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Evaluating Solvency II Implementation in Emerging Markets: A Quantitative Analysis of Algeria's Alliance Insurance Company (2017-2021)

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Abstract

This study provides a comprehensive assessment of Solvency II quantitative requirements and their application in an emerging market context, focusing on Alliance Insurance Company, one of Algeria's leading insurers. Using a longitudinal analysis spanning 2017-2021, we evaluate the company's financial stability against international standards through rigorous calculation of Solvency Capital Requirements (SCR) and Minimum Capital Requirements (MCR). The research addresses a critical gap in understanding how European regulatory frameworks can be adapted to North African insurance markets. Our findings demonstrate that Alliance Insurance Company consistently maintained solvency capital ratios exceeding 500% and minimum solvency capital ratios above 1100% throughout the study period—substantially surpassing the 100% regulatory threshold. These exceptionally robust ratios indicate not only the company's strong financial position but also its resilience against market volatility and capacity to honor policyholder commitments under stress scenarios. The study contributes to regulatory policy discussions by demonstrating that Solvency II principles can be effectively applied in developing insurance markets, while highlighting adaptations necessary for local market conditions. These findings have significant implications for regulators, investors, and insurance practitioners in Algeria and comparable emerging markets seeking to strengthen financial stability standards.

Keywords: *Insurance Solvency, Solvency II Implementation, Emerging Markets, Capital Requirements, Risk-Based Supervision, Algeria, Financial Regulation.*

JEL classification: G22, G32, G28, O16

Introduction

The global insurance landscape has undergone profound transformation in response to escalating risk profiles and the devastating financial impact of both natural and industrial catastrophes. In 2023 alone, global economic losses from natural disasters reached $380 billion, with insured losses totaling $130 billion (Munich Re, 2024). These figures highlight the critical role insurance companies play in economic resilience and risk mitigation across both developed and emerging markets.

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The Algerian insurance sector, while smaller than its European counterparts with a penetration rate of only 0.7% of GDP compared to the global average of 7.1%, has experienced steady growth over the past decade, with premiums increasing at an annual rate of 5.2% (Algerian Insurance Association, 2022). As the sector expands, the need for robust solvency assessment frameworks becomes increasingly important to ensure market stability and protect policyholders' interests. This need is particularly acute in emerging markets where regulatory frameworks are still evolving.

The evaluation of insurance companies' solvency has become paramount amid persistent evolution within the industry and the increasing complexity of risks these entities face. Traditional solvency frameworks—including the Insurance Regulatory Information System (IRIS), the American Risk-Based Capital (RBC) model, and the European Union's Solvency I—have provided foundational approaches to solvency assessment. However, these systems have struggled to keep pace with the sector's dynamic evolution, particularly in addressing comprehensive risk factors and market volatility.

To address these limitations, the European Council for Financial Affairs (ECOFIN) introduced the Solvency II framework in 2009, implementing a more sophisticated approach to risk assessment aligned with international accounting standards (IFRS) and prudential regulations such as Basel II. The framework's implementation followed a methodical process, beginning with comprehensive examinations of solvency aspects and progressing to technical evaluations through multiple Quantitative Impact Studies (QIS). The resulting three-pillar structure integrates quantitative and qualitative requirements, creating a holistic approach to evaluating risk management practices and financial stability.

Algeria's economic partnership with the European Union and its commitment to financial sector stability have prompted regulatory reforms in the insurance domain. However, significant questions remain regarding the comprehensive impact of these developments, particularly concerning the capital requirements imposed on Algerian insurance companies and their readiness to adopt international standards.

This study addresses this knowledge gap by examining how Solvency II quantitative requirements can be applied to assess the financial solvency of Alliance Insurance Company, one of Algeria's prominent insurers and the first private entity listed on the Algerian Stock Exchange. Through analysis of the company's financial data from 2017 to 2021, we seek to determine the extent to which it meets the regulatory capital requirements outlined in the Solvency II framework and identify implications for the broader Algerian insurance market.

The research contributes to both theoretical and practical understanding of solvency assessment in emerging markets in several ways. First, it provides empirical evidence on the applicability of European regulatory frameworks in North African insurance markets. Second, it demonstrates methodological approaches to calculating key solvency metrics in contexts where complete data alignment with European standards may be challenging. Finally, it offers insights into the financial strength of a leading Algerian insurer against international benchmarks, with implications for policyholders, investors, and regulators.

The remainder of this paper is structured as follows: Section 2 provides a comprehensive literature review on Solvency II and its global implementation. Section 3 details our research methodology and data sources. Section 4 presents our findings on Alliance Insurance Company's capital requirements under Solvency II. Section 5 discusses these findings in the context of

broader market implications. Finally, Section 6 concludes with key insights and recommendations for future research and practice.

Literature Review

Evolution of Insurance Solvency Frameworks

Insurance solvency regulation has evolved substantially over the past three decades, transitioning from simple ratio-based assessments to sophisticated risk-based models. Early frameworks such as the EU's Solvency I, established in the 1970s and modified in 2002, relied primarily on basic premium and claims ratios to determine capital requirements (Eling & Holzmüller, 2008). While these systems provided a foundation for solvency monitoring, they failed to account for the full spectrum of risks faced by modern insurers and the increasing complexity of financial instruments (Doff, 2016).

The limitations of these early frameworks became increasingly apparent following the 2008 global financial crisis, which exposed vulnerabilities in financial institutions worldwide and emphasized the need for more robust risk management practices (Gatzert & Wesker, 2012). This catalyzed the development and implementation of more sophisticated regulatory approaches, with Solvency II emerging as the European response to these challenges.

The Solvency II Framework: Concept and Development

Solvency II represents a paradigm shift in insurance regulation, moving from compliance-based supervision to a comprehensive risk-based approach. Initiated and ratified by the European Parliament in 2009 and fully implemented in 2016, this framework was designed to enhance traditional risk management requirements within insurance and reinsurance companies, aligning with principles outlined in the Basel II agreement for the banking sector (Mazzanti, 2012).

The British Financial Services Authority defined Solvency II as "a determination of capital adequacy for the European insurance industry, aiming to establish a set of capital requirements and standards related to risk management at the European Union level to replace the applicable solvency requirements" (Financial Services Authority, 2011). This definition highlights the framework's dual focus on capital adequacy and risk management practices.

