

Financial Liberalization under Governance Constraints: Assessing Corruption Control in Algeria

التحرير المالي في ظل قيود الحوكمة: تقييم دور مكافحة الفساد في الجزائر

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Abstract:

This study examines how corruption control affects Algeria's banking sector depth using the IMF's Financial Depth Index and an ARDL model, considering governance and key macroeconomic variables. Findings highlight a complex interaction between governance reforms and financial development.

Keywords: Financial Development; Financial Liberalization; Governance; Control of Corruption; ARDL; Algeria.

Jel Classification Codes : B52 ; C22 ; E44 ; E61 ; G34 ; I10.

ملخص:

تستكشف هذه الدراسة تأثير مكافحة الفساد على عمق القطاع المصرفي الجزائري باستخدام مؤشر العمق المالي للصندوق النقد الدولي ونموذج ARDL، مع الأخذ في الاعتبار مؤشرات الحوكمة والمتغيرات الاقتصادية الكلية الرئيسية. وتبرز النتائج التفاعل المعقد بين إصلاحات الحوكمة والتطور المالي.

كلمات مفتاحية: التطور المالي؛ تحرير القطاع المالي؛ الحوكمة؛ مكافحة الفساد؛ نموذج ARDL؛ الجزائر.
تصنيف JEL : B52; C22; E44; E61; G34 ; I10 .

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INTRODUCTION

The relationship between governance and financial development has been widely studied, with corruption control consistently identified as a key determinant of financial systems' efficiency and depth (Beck, Demirgüç-Kunt, & Levine, 2006). Corruption undermines trust in financial institutions, distorts credit allocation, and constrains financial innovation (Mauro, 1995). In resource-dependent economies such as Algeria, institutional weaknesses and reliance on hydrocarbon revenues exacerbate economic vulnerabilities (Beck, Demirgüç-Kunt, & Levine, 2007).

Sound governance frameworks enhance institutional credibility and reduce inefficiencies, thereby strengthening financial sector performance (Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1998). Yet limited research has examined how governance reforms interact with financial liberalization, particularly in Algeria's banking sector. Although the Monetary and Credit Law of 1990 sought to modernize the system, its long-term impact on banking deepening remains uncertain.

Recent reforms illustrate Algeria's gradual move toward stronger financial governance. The adoption of International Public Sector Accounting Standards (IPSAS) has improved the reliability of financial reporting, while internal auditing has reinforced corporate governance and risk management in Algerian banks (FELLAH & ABDERRAHIM, 2024). More recently, the Monetary and Banking Law of 2023 introduced measures to expand governance structures. However, persistent challenges—including corruption, limited transparency, insufficient technical capacity, and the dominance of public banks—continue to constrain progress (Nadji & Belfatmi, 2024).

This study investigates the impact of corruption control on the deepening of Algeria's banking sector, using the IMF's Financial Depth Index (FIDI) as the primary measure of performance. Employing an ARDL model, the analysis integrates governance indicators with macroeconomic variables such as the Human Development Index (HDI), inflation, and interest rates. By exploring the interplay between governance reforms and macroeconomic dynamics, the study contributes new empirical evidence on Algeria's financial development and offers insights into the opportunities and constraints of financial liberalization.

1. Introduction to Financial Development and Governance

Financial development represents a cornerstone of economic growth and stability, reflecting advancements in the quality, efficiency, and accessibility of financial services. The concept traditionally focuses on two key dimensions: financial deepening and financial inclusion. Financial deepening involves the expansion of financial markets and institutions, commonly assessed through indicators such as private sector credit and the ratio of money supply to GDP (King & Levine, 1993). In contrast, financial inclusion emphasizes equitable access to financial services, particularly for underserved groups, thereby broadening participation and reducing inequalities (Beck, Demirgüç-Kunt, & Levine, 2007).

A well-functioning banking sector plays a central role in fostering financial development. By channeling savings into investment, lowering transaction costs, and managing risks, banks optimize resource allocation and support innovation (Levine, 1997). In emerging economies,

they also provide the institutional stability needed for effective monetary policy and resilience against external shocks (Cecchetti & Schoenholtz, 2017).

Institutional governance is integral to this process. Strong governance frameworks promote transparency, enforce contracts, and combat corruption, thereby building trust in financial systems (Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1998). Weak governance, in contrast, undermines efficiency, distorts resource allocation, and erodes investor confidence (Acemoglu & Robinson, 2013). Empirical studies confirm a robust association between governance quality—as measured by the World Governance Indicators (WGI)—and financial depth and resilience (Beck, Demirgüç-Kunt, & Levine, 2006).

In Algeria, the governance–finance nexus is particularly salient. The country’s heavy reliance on hydrocarbon revenues has constrained financial sector development and delayed diversification. Overcoming this structural imbalance requires reforms that enhance transparency, reduce corruption, and strengthen institutional accountability. Within the WGI framework, control of corruption stands out as a key determinant of financial efficiency and institutional credibility (World Bank Group, Kaufmann, Kraay, & Mastruzzi, 2010), categorizes governance into six dimensions: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. Among these, control of corruption emerges as a pivotal determinant of financial efficiency and institutional trustworthiness.

