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Determinants of Financial Solvency in Algerian Insurance Companies: An Econometric Analysis Using ARDL

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Abstract

This study aims to investigate the determinants of financial solvency for Algerian insurance companies and the strength and direction of their impact on the solvency margin of these companies. This was done by constructing an econometric model of financial solvency and its influencing variables using the Autoregressive Distributed Lag (ARDL) methodology with Eviews 12 software for the period 1998–2021. The study found that the determinants of solvency—namely, insurance premiums, compensation, financial investments, and technical provisions—maintain a long-term equilibrium relationship with financial solvency. The findings revealed that a 1% increase in insurance premiums, financial investments, and technical provisions will lead to an increase in the financial solvency margin by 1.75%, 0.38%, and 0.78%, respectively, in the long term. Moreover, the study identified a long-term inverse relationship between compensation and the financial solvency margin, where a 1% increase in compensation results in a 1.79% decrease in the financial solvency margin. Additionally, the study found that any 1% shock to solvency determinants will have a lasting impact for one year and seven months before returning to its normal equilibrium state. The

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study recommends adopting an underwriting policy that increases the value of insurance premiums, thereby enhancing technical provisions and ensuring their optimal investment. It also emphasizes the importance of investment activities by reassessing the optimal composition of financial investments. Furthermore, it highlights the necessity of minimizing the negative impact of insurance compensations on financial solvency by swiftly addressing incurred losses to strengthen solvency and reinforce the financial stability of insurance companies.

Keywords: Financial Solvency Margin, Solvency Determinants, Insurance Companies, Algerian Solvency System, ARDL.

Introduction

The third chapter of this study aims to measure the impact of financial solvency on Algerian insurance companies and its determinants as the final step of this research. This chapter evaluates the **Autoregressive Distributed Lag (ARDL) model** from **statistical and economic perspectives** by testing the extent to which the study's determinants affect the financial solvency margin of insurance companies for the period **1998–2021**.

Section One: Evaluating the Model from Statistical and Economic Perspectives

The study seeks to establish the relationship between the **financial solvency margin** of Algerian insurance companies and four key determinants:

- **Insurance premiums**
- **Compensations**
- **Financial investments**
- **Technical provisions**

To achieve this, the study employs annual time-series data spanning **1998–2021** and utilizes the **Eviews 12 statistical software** to identify the statistical relationship between the variables.

Additionally, the software helps in determining the nature of the effect between the **independent variables (determinants)**—insurance premiums (**LIP**), compensations (**LCP**), financial investments (**LFP**), and technical provisions (**LTP**)—and the **dependent variable**, the financial solvency margin (**LSM**). The study further analyzes the results and tests hypotheses to understand the impact of each independent variable on the dependent variable.

Section Two: Identifying Study Variables and Time-Series Stability Analysis

This section focuses on identifying the study's variables, with the financial solvency margin being the most significant tool used by regulatory bodies to monitor and analyze the financial health of insurance companies. Moreover, it investigates the stability of the time-series data used in the study.

Subsection One: Identifying Study Variables

The selection of study variables is based on **economic theory and previous studies**, with particular emphasis on insights derived from the theoretical framework. The study identifies the key determinants influencing the financial solvency margin of insurance companies during the **1998–2021** period, as summarized in the following table:

This chapter provides an empirical analysis of the financial solvency determinants of Algerian insurance companies. By utilizing the ARDL model and statistical software, the study aims to offer a comprehensive understanding of the long-term equilibrium relationships between solvency determinants and the financial solvency margin. The results of this research contribute to financial policy recommendations aimed at enhancing the financial stability of the insurance sector.

Study Variables and Their Coding

Variable Name	Variable Definition	Type	Variable in English	Code
Solvency Margin	The additional capital reserve that insurance companies must maintain to handle unexpected events. It provides an additional source of capital to deal with unforeseen circumstances, thereby protecting customers.	Dependent	Solvency Margin	LSM
Underwritten Premiums	The amount paid by the insured to the insurer to benefit from the granted coverage, which is compensated according to contractual terms in case of the insured risk occurrence.	Independent	Insurance Premiums	LIP
Compensation Paid	A fundamental expense for insurance companies, representing the amounts paid to policyholders or beneficiaries when the insured risk materializes.	Independent	Compensation Paid	LCP
Financial Placements	Considered one of the pillars of financial solvency, it is a crucial element for insurance companies as it represents the investment of a portion of collected funds. It is one of the primary sources of profit.	Independent	Financial Placement	LFP
Technical Provisions	Reserves maintained by insurance companies to cover their losses over specific periods.	Independent	Technical Provisions	LTP

Source: Prepared by the researcher

Importance of the Solvency Margin

The solvency margin indicator was chosen for the econometric study as it is the most critical tool that regulatory bodies can use to monitor insurance companies. Its primary purpose is to ensure more effective risk management for these companies. Insurance firms retain it as the key measure of their ability to meet financial obligations. Therefore, this study presents the importance of the solvency margin in insurance companies and its analysis.

