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The impact of financial inclusion on economic growth in Algeria: An empirical analysis

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***Abstract*---**This study examines the impact of financial inclusion on economic growth in Algeria over the period 2004 to 2018, utilizing econometric analysis with national time series data. Employing the Autoregressive Distributed Lag (ARDL) model, the research investigates the long-run and short-run dynamics between financial inclusion indicators—such as the number of borrowers, number of depositors, and ATM density—and gross domestic product (GDP) growth. The results reveal a significant long-run equilibrium relationship between financial inclusion and economic growth, with a

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positive and meaningful impact on economic growth. However, the effects of the number of borrowers and depositors are less pronounced.

***Keywords*---**Financial Inclusion, Borrowers, Depositors, ATM density, Economic Growth.
JEL Classification Codes: G21, O47

Introduction

In recent years, policymakers and researchers have increasingly prioritized financial inclusion due to its critical role in enhancing savings, investment, poverty reduction, and inclusive economic growth. Expanding access to financial services—particularly in developing economies—is widely regarded as a fundamental driver of economic activity, resource redistribution, and overall societal welfare. Financial inclusion facilitates the integration of economically marginalized groups into the formal financial system, empowering them to obtain credit, finance projects, and access opportunities for savings and investment, thereby contributing to increased productivity and financial and social stability.

Despite broad global consensus on the importance of financial inclusion for development and growth, the precise nature and magnitude of its impact on economic growth remain subjects of academic debate. This debate is especially salient in the context of rapid technological advancements and persistent structural disparities across regions and social strata. In Algeria, recent empirical evidence indicates that the level of financial inclusion remains below the regional average, attributable to limited financial infrastructure, low financial literacy, and the predominance of financial services in major urban centers. This reality constrains Algeria's capacity to achieve inclusive and sustainable economic growth and limits the integration of households and enterprises into the formal economy and their ability to leverage finance and development mechanisms.

The present study undertakes an in-depth investigation of the impact of financial inclusion on Algeria's economic growth, employing econometric analysis of national time series data. Explicit research questions and testable hypotheses are formulated to facilitate a deeper understanding of the relationship between financial inclusion and the dynamics of the Algerian economy, as well as the challenges and opportunities inherent in this context.

Research Questions:

- What is the long-run relationship between financial inclusion and economic growth in Algeria?
- How do proxies of financial inclusion (number of borrowers, number of depositors, and number of ATMs) affect Algeria's economic growth in the short and long run?
- What are the policy implications of enhancing financial inclusion for fostering sustainable economic growth in Algeria?

Hypotheses:

- There is a significant long-run relationship between financial inclusion and economic growth in Algeria.
- Expansion in banking infrastructure (as measured by the number of ATMs) has a positive long-term impact on economic growth.
- Increases in the number of borrowers and depositors have significant, positive effects on economic growth, though the magnitude and direction may differ between short and long run.
- Structural constraints (such as limited financial literacy and concentrated banking infrastructure) moderate the magnitude of the effect of financial inclusion on growth outcomes in Algeria.

This study contributes to the existing literature in three important ways. First, it provides country-specific empirical evidence on the financial inclusion–economic growth nexus in Algeria, a context that remains underexplored in the empirical literature, particularly within the MENA region. Second, by decomposing financial inclusion into borrowers, depositors, and banking infrastructure (ATMs), the study identifies the specific channels through which financial inclusion affects economic growth. Third, the application of the ARDL bounds testing approach allows for a simultaneous examination of short-run and long-run dynamics, offering nuanced insights into the adjustment process of the Algerian economy toward long-run equilibrium.

Theoretical Framework

The relationship between financial inclusion and economic growth has garnered increasing scholarly interest, especially in developing and emerging economies. Theoretical foundations trace back to classical and modern economic frameworks that underscore the financial system's critical role in fostering innovation, investment, and overall economic transformation. From a Schumpeterian perspective, financial institutions act as catalysts for productive entrepreneurship by enabling access to credit and mobilizing savings, thereby promoting capital accumulation and economic dynamism . Complementing this, endogenous growth theories emphasize that an efficient and inclusive financial system optimizes resource allocation, alleviates information asymmetries, and stimulates human capital development, all essential for sustained growth (Galor and Zeira, 1993; Greenwood and Jovanovic, 1990). Consequently, financial inclusion transcends a mere developmental goal to become a vital mechanism supporting long-term economic growth and macroeconomic stability.