Corruption, whether petty or systemic, weakens oversight, reduces transparency, and erodes accountability. Its consequences include distorted credit allocation, inefficient use of resources, and stifled financial innovation (Mauro, 1995; Beck, Demirgüç-Kunt, & Levine, 2006). For Algeria, addressing these challenges through strengthened governance structures is essential. Reducing corruption not only safeguards financial stability but also creates conditions for innovation and long-term growth. Thus, linking governance reforms with financial development offers a pathway to resilience and sustainable economic transformation.

2. Financial Liberalization and Its Relationship with Corruption

Financial liberalization has long been debated as both a driver of growth and a potential source of instability. On the one hand, it is viewed as a mechanism for expanding financial markets, improving efficiency, and promoting private sector development. On the other hand, without sound governance, liberalization can exacerbate vulnerabilities, encourage speculative behavior, and even widen the scope for corruption. Thus, the outcomes of liberalization depend not only on market forces but also on the quality of institutions and the degree of regulatory oversight.

The McKinnon–Shaw hypothesis provides a foundational framework for understanding the relationship between financial liberalization and economic development. (McKinnon, 1973) and (Shaw., 1973) argue that financial repression—characterized by artificially low interest rates and extensive government intervention—restricts both savings and investment. By contrast, financial liberalization can mobilize savings more effectively, improve credit allocation, and stimulate financial innovation, thereby fostering growth through more efficient resource distribution.

However, financial liberalization carries inherent risks, (Stiglitz, 2000) warns that while liberalization can boost efficiency, it may also introduce vulnerabilities such as market volatility

and financial crises, particularly in economies with weak institutional foundations. Similarly, (Arestis & Demetriades, 1999) underscore the importance of robust regulatory frameworks and institutional resilience, emphasizing that without these safeguards, liberalized financial markets can lead to instability, credit misallocation, and speculative bubbles.

Empirical studies highlight the dual nature of financial liberalization. For example, (Levine, Loayza, & Beck, 1999) find a positive correlation between liberalization and economic growth in nations with strong governance. Conversely, (Fry, 1994) and (Demirgüç-Kunt & Detragiache, 1998) document that poorly regulated economies face heightened risks, including banking crises and macroeconomic instability, when undergoing liberalization.

These findings indicate that the impact of financial liberalization depends heavily on governance quality. Where corruption weakens oversight and undermines institutional trust, liberalization may amplify risks rather than support development. Thus, the relationship between liberalization and corruption is critical, especially for emerging economies like Algeria, where governance reforms remain essential for achieving financial stability and long-term growth.

2.1 Corruption as an Obstacle to Financial Liberalization

Corruption represents a major impediment to the effective implementation of financial liberalization, as it undermines potential benefits and exacerbates inefficiencies. A key challenge is the misallocation of credit, whereby corrupt practices channel resources toward politically connected borrowers rather than economically viable ones (Rajan & Zingales, 2004). Such distortions reduce market efficiency, stifle innovation, and deter productive investment.

In resource-dependent economies such as Algeria, institutional weaknesses combined with heavy reliance on hydrocarbon revenues further aggravate these challenges (IMF, 2022; World Bank, 2021). Dependence on hydrocarbon exports creates avenues for elite capture of financial institutions, diverting funds away from productive sectors. Moreover, the lack of transparency in public banking operations and the dominance of state-linked entities amplify vulnerabilities (Ross, 2012; Gelb, 1988). In these contexts, weak governance tends to prioritize short-term rents over long-term diversification, thereby undermining the intended benefits of financial liberalization.

Empirical research reinforces the adverse impact of corruption on financial systems. (Mauro, 1995) demonstrates that corruption depresses investment rates and hampers growth, while (Beck, Demirgüç-Kunt, & Levine, 2006) identify it as a major barrier to financial development, particularly in economies undergoing liberalization. Corruption erodes trust in financial institutions, discourages foreign capital inflows, and limits financial deepening.

Furthermore, corruption heightens the risk of financial crises during liberalization episodes. The Asian Financial Crisis of the late 1990s illustrates how weak governance and corrupt practices amplified systemic risks (Stiglitz, 2000). Such experiences underscore the necessity of robust institutional frameworks and anti-corruption strategies for ensuring successful liberalization.

Ultimately, policymakers design financial liberalization to improve efficiency and promote growth, but governance quality largely determines its success. Governments must therefore address corruption to unlock the full potential of liberalization reforms, especially in resource-

dependent economies. By strengthening institutions, increasing transparency, and enforcing anti-corruption mechanisms, states can ensure that liberalization drives sustainable financial development rather than deepening existing vulnerabilities.

3. The Algerian Context

After independence, Algeria adopted a centralized economic model that included the nationalization of its banking sector. For decades, state-owned banks dominated the financial landscape. While they provided economic support, their operations were characterized by inefficiencies, inflexibility, and limited innovation. Rigid state directives constrained their adaptability, producing a stagnant financial environment that failed to meet the evolving needs of businesses and individuals. Over time, this model became increasingly misaligned with the rapid global evolution of financial markets, reflecting Algeria's difficulty in modernizing its financial sector and maintaining competitiveness.

The economic crisis of the early 1990s prompted Algeria to launch structural reforms under the guidance of international institutions such as the International Monetary Fund (IMF) and the World Bank. These reforms sought to liberalize the economy, attract private investment, and reduce state dominance in finance. Policymakers envisioned that privatizing state-owned banks would strengthen competition and efficiency by introducing private capital and market-oriented governance standards. Yet, socio-political resistance—rooted in concerns over sovereignty and fears of foreign dominance—delayed their implementation.

