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The Contribution of Digital Transformation to Expanding the Distribution of Insurance Services in Algeria: A Study Covering the Period 1995–2024

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Abstract

This study investigates the extent to which digital transformation has contributed to expanding the distribution of insurance services in Algeria over the period 1995–2024. To examine this relationship, an econometric model was developed and estimated using the Autoregressive Distributed Lag (ARDL) approach. The empirical findings reveal a statistically significant positive association between digital transformation and the development of insurance services. Specifically, a one-unit increase in internet usage is associated with a 0.0027-unit increase in the growth rate of insurance premiums, which serves as a proxy for the level of insurance services.

The observed effect can be explained by the ability of digital technologies to improve access to insurance products while enhancing distribution and marketing channels. These improvements have contributed to a noticeable expansion in the volume of written premiums. Moreover, the increase in premiums should not be interpreted solely as a quantitative change; rather, it reflects the broader diffusion of insurance services and their growing accessibility to a wider range of economic agents, including both individuals and business entities. The results further indicate that this positive relationship is reinforced within a macroeconomic environment characterized by controlled inflation, thereby supporting financial stability and strengthening the contribution of the insurance sector to overall economic output.

Keywords: Digital Transformation, Insurance Services, Insurance Premiums, ARDL model.
JEL Classification Codes: G22, O33 , C22, E31.

Introduction

Over the past few decades, the global economic system has undergone profound structural transformations that have affected almost every sector of economic activity. These changes have been driven primarily by the emergence of the digital economy, fueled by rapid advances in information and communication technologies (ICT), widespread internet adoption, and the growing integration of artificial intelligence applications. As a result, traditional business models have been fundamentally reshaped, with digital transformation becoming a

key driver of productivity, operational efficiency, cost reduction, and organizational adaptability in an increasingly dynamic and competitive environment.

The financial sector has been among the industries most significantly influenced by these technological developments, owing to its heavy reliance on the efficient processing and exchange of information. Digitalization has transformed financial services through the introduction of innovative solutions such as online banking, digital payment systems, and modern financing platforms. These innovations have enhanced financial inclusion while improving the accessibility, efficiency, and quality of financial services delivered to consumers. Similarly, the insurance industry has experienced substantial changes as a consequence of digital transformation. The rapid pace of technological innovation has compelled insurance companies to reconsider their conventional business models and adopt technology-driven operating frameworks. Consequently, digital transformation has evolved from being a strategic option for performance enhancement into a competitive necessity, particularly in response to customers' increasing demand for faster, more transparent, and personalized insurance services.

In Algeria, the insurance sector has undergone a series of economic and institutional reforms since 1995 aimed at strengthening its performance and improving its competitiveness. These reforms have emphasized the digitalization of insurance operations and the modernization of information systems, contributing to higher service quality and greater operational efficiency. Against this background, the present study addresses the following research question: **To what extent has the adoption of digital transformation strategies in the Algerian insurance sector contributed to improving the quality of insurance services during the period 1995–2024?**

Sub-Research Questions

Based on the main research question, the following sub-questions are formulated:

-What is meant by digital transformation, and what are its main characteristics?

-What is the nature of the relationship between digital transformation and the enhancement of insurance services?

Research Hypotheses

To address the main research question, the study proposes the following hypotheses:

-The adoption of digital transformation by insurance companies in Algeria, as reflected by internet usage, contributes to expanding the provision and distribution of insurance services.

-Lower inflation rates enhance the ability of insurance companies to expand the distribution and delivery of insurance services within the economy.

Significance of the Study

The significance of this study lies in highlighting the pivotal role of digital transformation as a fundamental driver of efficiency and innovation within the insurance industry. By leveraging digital technologies—particularly internet-based platforms—insurance companies can streamline their operations, improve service delivery, and respond more effectively to the evolving needs and expectations of customers. Digital transformation also enables insurers to

expand their market reach, enhance customer engagement, reduce operational costs, and increase the speed, transparency, and reliability of insurance transactions.

Furthermore, this study contributes to a better understanding of how digital transformation can support the modernization and competitiveness of the Algerian insurance sector. Its findings provide valuable insights for policymakers, insurance practitioners, and researchers by emphasizing the importance of adopting digital strategies to improve the accessibility, quality, and distribution of insurance services, thereby fostering financial inclusion and promoting sustainable growth within the insurance industry.

Objective of the Study

The primary objective of this study is to examine the impact of digital transformation on the expansion of insurance service distribution in the Algerian insurance sector. Specifically, the research seeks to assess how the adoption of digital technologies—particularly internet-based solutions—has contributed to improving the accessibility, efficiency, and geographical reach of insurance services during the period 1995–2024.

To achieve this objective, the study employs the Autoregressive Distributed Lag (ARDL) modeling approach to investigate both the short-run and long-run relationships between digital transformation and insurance service development. By estimating these dynamic relationships, the research aims to provide empirical evidence on the extent to which digital transformation has enhanced the performance of insurance companies, expanded insurance market penetration, and supported the modernization and sustainable development of the insurance sector in Algeria.

