





Predicting Financial Failure in Algerian Public Insurance Companies Using the Kida Model (2015-2021)

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Abstract

This study evaluates the effectiveness of financial ratios in predicting the financial health of Algerian public insurance companies using the Kida model, a robust tool for identifying potential financial failure and bankruptcy risks. The primary objective is to assess the predictive power of the Kida model for early detection of financial failure. The research employs a case study approach, analyzing financial statements from three major public insurance companies in Algeria (SAA, CAAR, CAAT) over the period from 2015 to 2021. Key contributions include a comprehensive analysis of financial ratios such as profitability, solvency, liquidity, and management efficiency, and their integration into the Kida model. The methodology involves a detailed examination of financial data, application of the Kida model, and interpretation of the financial failure index. Our findings reveal that the Kida model accurately predicts financial failure risks, with all values of the financial failure index being negative, indicating potential vulnerability. The study underscores the importance of early detection systems and proactive financial management to ensure stability and sustainability in the insurance sector. The results have significant implications for policymakers and stakeholders, emphasizing the need for tailored financial failure prediction models for the Algerian insurance industry. Future research could expand on this work by incorporating real-world data and exploring other predictive models to enhance accuracy and reliability.

Keywords: Financial Failure Prediction, Kida Model, Insurance Sector, Liquidity Risk Management, Predictive Analytics, Financial Ratio

1. Introduction

Insurance companies are pivotal entities within the economic framework, serving as guardians against risks and bolstering the financial stability of nations. Their role in mitigating risks is indispensable, as they safeguard individuals and businesses from potential financial upheavals. However, the management and investment of funds expose these companies to various financial risks, particularly liquidity risks, which pose threats to their solvency and operational continuity [1]. Detecting signs of potential financial failure early on is imperative for upholding financial stability and safeguarding the interests of policyholders, stakeholders, and the broader economy.

Public insurance companies, recognized as barometers of a nation's financial robustness, employ predictive models to assess and manage risks effectively. One such notable model is the Kida model, which leverages calculated financial ratios from companies' financial statements to gauge their financial well-being [2], [3]. This study endeavors to evaluate the effectiveness of financial ratios, specifically within the Kida model, in predicting financial failure for public insurance companies in Algeria during the period spanning from 2015 to 2021.

The research endeavor confronts the challenge of assessing the accuracy with which financial ratios and statements forecast financial failure in Algiers' public insurance companies over the specified period. A comprehensive understanding of financial failure, its antecedents, and associated indicators holds paramount significance for both theoretical discourse and practical application. Financial failure ensues when a company's financial resources prove inadequate to sustain operational exigencies, precipitating dwindling revenues, cash flows, and eventual financial distress [4]. This downward spiral culminates in sequential financial losses, ultimately leading to financial hardship,

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collapse, liquidation, and cessation of operations. Identifying early warning signs through predictive models facilitates the implementation of timely corrective measures.

While several models, including the Altman Z-Score [5], Sherrod [6], Ohlson [7], and Taffler models [8], are commonly employed for predicting financial failure, the focus of this study lies on the Kida model. The Kida model, established in 1981, distinguishes itself by integrating diverse financial ratios such as profitability, solvency, liquidity, and management efficiency to provide a comprehensive assessment of a company's financial position.

However, it's pertinent to acknowledge the limitations and potential biases introduced by the study's focus on Algerian public insurance companies from 2015 to 2021. These encompass the geographical concentration in Algeria and the specific timeframe, which may impact the generalizability of the findings. The Algerian insurance market harbors unique characteristics and regulatory frameworks that may not align with other regions, potentially restricting the applicability of the results. Moreover, the chosen timeframe may encapsulate specific economic conditions that influenced the financial performance of the companies under scrutiny. It's imperative to recognize these limitations to interpret the results accurately and discern the broader applicability of the study's conclusions.

By analyzing the predictive power of financial ratios, this study endeavors to furnish insights into their efficacy in forecasting financial failure for the studied insurance companies. The findings contribute to the theoretical discourse surrounding financial distress prediction models while offering pragmatic recommendations tailored to the insurance sector. The study underscores the significance of adopting comprehensive predictive models, like the Kida model, for early detection of financial challenges. This proactive stance enables insurance companies to effect strategic adjustments, fortify their financial resilience, and uphold their pivotal role in the national economy.