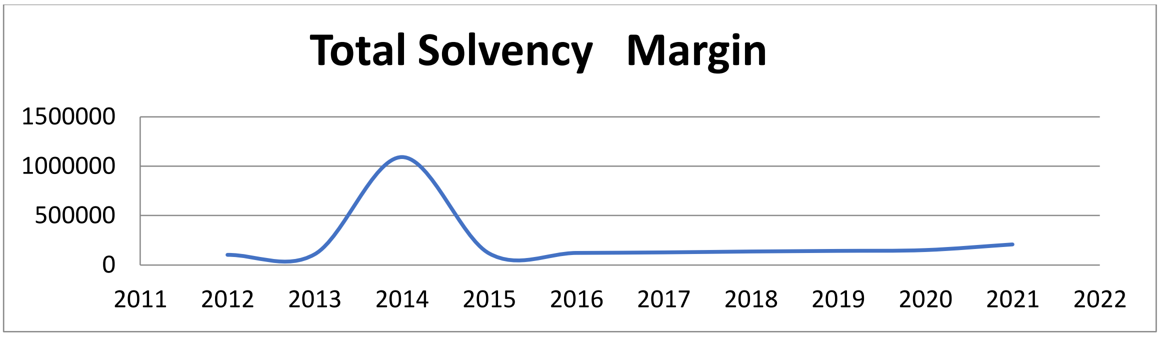
1. The Importance of the Solvency Margin

The solvency margin is the most crucial tool for supervising insurance companies. The financial position of these companies can be jeopardized for various reasons. The solvency margin serves as a safety net to protect the public and insurance companies from competitive pressures. It works in favor of both the public and insurers that adopt prudent underwriting policies. It also enables supervisory authorities to verify the company's ability to meet its obligations. The solvency margin aims to provide an early warning to the company before it reaches financial insolvency, allowing for corrective measures or regulatory intervention. If the company is unwilling or unable to take corrective action, the solvency margin should be large enough to allow timely intervention.

2. Development of the Solvency Margin (2012-2021)

The following figure illustrates the development of the solvency margin for the period 2012-2021.

Figure (03-05): Solvency Margin Development (2012-2021) - Unit: Million Dinars



Source: Prepared by the student based on the reports of insurance activity in Algeria, Ministry of Finance, Directorate

From the figure above, we observe that the solvency margin of Algerian insurance companies experienced a continuous increase throughout the period (2012-2021), rising from 102,397 million Algerian dinars in 2012 to 208,113 million Algerian dinars in 2021. This increase is attributed to the rise in total social capital in 2012 and 2013, as well as the increase in underwriting operations during the studied period. The table below illustrates the solvency margin level (mandatory margin) for the period (2012-2021).

Table No. (03-08): Solvency Margin Level for the Period (2012-2021) (Unit: Million Dinars)

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Solvency Margin	102,397	108,450	109,217	116,717	121,903	127,270	136,451	142,847	150,859	208,113
Technical Provisions	105%	91%	90%	96%	98%	93%	97%	92%	97%	92%
Number of Times	7	6	6	6	7	6	6	6	6	7
Premiums	143%	105%	87%	93%	94%	95%	99%	97%	110%	111%
Number of Times	7	7	4	5	5	5	5	5	5	5

Source: Prepared by the student based on insurance activity reports in Algeria, Ministry of Finance, Insurance Directorate, years (2012-2021).

From the previous table, we observe that Algerian insurance companies have continued to achieve a very high solvency margin compared to the size of premiums from 2012 to 2021, reaching 111% in 2021, which is equivalent to five times the legally required minimum.

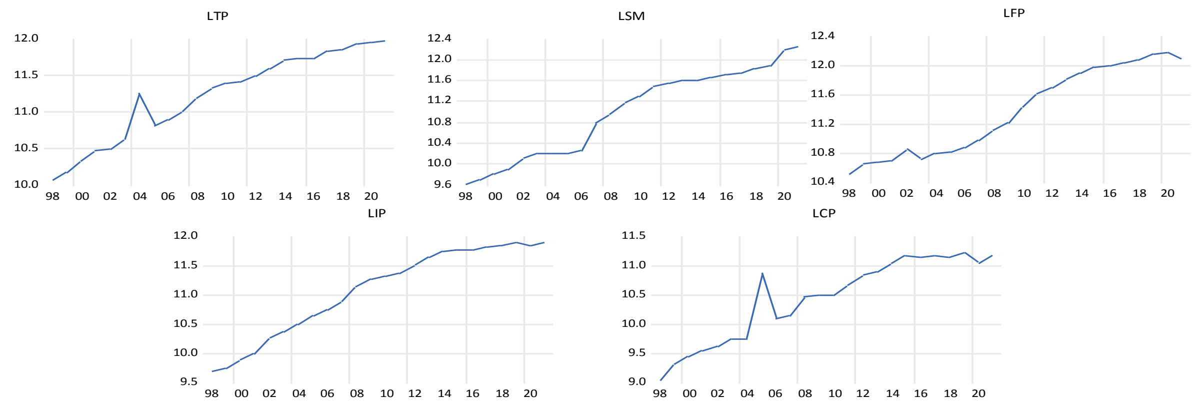
Additionally, the solvency margin represents 92% of technical provisions in 2021, which amounts to seven times the legally required minimum. This reflects the extent to which Algerian insurance companies comply with existing regulations and adhere to the necessary conditions to ensure their continuity and maintain their presence in the market by demonstrating their ability to meet their financial obligations to creditors.