Scope of the Study

Based on the main research question and the hypotheses formulated within its framework, and in light of the importance of the study and its objectives, the temporal and spatial scope of this research is defined as the period extending from 1995 to 2024 within the Algerian context.

Research Methodology

Given the nature of the research topic, the study adopts an inductive approach, relying on statistical tools and econometric techniques to examine and estimate the relationship between digital transformation and the enhancement of insurance services. This methodological framework allows for the empirical investigation of both short-run and long-run dynamics, providing a more rigorous and evidence-based assessment of how digital transformation influences the performance and expansion of the insurance sector.

1. Digital Transformation

Digital transformation is considered one of the most pressing topics of the present era. It has become essential for institutions and economies to adopt and adapt to it, given its significant impact on enhancing efficiency, competitiveness, and innovation across various sectors.

1.1. Concept of Digital Transformation

Digital transformation refers to the continuous interaction, integration, and coordination between information and communication technologies on the one hand, and the national, sectoral, and international economy on the other. This aims to achieve transparency and

immediacy in all economic indicators that support economic, commercial, and financial decision-making within the state over a given period (Ouyada & Ahmed, p. 5) .

It is also defined by the United Nations Commission on Technology for Development as a digital economy based on digital technology, relying on components such as technological infrastructure, hardware, software, and networks, in addition to digital mechanisms through which business and economic activities are conducted, including e-commerce and electronic transactions carried out entirely over the Internet (Borji, 2021, p. 825). In other words, it refers to the use of computer and Internet technologies in creating more efficient and effective economic value. Broadly, it also refers to the changes brought about by new technologies in general regarding how we work, interact, and generate wealth within this system (Ramadan Saeed & Mohamed Baha El-Din, 2024, p. 69).

It is also defined as the process of transforming the business model of governmental institutions or private sector companies into a model based on digital technologies in providing services, manufacturing products, and managing human resources (Belkacemi & Dehimi, 2023, p. 3)

As for the concept of digital transformation in insurance companies, it is a modern term that refers to the use of digital technologies and financial and accounting information in order to increase the efficiency, effectiveness, transparency, and accountability of insurance companies in the services they provide to citizens and the business community. This supports all procedural systems, helps eliminate corruption, and provides opportunities for citizens, thereby impacting various aspects of life (Osama Mohamed Al-Tabi'i, 2022, p. 554) .

1.2.Types of Digital Transformation (Benahmed & benahmed, 2025, pp. 501-512)

Government Digital Transformation: This type focuses on improving the delivery of public services to citizens and simplifying administrative procedures. It is achieved through mobile applications and websites designed to enhance accessibility and improve the user experience.

Operational Digital Transformation: This type aims to improve the efficiency of organizations' internal operations through the adoption of digital technologies. It includes process automation and data analytics to enhance operational efficiency and support continuous improvement.

Digital Transformation in Production and Manufacturing: This involves the use of digital technologies to improve production processes and foster innovation in traditional industries. These efforts include the application of robotics, artificial intelligence, and data analytics to achieve greater efficiency and improved quality.

Digital Transformation of Supply Chains: This type seeks to improve supply chain management by enhancing shipping and distribution processes. It includes the use of tracking technologies, data analytics, and digital communication to strengthen efficiency and collaboration with suppliers.

Digital Transformation in the Financial Sector: This type aims to enhance financial services and facilitate banking operations. It encompasses mobile banking applications, digital wallets, and electronic payment technologies to provide an innovative and seamless financial experience.

Digital Transformation in Education: This type seeks to improve the learning experience by integrating digital technologies into educational methods. It includes online learning platforms, e-learning applications, and the provision of modern digital educational content.

Digital Transformation in Tourism and Hospitality: This type focuses on enhancing the experience of tourists and travelers by facilitating booking and accommodation processes. It includes the use of augmented reality technologies and digital tourism applications to improve convenience and visitor engagement.

Digital Transformation in Marketing and Sales: This type relies on digital tools to strengthen marketing and sales strategies. It includes email marketing, social media platforms, and e-commerce solutions to better satisfy customer needs.

Digital Transformation of Customer Experience: This type aims to improve customer interaction with products and services by delivering a personalized and distinctive experience. It is achieved through the use of data analytics and artificial intelligence technologies to meet customer expectations more accurately and effectively.

In summary, digital transformation encompasses a wide range of sectors and fields, with each type contributing to specific objectives related to efficiency, innovation, and the enhancement of user or customer experience in line with the requirements of the modern digital era.

3.1. Determinants of the Success of Digital Transformation (Rabie, 2023, p. 61)

-Improving national readiness and developing the necessary technological infrastructure by directing and allocating domestic investments, attracting foreign capital to the information and communication technology (ICT) sector, encouraging public–private partnerships, and providing appropriate incentives.

