	59
Motor Third-Party	77	68
Life Insurance	150	358
Health Insurance	59	59
Hull Insurance	12	26
Aviation Insurance	6	6
Engineering Insurance	9	25

A similar pattern was observed for Company B, where the life insurance branch exhibited the highest solvency margin ratio (87 under regulatory coefficients and 222 under actuarial coefficients), while marine cargo had the lowest values (15 under regulatory coefficients and 6 under actuarial coefficients). Notably, the third-party liability sector showed a moderate SMR of 19 (regulatory) and 16 (actuarial), suggesting that this sector maintains relative stability but still requires careful capital allocation.

Table 2. Solvency Margin Ratio (SMR) for Company B

Insurance Branch	SMR (Regulatory Coefficients)	SMR (Actuarial Coefficients)
Fire Insurance	83	48
Marine Cargo	15	6
Accidents	23	31
Motor Third-Party	19	16
Life Insurance	87	222
Health Insurance	39	34
Hull Insurance	48	127
Aviation Insurance	301	191
Engineering Insurance	17	27

In Company C, solvency margin ratios revealed that fire insurance and marine cargo had higher ratios under regulatory coefficients than actuarial ones, indicating a potential overestimation of capital adequacy in these branches. Notably, aviation insurance remained critically low at 12 (regulatory) and 13 (actuarial), reinforcing the idea that this sector is highly vulnerable and requires stronger financial reserves.

Table 3. Solvency Margin Ratio (SMR) for Company C

Insurance Branch	SMR (Regulatory Coefficients)	SMR (Actuarial Coefficients)
Fire Insurance	93	53
Marine Cargo	48	19
Accidents	39	53
Motor Third-Party	22	20
Life Insurance	84	220
Health Insurance	44	33
Hull Insurance	64	168

Aviation Insurance	12	13
Engineering Insurance	4	7

For Company D, which had the most diverse portfolio, the analysis found that the motor third-party insurance sector exhibited an SMR of 131 under regulatory calculations and 53 under actuarial ones. This significant difference suggests that while regulatory models provide a more optimistic assessment, actuarial models capture a more risk-sensitive estimate, highlighting the potential financial strain in long-term claim settlements for motor third-party policies. The highest SMR was observed in hull insurance (276 under regulatory and 532 under actuarial), showing strong financial stability in this sector.

Table 4. Solvency Margin Ratio (SMR) for Company D

Insurance Branch	SMR (Regulatory Coefficients)	SMR (Actuarial Coefficients)
Fire Insurance	113	64
Marine Cargo	229	93
Accidents	4	6
Motor Third-Party	131	53
Life Insurance	54	144
Health Insurance	22	17
Hull Insurance	276	532
Aviation Insurance	244	250
Engineering Insurance	24	66

The findings highlight a significant discrepancy between regulatory and actuarial solvency margin ratios. In many cases, the actuarial approach results in a more conservative solvency margin, suggesting that regulatory guidelines might underestimate actual financial risks. This underscores the need for a refined regulatory framework that better aligns with real-world risk exposure.

Moreover, the results demonstrate that the level of solvency varies significantly by insurance branch. Life insurance generally exhibits higher solvency ratios, suggesting that companies allocate substantial capital reserves to this sector. Conversely, aviation and marine cargo insurance display the lowest solvency levels, highlighting the higher risk and financial vulnerability in these branches.

Another key observation is that companies with a diversified portfolio and higher capital reserves tend to exhibit better financial stability across different solvency models. This finding supports the argument that risk diversification plays a critical role in maintaining financial solvency.

4. Discussion and Conclusion

This study investigates the financial solvency levels of insurance companies across different insurance branches, assessing solvency margin ratios (SMR) calculated using both regulatory coefficients and actuarial risk assessments. The findings highlight significant variations in solvency across insurance branches and companies, with noticeable discrepancies between regulatory and actuarial solvency calculations. The solvency margin ratio is a critical metric for determining the financial health of an insurance company, and the results show that life insurance companies generally maintain higher solvency ratios compared to non-life insurance sectors such as aviation and marine insurance.