Section Two: Examining the Stability of Time Series

The stability test of time series is one of the most important tests aimed at determining the degree of integration of time series to avoid obtaining a spurious regression. Additionally, it helps in identifying the appropriate econometric model to measure the relationship between variables by following these methods:

First - Graphical Representation of Time Series for Study Variables: From the figure below, which illustrates the time series of the study variables in their logarithmic form, it is evident that all five time series exhibit a general trend. The presence of both a general trend and a constant in the time series of the study variables has been verified by conducting regressions for the five variables on both the constant and the general trend. The results indicate that both the constant and the trend are statistically significant in all models.

Figure No. (03-06): Graphs of Time Series



Source: Prepared by the researcher based on the outputs of Eviews

Second - Unit Root Test Results:

The stability of time series is verified by detecting the presence of a unit root. Unit root tests are conducted through three regressions:

1.Without a trend and with an intercept.

2.With an intercept only.

3.With a trend and an intercept.

Empirical studies rely on one of these models based on their characteristics, particularly whether they include a constant or a trend.

The following table presents the results of the unit root test using the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test.

Table No. (03-09): Unit Root Test Results (ADF-PP)

Augmented Dickey-Fuller (1979)

Observation	**P-value**	**Critical Value**	**ADF-stat**	**Variables**
I(1)	**0.0146**	-3.632896	-4.2256386	LSM
I(1)	**0.0498**	-3.632896	-3.635360	LFP

I(0)	**0.0487**	-3.622033	-3.635233	LCP
I(1)	**0.0338**	-3.644963	-3.852012	LIP
I(1)	*0.0000*	-4.616209	-8.00855	LTP

Phillips & Perron (1988)

Observation	**P-value**	**Critical Value**	**PP-stat**	**Variables**
I(1)	**0.0146**	-3.632896	-4.255001	LSM
I(1)	**0.0403**	-3.632896	-3.745431	LFP
I(0)	**0.0487**	-3.622033	-3.635233	LCP
I(1)	*0.0009*	-4.440739	-5.610890	LIP
I(1)	*0.0000*	-4.440739	-16.88971	LTP

Source: Prepared by the researcher based on EViews 12 output.

(* **) Indicates acceptance of the alternative hypothesis (H1), meaning the series are stationary at significance levels of (5% and 1%), respectively.

Based on the results in the table above, it is clear that all study variables, according to the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) models, are non-stationary at their original level, except for the **LCP (Compensations)** variable. The other variables—**LSM (Solvency Margin), LIP (Insurance Premiums), LFP (Financial Investments), and LTP (Technical Reserves)**—were not stationary because the calculated **t-value** was lower than the critical **t-value** at significance levels of **1% and 5%**, indicating acceptance of the **null hypothesis (H0: B = 0)**, meaning the presence of a unit root in the time series data.

After taking the first difference, all variables became stationary at different significance levels, as the calculated **t-value** was greater than the critical **t-value** at **1% and 5%** significance levels, leading to the acceptance of the alternative hypothesis **(H0: B ≠ 0)**.

Thus, we conclude that the time series of the study variables are a mixture of **I(0)** and **I(1)** orders. Consequently, the **Autoregressive Distributed Lag (ARDL) model** is the most suitable for measuring and analyzing the relationship between the variables.

Summary of Stationarity Results

Variable	SM	FP	CP	IP	TP
Order of Integration	(1)	(1)	(0)	(1)	(1)

Source: Prepared by the researcher based on Table (03-09) data.

Second Requirement: Results of Estimating the Impact of Study Determinants on the Solvency Margin of Insurance Companies (1998-2021)

After conducting the stationarity test for the time series of all study variables using both graphical representation and the unit root test, the results showed that the time series exhibit stationarity at different orders **I(0) and I(1)** after applying the logarithmic transformation.

Based on econometric studies, the most appropriate econometric model for achieving the study's objective—**measuring and analyzing the impact of the study determinants on the solvency margin of insurance companies in Algeria over a 24-year period (1998-2021)**—is the **Autoregressive Distributed Lag (ARDL) model**.

This model does not require all time series to be integrated at the same order and is used to study **short-term and long-term effects** and the **equilibrium relationship** between the dependent and independent variables. This approach helps answer the study's main research question.