Privatization efforts also faced major setbacks. The collapse of Khalifa Bank in the 2000s severely eroded public trust in private-sector solutions and revealed weaknesses in corporate governance, internal controls, and regulatory oversight. This failure exposed systemic vulnerabilities that constrained reform momentum. Nevertheless, Algeria advanced in 2023 by partially privatizing large state-owned banks through public offerings. This initiative sought to diversify funding sources and enhance transparency by integrating banks into capital markets. However, it also entailed potential risks, including market concentration and employment disruptions in regions heavily reliant on these institutions.

Corruption continues to represent a central obstacle to financial development. Weak regulatory enforcement, limited transparency, and Algeria's poor performance on international corruption indices discourage investment and undermine predictability. Corruption distorts credit allocation, erodes trust in institutions, and exacerbates inefficiencies, particularly harming small and medium enterprises (SMEs) that struggle to compete against firms benefiting from privileged access. Efforts such as the establishment of the High Authority for Transparency and Anti-Corruption in 2020 indicate progress, but aligning enforcement mechanisms with the complex realities of contemporary corruption remains challenging (MOUKHNACHE, 2022).

Dependence on hydrocarbon revenues further compounds governance difficulties. Resource dependence fosters rent-seeking behavior and reduces incentives to diversify the economy or deepen financial markets. Structural reforms are also constrained by weak regulatory frameworks and incomplete integration with international capital markets, which limits financial resilience. The Monetary and Banking Law of 2023 introduced new governance structures, including the Market Orientation and Steering Committee, the Financial Oversight Committee, and the National Forecasting Council, aimed at broadening the scope and effectiveness of the financial sector. These reforms represent important progress, but challenges

related to technical capacity, transparency, and enforcement continue to hinder their full realization (Nadji & Belfatmi, 2024).

Strengthening governance frameworks remains crucial for Algeria's financial development. Future reforms must prioritize transparency, regulatory modernization, and robust anti-corruption measures to address persistent inefficiencies and rebuild confidence in financial institutions. A reliable governance architecture, coupled with economic diversification and deeper integration into international markets, is essential to reduce reliance on hydrocarbons and foster sustainable financial growth. In this regard, exploring how decision-making processes and institutional reforms interact offers valuable insights into building a more competitive and resilient financial sector.

4. Empirical Analysis of Corruption Control and Banking Sector Deepening in Algeria: Evidence from the ARDL Model

The relationship between corruption control and financial development has been the subject of extensive empirical inquiry, particularly in emerging markets where institutional weaknesses often impede sustainable growth. (Mauro, 1995) demonstrates that corruption erodes trust in financial institutions, distorts resource allocation, and limits credit access, while (Beck, Demirgüç-Kunt, & Levine, 2006) show that corruption reduces financial inclusion and stifles innovation in banking systems. Collectively, this evidence highlights corruption as a critical obstacle to financial deepening.

Empirical studies examining the interaction between governance and financial development commonly rely on the World Governance Indicators (WGI) to assess corruption control and on the Financial Depth Index (FIDI) to measure financial performance. For example, (Law & Habibullah, 2009) conclude that stronger governance mechanisms, including effective corruption control, significantly enhance credit allocation efficiency. Similarly, (Samargandi, Fidrmuc, & Ghosh, 2015) incorporate macroeconomic variables such as inflation and interest rates to assess their moderating effects on financial development in resource-dependent economies.

In Algeria, the issue of financial governance is particularly pressing given the country's reliance on hydrocarbons and persistent structural inefficiencies. Previous studies underscore the need for comprehensive governance reforms, especially in combating corruption, to foster banking sector deepening. Although legislative initiatives such as the Monetary and Credit Law of 1990 sought to modernize the financial system, significant gaps remain in understanding how governance improvements interact with macroeconomic dynamics to influence Algeria's financial trajectory.

This study seeks to address this gap by employing the Financial Depth Index (FIDI) from the International Monetary Fund (IMF) as a comprehensive measure of Algerian banking sector performance. To analyze both short- and long-run dynamics, it applies the Autoregressive Distributed Lag (ARDL) model, enabling a systematic examination of the relationship between corruption control and financial deepening in the Algerian context.

4.1 The ARDL Approach: Definition, Steps, and Advantages

The ARDL framework offers several advantages. It flexibly handles both stationary and non-stationary variables, works well with small sample sizes, and simultaneously analyzes short-term dynamics and long-term equilibrium. Researchers also value it for its ease of implementation and the availability of robust diagnostic tools that help validate assumptions. These strengths make ARDL particularly suitable for studies in emerging markets or in contexts with limited data.

Researchers typically follow several steps when applying ARDL. First, they test the stationarity of the variables using methods such as the Augmented Dickey-Fuller (ADF) or Phillips-Perron (PP) tests, ensuring that none of the variables are integrated of order two, since ARDL cannot accommodate such cases. Next, they select the optimal lag length by applying criteria such as the Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC), striking a balance between capturing dynamic interactions and avoiding overfitting.