-Expanding Internet access and usage by extending services to all regions of the country, ensuring continuous maintenance and development of communication networks, and reducing connection costs to make Internet services accessible to everyone.

-Establishing a comprehensive set of policies that define the national framework for digital transformation, including a clear vision, guiding principles, objectives, expected benefits, and the authorities responsible for implementation and monitoring.

-Encouraging institutions to adopt their own digital transformation vision and strategy aligned with the government's strategic vision, while ensuring that these strategies encompass both public and private sector organizations.

-Promoting the implementation of an open data model to facilitate participation and collaboration among government, citizens, and other stakeholders, while ensuring the quality, management, and periodic evaluation of published data.

-Identifying existing digital services and related services, as well as services that can be developed and transformed into digital services. This also includes implementing a digital identity system through the development of a comprehensive plan for collecting accurate citizen data.

2. Insurance Service:

An insurance service is defined as a product developed and marketed by an insurance company to meet customers' insurance needs and preferences by providing protection against potential

future risks that may result in losses affecting their person, property, or liability toward third parties, As a service, it is an activity subject to exchange rather than the transfer of ownership. However, this exchange results in the customer obtaining an insurance policy, which serves as proof of the customer's right to benefit from the insurance service under the terms and conditions agreed upon in the contract, Insurance services are therefore the products offered by insurance organizations to customers or beneficiaries—whether individuals or entities—to provide reassurance and financial protection to the insured with respect to their life or property. Based on the foregoing, the concept of insurance services does not include services that are provided free of charge (Abdul Karim & Ahmed Khalaf Hussein, 2013, pp. 151-152).

2.2. Characteristics of Insurance Services

Insurance services possess several distinctive characteristics, the most important of which are as follows (Kafi & Mouwali, 2018):

-An insurance service is a future-oriented service rather than an immediate one, unlike most other services. Although the customer purchases the insurance service at the time of contracting, they only benefit from it if the insured risk actually occurs.

-The marketing of insurance services is closely related to the characteristics of the targeted customer, including their culture, social status, insurance awareness, need for insurance coverage, the priority they assign to such coverage, their perception of security and risk in their life, and, finally, their ability to purchase an insurance policy.

-An insurance service represents a promise documented in the insurance policy. This promise is fulfilled if the insured risk occurs; otherwise, it remains unfulfilled if the insured event does not take place.

-The customer cannot negotiate the price of the insurance policy, as insurance premiums are determined according to standardized actuarial studies and are not subject to the forces of supply and demand.

-The relationship between the insurance company and the customer is contractual, based on an insurance contract that generally remains in effect for one year or longer.

-The contractual relationship between the insurance applicant and the insurance company may extend to include a third-party beneficiary for whose benefit the insurance has been arranged. Consequently, the policyholder may not necessarily be the person who ultimately benefits from the insurance coverage.

3.2. The Importance of Digital Transformation in the Insurance Sector

Digital transformation contributes to the development of a modern insurance industry that relies on advanced technologies such as artificial intelligence, cloud computing, and blockchain across its business operations. The importance of digital transformation can be distinguished from two perspectives: its significance for insurance companies and its significance for customers (Ben Saad, 2024, p. 30).

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Table No. (1): The Importance of Digital Transformation in the Insurance Sector (Insurance Companies)

Customers:	Insurance Companies:
- Access to insurance products at competitive prices. - Ability to compare offers and select the best option. - Ability to purchase, renew, and process claims digitally. - Communication and interaction with the company, including after-sales services.	- Openness to local and global markets. - Cost reduction and profit maximization. - Diversification of distribution channels and improvement of operational efficiency. - Utilizing data for decision-making and risk reduction. - Rapid response to market changes. - Enhanced customer engagement and interaction.

Source :(Ben Saad, 2024, p. 30)

2. Measuring the Relationship Between Digital Transformation and Insurance Services

To examine the relationship between the digital transformation index and the expansion of insurance services in Algeria during the study period, the following aspects are addressed:

2.1. Study Variables and the Model Used

The following table presents the study variables employed in the analysis.

Table 2: Definition of the Study Variables

Table 01: Definition of study variables

Symbol	Index	Variables	Explanation
dependent variable			
y	Expansion of Insurance Services	Insurance Premium Growth Rate	This indicator reflects the ability of insurance companies to expand the provision and distribution of insurance services.
independent variables			
$\mathbf{x_1}$	Digital Transformation	Internet Usage	The use of the Internet in delivering insurance operations is considered one of the fundamental pillars for expanding the provision of insurance services by insurance companies.
$\mathbf{x_2}$	The annual change in the		Inflation is defined in various economic literature as representing a continuous rise in the general

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	consumer price index	inflation	level of prices, which affects the levels of purchasing power of economic agents (Hamed Abu Ziada, 2021, p. 387) , As the rise of this indicator negatively affects the levels of financial development

Source: prepared by the researcher

2.2 Model Estimation

Many empirical studies relying on the Ordinary Least Squares (OLS) technique often face econometric estimation issues, the most common of which is the problem of spurious regression. This problem typically arises when time series data include non-random components that influence their evolution over time, thereby potentially distorting the true dynamic relationships among economic variables.