Subsection One: Determining the Optimal Lag Length and Model Estimation

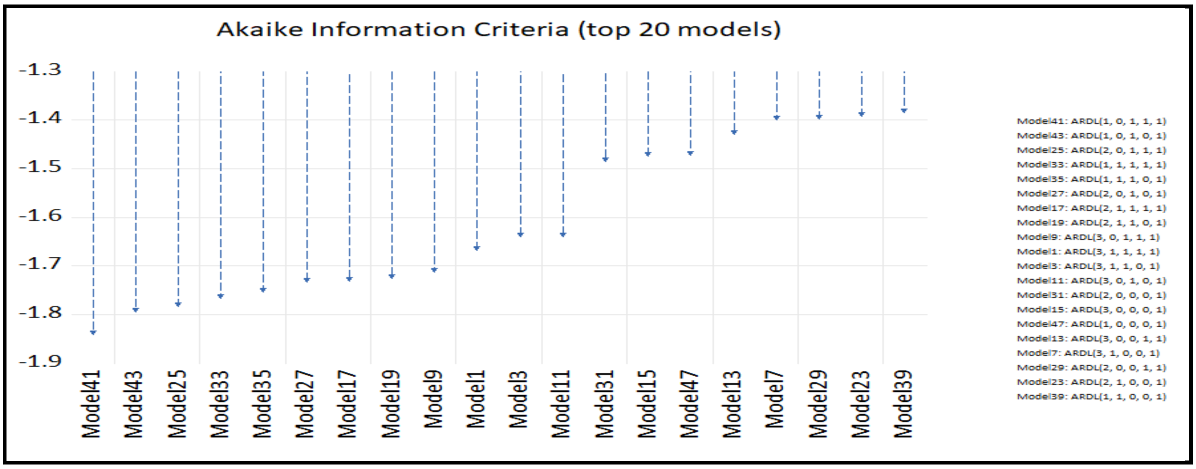
There are several criteria for determining the optimal lag length for the model. As a first step, we will select the most appropriate criterion before estimating the study model. The following sections outline this process:

First – Determining the Optimal Lag Length:

The **Akaike Information Criterion (AIC)** is a key indicator in selecting the optimal model. The model with the lowest AIC value is considered the best choice. This step is crucial before estimating the model and analyzing the relationship between **LCP (Compensations), LIP (Insurance Premiums), LFP (Financial Investments), LTP (Technical Reserves),** and **LSM (Solvency Margin of Insurance Companies).**

The following figure illustrates the results of the optimal lag selection test for the study model:

Figure (03-07): Optimal Lag Selection Test for the Model.



Source: Prepared by the researcher based on the outputs of 12Eviews

Based on the figure and table above, it is evident that the optimal model for measuring the relationship between the **solvency margin of insurance companies** and its determinants is the **ARDL (1,0,1,1,1) model**, selected from 48 models based on the **Akaike Information Criterion (AIC).**

Second – Estimating the Study Model:

After identifying the stationarity level of the study variables and selecting the optimal model according to the AIC criterion, we proceed with estimating the model in this step. The estimation results are presented in the following table:

Table (03-11): ARDL Model Estimation Results.

Dependent Variable: LSM
Method: ARDL
Date: 11/08/23 Time: 00:07
Sample (adjusted): 1999 2021
Included observations: 23 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): LFP LCP LIP LTP
Fixed regressors: C
Number of models evaluated: 48
Selected Model: ARDL(1, 1, 1, 0, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LSM(-1)	0.353604	0.189395	1.867019	0.0830
LFP	-0.104550	0.287916	-0.363127	0.7219
LFP(-1)	0.352793	0.277364	1.271952	0.2241
LCP	-0.867159	0.185767	-4.668003	0.0004
LCP(-1)	-0.294452	0.104272	-2.823890	0.0135
LIP	1.136259	0.261575	4.343918	0.0007
LTP	-0.407336	0.176079	-2.313366	0.0364
LTP(-1)	0.914328	0.265647	3.441891	0.0040
C	-1.728289	0.976039	-1.770717	0.0984

R-squared	0.993313	Mean dependent var	11.04718
Adjusted R-squared	0.989492	S.D. dependent var	0.820531
S.E. of regression	0.084111	Akaike info criterion	-1.827194
Sum squared resid	0.099045	Schwarz criterion	-1.382871
Log likelihood	30.01274	Hannan-Quinn criter.	-1.715448
F-statistic	259.9602	Durbin-Watson stat	1.525952
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Source: Prepared by the researcher based on the outputs of 12Eviews

From the table above, the overall significance of the study model is evident, as indicated by the **F-statistic**, which is estimated at **259.9602** with a **significance level of 0.0000** at the **1% level**. This confirms that the model effectively explains the studied phenomenon. Additionally, all the estimated parameters in the model are significant at different levels (**1%, 5%, and 10%**), except for the **financial investments variable (LFP)**.