After completing the preparatory steps, researchers estimate the ARDL model to identify both short- and long-term relationships among the variables. They apply the bounds test to verify the existence of a long-term equilibrium between the dependent and independent variables. To ensure the model's reliability, they conduct diagnostic checks for autocorrelation, heteroscedasticity, and normality. Finally, they extract the long-term coefficients to analyze equilibrium relationships, while they use the error correction term (ECT) to measure the speed of adjustment toward equilibrium.

The general ARDL specification takes the following form:

$$Y_t = \varphi + \theta_1 Y_{t-1} + \dots + \theta_p Y_{t-p} + \beta_0 X_t + \dots + \beta_q X_{t-q} + \varepsilon_t$$

Here, $\varepsilon_t \sim iid(0, \sigma)$ denotes the error term, and « β_0 » captures the short-term effect of X_t on Y_t . Researchers derive the long-term effect from the following equilibrium relationship:

$$Y_t = k + \varphi X_t + u$$

In this case, the long-term effect of X_t on Y_t denoted by φ , can be determined as follows:

$$\varphi = \frac{\sum \text{des coefficients de } X_t}{1 - \sum \text{des coefficients de } Y_t}$$

4.2 Path to Model Specification

This study investigates the impact of corruption control on banking sector deepening by specifying an ARDL model. The dependent variable is the Financial Depth Index (FIDI), which serves as a comprehensive measure of banking sector performance. Corruption control (WGI) is included as the main independent variable, reflecting governance quality. To account for

broader macroeconomic influences, the model also incorporates the Human Development Index (HDI) to capture human capital, inflation as an indicator of economic stability, and interest rates to reflect the effects of monetary policy. The following equation expresses the relationship between these variables:

$$FIDI_t = \alpha + \beta_1 CC_t + \beta_2 HDI_t + \beta_3 INF_t + \beta_4 IR_t$$

Before estimation, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests will assess the stationarity of the variables to confirm their order of integration. Once this is established, the optimal lag length will be selected using the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC), ensuring that the model captures dynamic interactions without overfitting.

Researchers will then estimate the ARDL model to derive both short-term and long-term coefficients. They will apply the bounds testing approach to verify whether a long-term equilibrium relationship exists between the variables. Finally, they will conduct diagnostic checks for autocorrelation, heteroscedasticity, and normality to validate the robustness and reliability of the results.

4.3 Empirical Estimation and Result Interpretations

The empirical analysis follows a structured sequence to ensure the reliability of the ARDL estimation. It begins with unit root tests to verify the integration order of the variables, followed by the identification of the optimal lag length. The study then applies the bounds testing approach to determine the existence of a cointegration relationship. After establishing this, researchers evaluate the robustness of the estimated ARDL model. Finally, they analyze the results in both the long-term and short-term dimensions to capture the full dynamics of the relationship between corruption control and banking sector deepening.

4.3.1 Unit Root Tests

This section analyzes the stationarity properties of the time series in the model to verify their level of integration. The study applies the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, both widely used to determine whether a series is stationary. A series qualifies as stationary when the test statistic exceeds, in absolute terms, the critical value at a chosen level of significance (1%, 5%, or 10%).

Table 1. Unit Root Tests variable FIDI

Model	Model 1: With Trend and Constant		Model 2: Without Trend but With Constant		Model 3: Without Trend and Without Constant	
Level of Integration	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
ADF	0.0364	0.0066	0.8127	0.0010	0.9415	0.0001
PP	0.1903	0.0001	0.8608	0.0002	0.9861	0.0001

Source: Author's calculations using EViews software.

Results indicate that, while the ADF test with trend and constant suggests borderline stationarity at levels ($p=0.0364$), the PP test under the same specification does not confirm this finding. In contrast, both tests consistently fail to reject the null of non-stationarity in the level series for the constant-only and no-constant models. Across all specifications, both ADF and PP tests strongly reject the null of non-stationarity after first differencing ($p<0.01$). Accordingly, the FIDI series is most appropriately treated as integrated of order one, $I(1)$.

Table 2. Unit Root Tests variable CC

Model	Model 1: With Trend and Constant		Model 2: Without Trend but With Constant		Model 3: Without Trend and Without Constant	
Level of Integration	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
ADF	0.6007	0.0000	0.2775	0.0000	0.5977	0.0000
PP	0.0023	0.0000	0.0004	0.0000	0.6342	0.0000

Source: Author's calculations using EViews software.

The ADF test indicates that the CC variable is non-stationary at the level in all models but becomes stationary after the first difference ($p = 0.0000$). The PP test shows partial stationarity at the level in Models 1 and 2 ($p = 0.0023$ and $p = 0.0004$, respectively) but confirms stationarity after the first difference across all models. Overall, the CC variable is $I(1)$, requiring differencing to achieve stationarity.

Table 3. Unit Root Tests variable HDI

Model	Model 1: With Trend and Constant		Model 2: Without Trend but With Constant		Model 3: Without Trend and Without Constant	
Level of Integration	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
ADF	0.6007	0.0000	0.2775	0.0000	0.5977	0.0000
PP	0.0000	0.0000	0.0000	0.0024	1.0000	0.0024

Source: Author's calculations using EViews software.