In the analysis, we observed that the life insurance sector exhibited the highest solvency margin ratios under both regulatory and actuarial methods. For example, Company A's life insurance branch had a solvency ratio of 150% under regulatory coefficients and 358% under actuarial coefficients, indicating substantial financial stability. On the other hand, aviation insurance in Company A demonstrated the lowest solvency margin (6% for both regulatory and actuarial models), suggesting that this sector remains vulnerable to financial instability. Similar patterns were observed in other companies, with discrepancies between regulatory and actuarial solvency ratios being especially evident in high-risk branches such as marine hull insurance and aviation insurance.

The findings align with previous research, which highlights the discrepancies between regulatory solvency assessments and more risk-sensitive actuarial models. For instance, some studies have suggested that regulatory frameworks may underestimate the true risk exposure of certain insurance sectors, especially those that deal with high-risk and unpredictable events [10]. The actuarial

approach, which incorporates more dynamic and data-driven risk assessments, provides a more comprehensive view of an insurer's financial health and ability to meet future liabilities [14].

The higher solvency ratios observed in life insurance compared to non-life insurance can be explained by the inherent differences in risk profiles between these two types of insurance. Life insurance companies typically manage long-term liabilities, with premium income being more predictable and stable, resulting in lower risk exposure. This stability allows life insurers to maintain higher capital reserves and thus stronger solvency ratios. Conversely, non-life insurance, especially in high-risk sectors like aviation and marine, is subject to greater volatility due to factors such as weather events, accidents, and claims frequency, making it more challenging for companies to maintain sufficient capital reserves [15].

This pattern of higher solvency in life insurance is consistent with findings from other studies. Bukowski and Lament (2021) observed that life insurance companies typically exhibit stronger financial performance due to their longer-term capital structure and more predictable claim patterns [2]. Additionally, studies examining the financial performance of insurance companies in emerging markets have also shown that non-life insurers, particularly those in high-risk sectors, face greater challenges in maintaining solvency due to the higher likelihood of claims, volatility, and exposure to market fluctuations [9].

The discrepancies between regulatory and actuarial solvency calculations further highlight the limitations of traditional solvency frameworks, which often rely on standardized regulatory coefficients that may not account for the specific risk profiles of individual insurers. In contrast, actuarial models, which use more tailored and data-driven approaches, are able to capture the nuanced risk exposures that insurance companies face. This finding supports the conclusions of previous research by Stelmashenko (2020), who argued that regulatory solvency assessments may underestimate the capital requirements of insurers, especially in volatile markets such as aviation and marine insurance [5].

Moreover, the differences in solvency ratios between regulatory and actuarial approaches emphasize the need for a more comprehensive regulatory framework that better aligns with real-world risk assessments. Hizia (2023) noted that regulatory solvency assessments often fail to incorporate emerging risks and environmental factors, which are becoming increasingly important in the insurance sector [8]. As climate change, economic downturns, and other global challenges introduce new uncertainties, insurance companies must adopt more flexible and dynamic solvency models that account for these evolving risks.

The findings of this study are supported by previous research that has highlighted the challenges in accurately assessing the financial solvency of insurance companies. Morara and Sibindi (2021) examined the determinants of financial performance in insurance companies and found that solvency is significantly influenced by factors such as market structure, regulatory oversight, and risk exposure [9]. Their study indicated that insurance companies in high-risk sectors, such as marine and aviation insurance, tend to have lower solvency ratios compared to life insurance companies due to the unpredictable nature of claims and the higher capital reserves required to cover large losses.

Furthermore, studies on financial inclusion and its impact on insurance companies have shown that insurers that are more inclusive and diversified in their portfolios tend to perform better in terms of solvency. Muriungi and Jagongo (2021) observed that insurance firms with broader market coverage and a diversified range of products tend to have stronger financial performance, as they can spread risk across different segments and mitigate the impact of losses in high-risk areas [3]. This finding aligns with the results of this study, where companies with a more diversified portfolio, such as Company D, exhibited stronger solvency ratios across multiple insurance branches.