Regarding the explanatory power of the model, the **adjusted coefficient of determination ($\bar{R}^2$) is 0.993313**, meaning that **99.3% of the variations in the dependent variable (solvency margin) are explained by the independent variables included in the model**. The remaining **0.7% is attributed to other factors not included in the model**. Moreover, the **constant term** is significant at the **10% level** and has a negative value of **-1.728289**, indicating that **there are additional factors influencing the solvency margin that were not accounted for in the model**.

Section Two: Model Validation Tests

First – Model Validity Test:

After estimating the selected **ARDL model** using the **Akaike Information Criterion (AIC)** and before using it to estimate **short-run and long-run effects**, the model must undergo several **residual diagnostics tests**, including:

- **Serial Correlation LM Test**
- **Heteroskedasticity Test**
- **Normality Test**

1. Serial Correlation Test (Breusch-Godfrey Serial Correlation LM Test):

This test examines whether there is serial correlation in the residuals. The **null hypothesis (H_0)** states that **there is no serial correlation**, while the **alternative hypothesis (H_1)** suggests **the presence of serial correlation**. If the **F-statistic is not significant**, it indicates that there is **no autocorrelation in the errors**.

The results of the **serial correlation test** are summarized in the following table:

Table (03-12): Serial Correlation Test Results.

Breusch-Godfrey Serial Correlation LM Test

Prob. F(2,12)	F-Statistic	Prob. Chi-Square(12)	Obs*R-Square
0.5298	0.670202	0.3149	2.310970

Source: Prepared by the researcher based on Eviews 12 output.

From the table above, it is evident that the results of the **Breusch-Godfrey Serial Correlation LM Test** indicate that the residuals do **not suffer from serial correlation issues**. The **probability value of the Fisher statistic is 0.5298**, which is **greater than the 5% significance level**.

Consequently, we **reject the alternative hypothesis** that assumes the presence of serial correlation and **accept the null hypothesis**, which states that **there is no serial correlation in the residuals.**

Heteroskedasticity Test (ARCH Test)

Prob. F(1,20)	F-Statistic	Prob. Chi-Square(1)	Obs*R-Square
0.5656	0.341288	0.5435	0.369118

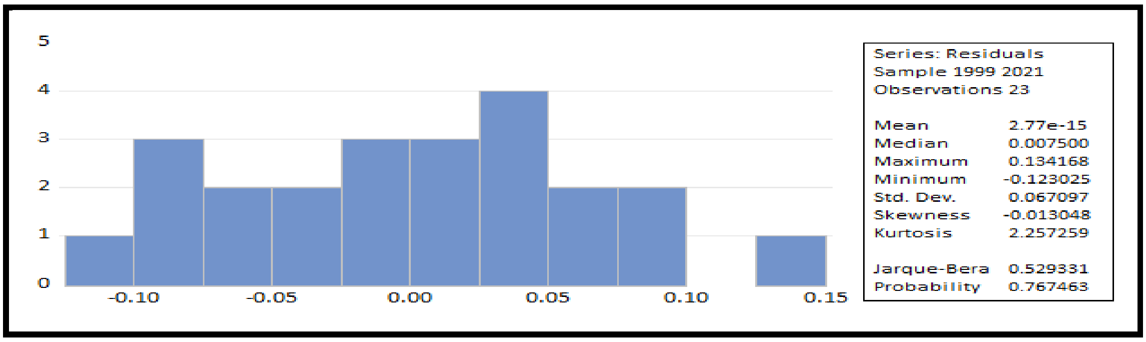
Source: Prepared by the researcher based on Eviews 12 output.

From the table above, the results of the **Heteroskedasticity Test (ARCH Test)** confirm that the model **does not suffer from heteroskedasticity issues.** The **probability value of the ARCH test statistic is 0.5656**, which is **greater than the 5% significance level.** Therefore, we **accept the null hypothesis**, which suggests that the **variance of the error term is stable** across observations.

Normality Test of Residuals (Jarque-Bera Test)

The following figure presents the results of the **Jarque-Bera Test**, which is used to check whether the residuals of the estimated model follow a **normal distribution**:

Figure (03-08): Normality Test of Residuals (Jarque-Bera Test Results)



Source: Prepared by the researcher based on the Eviews12 program

Normality Test (Jarque-Bera Test)

The **Jarque-Bera Normality Test** provides insight into whether the residuals of the model follow a **normal distribution** or not. The results indicate that the **probability value of the Jarque-Bera test is 0.767463**, which is **not statistically significant at the 5% level.** Consequently, we **accept the null hypothesis**, which states that the **residuals are normally distributed.**