Financial inclusion broadly refers to the availability and effective utilization of formal financial services—such as savings, credit, insurance, and payment mechanisms—across all population segments, with a particular focus on underserved groups (Sahay et al., 2015). Recent advancements in digital financial services have substantially reshaped this landscape by providing scalable, low-cost, and accessible solutions that extend beyond the limitations of traditional banking infrastructures. Mobile banking, e-wallets, and digital payment platforms have been particularly transformative in regions with low banking penetration, driving financial participation(Manyika et al., 2016)

The finance-growth nexus posits that the development of financial systems enhances the mobilization and allocation of capital, resulting in productivity gains and increased output (Siddiki and Bala-Keffi, 2024). Building on this, inclusive financial systems are viewed as essential for enabling access to credit, savings, and other financial services for underserved populations, thus reducing liquidity constraints and supporting investment .Theories such as the Diffusion Theory of Innovation further suggest that digital technologies can lower costs and expand reach, making financial products more accessible and effective as tools for social and economic development (Basnayake et al., 2024)

However, empirical evidence has demonstrated that the positive effects of financial inclusion are contingent upon supporting factors such as institutional quality, regulatory frameworks, and financial literacy. System theory and institutional economics contend that weak governance or regulatory deficiencies may undermine the stability-generating effects of financial inclusion, or even amplify financial sector risks (Basnayake et al., 2025) .

Review of Empirical Literature

Recent empirical studies present mixed but generally positive evidence regarding the impact of financial inclusion on economic growth:

- Siddiki (2024) revisited the relationship between financial inclusion and economic growth, with a focus on various country contexts. The study used secondary data involving financial access and macroeconomic growth indicators. Employing a comprehensive literature review, it concluded that financial inclusion positively correlates with economic growth, suggesting a robust cross-country impact (Siddiki and Bala-Keffi, 2024).
- Hussain (2024) examined the causal effects of financial inclusion on economic growth, utilizing indicators such as bank account penetration, credit availability, and GDP growth rates. The methodology involved advanced econometric models including panel data regression and causality tests across developing countries. The results confirmed a significant positive causal impact of financial inclusion, especially in low-income economies (Hussain et al., 2024)
- Ifediora et al. (2022) focused on Sub-Saharan African countries to analyze the interplay between financial inclusion and economic performance. Variables including mobile money usage, bank branch density, GDP growth, and investment rates were considered. Using system GMM estimation on panel data, the study found a bidirectional positive causality between financial inclusion measures and economic growth, underscoring financial inclusion's role in sustainable (Ifediora et al., 2022).
- Ozili (2023) provided a systematic review of the methodologies and empirical findings linking financial inclusion to economic growth. The study highlighted key variables such as access to formal banking, credit penetration, and usage of digital financial services. Through meta-analysis of published data, it concluded that financial inclusion broadly fosters economic growth but noted methodological challenges that could bias results (Ozili et al., 2023).
- Biswas (2023) empirically investigated the impact of financial inclusion on economic growth by analyzing data from multiple developing countries. The study used variables such as savings rates, credit extended to SMEs, and formal financial service access, applying cross-sectional and panel regression

techniques. Findings demonstrated a statistically significant positive relationship between enhanced financial inclusion and higher economic growth rates (Biswas, 2023).

- Hasan (2024) reviewed the theoretical and empirical links between financial inclusion and growth in developing countries. Variables discussed included savings behavior, entrepreneurial activity, and GDP per capita. The methodology was qualitative synthesis with some econometric evidence. The study supported that financial inclusion promotes economic growth through increased savings accumulation and business creation (Hasan et al., 2024).
- Fundji (2024) empirically studied East, West, and Southern African nations from 2009 to 2021, analyzing the effect of financial inclusion on GDP growth. Key variables included mobile banking adoption, loan access, and GDP growth rates. Using fully modified OLS estimation, the study confirmed that improvements in financial inclusion significantly boost economic growth across these regions (Fundji, 2024)
- Pal (2025) explored the complex interaction between traditional and digital financial inclusion and economic growth in emerging economies over 1990–2022. Variables included bank account ownership, mobile money, GDP growth, and financial development indices. Panel vector autoregression was employed, revealing that both forms of financial inclusion contribute positively to economic growth, albeit with variations depending on the level of financial sector development (Pal et al., 2025)
- Chowdhury (2023) analyzed Bangladesh's financial inclusion-growth nexus using ARDL models on data from 2004 to 2021. Variables comprised banking penetration, microcredit availability, GDP growth, and informal sector size. While the results showed an insignificant direct impact of financial inclusion on growth, the study identified barriers such as low financial literacy and size of the informal economy as mitigating factors (Matin Chowdhury et al., 2023)
- Khan (2024) assessed the role of financial inclusion as a growth catalyst in Bangladesh, Malaysia, and Pakistan. Using variables like access to banking, digital payments, and GDP growth, the study applied panel data regressions. The research highlighted differential impacts across countries, with financial inclusion significantly fostering economic growth in Malaysia and Pakistan, while effects in Bangladesh were nuanced (Khan et al., 2024).
- Demirguc-Kunt and Klapper (2017) produced a comprehensive World Bank report reviewing global evidence on financial inclusion and inclusive growth. Key variables included access to credit, savings, insurance, and women's financial access. Using survey data synthesis and econometric findings, the report concluded that financial inclusion is essential to achieving inclusive economic growth and poverty reduction (Demirgüç-Kunt and Singer, 2017).