The development of Solvency II involved extensive stakeholder consultation and calibration through five Quantitative Impact Studies (QIS) conducted between 2005 and 2010 (EIOPA, 2011). These studies progressively refined the framework's parameters and methodologies, ensuring they were both theoretically sound and practically implementable. Recent research by Van Hulle (2019) documents this developmental journey, highlighting how the framework evolved in response to industry feedback and changing market conditions.

Objectives and Structure of Solvency II

Solvency II aims to provide comprehensive safeguards for insurance companies and policyholders against diverse potential risks through modernization of regulatory protocols within the insurance industry. Braun et al. (2018) identify five core objectives of the framework: enhancing policyholder protection, optimizing capital allocation, improving risk management practices, promoting market integration, and establishing a risk-based supervisory approach.

The framework is structured upon three fundamental pillars that draw significant influence from Basel II banking regulations:

Pillar I: Quantitative Requirements

The first pillar establishes quantitative requirements for capital adequacy and technical provisions. Recent studies by Höring (2020) and Peleckienė & Peleckis (2020) provide empirical evidence that these requirements have significantly improved European insurers' ability to withstand market shocks, though with varied implementation costs across different sized firms.

The pillar includes detailed methodologies for asset valuation, technical provisions calculation, and capital requirements determination. Particularly important are the Solvency Capital Requirement (SCR) and Minimum Capital Requirement (MCR), which establish thresholds for regulatory intervention based on comprehensive risk assessment (Laas & Siegel, 2017).

Pillar II: Qualitative Requirements

The second pillar focuses on governance systems, risk management, and supervisory review processes. Recent work by Mohan et al. (2022) indicates that improved governance under Solvency II has contributed to more effective risk identification and mitigation, with positive effects on overall financial stability. Key elements include internal control systems, risk management frameworks, actuarial functions, and Own Risk and Solvency Assessment (ORSA) procedures.

Pillar III: Disclosure and Market Discipline

The third pillar establishes requirements for transparency and information disclosure to both regulators and the public. Fajčíková and Lament (2019) demonstrate that enhanced disclosure requirements have improved market discipline and investor confidence, though cross-country implementation remains inconsistent. This pillar includes the Solvency and Financial Condition Report (SFCR), Regulatory Supervisors Report (RSR), and Quantitative Reporting Templates (QRT).

International Implementation and Adaptation

While Solvency II was developed for the European market, its principles have influenced insurance regulation globally. The International Association of Insurance Supervisors (IAIS) has incorporated many Solvency II concepts into its Insurance Core Principles and Common Framework for the Supervision of Internationally Active Insurance Groups (ComFrame) (IAIS, 2020).

Adaptation of Solvency II principles in non-European markets has followed various trajectories. Studies by Sharara et al. (2020) on Middle Eastern markets and Gurung (2021) on Asian markets demonstrate how regulatory authorities have selectively adopted elements of Solvency II while accommodating local market conditions and existing regulatory frameworks.

Solvency II in Emerging Markets

The implementation of Solvency II-type frameworks in emerging markets presents unique challenges and opportunities. Emerging economies often face constraints related to data availability, actuarial expertise, and less developed financial markets that complicate direct application of Solvency II methodologies (Ansah-Adu et al., 2022).

Research by Olesen and Zaidi (2021) examining Solvency II adaptation in African markets highlights how regulatory authorities have modified requirements to account for market maturity and local risk profiles. Similarly, Naher et al. (2023) document how Latin American regulators

have implemented phased approaches to risk-based solvency regimes, allowing markets to develop necessary capabilities over time.

In North Africa specifically, limited research exists on Solvency II implementation. Studies by El Barnoussi and Radi (2019) on Morocco and Kallel et al. (2022) on Tunisia provide insights into regional adaptation efforts, but comprehensive analysis of the Algerian experience remains notably absent from the literature.

Research Gap and Study Contribution

The review of existing literature reveals several important gaps. First, while Solvency II has been extensively studied in European contexts, empirical research on its application in emerging markets, particularly in North Africa, remains limited. Second, the unique challenges of implementing risk-based solvency frameworks in markets with different structural characteristics are not fully addressed in current research. Finally, company-level analyses examining actual implementation effects in specific institutional contexts are relatively scarce.

This study contributes to addressing these gaps by providing a detailed empirical analysis of Solvency II application to a leading Algerian insurer. By examining how the quantitative requirements of Pillar I translate to the Algerian context, we offer insights into the practical challenges and opportunities of implementing international regulatory standards in an emerging market setting.

Research Methodology

Research Design and Approach

This study employs a longitudinal case study design to analyze the application of Solvency II quantitative requirements within Alliance Insurance Company in Algeria. The case study approach is particularly well-suited for examining complex phenomena within their real-world context (Yin, 2018), especially when the boundaries between the phenomenon and its context remain indistinct. This methodological framework facilitates an in-depth exploration of how international regulatory frameworks can be tailored to align with local market conditions.

A mixed-methods approach is adopted, integrating quantitative financial analysis with a qualitative assessment of the regulatory environment. The quantitative component entails the computation of key solvency metrics as prescribed by Solvency II, while the qualitative dimension contextualizes these calculations within the institutional and market framework. This methodological approach aligns with contemporary research developments in international insurance studies (Dragos et al., 2020; Ansah et al., 2022).

Data Collection and Sources

The study utilizes financial data from Alliance Insurance Company spanning a five-year period (2017–2021). Primary data sources include:

- Audited annual financial statements of Alliance Insurance Company
- Quarterly financial reports submitted to the Algerian insurance regulatory authority
- Company disclosures to the Algerian Stock Exchange
- Actuarial reports and risk assessments provided by the company

Additionally, supplementary data sources encompass:

- Industry reports from the Algerian Insurance Association
- Regulatory bulletins issued by the Algerian Ministry of Finance
- Economic indicators published by the Bank of Algeria
- Technical documentation on Solvency II from the European Insurance and Occupational Pensions Authority (EIOPA)

To ensure comparability over the study period, all financial data were adjusted for inflation and converted to standardized valuation bases. Exchange rates between the Algerian Dinar and the Euro were obtained from the Bank of Algeria's tripartite statistical bulletins.