2. Literature Review

Numerous studies have delved into the critical role of financial ratios in predicting financial distress or failure across various industries, with a notable emphasis on diverse predictive models, including the influential KIDA model. While these studies offer valuable insights, a deeper critical analysis focusing on their methodologies and findings is essential to position our study within this context.

A comprehensive examination of the determinants of financial distress in Ethiopian insurance companies was conducted in [9], establishing significant correlations between financial distress and various influencing factors. However, the study's methodology and data sources warrant scrutiny to assess the robustness of the findings.

In [10] exists an extension to this discourse by investigating threats of financial failure in Jordanian insurance companies, highlighting the efficacy of predictive models in anticipating potential failures. While the study contributes to the understanding of financial distress prediction, further analysis of the model's predictive accuracy and generalizability to other contexts is necessary.

The Altman Z-Score model's applicability for predicting financial failure in Jordanian insurance companies was scrutinized in [11], emphasizing its practical utility. However, the study's reliance on historical financial data and limited sample size may affect the model's reliability in dynamic environments. Furthermore, [12] focused on predicting financial distress for JSE-listed companies, emphasizing the growing importance of advanced AI models in this context. While the study showcases the potential of AI-driven approaches, concerns regarding model interpretability and data quality pose challenges to widespread adoption.

Additionally, integrated textual website content into business failure prediction models was innovatively presented in [13], demonstrating enhanced predictive performance. Despite the promising results, further validation and replication studies are necessary to assess the model's robustness across different industries and geographies.

A novel approach that combines speech emotion recognition and text sentiment analysis to predict financial distress was presented in [14]. Their study highlights the significance of emotional cues extracted from conference call transcripts in assessing financial health. By integrating emotional indicators with traditional financial metrics, their model demonstrates improved prediction accuracy. This underscores the potential for leveraging non-financial data in financial distress prediction, aligning with our study's focus on evaluating the effectiveness of the Kida model and financial ratios in predicting financial failure for Algerian public insurance companies.

Tree-based gradient-boosting models for predicting financial distress were explored in [15], emphasizing the need for model interpretability. Their study, conducted on Chinese listed companies from 1998 to 2014, finds that these models outperform others in prediction accuracy. By employing TreeSHAP and Shapley regression, they uncover significant relationships between financial indicators and distress, revealing nonlinear associations. This research sheds light on effective prediction methods and enhances understanding of financial risk assessment, aligning with our study's aim to improve financial failure prediction in the insurance sector.

Case-based reasoning (CBR) driven ensemble learning paradigm for financial distress prediction with missing data was introduced in [16]. Their approach involves CBR-driven missing data imputation, constructing CBR-driven single classifiers, and employing a CBR-driven weighted ensemble model. By filling in missing values and combining prediction results, their paradigm enhances prediction accuracy and robustness. Although their focus is on missing data imputation and ensemble classification, their methodology offers insights into improving financial distress prediction models, complementing our study's aim to enhance prediction accuracy in the insurance sector.

A framework to predict financial distress using question-and-answer (Q&A) text from online interactive platforms, was proposed by [17]. They extract interactive features, question sentiment, answer satisfaction, and topic features from the Q&A text to enhance the performance of financial distress prediction (FDP) models. Their study reveals that incorporating interactive and topic features significantly improves FDP model performance compared to using only financial features. This approach complements our study's aim to refine prediction accuracy within the insurance sector by leveraging non-financial text-based information. While our study focuses on the insurance sector, their study extends the application to online interactive platforms, demonstrating the broader applicability of text-based features in FDP models.

To enhance prediction accuracy in the insurance sector, bankruptcy prediction models complement were studied in [18]. While their focus is on the context of credit scoring, our study seeks to improve predictive models within the insurance industry. Both studies emphasize the importance of considering nonlinear relationships in predictive modeling to enhance model validity and profitability. However, while their research addresses bankruptcy prediction using generalized additive models (GAMs), our study may employ different methodologies tailored to the insurance sector. Nonetheless, the overarching goal of refining predictive models through the consideration of nonlinear relationships aligns with the objectives of our study in enhancing prediction accuracy within the insurance domain.