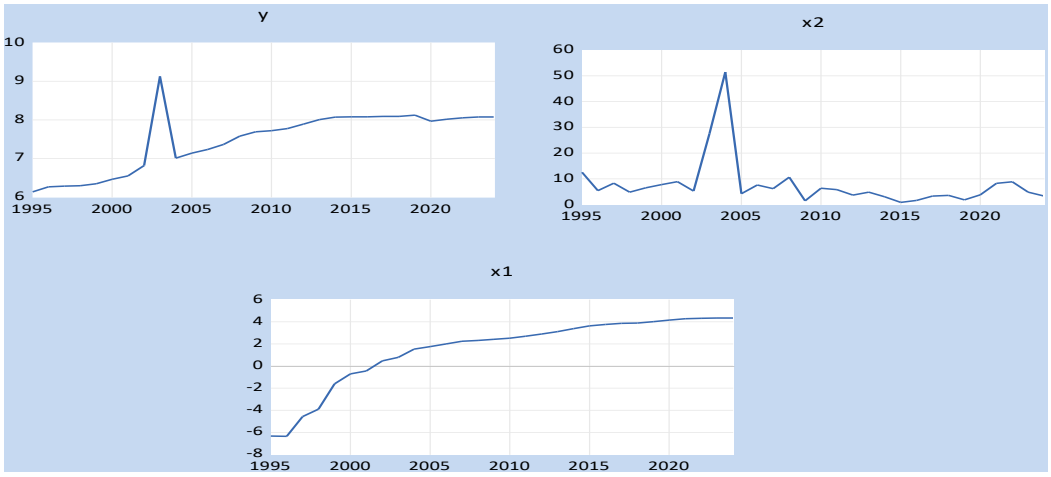
To estimate the model in a proper econometric framework, the following steps are adopted:

2.2.1. Time Series Stationarity Analysis

The examination of time series stationarity is a fundamental step aimed at detecting the presence of non-stationary components that may lead to spurious regression problems. Among the most widely used unit root tests are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests.

However, before applying these formal tests, a preliminary graphical analysis of the series is conducted in order to gain an initial understanding of their behavior. The graphical representation of the study variables suggests that their evolution over time does not follow a stable pattern. Accordingly, it is initially assumed that the series under consideration are non-stationary.

Figure 1: Graphical Representation of the Time Series



Source: *Prepared by the researchers based on the outputs of EViews 12 software.*

Based on the interpretation of the above figure, we proceed to apply the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests in order to verify the non-stationarity of the time series, as presented in the following table:

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Table 2: Results of the Unit Root Tests for the Time Series

UNIT ROOT TEST TABLE (PP)

At Level				
		Y	X1	X2
With Cons...	t-Statistic	-2.5567	-8.2646	-3.7617
	Prob.	***0.1133***	***0.0000***	***0.0082***
		n0	***	***
With Cons...	t-Statistic	-4.1671	-3.0520	-3.8342
	Prob.	***0.0139***	***0.1363***	***0.0289***
		**	n0	**
Without C...	t-Statistic	1.4601	-1.4005	-2.7694
	Prob.	***0.9608***	***0.1467***	***0.0074***
		n0	n0	***
At First Difference				
		d(Y)	d(X1)	d(X2)
With Cons...	t-Statistic	-16.2597	-4.1018	-16.3892
	Prob.	***0.0001***	***0.0037***	***0.0001***
		***	***	***
With Cons...	t-Statistic	-27.0649	-6.1726	-16.5404
	Prob.	***0.0000***	***0.0001***	***0.0000***
		***	***	***
Without C...	t-Statistic	-9.8917	-2.8730	-16.1888
	Prob.	***0.0000***	***0.0057***	***0.0000***
		***	***	***

UNIT ROOT TEST TABLE (ADF)

At Level				
		Y	X1	X2
With Cons...	t-Statistic	-2.5567	-2.0791	-3.7349
	Prob.	***0.1133***	***0.2541***	***0.0087***
		n0	n0	***
With Cons...	t-Statistic	-4.1842	-3.2950	-3.8965
	Prob.	***0.0133***	***0.0920***	***0.0253***
		**	*	**
Without C...	t-Statistic	0.7389	0.0633	-2.8032
	Prob.	***0.8685***	***0.6930***	***0.0068***
		n0	n0	***
At First Difference				
		d(Y)	d(X1)	d(X2)
With Cons...	t-Statistic	-8.3346	-1.3445	-5.6849
	Prob.	***0.0000***	***0.5908***	***0.0001***
		***	n0	***
With Cons...	t-Statistic	-8.2612	-1.7341	-5.5667
	Prob.	***0.0000***	***0.7027***	***0.0006***
		***	n0	***
Without C...	t-Statistic	-8.3087	-1.4071	-5.7995
	Prob.	***0.0000***	***0.1442***	***0.0000***
		***	n0	***

Notes: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant
*MacKinnon (1996) one-sided p-values.