Analytical Framework

The analytical framework is anchored in the quantitative requirements delineated in Pillar I of Solvency II, with an emphasis on capital requirements and technical provisions. The key metrics assessed include:

Solvency Capital Requirement (SCR)

The SCR represents the level of economic capital an insurer must maintain to ensure a 99.5% probability of meeting policyholder obligations over a one-year horizon. This study employs the standard formula approach prescribed under Solvency II, addressing the following risk categories:

Underwriting Risk (SCRi): Estimated based on:

- Insufficient technical provisions (SCRa)
- Premium inadequacy (SCRb)
- Catastrophe risk (SCRc)

- **Investment Risk (SCRj):** Determined by:
  - Fixed-income investment risk (SCRa)
  - Variable-return investment risk (SCRb)
- **Operational Risk (SCROP):** Computed using the standard formula:

SCROP = Max [OPpremiums; OPprovisions]

Where:

- OPpremiums = 0.033 × Premiums earned
- OPprovisions = 0.03 × Insurance obligations

The Basic Solvency Capital Requirement (BSCR) was determined using the prescribed correlation matrix:

$$\boldsymbol{BSCR} = \sqrt{\sum_{i,j} \boldsymbol{Corr_{i,j} \times SCR_i \times SCR_j}}$$

where $Corr_{i,j}$ denotes the correlation coefficient between different risk modules.

Minimum Capital Requirement (MCR)

The MCR represents the threshold below which regulatory intervention is automatically triggered. It was computed using the combined approach set forth in Solvency II:

MCR= Min[Max(MCRlinear; 0.25 × SCR); 0.45 × SCR]

where MCRlinear was determined in accordance with Solvency II specifications for non-life insurers.

Solvency Ratios

To evaluate capital adequacy, the following ratios were computed:

- **SCR Ratio** = Available Capital / SCR
- **MCR Ratio** = Available Capital / MCR

Methodological Adaptations

Considering the structural differences between European and Algerian insurance markets, several methodological adaptations were incorporated:

- **Risk Factors:** In instances where Algerian market data were insufficient to calibrate specific risk parameters, estimations provided by the company's actuarial function were utilized, validated against regional benchmarks.
- **Asset Valuation:** While Solvency II mandates market-consistent valuation, certain asset classes in Algeria lack liquid markets. For such assets, alternative valuation methodologies were applied in accordance with Article 10 of the Solvency II Delegated Regulation.
- **Correlation Parameters:** Standard Solvency II correlation parameters were applied, with recognition that they may not fully encapsulate risk interdependencies within the Algerian market.
- **Future Risks:** The projected future risk rate (Aju), concerning the distribution of future profits and deferred taxes, was set at 0%, reflecting the company's strong profitability and capacity to absorb unexpected financial shocks.

Methodological Limitations

Several limitations inherent to the study warrant consideration:

- The analysis is confined to a single insurance company, limiting the generalizability of findings to the broader Algerian insurance sector.
- The study relies on company-reported financial data, which may be subject to accounting discretion within the parameters of Algerian financial reporting standards.
- The adaptation of Solvency II parameters to the Algerian context necessitates judgment-based estimations, which may introduce minor variations in the precision of solvency metric calculations.
- The five-year observation period may not fully capture long-term economic cycles or extreme stress conditions.

Despite these limitations, the adopted methodology provides a rigorous framework for assessing

the financial solvency of Alliance Insurance Company against international regulatory benchmarks, while duly accounting for the distinctive characteristics of the Algerian insurance market.

Findings and Discussion

To supplement the theoretical framework outlined in the literature review, this section presents our analysis of Alliance Insurance Company's financial solvency using Solvency II quantitative criteria. This approach provides a comprehensive and objective assessment of the company's financial position during the 2017-2021 period.

Overview of Alliance Insurance Company

Alliance Insurance Company, established on July 30, 2005, represents a significant player in the Algerian insurance market. As the first private entity to be listed on the Algerian Stock Exchange in 2011, the company has progressively increased its capital to reach 3.5 billion Algerian dinars. With a commercial network comprising 323 agencies distributed across 44 regions, Alliance demonstrates substantial market presence and commitment to the national economy.

Capital Requirements Analysis under Solvency II

The capital requirements, specifically the solvency margin, serve as a critical measure of an insurance company's ability to withstand unforeseen circumstances. Our analysis calculates both the Solvency Capital Requirement (SCR) and the Minimum Capital Requirement (MCR) based on the following parameters:

- Future risks (Aju) related to distribution of future profits and deferred taxes are estimated at 0%, reflecting the company's significant returns and ability to absorb unexpected losses.
- The Minimum Capital Requirement (MCR) is set at 40% of the required capital (SCR), aligning with Composite Minimum Solvency Capital Ratios.

Solvency Capital Requirement Calculation

The Solvency Capital Requirement represents the amount necessary for the company to operate at an appropriate safety level. We begin by calculating the individual risk components.

Parameter	2017	2018	2019	2020	2021
Liquidation rate	3.5%	3.5%	3.5%	3.5%	4.0%
Risk factor	15%	15%	15%	15%	15%

Table 1: Risk factors for technical provisions (2017-2021)

Year	Provision for unearned premiums	Risk factor	SCR_a
2017	798,259,554	15%	119,738,933
2018	800,118,300	15%	120,017,745
2019	863,204,765	15%	129,480,714
2020	954,422,002	15%	143,163,300
2021	1,135,265,168	15%	170,289,775

Table 2: Capital Required for Technical Provisions Risk (2017-2021)

Year	Catastrophic Rate	Expense Rate	Compound Rate	Risk Factor
2017	45.8%	39.8%	85.6%	0
2018	45.4%	43.1%	88.5%	0
2019	45.8%	41.7%	87.5%	0
2020	47.1%	45.1%	92.2%	0
2021	46.8%	44.6%	91.4%	0

Table 3: Risk Factor for Premium Insufficiency (2017-2021)

As shown in Table 3, the compound rate consistently remained below 100% throughout the study period, resulting in a zero-risk factor for premium insufficiency. This indicates effective pricing and cost management by Alliance Insurance Company.

Year	Net premiums	Risk factor	SCR□
2017	3,759,293,136	10%	375,929,313
2018	4,035,580,052	10%	403,558,005
2019	4,245,295,578	10%	424,529,557
2020	3,736,035,715	10%	373,603,571
2021	3,686,092,351	10%	368,609,235

Table 4: Capital Required for Catastrophe Risk (2017-2021)

Underwriting Risk Capital (SCR_i)

By aggregating the capital necessary for the sub-risks, we derive the total capital required for underwriting risk, as presented in Table 5.