[19] contributes to the field of bankruptcy prediction by integrating socio-economic costs into machine learning models, aligning with our study's objective to enhance prediction accuracy in the insurance sector. While our focus is on refining predictive models within the insurance industry, their research addresses the broader implications of bankruptcy prediction, considering the financial and social impacts of bankruptcy. Both studies emphasize the importance of evaluating prediction models beyond statistical performance measures, highlighting the need to minimize misclassification costs and maximize saved costs. While our study may employ different methodologies tailored to the insurance domain, the overarching goal of optimizing predictive models to mitigate socioeconomic consequences resonates with the objectives outlined by Radovanovic and Haas.

In predicting financial failure in Iraqi commercial banks, using the Kida and Sherrod models highlights the importance of early detection and the reliance of such models on key financial ratios [20]. While our study focuses on enhancing prediction accuracy in the insurance sector, both research endeavors share the goal of leveraging predictive models to assess and mitigate financial risks, albeit in different contexts.

[21] delves into predicting financial failure and its impact on reducing financial risks, with a focus on the mediating role of financial analysis models. While they analyze Jordanian public joint stock companies, our study concentrates on enhancing prediction accuracy in the insurance sector. Despite the different contexts, both studies underscore the importance of utilizing financial models to foresee and mitigate potential financial risks.

Our study aims to contribute to this body of research by focusing on enhancing prediction accuracy within the insurance sector. By evaluating the effectiveness of the Kida model and financial ratios in predicting financial failure for Algerian public insurance companies, we seek to address specific challenges and opportunities within this domain. Drawing on

insights from previous research, we aim to refine predictive models tailored to the insurance industry's unique dynamics and requirements.

3. Methodology

3.1. Data Collection

This study utilizes financial data from three prominent public insurance companies in Algeria: The National Insurance Company (SAA), the Algerian Insurance and Reinsurance Company (CAAR), and the Algerian Insurance Company (CAAT). The data spans from 2015 to 2021, providing a comprehensive view of the financial health of these companies over a significant period. The data includes annual financial statements such as balance sheets, income statements, and cash flow statements, which were sourced from publicly available company reports and financial disclosures.

3.2. Data Validation

To ensure valid and reliable financial data, it is important to undertake various steps through which compliance of data can be collected. Validation accuracy was established through extensive validation approaches, which involved confirming the primary source of the data as well as conformation to the accounting standards, circulars, and guidelines awareness on the organization or industry where the data was sourced, among others. Data validation involved the following steps:

Source Verification

Financial statements were obtained directly from the companies' official reports and verified against filings with relevant regulatory bodies, such as the Algerian Ministry of Finance and the Insurance Supervisory Authority. This cross-checking ensures the data's authenticity, as these regulatory bodies maintain strict compliance standards for financial reporting.

3.2.2. Consistency Checks

The financial statements were reviewed for internal consistency. This involved checking that the balance sheets, income statements, and cash flow statements align with each other, ensuring that the reported figures are consistent across different financial documents. For instance, net income reported on the income statement should correlate with changes in equity on the balance sheet and be reflected in the cash flow statements.

3.2.3. Auditor Reports

The study incorporated auditor reports attached to the financial statements. These reports provide an additional layer of verification, as they reflect independent assessments of the companies' financial health by certified auditors. They include an opinion on the fairness of the financial statements and any significant issues identified during the audit.

3.2.4. Comparative Yearly Analysis

Data was compared across different years to identify any anomalies or irregularities. Significant discrepancies or unexpected variations were flagged and investigated further to confirm their validity or identify potential errors. This longitudinal analysis helps in understanding the financial trends and patterns over time, ensuring that the data reflects the true financial performance of the companies.

3.2.5. Ratio Recalculation

Key financial ratios used in the study were recalculated independently to verify the accuracy of the reported figures. This step involved using raw financial data to compute the ratios and compare them with those reported in the financial statements. Ratios such as liquidity ratios, profitability ratios, and leverage ratios were recalculated to ensure that the financial metrics used in the analysis were accurate.

3.4. Data Analysis

The financial ratios for each year were calculated and input into the Kida model formula to derive the financial failure index (Z). This process was repeated for each of the three companies across the seven years. The results were then analyzed to identify trends and assess the companies' financial stability over time.

3.5. Limitations

The study's focus on Algerian public insurance companies introduces certain limitations and potential biases. The unique characteristics of the Algerian insurance market and the specific regulatory frameworks may affect the generalizability of the findings. Furthermore, the chosen timeframe may capture specific economic conditions that influenced the financial performance of the companies studied. These limitations should be considered when interpreting the results and their broader applicability.