The ADF and PP unit root tests for the HDI series yield mixed results across three models. Model 1 (trend and constant) shows non-stationarity at the level with the ADF test (p-value = 0.9888) but confirms stationarity after first differencing (p-value = 0.0000). The PP test, however, indicates stationarity at the level (p-value = 0.0000) and remains significant after differencing, highlighting discrepancies between the tests. Model two (constant only) reveals stationarity at the level with both tests (ADF p-value = 0.0006; PP p-value = 0.0000), eliminating the need for differencing. Model three (no trend or constant) confirms non-stationarity at the level (p-value = 1.0000 for both tests) but shows stationarity after differencing, though ADF significance (p-value = 0.1044) is marginal.

Table 4. Unit Root Tests variable INF

Model	Model 1: With Trend and Constant		Model 2: Without Trend but With Constant		Model 3: Without Trend and Without Constant	
Level of Integration	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
ADF	0.0001	0.0083	0.0000	0.0027	0.0000	0.0001
PP	0.0000	0.0062	0.0000	0.0014	0.0000	0.0000

Source: Author's calculations using EViews software.

The ADF and Phillips-Perron (PP) tests confirm that the inflation variable is stationary at the level across all three models, without the need for differentiation.

Table 5. Unit Root Tests variable IR

Model	Model 1: With Trend and Constant		Model 2: Without Trend but With Constant		Model 3: Without Trend and Without Constant	
Level of Integration	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
ADF	0.0016	0.0005	0.0004	0.0027	0.0001	0.0000
PP	0.0000	0.0062	0.0001	0.0014	0.0001	0.0000

Source: Author's calculations using EViews software.

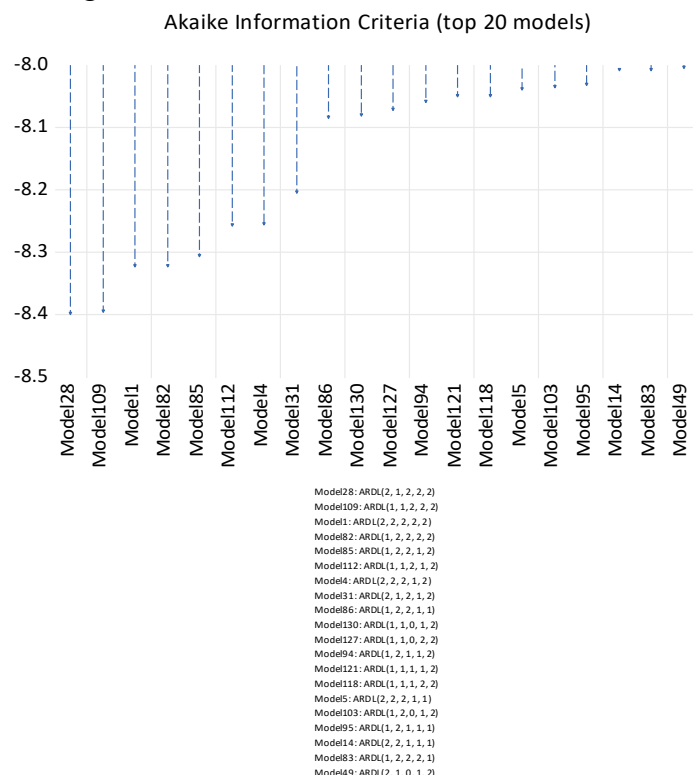
The ADF and Phillips-Perron (PP) tests confirm that the interest rate (IR) variable is stationary at the level across all three models, with highly significant p-values:

4.3.2 Identification of the optimal lag

This study develops an optimal model to explain the relationship between the dependent variable (FIDI) and the explanatory variables (CC, HDI, INF, IR), while accounting for the time dynamics of the series. Since the autoregressive distributed lag (ARDL) model is appropriate for variables integrated of order I(0) or I(1), it was selected for the analysis.

Lag selection plays a critical role in capturing dynamic effects. Using the Akaike Information Criterion (AIC), the study evaluated 163 possible models and retained the specification with the lowest AIC value to ensure accuracy while avoiding overfitting.

Fig.1. Optimal Lag Selection Based on the Akaike Information Criterion (AIC)



Source: Author's calculations using EViews software.

The optimal lag structure balances dynamic accuracy with model simplicity. Based on the AIC and Schwarz Bayesian Criterion (SBC), the study identifies the optimal lag configuration as (2,1,2,2,2), which assigns two lags to FIDI, two lags each to HDI, inflation, and interest rates, and one lag to corruption control.

4.3.3 Determining the presence of a cointegration relationship using the "Bound Test"

To assess cointegration in the ARDL model, this study applies the Bounds Test developed by (Pesaran & Smith, 2001). The null hypothesis (H_0) assumes no cointegration, implying that the coefficients of the explanatory variables equal zero. The alternative hypothesis (H_1) posits that at least one cointegration relationship exists, suggesting a long-term connection among the variables.

The Bounds Test relies on the F-statistic to determine cointegration. When the F-statistic exceeds the upper bound, cointegration is confirmed; when it falls below the lower bound, cointegration is rejected. If the statistic lies between the bounds, the result remains inconclusive.

Table 6. Bounds testing outcomes

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	8.678618	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Finite Sample: n=35				
Actual Sample Size	26	10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532
Finite Sample: n=30				
		10%	2.525	3.56
		5%	3.058	4.223
		1%	4.28	5.84

Source: Author's calculations using EViews software.