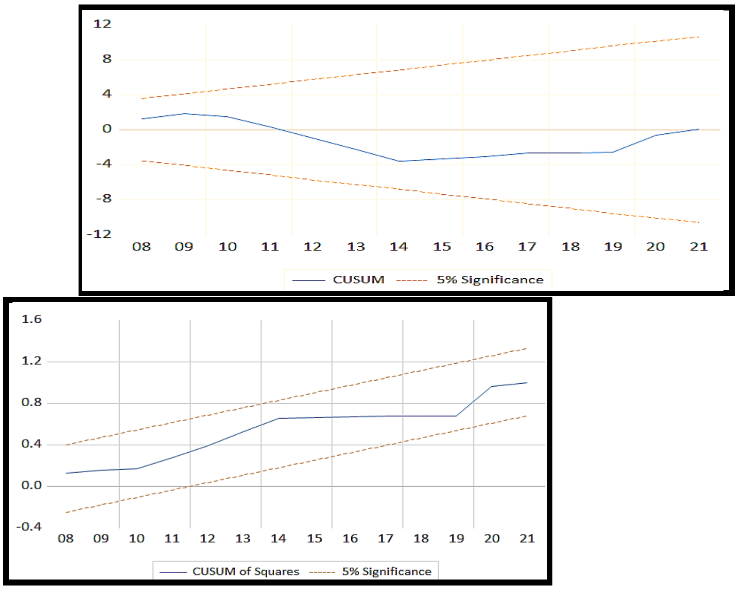
Structural Stability Test of the Model

To ensure that the dataset used in the study does not contain any **structural changes over time** and to verify the **stability of long-term coefficients along with short-term parameter estimates**, a set of tests has been applied, including:

- **Cumulative Sum of Recursive Residuals Test (CUSUM Test)**
- **Cumulative Sum of Squares of Recursive Residuals Test (CUSUM of Squares Test)**
- **Ramsey RESET Test**, which examines the **functional form of the model**.

The following **figure and table** illustrate the results:

Figure (03-09): Structural Stability Test of the Model



Source: Prepared by the student based on the Eviews12 program

From the above figure, it is clear that the results of the **CUSUM and CUSUM of Squares tests** show that the **Cumulative Sum of Recursive Residuals (CUSUM)** statistic, which is represented by a central line, falls within the **critical bounds (upper and lower limits) at the 5% significance level.** The same applies to the **Cumulative Sum of Squares of Recursive Residuals (CUSUM of Squares) test**, which also falls within the **critical bounds at the 5% significance level.** This confirms that the model is **stable**, its parameters remain **consistent** upon repeated sampling, and there is **coherence between short-term and long-term error correction results.**

Table (03-14): Results of the Model Specification Test (Ramsey RESET Test)

Test	**Value**	**f**	**Probability**
t-statistic	1.604298	3	0.1327

Test	Value	f	Probability
F-statistic	2.573772	1,13)	0.1327

Source: Prepared by the researcher based on EViews12 software.

From the above table related to the **functional specification of the model**, we observe that the **F-statistic probability is 0.1327**, which is **greater than the 5% significance level**. This means that the model **does not suffer from misspecification issues** and is therefore correctly and appropriately specified.

Thus, after the model has successfully passed all validity tests, we can conclude that it is **statistically robust** and can be **relied upon** in estimating the **relationship between the solvency margin and its determinants in both the short and long term**.

Section Three: Results of the Cointegration Test and Determining the Short-Term and Long-Term Relationship

To confirm the existence of a **cointegration relationship**, we conduct the **Bounds Test**, which allows us to proceed with analyzing **short-term results**.

First Subsection: Results of the Cointegration Test (Bounds Test)

After ensuring that the model is **free from econometric problems**, we proceed to confirm the existence of a **long-run equilibrium relationship** by applying the **Bounds Test**, which is based on the following hypothesis:

- **Null Hypothesis (H_0):** $\varphi_1 = \varphi_2 = \varphi_3 = 0$ (No cointegration)
- **Alternative Hypothesis (H_1):** $\varphi_1 \neq \varphi_2 \neq \varphi_3 \neq 0$ (Existence of cointegration)

The **null hypothesis (H_0)** indicates the **absence of a cointegration relationship**, while the **alternative hypothesis (H_1)** suggests its presence. This is tested using the **F-statistic**, which follows a **non-standard distribution** and does not depend on factors such as **sample size or the inclusion of a trend variable** in estimation.

The **calculated F-statistic** is compared with the **critical values of F**:

- If the **F-statistic is greater than the upper bound of the critical values**, we **reject the null hypothesis** (H_0) and **accept the alternative hypothesis** (H_1), indicating the **existence of cointegration** between the study variables.
- If the **F-statistic is lower than the lower bound of the critical values**, we **reject the alternative hypothesis** (H_1) and **accept the null hypothesis** (H_0), meaning **no long-term equilibrium relationship** exists between the study variables.

The following table presents the obtained results:

Table (03-15): Cointegration Test (Bounds Test)

Test	Value	Sample: 1999-2021	Observations: 23
F-Statistic	7.149331	K = 4	
Critical Value Bounds	Lower Bound	Upper Bound	Significance Level
	2.20	3.09	10%
	2.56	3.49	5%
	2.88	3.87	2.5%
	3.29	4.37	1%

Source: Prepared by the researcher based on EViews12 software.