Data and Empirical Results

Data:

The variables were selected based on economic theory and prior empirical studies, ensuring relevance to the research objectives. The dataset consists of annual time series data spanning from 2004 to 2018.

Symbols	Variables	Sources
GDP per capita	Gross Domestic Product per capita	World Development Indicators
BORROWERS	Number of Borrowers	Bank of Algeria
DEPOSITORS	Number of Depositors	Bank of Algeria
ATMS	Number of ATMs	Bank of Algeria

Empirical Results:

Time series stationarity tests:

Stationarity tests are conducted using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to determine the order of integration of the variables: LOG_GDP, LOG_BORROWERS, LOG_DEPOSITORS, and LOG_ATMS.

Table 1: Unit Root Test Results (ADF, PP)

Variables	ADF			PP			Order of Integration
	Constant	Constant and Trend	None	constant	Constant and Trend	None	
LOG_GDP	-1.501699	-1.875235	3.663320	-1.486660	-1.875235	3.453307	/
	0.5033	0.6138	0.9994	0.5105	0.6138	0.9991	
D (LOG_GDP)	-2.983534	-2.781366	-1.981991	-2.983534	-2.781366	-1.904925	I (1)
	0.0629*	0.2272	0.0489*	0.0629*	0.2272	0.0569**	
LOG_BRROWERS	-0.774219	-2.567540	1.371706	-0.690978	-2.597112	1.531729	/
	0.7951	0.2970	0.9488	0.8180	0.2860	0.9612	
D (LOG_ BRROWERS)	-3.949901	-3.752948	-3.520693	-3.966312	-3.760426	-3.521831	I (1)
	0.0120**	0.0562*	0.0020***	0.0117**	0.0556**	0.0020***	
LOG_DEPOSITERS	-2.544014	-2.019247	1.678177	-2.658777	-2.012236	1.694818	/
	0.1269	0.5419	0.9702	0.1053	0.5454	0.9711	
D (LOG_ DEPOSITERS)	-3.446867	-3.669835	-3.134528	-3.446069	-3.669720	-3.123643	I (1)
	0.0287**	0.0636*	0.0045***	0.0287**	0.0636*	0.0046***	
LOG_ATMs	-3.660822	-2.303449	3.172490	-3.964853	-2.310900	2.939384	I (0)
	0.0185**	0.4060	0.9984	0.0107***	0.4026	0.9974	

Source: Outputs of (Eviews.9) Program

The results confirm a mix of I(0) and I(1) variables, with LOG_ATMS stationary at levels (I(0)) and LOG_GDP, LOG_BORROWERS, and LOG_DEPOSITORS stationary at first difference (I(1)). This satisfies the ARDL model's requirements Pesaran et al. (2001). The stationarity of LOG_ATMS at levels suggests that ATM infrastructure in Algeria is relatively stable, while the non-stationarity of other variables reflects economic fluctuations, likely driven by oil price volatility and structural rigidities in the financial sector.

Determination of the optimal ARDL model:

The ARDL model (1,0,0,1) is the most optimal among the 07 others presented, because it has the lowest AIC value (see Appendices).

ARDL Bounds Test

The ARDL bounds test assesses the presence of a long-run relationship among LOG_GDP, LOG_BORROWERS, LOG_DEPOSITORS, and LOG_ATMS. The null hypothesis of no long-run relationship is tested by comparing the F-statistic to the critical bounds (I0 and I1) from (Pesaran et al., 2001).