The Bounds Test yields an F-statistic of 8.678618, which surpasses the upper bound (I(1)) at all significance levels. These results lead to rejecting the null hypothesis of no cointegration and confirm the existence of a long-term equilibrium relationship among the variables in the ARDL model. Although short-term fluctuations persist, the variables converge toward stability over time. The next step involves conducting diagnostic tests to validate the robustness of the estimated model.

4.3.4 Evaluation of the Robustness of the Estimated ARDL Model

To ensure the reliability of the estimated ARDL model that examines the relationship between financial development and economic growth in Algeria, this study applies several diagnostic tests. It uses the Breusch–Godfrey LM test to detect serial correlation, the White test to identify heteroscedasticity, and the Jarque–Bera test to check residual normality. In addition, it applies the CUSUM and CUSUM of Squares tests to verify model stability. Together, these procedures provide a comprehensive assessment of the model's robustness and validity.

4.3.4.1 Breusch-Godfrey Serial Correlation (LM) Test

The Breusch–Godfrey LM test checks whether the residuals suffer from autocorrelation. We formulate the hypotheses as follows:

- H0: No serial correlation in the errors; $COV(\varepsilon_t, \varepsilon_s) = 0, \text{ pour } t \neq s$
- H1: Presence of autocorrelation; $COV(\varepsilon_t, \varepsilon_s) \neq 0$

Table 7. Results of the Residual Autocorrelation Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.289394	Prob. F(2,10)	0.7548
Obs*R-squared	1.422516	Prob. Chi-Square(2)	0.4910

Source: Author's calculations using EViews software.

The test returned a probability of 0.7548, which supports the null hypothesis and indicates no residual autocorrelation. This outcome validates the chosen lag structure of the ARDL model and confirms the reliability of the estimates.

4.3.4.2 White Heteroscedasticity Test

The null hypothesis of homoscedasticity assumes that the variance of errors remains constant across all observations. To verify this assumption, we apply White's heteroscedasticity test and state the hypotheses as follows:

- H0: Errors are homoscedastic, with constant variance $V(\epsilon_t) = \sigma^2$ for all t .
- H1: Errors exhibit heteroscedasticity, with variance dependent on t , i.e. $V(\epsilon_t) = \sigma_t^2$

Table 8. Results of the Residual Autocorrelation Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

F-statistic	0.485857	Prob. F(13,12)	0.8944
Obs*R-squared	8.965840	Prob. Chi-Square(13)	0.7755
Scaled explained SS	1.780930	Prob. Chi-Square(13)	0.9999

Source: Author's calculations using EViews software.

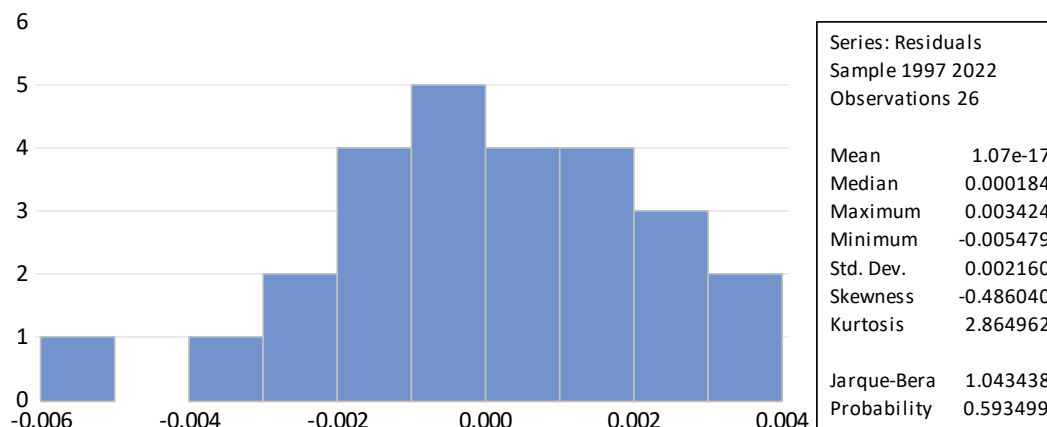
The White test produces a p-value of 0.8944, which far exceeds the 0.05 threshold. Therefore, we confirm that the model's errors remain homoscedastic.

4.3.4.3 Test for Error Normality

We use the Jarque–Bera test to assess whether the model's errors follow a normal distribution. This test evaluates the third moment (skewness) and the fourth moment (kurtosis) of the distribution. The hypotheses are:

- H0: The errors follow a normal distribution, $\epsilon_t \sim N(0, \sigma^2)$
- H1: The errors do not follow a normal distribution.

Fig.2. Residuals Histogram and Descriptive Statistics



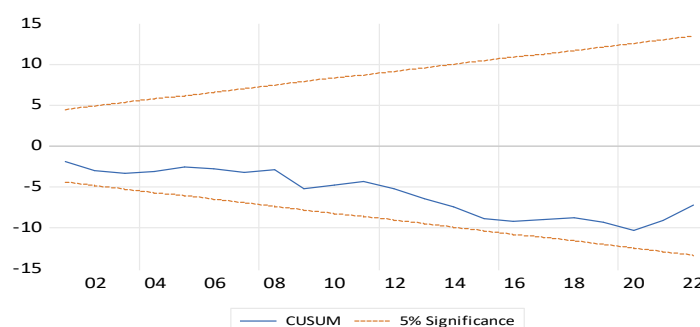
Source: Author's calculations using EViews software.