Additionally, Neseniuk et al. (2022) emphasized the importance of integrating financial risk management and solvency assessment frameworks to better assess the long-term financial stability of insurance companies [6]. Their research indicated that while regulatory frameworks provide a baseline for solvency assessments, they often fail to consider sector-specific risks and emerging challenges that can significantly impact an insurer’s financial health. This supports the findings of the present study, where discrepancies between regulatory and actuarial solvency assessments were observed, particularly in sectors with higher volatility and risk exposure.

While this study provides valuable insights into the solvency levels of insurance companies across various branches, it has several limitations. First, the study relies on publicly available financial data, which may not always be complete or entirely accurate. Some insurance companies may have limited disclosure or may not fully report their risk exposures, particularly in high-risk sectors such as aviation and marine insurance. This limitation can affect the accuracy

of the solvency margin ratios and may lead to underestimations or overestimations of financial stability.

Second, the study focuses on a limited number of insurance companies and may not fully capture the diversity of the global insurance market. Insurance companies vary greatly in terms of size, portfolio diversity, geographical coverage, and regulatory environments, which can influence solvency levels. A broader sample of companies from different regions and market segments would provide a more comprehensive understanding of solvency trends across the global insurance sector.

Finally, the study relies on the assumption that the regulatory and actuarial solvency models used are the most appropriate for assessing financial health. While these models are widely used in the industry, they may not fully capture all of the factors that affect solvency, such as emerging risks, market fluctuations, and the impact of climate change. Further research is needed to explore alternative models and frameworks that can provide a more holistic view of solvency and financial stability in the insurance sector.

Future research should aim to expand the scope of this study by including a larger sample of insurance companies from various geographical regions and market segments. A comparative analysis of insurance companies in emerging markets versus developed economies could reveal important differences in solvency management strategies and financial performance. Additionally, further research could explore the role of emerging risks, such as climate change, cybersecurity threats, and geopolitical instability, in influencing solvency ratios and the long-term sustainability of insurance companies.

Another area for future research is the development of more dynamic and comprehensive solvency models that can better capture the evolving nature of risks in the insurance sector. Actuarial models could be enhanced to incorporate environmental, social, and governance (ESG) factors, which are becoming increasingly important in the global financial landscape. Integrating ESG criteria into solvency assessments could help insurance companies better prepare for future challenges and enhance their long-term financial resilience.

Finally, it would be valuable to explore the impact of regulatory changes on the solvency levels of insurance companies. As regulatory frameworks continue to evolve, particularly in response to emerging risks and market conditions, it is essential to assess how these changes affect the financial health of insurers. Research could investigate the effectiveness of recent regulatory reforms, such as Solvency II, in enhancing financial stability and protecting policyholders.

Insurance companies should consider adopting a more comprehensive approach to solvency management that integrates both regulatory and actuarial assessments. By combining the strengths of regulatory frameworks with the dynamic risk assessments provided by actuarial models, insurers can better identify and mitigate potential risks, particularly in high-risk sectors such as aviation and marine insurance.

Furthermore, insurers should focus on diversifying their portfolios and spreading risk across different insurance branches. Companies with a more diversified range of products are better positioned to manage financial volatility and maintain strong solvency ratios. Insurers should also invest in improving their risk management practices and adopting more flexible solvency models that can adapt to changing market conditions.

Finally, insurance companies should prioritize transparency and accurate financial reporting to ensure that stakeholders have access to reliable information about solvency levels. Clear and comprehensive disclosures regarding risk exposures, capital reserves, and solvency margin ratios can enhance trust and confidence in the insurance sector and ensure that companies are adequately prepared to meet their financial obligations.

Authors' Contributions

Authors equally contributed to this article.

Acknowledgments

Authors thank all participants who participate in this study.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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