This Result is The Out-Put of Program Has Developed By:
Dr. Imadeddin AlMosabbeh
College of Business and Economics
Qassim University-KSA

Source: *Prepared by the researchers based on the outputs of EViews 12 software.*

From the results presented in the table above, and based on the Dickey-Fuller methodology used to test for the presence of unit roots in the time series, the stationarity properties of the variables can be summarized as follows:

The insurance premium growth rate series is stationary at first difference with no intercept, denoted as: Y → I(1);

The internet usage per 1,000 people series is stationary at first difference with no intercept, denoted as: X1 → I(1);

The inflation rate series is stationary at level with no intercept, denoted as: X2 → I(0).

2.2.2 Cointegration Test

Since the time series variables are not integrated of the same order, the Johansen cointegration technique cannot be appropriately employed in this case. As a result, the study relies on the alternative bounds testing approach introduced by Pesaran and Shin (1998) and further

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developed by Pesaran et al. (2001), which is specifically designed to handle variables with mixed orders of integration, provided that none of them is integrated of order two or higher.

Given that the variables in this study satisfy the basic requirements of the ARDL framework, this methodology is considered suitable for examining the existence of a long-run equilibrium relationship among the variables. The ARDL approach offers the advantage of simultaneously estimating both short-run dynamics and long-run coefficients within a unified econometric specification.

Accordingly, the standard steps of this methodology are followed in order to test for the presence of long-run cointegration among the variables. The implementation of this technique proceeds through the following stages (Achiț & Mekid, 2017)**:**

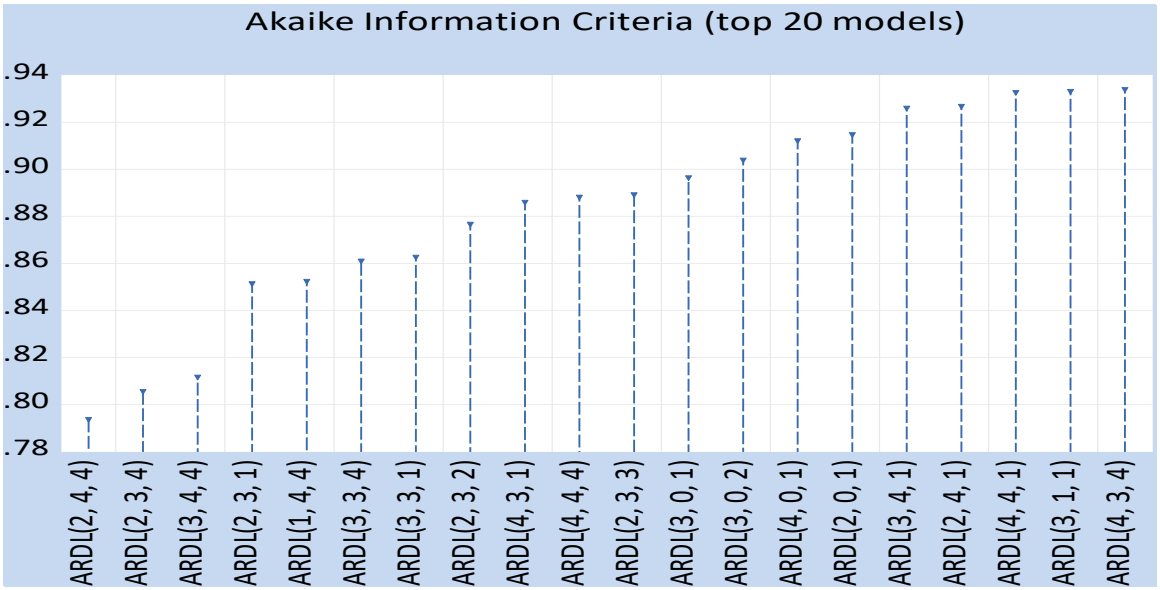
The selection of the optimal lag length for the first differences of the variables in the Unrestricted Error Correction Model (UECM) is based on minimizing the Akaike Information Criterion (AIC: 1973) and the Schwarz Criterion (SC: 1978). Accordingly, the ARDL(P, q_1, q_2, q_3) model for the variables *included in the specification is formulated according to the following relationship:*

$$\Delta y = \beta_0 + \sum_{i=1}^{P-1} \beta_{1i}\, y_{t-i} + \sum_{i=0}^{q_1-1} \beta_{2i}\, \Delta X_{1_{t-i}} + \sum_{i=0}^{q_2-1} \beta_{3i}\, X_{2_{t-i}} + \emptyset_1 y_{t-1} + \emptyset_2 X_{1_{t-1}} + \emptyset_3 X_{2_{t-1}} + \mu_t$$

Here, the optimal model is selected based on the lowest values of the two previously mentioned information criteria. This selection process is carried out after estimating the model using different lag structures in order to identify the most appropriate specification.