The results show that the Jarque–Bera statistic equals 0.1043483, with a p-value of 0.593499, which is far above the 5% threshold. We therefore do not reject the null hypothesis of normality. This finding confirms that the residuals follow a normal distribution, meeting one of the key validity requirements for econometric models.

4.3.4.4 CUSUM and CUSUMSQ tests

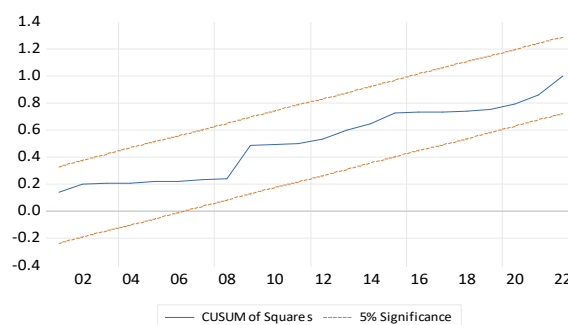
We use the CUSUM and CUSUMSQ tests to assess the stability of the model's coefficients over time. When the curve remains within the critical limits, we accept the null hypothesis of stability, which confirms that the model is stable. If the curve crosses the limits, the results point to coefficient instability.

Fig.3. CUSUM Test for Stability of Coefficients



Source: Author's calculations using EViews software.

Fig.4. CUSUMSQ Test for Stability of Coefficients



Source: Author's calculations using EViews software

The results show that both the CUSUM and CUSUMSQ curves stay within the critical bounds, which confirms that the model's coefficients remain stable at the 5% significance level.

4.4.1 Analysis of Long-Term

This subsection examines the estimated long-term coefficients from the ARDL model, highlighting how corruption control, human development, inflation, and interest rates influence Algeria's financial depth.

Table 9. Long-term findings

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CC	-0.002729	0.000616	-4.432491	0.0008
HDI	1.019949	0.208823	4.884263	0.0004
INF	-0.001796	0.001319	-1.362455	0.1981
IR	-0.000834	0.000437	-1.905720	0.0809
C	-0.583529	0.133309	-4.377257	0.0009
EC = FIDI - (-0.0027*CC + 1.0199*HDI - 0.0018*INF - 0.0008*IR - 0.5835)				

Source: Author's calculations using EViews software.

The results shed light on both expected economic dynamics and counterintuitive relationships that Algeria's institutional and structural context shapes.

Corruption control shows a negative and highly significant relationship with financial depth. Although counterintuitive, this outcome matches findings from economies struggling with governance challenges. (Beck, Demirgüç-Kunt, & Levine, 2006) argue that anti-corruption

measures, especially in the early stages of reform, often generate uncertainty and inefficiencies. In Algeria, rigid structures and the dominance of state-linked entities amplify these problems. (Mauro, 1995) also found that poorly implemented reforms hinder financial development, while (Law & Habibullah, 2009) identified positive effects of governance improvements in more institutionally robust settings. These results highlight Algeria's need to strengthen its institutional environment to unlock the benefits of governance reforms.

The Human Development Index (HDI) exerts a strong positive and highly significant impact on financial depth, confirming the crucial role of education, health, and income in driving financial sector performance. (Samargandi, Fidrmuc, & Ghosh, 2015) show that human capital development fosters financial inclusion and innovation, particularly in resource-dependent economies. (Beck, Demirgüç-Kunt, & Levine, 2007) also demonstrate that improvements in human development reduce inequality and expand participation in financial systems. These findings stress the importance of combining human capital development with financial reforms to achieve sustainable growth.

Inflation produces a weak and statistically insignificant effect on financial depth, although the negative coefficient aligns with theory. (Fry, 1994) explains that inflation often damages financial development in the short run by eroding trust in financial institutions, discouraging savings, and raising transaction costs. (Demirgüç-Kunt & Detragiache, 1998) also show that inflationary pressures destabilize financial systems. In Algeria, however, the long-term insignificance suggests that other macroeconomic or institutional factors may offset inflation's negative influence.

Interest rates show a marginally significant negative effect on financial depth, indicating that higher borrowing costs slightly constrain credit and investment. (Laeven, 2009) links high rates to restricted lending in emerging markets, while (Rajan & Zingales, 2004) argue that expensive credit in underdeveloped systems discourages financial participation. Effective management of interest rate policies remains essential for Algeria to strengthen financial depth and safeguard monetary stability.

The constant term carries a significant negative value, which reflects systemic inefficiencies and structural weaknesses in Algeria's financial sector. Public banks dominate the sector, and heavy reliance on hydrocarbon revenues limits diversification. (Ross, 2012) and (Gelb, 1988) reached similar conclusions, noting that resource-dependent economies often face weak institutional frameworks that constrain financial sector growth. These findings stress the urgency of reforms that strengthen governance, ensure macroeconomic stability, and remove structural barriers to achieve a deeper and more resilient financial system.

4.4.1 Analysis of Short-Term

The short-term dynamics of the ARDL model reveal how immediate changes in the explanatory variables influence financial depth (FIDI) and how quickly the system adjusts back to equilibrium.