3.6. The Kida Model application

The Kida Model, established in 1981, is a robust tool designed to identify potential financial failure and bankruptcy risks in companies [21].

This model uses five financial ratios, which are:

X₁: Net Profit to Total Assets: This ratio measures the rate of net profit relative to the company's total assets, indicating overall profitability.

X₂: Equity to Total Debt: This solvency ratio assesses the company's ability to cover its obligations with its equity. A higher ratio indicates better financial health.

X₃: Cash to Current Liabilities: This liquidity ratio evaluates the company's ability to meet short-term obligations using available cash.

X₄: Sales to Total Assets: This ratio gauges the efficiency of asset utilization in generating sales revenue.

X₅: Cash to Total Assets: This ratio measures the financial liquidity available concerning the company's total assets.

This model employs a comprehensive approach, evaluating five independent financial ratios to calculate the company's financial failure index through a discriminatory analysis. The formula is represented as

$$Z = -1.042X_1 - 0.427X_2 - 0.461X_3 - 0.463X_4 + 0.271X_5 \quad (1)$$

This formula generates the Z value, serving as an indicator of financial health. A higher Z value signifies a favorable financial position, indicating safety from risks, while a decrease in Z suggests vulnerability to collapse. The financial ratios in the Kida model, including Net Profit to Total Assets (X₁), Property Rights to Total Debts (X₂), Cash to Current Liabilities (X₃), Sales to Total Assets (X₄), and Cash to Total Assets (X₅) collectively provide stakeholders with valuable insights into a company's financial health and its susceptibility to future financial challenges.

While the Kida Model offers a robust framework for predicting financial failure, it is essential to acknowledge other predictive models commonly used in financial analysis. One notable comparison is the Altman Z-Score Model, developed by Edward Altman in 1968 [1]. Like the Kida Model, the Altman Z-Score Model utilizes financial ratios to assess a company's financial health and predict the likelihood of bankruptcy. However, the Altman Z-Score Model incorporates different financial ratios and weighting coefficients, leading to variations in its predictive accuracy and applicability across different industries and contexts.

4. Case Study: Financial Failure Prediction in Public Insurance Companies in Algeria

This case study delves into the efficacy of the Kida model and five financial ratios in forecasting financial failure for public insurance companies in Algeria, spanning from 2015 to 2021. The analysis seeks to provide nuanced insights into financial health, risk management strategies, and implications for stakeholders. By meticulously examining financial data and performance trends, the study contributes to elucidating the dynamics influencing the stability of the Algerian public insurance sector.

4.1. Overview of Studied Public Insurance Companies

Founded in 1963, SAA stands as Algeria's foremost insurance and reinsurance company, boasting a nationwide presence with over 520 selling points. It holds a pivotal role in fostering the industry's expansion and development.

CAAR, also established in 1963, holds the distinction of being the oldest insurance company in Algeria. It specializes in industrial risk management and has adeptly adapted its activities to align with evolving market dynamics.

CAAT, originating in 1985, primarily operates in transportation insurance. Transitioning into a Public Economic Company/Joint Stock Company (EPE/SPA) in 1989, it focuses on providing insurance coverage for maritime, air, and land transport. This contextual overview lays the groundwork for subsequent financial analysis and the application of the Kida model.

4.2. Prediction of Financial Failure According to the Kida Model for Studied Public Insurance Companies

The Kida model was deployed to evaluate the financial viability of public insurance companies in Algeria over the 2015-2021 period. Financial ratios were meticulously computed, and the resulting Z-index values were extracted to prognosticate the companies' financial standing, delineating between success and failure. Table 1 and figure 1 illustrate the results of the Kida model for SAA, showing the financial ratios and Z-index values for the years 2015 through 2021.