From the table above, we observe that the **F-Statistic (7.149331) is greater than the upper bound of the critical values (4.37) at the 1% significance level**. This means that we **reject the null hypothesis (H_0)**, which states that there is **no cointegration** among the study variables ($b_1 = b_2 = b_3 = \ldots = 0$). Instead, we **accept the alternative hypothesis (H_1)**, which confirms the **existence of a cointegration relationship** ($b_1 \neq b_2 \neq b_3 \neq \ldots \neq 0$).

This indicates the presence of a **long-run equilibrium relationship** that moves **jointly from the explanatory variables toward the dependent variable (solvency margin)**.

Second Subsection: Estimation of the Error Correction Model and Short-Term Results

By analyzing the results of the **Bounds Test**, we confirmed the existence of a **long-term equilibrium relationship** between **solvency margin** and its determinants, namely:

- **Insurance premiums**
- **Financial investments**
- **Compensations**
- **Technical provisions**

Thus, we proceed to the next step to examine the impact of these determinants on the **solvency margin of insurance companies in the short term** through the **Error Correction Model (ECM) in the ARDL framework**.

The following table presents the results:

Table (03-16): Short-Term Parameter Estimates

From the above figure, it is clear that the results of the CUSUM and CUSUM of Squares tests indicate that the cumulative sum test statistic of recursive residuals (CUSUM) represents a central line that falls within the critical bounds (upper and lower limits) at a 5% significance level. The same applies to the cumulative sum of squared residuals test (CUSUM of Squares), which also falls within the critical bounds at a 5% significance level. This confirms that the model exhibits stability, and its parameters remain consistent upon repeated sampling. Additionally, there is harmony in the model between the error correction results in both the short and long term.

Table No. (03-14): Results of the Model Specification Test using the Functional Form Approach

Test	Value	f	Probability
t-statistic	1.604298	3	0.1327
F-statistic	2.573772	1,13)	0.1327

Source: Prepared by the researcher based on EViews12 software

From the table above, which pertains to the mathematical specification of the model, we observe that the probability value of the F-statistic is estimated at 0.5227, which is greater than the 5% significance level. Consequently, the model does not suffer from an identification problem, meaning it is appropriately and correctly specified.

Accordingly, after the model has successfully passed all validity tests, it can be said that it has achieved statistical robustness, making it reliable for estimating the relationship between the solvency margin and its determinants in both the short and long term.

Section Three: Cointegration Test Results and Determining the Short- and Long-Term Relationship

To confirm the presence of a cointegrating relationship, we conduct the Bounds Test, which allows us to proceed with analyzing the short-term results.

First Subsection: Cointegration Test Results – Bounds Test

After ensuring that the model is free from statistical issues, we proceed to verify whether a long-term equilibrium relationship exists by conducting the Bounds Test, which is based on the following hypothesis:

- **Null Hypothesis (H0):** $\varphi1 = \varphi2 = \varphi3 = 0$ (No cointegration)
- **Alternative Hypothesis (H1):** $\varphi1 \neq \varphi2 \neq \varphi3 \neq 0$ (Cointegration exists)

The null hypothesis suggests no cointegration, whereas the alternative hypothesis indicates the presence of cointegration. The test relies on the F-statistic, which follows a non-standard distribution and does not depend on factors such as sample size or the inclusion of a trend variable in the estimation.

If the computed F-statistic is greater than the upper bound of the critical values, we reject the null hypothesis (which assumes no long-term equilibrium relationship) and accept the alternative hypothesis, confirming cointegration among the study variables. Conversely, if the computed F-statistic is lower than the lower bound of the critical values, we reject the alternative hypothesis and accept the null hypothesis, indicating the absence of a long-term equilibrium relationship between the study variables.

The following table presents the obtained results:

Table No. (03-15): Cointegration Test – Bounds Test

	Test Statistic	Value
	F-Statistic	7.149331

Critical Value Bounds

Significance	Lower Bound	Upper Bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: Prepared by the researcher based on EViews12 software

From the table above, we observe that the F-statistic value (7.149331) is greater than the upper bound of the critical values (4.37) at a 1% significance level. This means we reject the null hypothesis (H0: b1 = b2 = b3 = ... = 0), which suggests no cointegration, and accept the alternative hypothesis (H1: b1 ≠ b2 ≠ b3 ≠ ... ≠ 0), confirming the existence of a long-term equilibrium relationship. This indicates that the explanatory variables jointly influence the dependent variable (solvency margin).

Second Subsection: Error Correction Model Estimation and Short-Term Results

By analyzing the Bounds Test results, we confirmed the existence of a long-term equilibrium relationship between the solvency margin and the variables (insurance premiums, financial investments, compensations, and technical provisions). Therefore, we proceed to the next step to examine the effect of the study's determinants on the solvency margin of insurance companies in the short term using the Error Correction Model (ECM) in the ARDL model analysis. The following table presents the obtained results:

Table No. (03-16): Estimation of Short-Term Parameters

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob**
D(LIP)	1.136259	0.261575	4.343918	0.0007
D(LFP)	-0.104550	0.203908	-0.512732	0.6161
D(LCP)	-0.867159	0.128387	-6.754269	0.0000
D(LTP)	0.407336	0.116395	-3.499598	0.0035
CointEq(-1)	-0.64639	0.084718	-7.629940	0.0000

Source: Prepared by the researcher based on EViews12 software

The error correction term measures the speed at which short-term disequilibrium adjusts toward long-term equilibrium. If the error correction coefficient is negative and statistically significant, it confirms the presence of a long-term relationship between the variables.