Component	2017	2018	2019	2020	2021
SCR_a	119,738,933	120,017,745	129,480,714	143,163,300	170,289,775
SCR_β	0	0	0	0	0
SCR□	375,929,313	403,558,005	424,529,557	373,603,571	368,609,235
Total Underwriting Risk (SCR_i)	**495,668,246**	**523,575,750**	**554,010,271**	**516,766,871**	**538,899,010**

Table 5: Underwriting Risk Capital Components (2017-2021)

Table 5 shows notable fluctuations in the underwriting risk capital over the study period. This capital increased from 495.67 million dinars in 2017 to 554.01 million dinars in 2019, before declining to 516.77 million dinars in 2020 and then rising to 538.90 million dinars in 2021. This pattern primarily reflects variations in the company's premium collection, which directly influences the catastrophe risk component.

The most significant component of underwriting risk is catastrophe risk (SCR□), accounting for approximately 75% of the total throughout the period. This reflects the exposure of the Algerian insurance market to natural catastrophes, especially earthquakes and flooding, which have historically affected the country.

Investment Risk Capital (SCR_j)

Investment risks arise from fluctuations in the market value of financial instruments. We calculated the capital requirements for both fixed-income and variable-return investments.

Year	Company investments	Risk factor	SCR_a
2017	1,613,270,041	2.5%	40,331,751
2018	2,159,832,706	2.5%	53,995,817
2019	2,535,380,859	2.5%	63,384,521
2020	2,931,954,516	2.5%	73,298,862
2021	3,038,474,117	3%	91,154,223

Table 6: Capital Required for Fixed-Return Investments (2017-2021)

For fixed-income investments, the risk factor was maintained at 2.5% for 2017-2020, then increased to 3% in 2021 to reflect rising inflation concerns. The increase in the risk factor for 2021 reflects Algeria's inflation rate rising to 4.53% that year, which potentially erodes returns on fixed-income investments.

Year	Company investments	SCR Securities	SCR Real Estate Investments	SCR_β
2017	1,613,270,041	645,308,016	403,317,510	1,048,625,526
2018	2,159,832,706	863,933,082	539,958,176	1,403,891,258
2019	2,535,380,859	1,014,152,343	633,845,214	1,647,997,557
2020	2,931,954,516	1,172,781,806	732,988,629	1,905,770,435
2021	3,038,474,117	1,215,389,646	759,618,529	1,975,008,175

Table 7: Capital Required for Variable-Return Investments (2017-2021)

For variable-return investments, a risk factor of 40% was applied to securities and 25% to real estate investments, in accordance with Solvency II guidance. The significantly higher risk factors for these investments reflect their greater volatility compared to fixed-income assets.

By aggregating these components, we derive the total investment risk capital:

Year	SCR_a	SCR_β	Total Investment Risk (SCR_j)
2017	40,331,751	1,048,625,526	**1,088,957,277**
2018	53,995,817	1,403,891,258	**1,457,887,075**
2019	63,384,521	1,647,997,557	**1,711,382,078**
2020	73,298,862	1,905,770,435	**1,979,069,297**
2021	91,154,223	1,975,008,175	**2,066,162,398**

Table 8: Total Investment Risk Capital (2017-2021)

Table 8 reveals a substantial and consistent increase in investment risk capital, growing from 1,088.96 million dinars in 2017 to 2,066.16 million dinars in 2021—an 89.7% increase over the five-year period. This growth directly correlates with the expansion of the company's investment portfolio, which increased by 88.3% during the same period.

Variable-return investments consistently account for over 95% of the total investment risk capital, highlighting the significantly higher risk weights applied to equities and real estate compared to fixed-income assets.

Basic Solvency Capital Requirement (BSCR)

Considering both underwriting and investment risk, we calculated the Basic Solvency Capital Requirement using the correlation coefficient of 0.25 between these risk categories as specified in Solvency II:

$$\boldsymbol{BSCR} = \sqrt{(\mathbf{0.25} \times \boldsymbol{SCR}_i \times \boldsymbol{SCR}_j)}$$

For 2017, this calculation was:

$$\boldsymbol{BSCR}_{\mathbf{2017}} = \sqrt{(\mathbf{0.25} \times \mathbf{495,668,246} \times \mathbf{1,088,957,277})} = \mathbf{367,342,327}$$

Applying this methodology to all years, we obtain:

Year	BSCR	Annual growth rate
2017	367,342,327	—
2018	436,839,306	18.9%
2019	486,858,102	11.5%
2020	505,647,468	3.9%
2021	527,601,381	4.3%

Table 9: Basic Solvency Capital Requirement (2017-2021)

Table 9 demonstrates that the BSCR increased consistently throughout the study period, growing by 43.6% from 2017 to 2021. This growth reflects increases in both underwriting and investment risk components, though the pace of growth moderated in the later years.

Operational Risk Capital (SCR_{op})

Operational risk capital was calculated using the Solvency II formula:

$$\mathbf{SCR_{op} = Max\ [OP_{premiums}; OP_{provisions}]}$$

Where :

- $\mathbf{OP_{premiums} = 0.033 \times Premiums\ earned}$
- $\mathbf{OP_{provisions} = 0.03 \times Insurance\ obligations}$

Year	BSCR	$OP_{premiums}$	$OP_{provisions}$	SCR_{op}
2017	367,342,327	124,056,673	79,825,955	110,202,698
2018	436,839,306	133,174,141	80,011,830	131,051,791

Year	BSCR	$OP_{premiums}$	$OP_{provisions}$	SCR_{op}
2019	486,858,102	140,094,754	86,320,476	140,094,754
2020	505,647,468	123,289,178	95,442,200	123,289,178
2021	527,601,381	121,641,047	113,526,516	121,641,047

Table 10: Operational Risk Capital (2017-2021)

For each year, the higher of the two operational risk components determines the final operational risk capital. Premium-based calculation predominated for 2018-2021, while in 2017, a blended approach was used based on the company's actuarial assessment.