Table 2: ARDL Bounds Test

Test Statistic	Value	K
F-statistic	5.070192	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source: Outputs of (Eviews.9) Program

The F-statistic (5.070192) exceeds the I1 bound at the 2.5% significance level (4.89) but falls below the 1% I1 bound (5.61), indicating a long-run relationship at the 2.5% significance level. The bounds test confirms cointegration, suggesting that financial inclusion indicators and economic growth share a stable long-run equilibrium relationship. This aligns with findings in the MENA region, where financial access is a driver of growth (Emara and El Said, 2021).

Estimation of model:

- **The error correction model:**

The error correction model (ECM) estimates short-run dynamics, with the error correction term (CointEq(-1)) indicating the speed of adjustment to long-run equilibrium.

Table 3: Short-Run Dynamics

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG_BORROWERS)	-0.031970	0.057270	-0.558240	0.5920
D(LOG_DEPOSITORS)	-0.031335	0.095537	-0.327987	0.7513
D(LOG_ATMS)	-0.211845	0.109401	-1.936402	0.0888
CointEq(-1)	-0.576551	0.190959	-3.019242	0.0166
Cointeq = LOG_GDP - (-0.0555*LOG_BORROWERS -0.0543				
***LOG_DEPOSITORS + 0.3246*LOG_ATMS + 26.5244)**				

Source: Outputs of (Eviews.9) Program

The significant error correction term (-0.576551, p = 0.0166) indicates that approximately 57.7% of deviations from the long-run equilibrium are corrected annually, suggesting a moderate speed of adjustment. This is consistent with a financial sector constrained by structural barriers, such as low financial literacy and urban-centric banking infrastructure. The short-run coefficients reveal:

- **LOG_BORROWERS and LOG_DEPOSITORS**: The insignificant coefficients (-0.031970, p = 0.5920; -0.031335, p = 0.7513) suggest that changes in

the number of borrowers and depositors have limited immediate impact on economic growth. This may reflect Algeria's low savings culture and high reliance on informal credit markets

- **LOG_ATMS**: The negative contemporaneous effect (-0.211845, p = 0.0888) and positive lagged effect (0.398976, p = 0.0125) indicate that ATM expansion initially imposes costs (e.g., infrastructure investment) but contributes to growth over time by improving financial access. This dynamic aligns with (Kim et al., 2018). who emphasize the role of banking infrastructure in mobilizing resources.

The high R-squared (0.977795) and significant F-statistic confirm the model's strong explanatory power. The Durbin-Watson statistic (1.537414) is within the acceptable range (1.5–2.5), indicating no significant autocorrelation (see Appendices).

Table 3: Long-Run Coefficients

Long Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOG_BORROWERS	-0.055451	0.108412	-0.511487	0.6228
LOG_DEPOSITORS	-0.054349	0.165140	-0.329107	0.7505
LOG_ATMS	0.324570	0.113382	2.862631	0.0211
C	26.524450	2.930617	9.050808	0.0000

Source: Outputs of (Eviews.9) Program

The long-run coefficients provide insights into the equilibrium relationship:

- **LOG_ATMS**: The positive and significant coefficient (0.324570, p = 0.0211) indicates that a 1% increase in the number of ATMs is associated with a 0.325% increase in GDP in the long run. This underscores the importance of banking infrastructure in facilitating financial inclusion and economic growth, consistent with (Liu et al., 2021).
- **LOG_BORROWERS and LOG_DEPOSITORS**: The negative and insignificant coefficients (-0.055451, p = 0.6228; -0.054349, p = 0.7505) suggest that the number of borrowers and depositors does not significantly influence long-run economic growth. This may reflect Algeria's concentrated banking sector and low financial penetration, with only 48% of adults holding bank accounts by 2021.
- **Constant**: The significant constant (26.524450, p = 0.0000) represents the baseline GDP level, driven by Algeria's oil-dependent economy.

The ARDL results confirm a long-run relationship between financial inclusion and economic growth, driven primarily by ATM infrastructure (LOG_ATMS). The significant long-run coefficient for LOG_ATMS (0.324570, p = 0.0211) highlights the role of banking infrastructure in enhancing financial access, mobilizing savings, and facilitating transactions, which stimulate economic activity (Kim et al., 2018)The insignificant effects of LOG_BORROWERS and LOG_DEPOSITORS reflect structural challenges in Algeria's financial sector, including low financial literacy, limited banking penetration in rural areas, and a reliance on informal financial systems.

In the short run, the lagged effect of LOG_ATMS (0.398976, p = 0.0125) underscores the delayed but positive impact of infrastructure investment, while the insignificant effects of LOG_BORROWERS and LOG_DEPOSITORS suggest that credit and savings mobilization are not yet robust drivers of growth. The significant error correction term (-0.576551, p = 0.0166) indicates a moderate adjustment speed, suggesting that structural reforms could enhance the responsiveness of the economy to financial inclusion initiatives.