By employing the statistical software EViews 12, various model specifications are estimated, and the corresponding values of the selected information criteria are generated and compared. This facilitates the model selection procedure by clearly indicating the specification that minimizes the criteria values and therefore provides the best fit for the data.

Figure 2: The Optimal ARDL Model among 20 Selected Models



Source: Prepared by the researchers based on the outputs of EViews 12 software.

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It can be observed from the figure that the minimum value of the Akaike Information Criterion (AIC) corresponds to the shortest bar (since all values are positive), which is associated with the ARDL (2,4,4) model specification.

The estimated model is first obtained using the Ordinary Least Squares (OLS) method. Subsequently, the existence of a long-run (cointegrating) relationship is verified using the Wald test. After applying this test to the specified model, the following results were obtained:

Table 2: Wald Test Results for the Verification of Cointegration (Long-Run Relationship)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	4.470089	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Source: *Prepared by the researchers based on the outputs of EViews 12 software.*

By comparing the calculated test statistic with the critical (tabulated) values, it can be observed that the computed Fisher statistic (F-statistic = 4.47) exceeds the upper bound critical value at all conventional significance levels. Accordingly, this result confirms the existence of a long-run equilibrium (cointegration) relationship among the time series under study. This finding allows us to proceed with the estimation of the Error Correction Model (ECM) within the ARDL framework.

2.2.3. Estimation of Long-Run Coefficients and the Error Correction Model

After confirming the existence of a cointegration relationship among the studied time series, it becomes possible to estimate both the long-run and short-run coefficients, as well as the error correction term, as follows:

A. Estimation of Long-Run Coefficients: The results of the long-run parameter estimation can be summarized in the following table:

Table 3: Long-Run Coefficient Estimation Results

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	0.027593	0.151639	0.181967	0.0084
X2	-0.006994	0.012201	-0.573246	0.0063
C	8.121883	0.695586	11.67632	0.0000
EC = Y - (0.0276*X1 -0.0070*X2 + 8.1219)				

Source: Prepared by the researchers based on the outputs of EViews 12 software.

B. Estimation of Short-Run Coefficients and the Error Correction Model (ECM):

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Error correction models are employed to capture the adjustment process of the system towards long-run equilibrium following short-run disequilibria. In particular, they allow for the estimation of the error correction term, which reflects the speed of adjustment back to long-run equilibrium when temporary shocks or deviations occur in the short run.

In this context, the coefficient of the error correction term is of central importance, as it measures the strength and speed with which the dependent variable returns to its long-run equilibrium path after a short-term disturbance. The estimation results of this coefficient, along with the short-run dynamics of the model, are presented in the table below:

Table 4: Short-Run Coefficient Estimation Results

ARDL Error Correction Regression
Dependent Variable: D(Y)
Selected Model: ARDL(2, 4, 4)
Case 2: Restricted Constant and No Trend
Date: 03/29/26 Time: 00:08
Sample: 1995 2024
Included observations: 26

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.577952	0.277332	-2.083974	0.0575
D(X1)	-0.347030	0.173487	-2.000328	0.0668
D(X1(-1))	-0.352880	0.183864	-1.919244	0.0772
D(X1(-2))	-0.622509	0.194121	-3.206809	0.0069
D(X1(-3))	-0.226823	0.179738	-1.261965	0.2291
D(X2)	0.052182	0.011704	4.458512	0.0006
D(X2(-1))	0.028370	0.009465	2.997273	0.0103
D(X2(-2))	0.018973	0.007520	2.523136	0.0255
D(X2(-3))	0.013710	0.006409	2.139097	0.0520
CointEq(-1)*	-1.320071	0.281398	-4.691118	0.0004

Source: Prepared by the researchers based on the outputs of EViews 12 software.

It can be observed from Table (4) that the sign and magnitude of the error correction term indicate a value of -1.320071. This negative and statistically meaningful coefficient suggests that short-run disequilibria in the proposed model are automatically corrected over time, with the system converging back to its long-run equilibrium path within approximately eight months following any shock or disturbance.

2.3. Diagnostic Tests of the Estimated Model

These tests are conducted to assess the overall validity and reliability of the estimated model. They aim to verify whether the classical assumptions of econometric modeling are satisfied and whether the model is free from statistical problems that could affect its explanatory or forecasting power. In this regard, several diagnostic tests are available; the most important of which are summarized below.