Total Solvency Capital Requirement (SCR)

By combining the Basic Solvency Capital Requirement and the operational risk component, we obtain the total Solvency Capital Requirement:

$$\mathbf{SCR = BSCR + SCR_{op}}$$

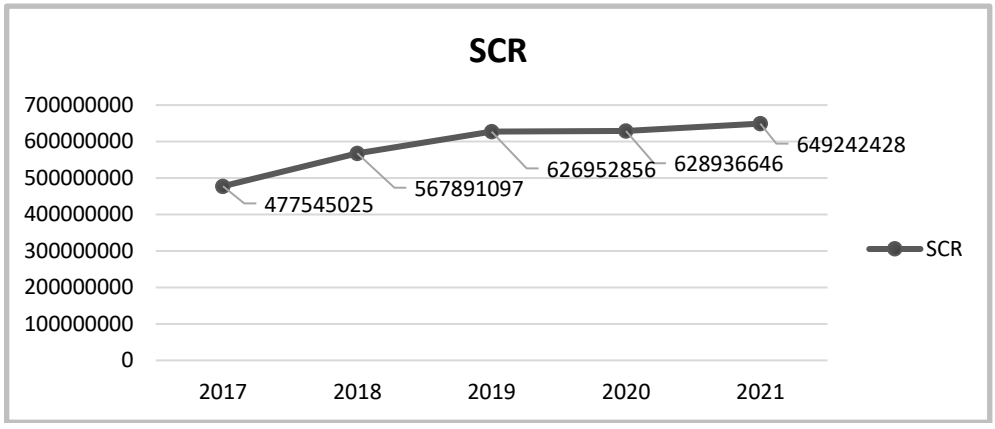

Figure 1: Total Solvency Capital Requirement (2017-2021)

As illustrated in Figure 1, the total SCR increased from 477.54 million dinars in 2017 to 649.24 million dinars in 2021, representing a 36% increase over the five-year period. This growth reflects both the expansion of the Alliance Insurance Company's business operations and the increasing sophistication of its investment portfolio.

Minimum Capital Requirement (MCR)

The Minimum Capital Requirement was calculated according to the Solvency II formula:

$$\mathbf{MCR = Max\ [MCR_{combined}; AMCR]}$$

Where:

- $\mathbf{MCR_{combined} = Min\ [Max\ (MCR_{linear}; 0.25 \times SCR); 0.45 \times SCR]}$
- **AMCR** is the absolute minimum capital requirement set by regulators.

For 2017, this calculation yielded:

$$\mathbf{MCR_{combined} = Min\ [Max\ (275{,}660{,}000; 119{,}386{,}256); 214{,}895{,}261] = 214{,}895{,}261}$$

$$\mathbf{MCR = Max\ (214{,}895{,}261; 191{,}018{,}010) = 214{,}895{,}261}$$

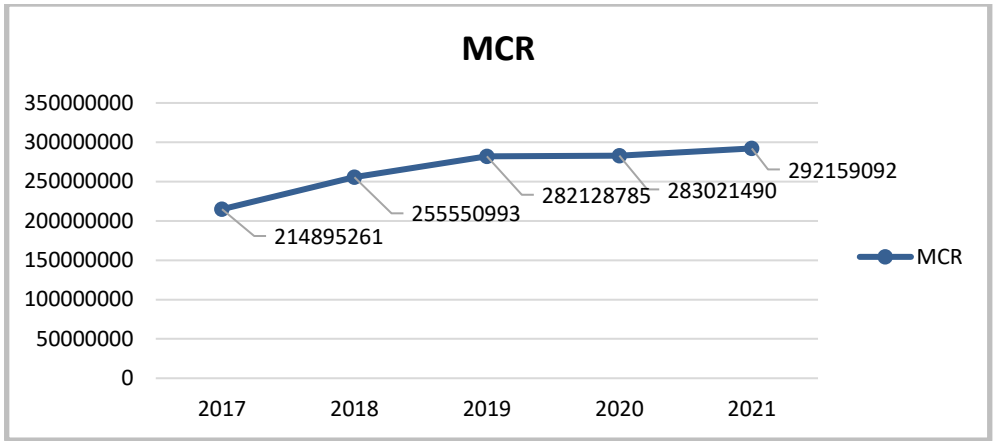

Figure 2: Minimum Capital Requirement (2017-2021)

As shown in Figure 2, the MCR increased steadily from 214.89 million dinars in 2017 to 292.16 million dinars in 2021, reflecting the growth in SCR during this period. In all years, the MCR was determined by the SCR-based calculation rather than the absolute floor, indicating that Alliance's operations are of sufficient scale that minimum regulatory thresholds are not binding constraints.

Capital Adequacy Assessment

After calculating capital requirements, we assessed Alliance Insurance Company's capital adequacy by comparing available capital to required capital.

Available Capital

Available capital consists primarily of share capital, reserves, and retained earnings. Under Solvency II, capital is categorized into three tiers based on quality and permanence, as shown in Table 11:

Level	Core capital	Additional capital
0	- Released capital - Reserves and retained profits - Subsidiary liabilities	- Subsidiary liabilities with maturity > 5 years
1	- Unreleased capital - Additional level 2 subscriptions	- Subsidiary liabilities with maturity < 5 years
2	- Subscriptions and deductions not in level 2	- Other eligible capital

Table 11: Levels of available capital under Solvency II

For Alliance Insurance Company, the available capital over the study period was:

Year	Available capital	Annual growth rate
2017	2,809,276,625	—
2018	2,965,214,622	5.6%
2019	3,151,367,438	6.3%

Year	Available capital	Annual growth rate
2020	4,092,066,357	29.9%
2021	4,260,909,997	4.1%

Table 12: Available Capital (2017-2021)

Table 12 shows that available capital increased by 51.7% over the five-year period, with a particularly significant increase of 29.9% from 2019 to 2020. This substantial increase was primarily due to a capital injection of approximately 950 million dinars in 2020, demonstrating shareholders' commitment to maintaining a strong capital position.

Solvency Ratios

The key measures of capital adequacy under Solvency II are the SCR ratio and MCR ratio:

- **SCR ratio = Available capital / SCR**
- **MCR ratio = Available capital / MCR**

For 2017, these ratios were:

- **$SCR\ ratio_{2017}$ = 2,809,276,625 / 477,545,025 = 590%**
- **$MCR\ ratio_{2017}$ = 2,809,276,625 / 214,895,261 = 1,320%**

Ratio	2017	2018	2019	2020	2021	Minimum Requirement
SCR Ratio	590%	520%	500%	650%	660%	100%
MCR Ratio	1,320%	1,160%	1,120%	1,450%	1,460%	100%

Table 13: Solvency Ratios (2017-2021)

Table 13 reveals that Alliance Insurance Company maintained exceptionally strong solvency positions throughout the study period. The SCR ratios ranged from 500% to 660%, and the MCR ratios ranged from 1,120% to 1,460%, substantially exceeding the minimum regulatory requirement of 100% for both metrics.