Table 1. Z-Index Values for SAA from 2015 to 2021

Year	2015	2016	2017	2018	2019	2020	2021	Avg.
X ₁	0.044	0.035	0.038	0.035	0.026	0.03	0.031	0.034
X ₂	0.81	0.739	0.877	0.987	0.961	0.97	0.984	0.904
X ₃	0.062	0.061	0.082	0.094	0.103	0.109	0.142	0.093
X ₄	0.315	0.264	0.28	0.289	0.29	0.262	0.24	0.277
X ₅	0.031	0.03	0.038	0.041	0.045	0.048	0.064	0.043
Z	-0.558	-0.494	-0.571	-0.624	-0.606	-0.604	-0.612	-0.581
Result	Vulnerable to Financial Failure							

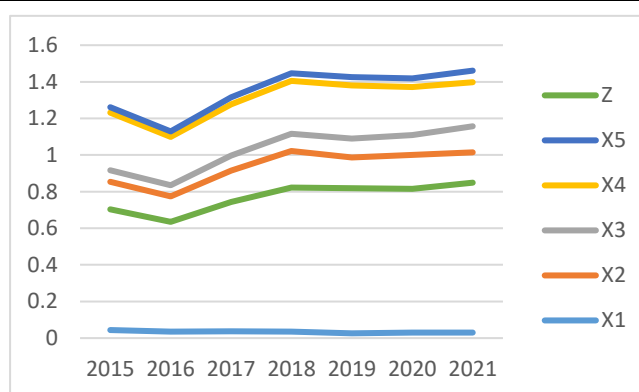


Figure 1. Results of the Kida Model in SAA

The data in table 1 indicates that SAA was vulnerable to financial failure throughout the observed period, with Z-index values consistently below the threshold for financial stability.

Figure 1 illustrates the complex dynamics of SAA's financial performance over the specified period. Despite improvements in specific financial ratios, the company remained vulnerable to financial distress. It suggests that while there are positive trends in individual financial ratios (X₂, X₃, X₄, and X₅), the overall financial health as measured by the Z-index remains concerning. The persistent low Z-index values underscore a continuing risk of financial failure despite improvements in certain areas.

Observations for SAA: The Z-index values show a general upward trend but remain significantly below the typical threshold indicating financial stability, suggesting SAA was vulnerable to financial failure throughout the period. Ratio X1 remains consistently near 0, showing little variation and representing 3.4% of total assets, which is somewhat acceptable. Ratio X2 shows an increasing trend, with private funds covering 90.4% of total debts, indicating an acceptable financial state. Ratio X3 exhibits a general upward trend with cash covering 9.3% of short-term debts, which is somewhat acceptable. Ratio X4 shows a steady increase, indicating very acceptable financial health with total sales at 27.7% of total assets. Ratio X5 presents a consistent upward trend with cash at 4.3% of total assets, which is somewhat acceptable. Despite improvements in specific financial ratios, the overall financial health as measured by the Z-index remains concerning, highlighting the need for comprehensive financial strategies to enhance stability and mitigate the risk of financial distress. The negative Z value throughout the period underscores the continuing vulnerability to financial failure despite these improvements.

Table 2 shows the results of the Kida Model in CAAR for the years 2015 to 2021. The average values for various ratios, including X1, X2, X3, X4, X5, and Z, are presented. The results indicate the financial health and vulnerability of the company over this period. Specifically, the ratios X1 to X5 represent different aspects of the company's financial position, while the Z value provides an overall assessment of its vulnerability to financial failure. Figure 2 visually represents the results of the Kida Model in CAAR, providing a graphical depiction of the company's financial performance over the specified years.

Table 2. Results of the Kida Model in CAAR

Year	2015	2016	2017	2018	2019	2020	2021	Avg.
X ₁	0.021	0.012	0.017	0.013	0.015	0.023	0.022	0.018
X ₂	0.575	0.603	0.652	0.682	0.663	0.758	0.894	0.69
X ₃	0.092	0.087	0.101	0.09	0.108	0.085	0.137	0.1
X ₄	0.312	0.293	0.3	0.31	0.299	0.302	0.312	0.304
X ₅	0.049	0.043	0.056	0.049	0.059	0.043	0.063	0.052
Z	-0.441	-0.434	-0.467	-0.476	-0.472	-0.515	-0.595	-0.486
Result	The Company Is Vulnerable to Financial Failure							