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- Test for Serial Correlation of Errors

The Breusch-Godfrey test is considered one of the most appropriate procedures for detecting the presence of autocorrelation in the residuals. The results of this test are summarized in the following table:

Table 5: Results of the Breusch-Godfrey Serial Correlation Test for Residuals

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	2.284050	Prob. F(2,11)	0.1480
Obs*R-squared	7.629101	Prob. Chi-Square(2)	0.0220

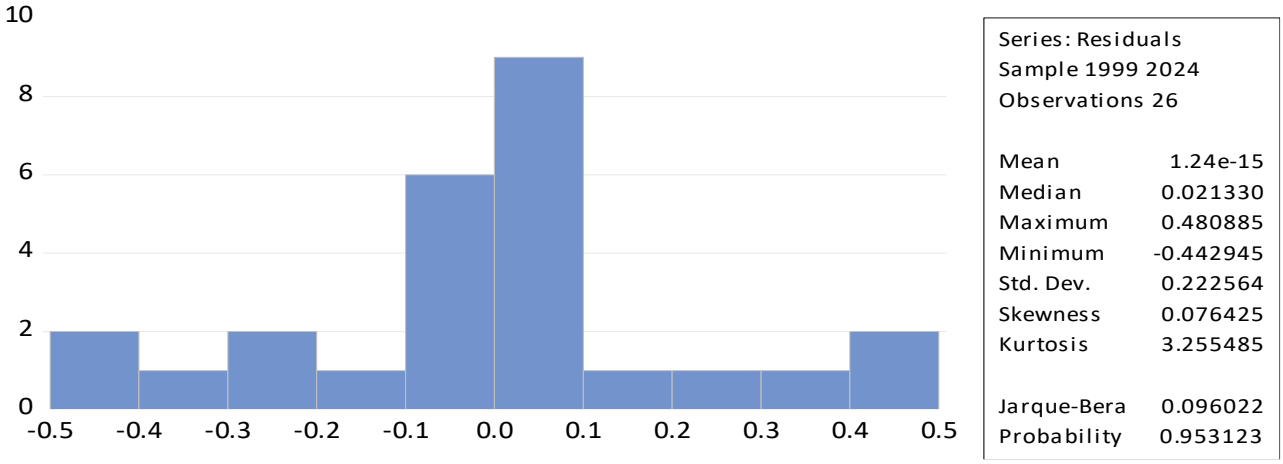
Source: Prepared by the researchers based on the outputs of EViews 12 software.

From the results presented in the table, it can be observed that the calculated Fisher statistic (F-statistic = 2.28) is lower than the critical value at the 5% significance level. Accordingly, the null hypothesis is accepted, indicating that there is no evidence of serial correlation among the residuals of the estimated model.

Normality of Residuals

To assess whether the residuals follow a normal distribution, the Jarque-Bera test is employed. Under the null hypothesis, the error terms are assumed to be normally distributed. The results of this test are illustrated in the following figure:

Figure 3: Jarque-Bera Test Results for the Residuals of the Estimated Model



Source: Prepared by the researchers based on the outputs of EViews 12 software.

It can be observed from the figure that the histogram of the residuals exhibits a distribution that closely resembles the bell-shaped curve of the normal distribution. In addition, the probability value of the Jarque-Bera test (0.95) is greater than the 5% significance level. Therefore, the null hypothesis of normality cannot be rejected, confirming that the residuals are normally distributed.

-Test for Heteroskedasticity of the Error Term

To verify the assumption of homoscedasticity (constant variance of the error terms), the Breusch-Pagan-Godfrey test is employed, as presented in Table (6).

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Table 6: Results of the Breusch-Pagan-Godfrey Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.040340	Prob. F(12,13)	0.4697
Obs*R-squared	12.73682	Prob. Chi-Square(12)	0.3885
Scaled explained SS	3.590963	Prob. Chi-Square(12)	0.9897

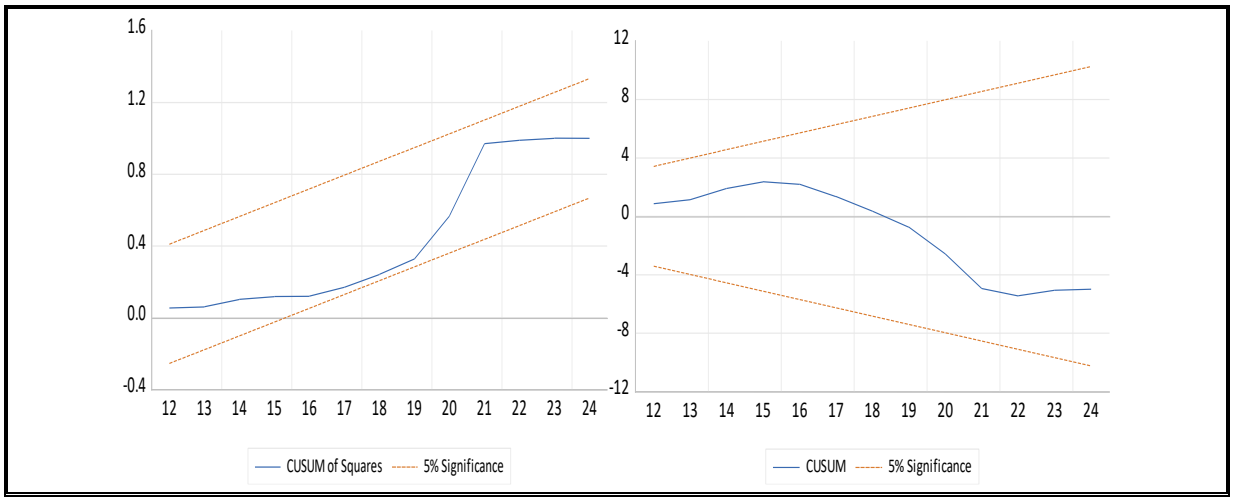
Source: Prepared by the researchers based on the outputs of EViews 12 software.