From the table above, we note that the estimated error correction term (CointEq(-1)) is negative (-0.64639) and statistically significant at a level below 1%. This indicates that 64% of short-term errors are corrected within one unit of time (1/0.64639 = 1.55), approximately one year and seven months, toward its equilibrium value. This means that if any shock affects the variables (insurance premiums, financial investments, compensations, and technical provisions), its effect on the solvency margin will last for about one year and seven months before returning to its equilibrium state.

The short-term results indicate that the estimated model parameters are statistically significant at a 1% significance level based on the t-statistic test, except for financial investments. The effects on the solvency margin vary between positive and negative relationships:

- **The lagged solvency margin (LSM) does not appear in the short-term model,** indicating that last year's solvency margin (t-1) is not related to the current year's solvency margin.
- **Insurance premiums (D(LIP)) have a statistically significant positive relationship with the solvency margin,** with a coefficient of 1.136259 and a probability value of 0.0007. This means that a 1% increase in insurance premiums leads to a 1.13% increase in the solvency margin.

- **Financial investments (D(LFP)) do not have a significant relationship with the solvency margin,** as the coefficient is insignificant, suggesting that financial investments do not influence the solvency margin of insurance companies in the short term.
- **Compensations (D(LCP)) have a statistically significant negative relationship with the solvency margin,** with a coefficient of -0.867159 and a probability value below 1%. This means that a 1% increase in compensations leads to a 0.86% decrease in the solvency margin.
- **Technical provisions (D(LTP)) have a statistically significant positive relationship with the solvency margin,** with a coefficient of 0.407336, meaning a 1% increase in technical provisions leads to a 0.40% increase in the solvency margin.
- **Financial Compensation:** The solvency margin responds inversely to changes in compensation, with a statistically significant coefficient of -1.797057 at a 1% significance level. This aligns with the logic of insurance theory, indicating that a 1% change in compensation will lead to a 1.79% change in the solvency margin in the opposite direction. Compensation represents expenses that negatively impact the insurance activity, potentially pushing the company into financial distress. The greater the incurred losses and the higher the compensation payments, the more negatively this affects the solvency margin.
- **Insurance Premiums:** Insurance premiums have a statistically significant positive relationship with the solvency margin in the long term, with a coefficient estimated at 1.757838 at a 1% significance level. The results indicate that a 1% change in insurance premiums leads to a 1.75% change in the solvency margin in the same direction. This positive correlation can be explained by the fact that insurance premiums serve as the primary source of funding for insurance companies, contributing to the formation of technical provisions, which are crucial in determining the solvency level. Increasing insurance premiums places companies in a stronger financial position, whereas a decline in premiums leads to a decrease in technical provisions, which are recorded on the liabilities side.
- **Technical Provisions:** Technical provisions exhibit a statistically significant positive relationship with the solvency margin in the long term, with a coefficient of 0.784337 at a 10% significance level. The findings suggest that a 1% change in technical provisions results in a 0.78% change in the solvency margin in the same direction. The positive correlation between the growth of technical provisions and the solvency margin in insurance companies indicates that technical provisions are essential in determining solvency. They directly influence the financial standing of insurance firms, as an increase in insurance premiums leads to a rise in technical provisions, enhancing the companies' ability to fully meet their obligations, which in turn positively impacts their solvency margin.

Conclusion

This study focused on the determinants of the solvency margin in insurance companies. After exploring the theoretical framework that provided insight into various aspects of insurance solvency, we aimed to reinforce this theoretical understanding with an empirical analysis. In this chapter, we examined key explanatory variables influencing the solvency margin of Algerian insurance companies based on previous studies. These variables were analyzed as key indicators for assessing financial solvency, highlighting their role in ensuring the financial stability and sustainability of these companies. We then applied econometric modeling to determine the factors influencing the solvency margin of Algerian insurance companies for the period 1998–2021.

Using modern econometric methods, our analysis revealed that the effects of these variables varied between positive and negative. However, most variables had a positive impact in both the short and long term. The key findings are:

• The time series variables (LSM, LIP, LFP, LCP, LTP) remained consistent throughout the study period.

• The time series for the study variables were a mix of those integrated at order I(0) and others at order I(1), making the ARDL model the most suitable for measuring and analyzing their relationships.

• The study showed that insurance premiums, financial investments, and technical provisions positively affected the solvency margin in the long term, while compensation had a negative impact on the solvency margin in both the short and long term.

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