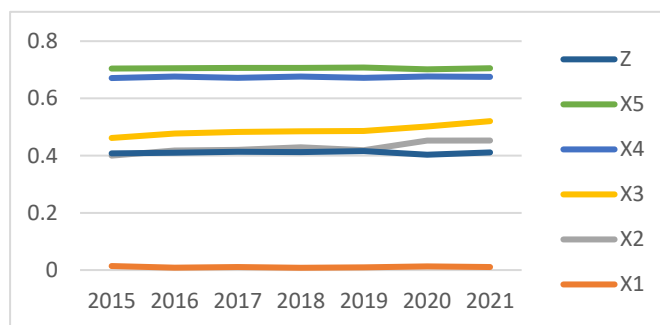


Figure 2. Results of the Kida Model in CAAR

Based on table 2 and figure 2 the results are as follows: ratio X1 is somewhat unacceptable, representing 1.8% of total assets. In contrast, ratio X2 is somewhat acceptable, with private funds covering 69% of total debts. Additionally, ratio X3 is fairly acceptable, as cash covers 10% of short-term debts. Moreover, ratio X4 is very acceptable, with total sales at 30.4% of total assets, and ratio X5 is acceptable, with cash at 5.2% of total assets. However, the Z value remains negative throughout, indicating vulnerability to financial failure. These observations collectively provide a comprehensive understanding of the company's financial standing and its susceptibility to potential financial challenges. The data presented in table 3 outlines the results of the Kida Model in CAAT for the years 2015 to 2021, along with the average values for the various ratios, including X1, X2, X3, X4, X5, and Z. This information provides insights into the financial performance and vulnerability of the company over the specified period. Accompanying the tabular data, figure 3 visually represents the results of the Kida Model in CAAT, offering a graphical representation of the company's financial performance over the specified years.

Table 3. Results of the Kida Model in CAAT

Year	2015	2016	2017	2018	2019	2020	2021	Avg.
X1	0.038	0.04	0.041	0.042	0.035	0.036	0.036	0.038
X2	0.568	0.582	0.582	0.584	0.553	0.538	0.55	0.565
X3	0.104	0.095	0.088	0.109	0.126	0.093	0.119	0.105
X4	0.213	0.216	0.183	0.179	0.169	0.154	0.138	0.179
X5	0.06	0.053	0.049	0.061	0.071	0.052	0.065	0.059
Z	-0.412	-0.421	-0.402	-0.41	-0.389	-0.367	-0.374	-0.396
Result	The Company Is Vulnerable to Financial Failure							

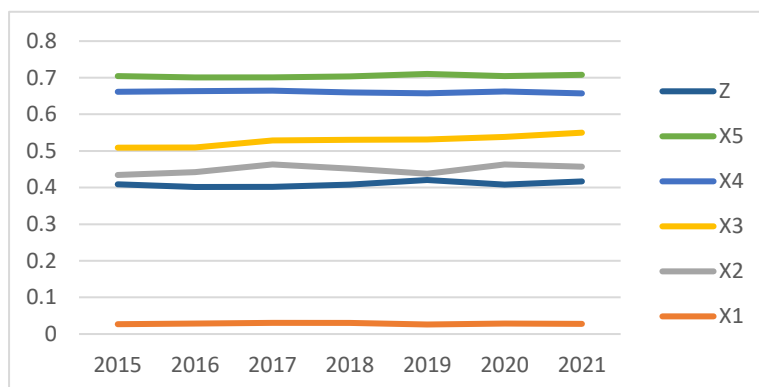


Figure 3. Results of the Kida Model in CAAT

The observations for CAAT based on the provided data are as follows: Ratio X1 is somewhat acceptable, representing 3.8% of total assets, while Ratio X2 indicates that the company is not financially independent, as it is somewhat unacceptable, with private funds covering only 56.5% of total debts. Additionally, Ratio X3 is fairly acceptable, with cash covering 10.5% of short-term debts, and Ratio X4 is somewhat acceptable, with total sales at 17.9% of total assets. Ratio X5 is also somewhat acceptable, with cash at 5.9% of total assets. However, the Z value remains negative throughout, indicating vulnerability to financial failure.