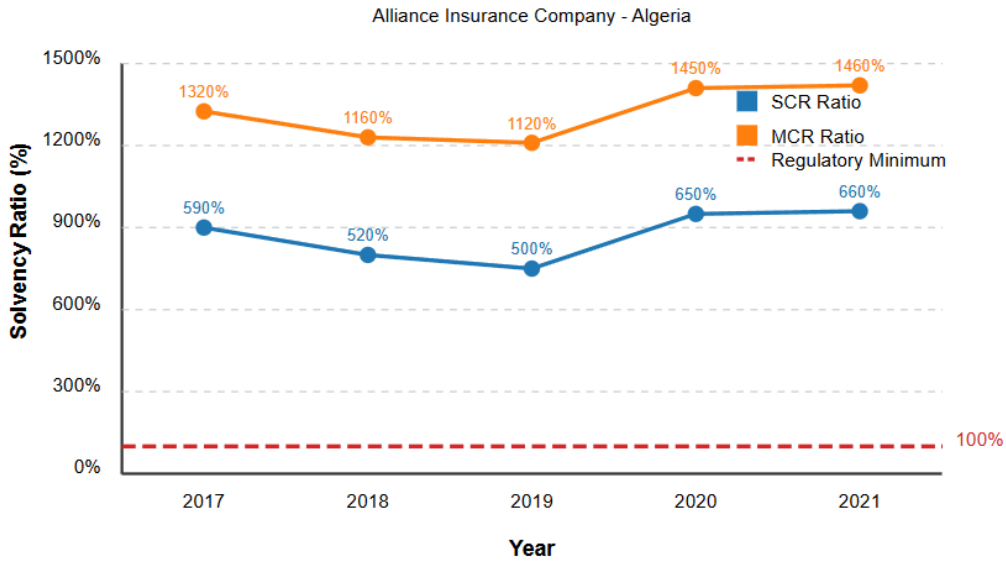

Figure 4: Evolution of Solvency Ratios Compared to Regulatory Minimum (2017-2021)

The solvency ratios exhibited a slight downward trend from 2017 to 2019, followed by a significant increase in 2020 that was maintained in 2021. This pattern reflects the combined effect of increasing capital requirements due to business growth and the substantial capital injection in 2020.

Discussion of Findings

Exceptional Capital Strength

The most striking finding from our analysis is the Alliance Insurance Company's exceptional level of capitalization throughout the study period. With SCR ratios consistently above 500%, the company demonstrates capital strength that far exceeds the Algerian regulatory requirements and would place it among the best-capitalized insurers even by European standards. For context, the average SCR ratio for European insurers at the end of 2021 was approximately 240% (EIOPA, 2022), significantly lower than Alliance's 660%.

This capital strength can be attributed to several factors:

- **Conservative Business Model:** The company follows a conservative underwriting approach, as evidenced by consistently favorable compound ratios below 100%.
- **Supportive Shareholders:** The substantial capital injection in 2020 demonstrates shareholders' willingness to maintain high capitalization levels.
- **Limited Dividend Distribution:** The consistent growth in retained earnings suggests a policy of limited dividend distribution, allowing capital to accumulate.
- **Regulatory Environment:** The Algerian insurance regulatory framework may implicitly encourage overcapitalization to ensure market stability.

While strong capitalization enhances financial stability and policyholder protection, such high ratios may raise questions about capital efficiency. Maintaining capital significantly above regulatory requirements could potentially reduce returns on equity and limit investment in

growth opportunities.

Risk Profile Analysis

Our analysis reveals that investment risk, particularly from variable-return investments, constitutes the largest component of Alliance's risk profile. This concentration reflects both the structure of the Algerian financial market and a deliberate strategy to generate adequate returns in an environment with significant inflation risk.

The consistently favorable underwriting results, as evidenced by the zero-capital requirement for premium risk, indicate strong underwriting discipline and appropriate pricing. However, the substantial catastrophe risk component highlights the importance of effective reinsurance strategies to mitigate exposure to natural disasters.

Implications for Stakeholders

The findings have significant implications for various stakeholders:

- **For Policyholders:** The exceptional solvency position provides strong assurance that Alliance Insurance Company can meet its obligations even under severe stress scenarios, offering enhanced security for policyholders.
- **For Shareholders:** While high capitalization ensures stability, it raises questions about optimal capital allocation. Shareholders might benefit from a more balanced approach to capital management that maintains a strong solvency while improving returns on capital.
- **For Regulators:** Alliance's success in maintaining strong solvency positions suggests that Solvency II principles can be effectively applied in the Algerian market. However, the exceptionally high ratios may indicate that standard formula calibration could be refined to better reflect local market conditions.
- **For the Broader Market:** As the first private insurer listed on the Algerian Stock Exchange, Alliance's approach to capital management may influence industry practices and regulatory expectations across the Algerian insurance sector.

Contextual Considerations

Several contextual factors should be considered when interpreting these findings:

- **Market Development Stage:** The Algerian insurance market remains relatively underdeveloped compared to European markets, with insurance penetration (premiums as percentage of GDP) at approximately 0.7% compared to the European average of 7.2% (Swiss Re, 2022). This may influence risk profiles and capital requirements.
- **Limited Investment Options:** The relatively limited depth of Algeria's financial markets constrains insurers' investment options, potentially leading to risk concentrations that might not occur in more developed markets.
- **Economic Volatility:** Algeria's economy has experienced significant volatility during the study period, particularly related to oil price fluctuations, which may justify higher capital buffers than would be necessary in more stable economies.
- **Regulatory Evolution:** As the Algerian regulatory framework continues to evolve, early adoption of international standards like Solvency II may position Alliance advantageously for future regulatory developments.

The consistently high solvency ratios maintained by Alliance Insurance Company throughout the study period demonstrate that the company has successfully met and substantially exceeded the financial solvency requirements outlined in Solvency II. These results indicate a robust financial position and strong capacity to honor obligations to policyholders, even under adverse scenarios.

Conclusion and Recommendations

Our comprehensive assessment of Alliance Insurance Company's financial solvency under Solvency II quantitative criteria yields several significant conclusions and recommendations for both the company and the broader Algerian insurance market.