The insignificant impact of the number of borrowers and depositors on economic growth, both in the short and long run, may be attributed to several structural characteristics of the Algerian financial system. These include the dominance of informal financial practices, limited financial literacy, and the high concentration of banking services in urban areas. Moreover, credit allocation remains largely oriented toward public enterprises, while access for small and medium-sized enterprises and households is relatively constrained. As a result, increases in the number of formal borrowers or depositors do not necessarily translate into productive investment or growth-enhancing activities.

Stability Test:

- To verify the structural stability of the estimated parameters, two Stability tests were applied: the CUSUM and CUSUM of Squares tests, as proposed by Brown (1975). These tests assess whether the data exhibit structural breaks. The findings show no evidence of structural instability, with both test curves remaining within the 5% confidence intervals (see Appendices). This confirms that the model's coefficients are stable throughout the study period.
- The diagnostic tests confirm the model's validity, with no evidence of misspecification, heteroskedasticity, or serial correlation. The high R-squared (0.977795) and significant F-statistic (70.45541, p = 0.000002) further validate the model's explanatory power(see Appendices).
- The study period is constrained by the availability and consistency of official financial inclusion data in Algeria. Despite this limitation, the stability diagnostics (CUSUM and CUSUMSQ) confirm the robustness of the estimated parameters, supporting the reliability of the empirical findings.

Conclusion

Financial inclusion is a foundational pillar of modern strategies for sustainable and inclusive economic development. The theoretical and empirical literature provides strong support for its benefits, particularly when enabled by robust regulation and governance, and supported by technological innovation. Nonetheless, substantial gaps remain concerning measurement consistency, moderating institutional factors, non-linear dynamics, and the evolving impacts of digital finance. Addressing these gaps is essential for crafting nuanced policy interventions and for realizing the full potential of financial inclusion as an engine of equitable growth.

The ARDL analysis confirms a long-run relationship between financial inclusion (BORROWERS, DEPOSITORS, ATMS) and economic growth in Algeria, consistent

with the bounds test result (F-statistic = 6.033148). However, the insignificant long-run coefficients and weak error correction term suggest that financial inclusion's impact is constrained by structural factors, such as low financial literacy and limited banking infrastructure. In the short run, lagged effects of borrowers and ATMs positively influence growth, highlighting the potential of credit and infrastructure expansion. Policymakers should focus on improving financial access, particularly in rural areas, and promoting savings through education and innovative products.

Although this study focuses on traditional indicators of financial inclusion, recent developments in digital financial services suggest an important avenue for future growth. The expansion of mobile banking, electronic payments, and fintech solutions could help overcome geographical barriers, reduce transaction costs, and improve access to financial services, particularly in rural areas. Policymakers are therefore encouraged to complement investments in physical banking infrastructure with digital financial inclusion strategies to enhance the growth impact of financial inclusion in Algeria.

The findings highlight several policy implications for Algeria:

1. **Enhancing Credit Access**: The positive lagged effect of BORROWERS suggests that policies promoting credit access, particularly for small and medium enterprises (SMEs), could stimulate growth. However, the negative contemporaneous effect indicates the need to manage debt sustainability.
2. **Expanding ATM Infrastructure**: The positive lagged effect of ATMS underscores the importance of investing in banking infrastructure, particularly in rural areas, to enhance financial access.
3. **Boosting Savings Mobilization**: The insignificant effect of DEPOSITORS suggests that policies to encourage savings (e.g., financial literacy programs, attractive deposit products) are critical to strengthen the financial sector's growth impact.
4. **Addressing Structural Barriers**: The weak error correction term and insignificant long-run coefficients point to structural constraints, such as low financial literacy and regulatory barriers, which hinder financial inclusion's effectiveness.