Since the computed Fisher statistic is lower than the critical value at the 5% significance level, the null hypothesis is accepted. This indicates that the error term variance is constant, confirming the homoscedasticity assumption for the estimated model.

2.4. Structural Stability Test of the Estimated ARDL Model

This test is used to ensure that the dataset does not exhibit any structural changes over time. It is conducted using two complementary procedures: the Cumulative Sum of Recursive Residuals (CUSUM) test and the Cumulative Sum of Squares of Recursive Residuals (CUSUM of Squares) test.

After performing these tests, Figure (4) shows that the estimated coefficients of the ARDL model remain structurally stable throughout the study period. This confirms the stability of the relationship between the study variables and the consistency of the model in both the short-run and long-run error correction specifications. Moreover, the test statistics for both procedures remain within the critical bounds at the 5% significance level, further validating the robustness and reliability of the model.



Source: Prepared by the researchers based on the outputs of EViews 12 software.

3. Hypothesis Testing and Interpretation of Results

Based on the results presented in Table (3), the estimated regression equation can be expressed as follows:

$$y = 8.121883 + 0.0027593x_1 - 0.006994x_2$$

-The results of the regression model estimation confirm the validity of the study's first hypothesis, which posits a positive and statistically significant relationship between digital

transformation and the expansion of insurance services. The estimated coefficient indicates that a one-unit increase in the digital transformation indicator (measured by the rate of internet usage) leads to an approximate 0.0027593 increase in the growth rate of insurance premiums. This increase reflects a rise in the overall volume of collected premiums.

-This outcome can primarily be attributed to the expansion of insurance services provided by insurance companies, both in terms of product diversification and improved accessibility through digital channels. Such developments have contributed to attracting a larger customer base and increasing demand for insurance services. Moreover, this result can be explained by the ability of digital technologies to enhance operational efficiency and reduce transaction costs, while simultaneously facilitating the broader dissemination of insurance services. Ultimately, these factors contribute to the growth of premiums and the strengthening of the insurance sector's activity.

-In addition, the regression results also support the validity of the second hypothesis. They indicate that a one-unit decrease in inflation levels leads to an increase of approximately 0.006994 units in the ability of insurance companies to expand and provide their services to the economy. This relationship can be explained by the fact that lower inflation contributes to macroeconomic and financial stability, which in turn enhances individuals' purchasing power and strengthens their confidence in engaging with insurance products.

Furthermore, a stable inflation environment enables insurance companies to plan more efficiently and offer products with more stable pricing structures. This stability positively affects the expansion of their activities and the broader dissemination of insurance services across the economy.

4. Conclusion

Through the analysis of the relationship between digital transformation and the enhancement of insurance service distribution in Algeria over the period 1995–2024, both from a theoretical and empirical perspective, the study has reached a set of key findings.

-First, digital transformation—particularly through the increased use of the Internet—represents a fundamental and supporting factor in strengthening and expanding the distribution channels of insurance services in Algeria. It plays a central role in improving accessibility, efficiency, and outreach within the insurance sector, thereby contributing to its overall modernization.

-Second, Algeria's economic policies demonstrate a certain degree of effectiveness in controlling inflationary pressures, which in turn contributes to maintaining a relatively stable macroeconomic environment. Such stability is essential for supporting the development and expansion of insurance service distribution, especially when combined with the advantages offered by digital transformation tools and technologies.

Based on these findings, the study proposes several recommendations:

-The government should prioritize the development and modernization of telecommunications and digital infrastructure to ensure a conducive environment for digital transformation. This can be achieved through increased public investment in information and communication technologies (ICT). Such an approach would enable various sectors, including the insurance

industry, to fully benefit from digitalization, particularly in light of increasing competition among insurance companies and the resulting need to enhance performance and improve service quality.

-It is also recommended to draw on the experiences of leading countries that have successfully implemented digital transformation strategies within their insurance sectors, in order to benefit from best practices and adapt them to the Algerian context.

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