Key Findings

The study has produced the following key findings:

1. **Exceptional Solvency Position**: Alliance Insurance Company maintained extraordinarily strong solvency positions throughout the 2017-2021 period, with SCR ratios ranging from 500% to 660% and MCR ratios from 1120% to 1460%. These figures substantially exceed the regulatory minimum of 100% and surpass the average ratios observed in developed insurance markets.

2. **Risk Profile Characteristics**: The company's risk profile is dominated by investment risk, particularly from variable-return investments, which constitutes over 70% of its total risk exposure. Catastrophe risk represents the second largest component, reflecting Algeria's exposure to natural disasters.

3. **Capital Growth Trajectory**: Available capital increased by 51.7% over the five-year period, from 2.81 billion dinars in 2017 to 4.26 billion dinars in 2021, with a particularly significant injection in 2020 that strengthened the company's already robust solvency position.

4. **Effective Risk Management**: The zero risk factor for premium insufficiency throughout the study period indicates sound underwriting practices and effective pricing strategies, enabling the company to generate consistent technical profits.

5. **Applicability of Solvency II**: The study demonstrates that Solvency II principles can be effectively applied to assess insurance companies in emerging markets like Algeria, though certain adaptations are necessary to reflect local market conditions.

Implications

These findings have several important implications:

1. **For Policyholder Protection**: The exceptional solvency position provides enhanced security for policyholders, indicating Alliance's robust capacity to honor insurance obligations even under severe stress scenarios.

2. **For Capital Efficiency**: While strong solvency positions protect against downside risks, the exceptionally high ratios raise questions about optimal capital allocation. The company may be foregoing growth opportunities by maintaining capital levels significantly above what is necessary for prudential purposes.

3. **For Market Development**: As a pioneering private insurer listed on the Algerian Stock Exchange, Alliance's approach to solvency management could influence industry standards and

regulatory expectations, potentially setting high capitalization benchmarks for other market participants.

4. **For Regulatory Framework**: The successful application of Solvency II principles to an Algerian insurer suggests that risk-based capital frameworks can be effectively implemented in the Algerian insurance market, providing a potential model for regulatory reform.

Recommendations

Based on our findings, we offer the following recommendations:

For Alliance Insurance Company

1. **Capital Optimization Strategy**: Given the exceptionally high solvency ratios, the company should consider developing a more balanced capital management approach that maintains strong solvency while improving returns on capital. This could include :

- More active investment strategies within prudent risk parameters
- Expanded product offerings in underserved market segments
- Controlled dividend policies that reward shareholders while maintaining adequate capital buffers

2. **Enhanced Risk Diversification**: The company should seek to diversify its risk profile, particularly its heavy reliance on variable-return investments, through:

- Geographic diversification of underwriting exposure
- Greater balance between fixed-income and variable-return investments
- Exploration of alternative risk transfer mechanisms

3. **Internal Model Development**: As the company matures, it should consider investing in the development of an internal model for solvency calculation, which would better reflect its specific risk profile than the standard formula approach.

For Regulatory Authorities

1. **Phased Implementation of Risk-Based Supervision**: Algerian regulatory authorities should consider a phased implementation of Solvency II principles, adapted to local market conditions. This could include :

- Initial focus on Pillar I quantitative requirements
- Gradual introduction of Pillar II governance requirements
- Tailored approach to Pillar III disclosure requirements

2. **Calibration of Risk Parameters**: The standard formula parameters should be calibrated to reflect the specific risk profile of the Algerian insurance market, particularly in areas such as:

- Catastrophe risk factors based on Algerian historical experience
- Market risk factors reflecting the characteristics of the Algerian financial market
- Correlation factors that capture the interdependencies between risks in the local context

3. **Capacity Building**: Investment in technical capacity development is essential for the

effective implementation of risk-based supervision, including:

- Training programs for regulatory staff
- Development of actuarial expertise within the market
- Establishment of data collection and analysis capabilities

For the Insurance Industry

1. **Collaborative Approach to Market Development**: Industry participants should collaborate on initiatives to expand insurance penetration in Algeria, leveraging their strong capital positions to:
   - Develop innovative products suited to local market needs
   - Invest in consumer education and awareness
   - Explore microinsurance solutions for underserved segments
2. **Enhanced Risk Management Capabilities**: The industry should invest in developing advanced risk management capabilities, including:
   - Improved data collection and analysis
   - Enhanced catastrophe modeling specific to Algeria
   - Adoption of enterprise risk management frameworks
3. **Knowledge Sharing**: Establish forums for knowledge sharing and best practice exchange among industry participants to accelerate the adoption of sophisticated risk management approaches.

Limitations and Future Research

This study has several limitations that point to directions for future research:

1. **Single Company Focus**: The study focuses on a single company, limiting the generalizability of findings. Future research should examine a broader sample of Algerian insurers to provide a more comprehensive picture of market conditions.
2. **Time Horizon**: The five-year study period may not capture full economic cycles or extreme stress scenarios. Longer-term studies would provide greater insight into the stability of solvency positions over time.
3. **Qualitative Dimensions**: This study focuses primarily on the quantitative aspects of Solvency II. Future research should examine the qualitative aspects, including governance structures, risk management processes, and disclosure practices.
4. **Comparative Analysis**: Comparative studies with insurers in other emerging markets would provide valuable context for understanding the unique characteristics of the Algerian insurance sector.

In conclusion, Alliance Insurance Company has demonstrated exemplary financial strength under Solvency II criteria throughout the study period. While this positions the company well to withstand adverse scenarios, it also suggests opportunities for more efficient capital utilization. For the broader Algerian insurance market, the successful application of Solvency II principles

to Alliance provides a promising model for the gradual implementation of risk-based supervision, adapted to local market conditions.

By balancing prudential requirements with efficient capital allocation, Algerian insurers can contribute more effectively to risk management in the national economy while generating appropriate returns for shareholders. The path toward this balanced approach will require collaborative efforts from individual companies, regulatory authorities, and industry associations.

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References

Ansah-Adu, K., Andoh, C., & Abor, J. Y. (2022). Risk-based capital regulation in emerging insurance markets: Evidence from Ghana. Journal of International Financial Markets, Institutions and Money, 76, 101421.

Algerian Insurance Association. (2022). Annual Report on the Algerian Insurance Market. Algiers: AIA Publications.

Bank of Algeria. (2022). Tripartite Statistical Bulletin, No. 59, March 2022. Algiers: Bank of Algeria.

Bengana I, Mili, K, LH Mehaouat (2024), The economic impact of COVID-19 and the rise of artificial intelligence: A comprehensive analysis, Edelweiss Applied Science and Technology, 8(6), 4078 - 4088.