Based on the data provided in table 4 and the comparative observations in figure 4, the following insights can be derived from the comparison between the public insurance companies SAA, CAAR, and CAAT:

Table 4. Comparison between Public Insurance Companies

	SAA	CAAR	CAAT
X ₁	0.034	0.018	0.038
X ₂	0.904	0.69	0.565
X ₃	0.093	0.1	0.105
X ₄	0.277	0.304	0.179
X ₅	0.043	0.052	0.059
Z	-0.581	-0.486	-0.396
Result	The Companies are Vulnerable to Financial Failure		

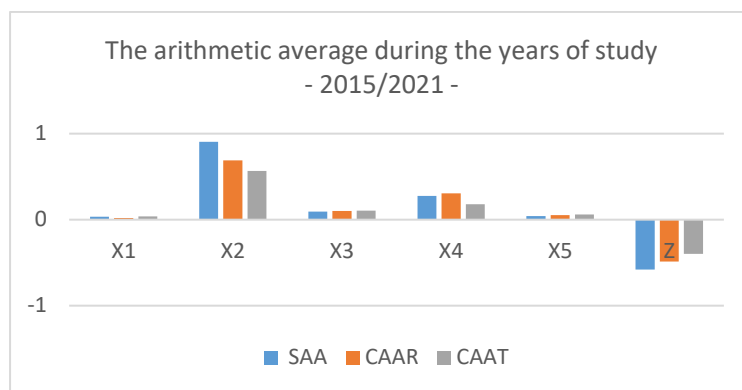


Figure 4. Comparison between Public Insurance Companies

In the comparison between public insurance companies SAA, CAAR, and CAAT, it is evident that CAAT exhibits several strengths across various financial ratios. Specifically, CAAT has the highest average net profit of total assets, followed by SAA and CAAR in Ratio X1. Additionally, CAAT demonstrates the highest average cash to short-term debts in Ratio X3, as well as the highest average cash to total assets in Ratio X5. Furthermore, the Z value analysis reveals that CAAT has the highest average Z value, indicating a relatively lower vulnerability to financial failure, followed by CAAR and SAA, thus positioning CAAT favorably in terms of financial stability and resilience.

It is evident from the data and figures obtained from this research that CAAT's stronger performance in these financial indicators positions it more favorably when compared to SAA and CAAR. This highlights the importance of further examination and proactive measures to address potential risks and enhance the overall financial stability of these insurance entities. By leveraging the insights gained from the Kida model and the comprehensive assessment of financial ratios and Z values, these companies can strategically implement measures to mitigate vulnerabilities, strengthen their financial positions, and ensure their future viability in the dynamic insurance market.

The application of the Kida model provides a comprehensive understanding of the financial standing of the public insurance companies SAA, CAAR, and CAAT, revealing their susceptibility to financial failure. Despite this overall vulnerability, CAAT stands out by exhibiting a relatively lower susceptibility compared to SAA and CAAR. This finding is substantiated by the assessment of financial ratios and Z values, which offer valuable insights into the financial health of each company. Specifically, the comparative observations from Ratio X1 to Ratio X5 and the Z values from the analysis indicate that CAAT demonstrates strengths in key financial metrics, such as net profit of total assets, cash reserves, and overall financial stability, which contribute to its relatively lower vulnerability to financial failure.

5. Declarations Results and Hypotheses Evaluation Summary

The study's comprehensive analysis offers key insights into the dynamics of insurance companies, their risks, and the efficacy of financial models. It reveals that insurance companies face ongoing risks, particularly liquidity risks, which, if prolonged, can lead to financial hardship and the risk of failure. Specialized predictive models, especially the Kida model, play a crucial role in identifying and rectifying imbalances. Financial failure prediction models depend on the aggregation of financial ratios, emphasizing their importance in predicting a company's financial position and detecting potential failure. The Kida model stands out for its comprehensive inclusion of various ratios, and all values of the financial failure index were consistently negative, indicating susceptibility to the risk of financial failure.

In addition to the financial ratios, external economic factors such as fluctuations in oil prices, political stability, and regulatory changes significantly impact the financial health of Algerian insurance companies. For instance, Algeria's heavy reliance on oil revenues means that any volatility in oil prices can affect economic stability and, consequently, the financial performance of insurance companies. Political stability also plays a crucial role, as instability can lead to economic uncertainty, affecting investor confidence and market conditions.

5.1. Evaluation of Hypotheses

First Hypothesis: Affirmed. Sustained financial hardship, especially from income deficiencies and high operational costs, can lead to future financial failure for companies, including insurance companies.

Second Hypothesis: Affirmed. The study confirms the existence of multiple financial failure prediction models, including Altman, Kida, Sherrod, Springate, and Conan-Holder, which companies rely on to mitigate the risks of financial failure.

Third Hypothesis: Affirmed. The Kida model is considered reliable for predicting financial failure due to the diverse combination of financial ratios within its linear formula with pre-calculated weighting coefficients.