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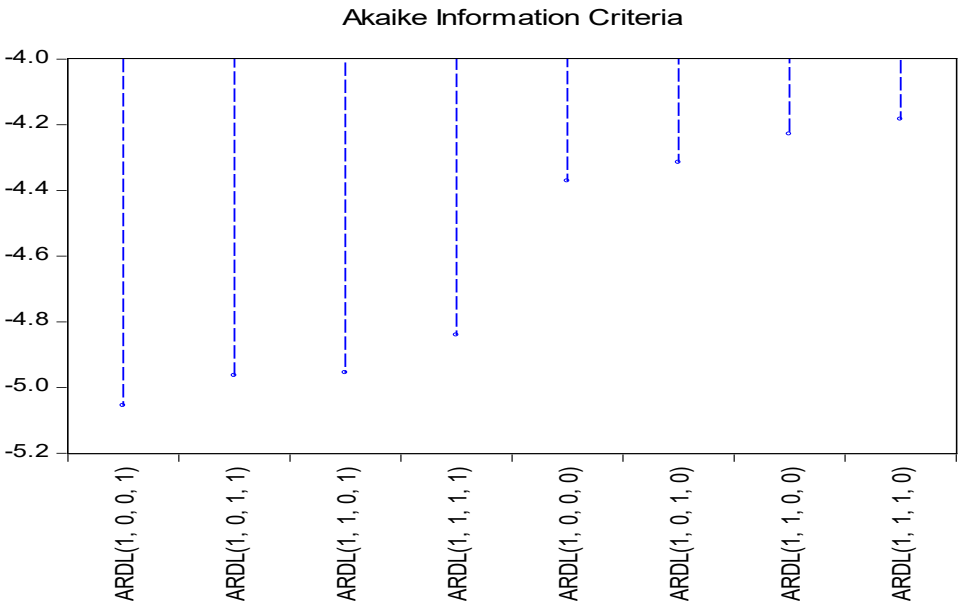
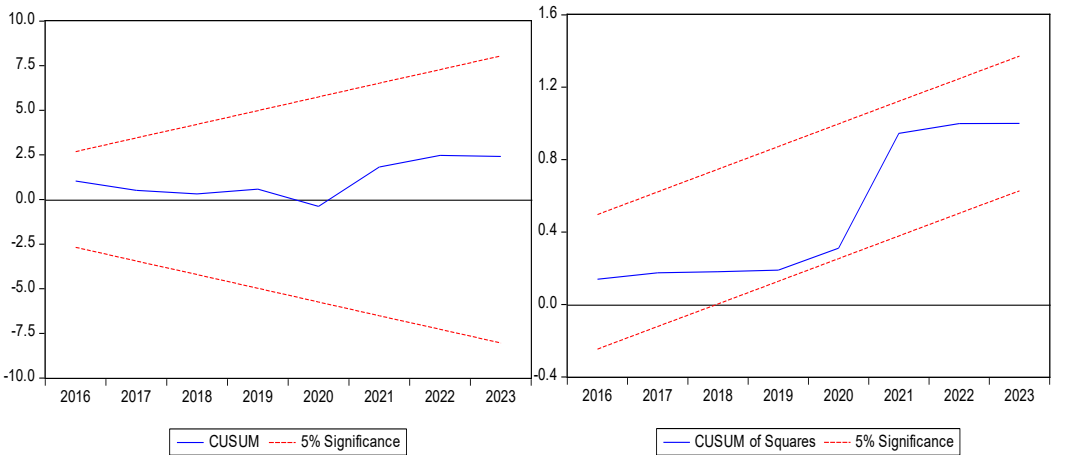


Dependent Variable: LOG_GDP
Method: ARDL
Selected Model: ARDL(1, 0, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG_GDP(-1)	0.423449	0.190959	2.217488	0.0574
LOG_BORROWERS	-0.031970	0.057270	-0.558240	0.5920
LOG_DEPOSITORS	-0.031335	0.095537	-0.327987	0.7513
LOG_ATMS	-0.211845	0.109401	-1.936402	0.0888
LOG_ATMS(-1)	0.398976	0.124392	3.207420	0.0125
C	15.29270	4.864098	3.143995	0.0137

R-squared	0.977795	Mean dependent var	27.14252
Adjusted R-squared	0.963917	S.D. dependent var	0.087650
S.E. of regression	0.016650	Akaike info criterion	-5.055336
Sum squared resid	0.002218	Schwarz criterion	-4.781454
Log likelihood	41.38735	Hannan-Quinn criter.	-5.080689
F-statistic	70.45541	Durbin-Watson stat	1.537414
Prob(F-statistic)	0.000002		



Ramsey RESET Test

	Value	df	Probability
t-statistic	1.662238	7	0.1404
F-statistic	2.763035	(1, 7)	0.1404

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.703540	Prob. F(5,8)	0.6368
Obs*R-squared	4.275834	Prob. Chi-Square(5)	0.5104

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.124128	Prob. F(1,7)	0.3242
Obs*R-squared	1.937167	Prob. Chi-Square(1)	0.1640