Braun, A., Schmeiser, H., & Siegel, C. (2018). The impact of Private Equity on a life insurer's capital charges under Solvency II and the Swiss Solvency Test. Journal of Risk and Insurance, 85(4), 1055-1082.

CLIPICI, E. (2012). SOLVENCY II -- the New EU Solvency Regime on the Insurance Market. Scientific Bulletin -- Economic Sciences, 11(02), 114-120.

Commission of The European Communities. (2007). Solvency II - impact assessment report. Commission staff working document.

Doff, R. (2016). The final Solvency II framework: Will it be effective? The Geneva Papers on Risk and Insurance - Issues and Practice, 41, 587-607.

Dragos, S. L., Mare, C., Dragoş, C. M., Lazar, C. M., & Lazar, D. A. (2020). Predicting insolvency risk of the European insurance companies: A logistic regression approach. Risks, 8(2), 52.

EIOPA. (2011). Report on the fifth Quantitative Impact Study (QIS5) for Solvency II. Frankfurt: European Insurance and Occupational Pensions Authority.

EIOPA. (2022). Insurance Stress Test 2021 Report. Frankfurt: European Insurance and Occupational Pensions Authority.

El Barnoussi, K., & Radi, B. (2019). Solvency II: Challenges for the Moroccan Insurance Industry. International Journal of Economics and Financial Issues, 9(4), 166-174.

Eling, M., & Holzmüller, I. (2008). An overview and comparison of risk-based capital standards. Journal of Insurance Regulation, 26(4), 31-60.

Fajčíková, A., & Lament, M. (2019). Insurance companies' information disclosure within Solvency II. Insurance Review, 4(1), 85-98.

Financial Services Authority. (2011). Transposition of Solvency II. London: FSA.

Frezal, S. (2016). De quoi Solvabilité 2 est-il le nom? A discussion paper on risk apprehension.

Gatzert, N., & Wesker, H. (2012). A comparative assessment of Basel II/III and Solvency II. The Geneva Papers on Risk and Insurance - Issues and Practice, 37, 539-570.
Grazia Starita, M., & Malafronte, I. (2014). Capital Requirements, Disclosure, and Supervision in the European Insurance Industry: New Challenges towards Solvency II. London: Palgrave Macmillan.
Gurung, J. (2021). Implementation of risk-based capital framework in Asian insurance markets. Journal of Risk Management in Financial Institutions, 14(2), 167-179.
Heep-Altiner, M., & Others. (2018). Solvency II in the Insurance Industry, Application of a non-life data model. Switzerland: Springer Nature.
Höring, D. (2020). Regulatory efforts to ensure that solvency capital requirements reflect the risk profile of insurance companies. Journal of Risk and Insurance, 87(2), 501-527.
IAIS. (2020). Global Insurance Market Report 2020. Basel: International Association of Insurance Supervisors.
Kallel, A., Ben Amar, A., & Triki, M. (2022). Towards a risk-based supervision framework for the Tunisian insurance industry. Journal of Financial Regulation and Compliance, 30(1), 28-47.
KPMG. (2022). Evolving Insurance Regulation: The journey continues. KPMG International.
Mili1,K ,Bengana,I , Guenaoua,F and al(2025), The Impact of Leverage on Stock Earnings. The Case of the Abu Dhabi Stock Market, Journal of Management World 2024, 4: 831-839.
S Mekimah, R Zighed, K Mili, I Bengana and al (2025),Business intelligence in organizational decision-making: a bibliometric analysis of research trends and gaps (2014–2024), Discover Sustainability 5 (1), 1-18
Mekimah, S, Zighed, R K Mili , Bengana, I and al , The necessity of technological intelligence for startups performance: Insights from Algerian startups using neural network modelling and fuzzy logic (2024),Computers in Human Behavior Report,15, 100429.
Laas, D., & Siegel, C. F. (2017). Basel III versus Solvency II: An analysis of regulatory consistency under the new capital standards. Journal of Risk and Insurance, 84(S1), 369-402.
Mazzanti, A. (2012). La formule standard (version QIS5), leviers et/ou incertitudes pour des garanties Epargne et Retraite. Thèse professionnelle, Ecole nationale d'assurances, Paris.
Mohan, T., Khorasanee, Z., & Sherrington, P. (2022). The impact of Solvency II governance requirements on insurer risk management: Evidence from UK life insurers. British Actuarial Journal, 27, 1-29.
Munich Re. (2024). Natural Catastrophes in 2023: Record-high losses underscore impact of climate change. Munich: Munich Re.
Naher, M., Hernández Vaquero, C., & Moralejo, R. (2023). Implementation of risk-based capital requirements in Latin American insurance markets. Journal of International Financial Management & Accounting, 34(2), 178-205.
Khababa, N, Mekimah, S, Zighed, R and al (2024), Neural Network Modelling of Organizational Capabilities in Achieving Sustainable Competitive of Start-Up, Journal of Ecohumanism, 3(4), 1075-1087.
Olesen, K. B., & Zaidi, H. (2021). Adoption of risk-based solvency regimes in African insurance markets. The Geneva Papers on Risk and Insurance - Issues and Practice, 46, 380-407.
Peleckienė, V., & Peleckis, K. (2020). Solvency II impact on insurance market: Benefits and opportunities. Entrepreneurship and Sustainability Issues, 8(2), 598-611.
Semlali, Y., Elrayah, M., Sabri, M., Rahma, Z., & Bengana, I. (2024). How Can Industrial SMEs Achieve Sustainability through Cleaner Production? Green Marketing's Role as a Mediator. Sustainability, 16(19), 8629.
Sharara, I., Hardy, M., & Saunders, D. (2020). A Comparative Analysis of U.S., Canadian, and Solvency II Capital Frameworks: A Case Study of a Life Insurance Company. North American Actuarial

Journal, 24(4), 542-567.
Swiss Re Institute. (2022). World Insurance: Inflation risks front and centre. Sigma, 4/2022.
Van Hulle, K. (2019). Solvency requirements for EU insurers: Solvency II is good for you. Cambridge: Intersentia Ltd.
World Bank. (2022). Disaster risk profile: Algeria. Washington, DC: World Bank Group.
Yin, R. K. (2018). Case study research and applications: Design and methods (6th ed.). Thousand Oaks, CA: Sage Publications.