Fourth Hypothesis: Affirmed. The Kida model allows earlier detection of the real financial position of insurance companies due to the variety of combined financial ratios, facilitating comprehensive assessment and early detection.

All four hypotheses are supported by the study's findings, reinforcing the significance of financial models, particularly the Kida model, in predicting and preventing financial failure for companies, especially within the context of insurance companies.

6. Conclusion

Our study provides valuable insights into the critical importance of assessing and mitigating financial risks faced by insurance companies, which play a vital role in the national economy. Specifically, we focused on evaluating the effectiveness of the Kida model and financial ratios in predicting the financial health of Algerian public insurance companies, namely SAA, CAAR, and CAAT, over the period from 2015 to 2021. Our findings underscore the significant challenges posed by liquidity risks and highlight the necessity for robust risk mitigation strategies within the insurance sector.

Through the application of the Kida model, we gained valuable insights into the varying levels of vulnerability among the studied insurance companies. The consistent observation of negative values in the financial failure index according to the Kida model signals potential susceptibility to future financial challenges. This underscores the importance of proactive measures, strategic reviews, and long-term planning to address underlying vulnerabilities and ensure sustained financial stability.

As insurance companies navigate the complexities of a dynamic economic landscape, continuous monitoring, proactive measures, and strategic adjustments emerge as critical imperatives for maintaining financial resilience. Our findings contribute to enhancing our understanding of financial dynamics within the insurance sector and emphasize the pivotal role of predictive models in identifying and addressing potential risks.

In addition to internal financial management, it is crucial to consider external economic factors such as oil price fluctuations and political stability, which have a profound impact on the financial health of Algerian insurance companies. The nation's reliance on oil revenues and the broader economic environment influences the stability and performance of these companies. Understanding these external influences is essential for a holistic approach to financial risk management.

6.1. Recommendations

To strengthen the financial positions of insurance companies and mitigate uncertainties, we recommend the following measures:

Firstly, implementing early detection systems is crucial. These systems should continuously monitor financial ratios and indicators, allowing for timely interventions. Identifying early signs of financial distress enables proactive measures to prevent further deterioration of financial health. Secondly, insurance companies should actively utilize financial failure prediction models, including the Kida model, to identify potential risks early and take corrective actions. Regular use of these models provides valuable insights into financial stability and helps mitigate risks before they escalate. Developing tailored financial failure prediction models for Algerian insurance companies is also essential. These models should consider local economic and regulatory conditions for more accurate predictions, enhancing the effectiveness of interventions. Selecting and monitoring relevant financial ratios is another key

recommendation. Companies should focus on liquidity, solvency, and profitability ratios to identify strengths and weaknesses, allowing for targeted improvements and efficient resource allocation. Finally, a strategic balance between maintaining adequate liquidity and achieving profitability should be pursued. Ensuring sufficient liquidity for short-term obligations while focusing on long-term profitability is crucial for financial stability. Companies should optimize both aspects to avoid cash flow problems and missed investment opportunities.

6.2. Future Work

Future research could expand on this work by incorporating more nuanced aspects of financial ratios and investigating industry-specific nuances that may impact financial health. Additionally, developing tailored financial failure prediction models for the Algerian insurance market and comparing the Kida model with other predictive models in different economic contexts could enhance the accuracy and reliability of predictions. Specific research questions could include:

- 1) How do macroeconomic variables such as oil prices and political stability affect the financial health of insurance companies?
- 2) What are the key differences in the performance of various predictive models (e.g., Kida, Altman Z-Score) in different economic environments?
- 3) How can predictive models be adapted to better account for the unique characteristics of the Algerian insurance market?

7. Declarations

7.1. Author Contributions

Conceptualization: M.M.E.B., K.M., I.B., and I.B.; Methodology: K.M.; Software: M.M.E.B.; Validation: M.M.E.B., K.M., I.B., and I.B.; Formal Analysis: M.M.E.B., K.M., I.B., and I.B.; Investigation: M.M.E.B.; Resources: K.M.; Data Curation: K.M.; Writing Original Draft Preparation: M.M.E.B. and I.B.; Writing Review and Editing: K.M. and M.M.E.B.; Visualization: M.M.E.B.; All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

7.3. Funding

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7.4. Institutional Review Board Statement

Not applicable.

7.5. Informed Consent Statement

Not applicable.

7.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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