Table 10. Short-term findings

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FIDI(-1))	-0.246631	0.133985	-1.840732	0.0905
D(CC)	-0.000647	9.80E-05	-6.596034	0.0000
D(HDI)	1.068192	0.188671	5.661652	0.0001
D(HDI(-1))	0.915745	0.182330	5.022472	0.0003
D(INF)	-0.001877	0.000245	-7.672161	0.0000
D(INF(-1))	-0.000444	0.000185	-2.407887	0.0330
D(IR)	0.000122	6.82E-05	1.795264	0.0978
D(IR(-1))	0.000332	8.27E-05	4.018220	0.0017
CointEq(-1)*	-0.507880	0.059133	-8.588845	0.0000
R-squared	0.848847	Mean dependent var		0.001753
Adjusted R-squared	0.777716	S.D. dependent var		0.005557
S.E. of regression	0.002620	Akaike info criterion		-8.783871
Sum squared resid	0.000117	Schwarz criterion		-8.348376
Log likelihood	123.1903	Hannan-Quinn criter.		-8.658464
Durbin-Watson stat	2.341277			

* p-value incompatible with t-Bounds distribution.

Source: Author's calculations using EViews software.

The lagged difference of FIDI carries a negative coefficient (-0.246631) and is marginally significant ($p = 0.0905$). This suggests inertia in financial depth adjustments, meaning the system responds slowly to shocks. Such sluggish adjustment is typical of resource-dependent economies, as noted by (Samargandi, Fidrmuc, & Ghosh, 2015), who linked it to structural rigidities.

Corruption control (D(CC)) exerts a strong negative short-term impact, with a coefficient of -0.000647 ($p = 0.0000$). This result echoes arguments in the literature that anti-corruption reforms can disrupt entrenched networks and create temporary inefficiencies. The evidence highlights the importance of gradual, well-sequenced reforms to reduce short-term disruptions while preserving long-term gains.

The Human Development Index (D(HDI) and D(HDI(-1))) shows consistently positive effects. The coefficients—1.068192 for the current term ($p = 0.0001$) and 0.915745 for the lagged term ($p = 0.0003$)—indicate both immediate and lasting benefits of human capital improvements. (Beck, Demirgüç-Kunt, & Levine, 2007) similarly stressed how investments in education and health foster financial inclusion and strengthen sectoral performance. The significance of the lagged effect underscores the persistent contribution of human development to financial deepening.

Inflation (D(INF) and D(INF(-1))) has significant negative short-term effects, with coefficients of -0.001877 (current, $p = 0.0000$) and -0.000444 (lagged, $p = 0.0330$). These findings are

consistent with (Fry, 1994) and (Demirgüç-Kunt & Detragiache, 1998), who argued that inflation erodes purchasing power, reduces savings, and undermines trust in financial institutions. The persistence of its impact suggests that strong inflation management is critical for financial stability.

Interest rates ($D(IR)$ and $D(IR(-1))$) show mixed outcomes. The immediate effect is marginally positive (0.000122, $p = 0.0978$), while the lagged effect is more strongly positive and highly significant (0.000332, $p = 0.0017$). (Laeven, 2009) explained this dynamic by noting that short-term changes may stimulate savings or investments, but the lasting effects of interest rate policy carry more weight in shaping financial depth.

Finally, the error correction term is highly significant and negative, confirming the model's ability to converge toward long-run equilibrium. The model adjusts at a speed of 50.8% per period, correcting over half of any short-term disequilibrium within a single period. With an R-squared of 84.88%, it strongly explains Algeria's short-term financial dynamics.

Conclusion

This study empirically investigated the impact of corruption control on the deepening of Algeria's banking sector, measured by the Financial Depth Index (FIDI). The findings provided valuable insights into both the long-term and short-term dynamics of Algeria's financial sector, offering significant implications for policy and governance reforms.

In the long-term analysis, corruption control exhibited a significant negative relationship with financial depth. This counterintuitive result suggests that the implementation of anti-corruption measures may initially disrupt entrenched financial processes, reflecting inefficiencies or resistance within Algerian banking system. Conversely, the HDI was found to have a strong and positive impact on financial depth, underscoring the critical role of human development in fostering a more inclusive and efficient financial sector. Inflation and interest rates, while showing negative coefficients, revealed limited or marginal statistical significance, aligning with the theory that macroeconomic stability is necessary but insufficient on its own to drive financial development.

The short-term dynamics revealed additional complexities. Corruption control again demonstrated a significant negative effect, likely indicating transitional challenges associated with governance reforms. The HDI emerged as a robust positive driver in the short term, reinforcing the importance of improvements in education, health, and income levels for immediate gains in financial sector performance. Inflation's short-term effects were consistently negative, reflecting its destabilizing impact on financial confidence and savings. Interest rates exhibited mixed effects, with marginally significant positive and negative coefficients, suggesting nuanced interactions within the Algerian financial system.

The study's results highlight the importance of a balanced approach to governance and financial reforms. Strengthening anti-corruption measures remains essential, but policymakers must carefully align their design and implementation with the existing institutional framework to avoid short-term disruptions. Future research could explore the interaction between governance reforms and external economic factors, such as foreign direct investment and trade liberalization, to provide a more comprehensive understanding of Algeria's financial landscape. Additionally, a closer examination of sector-specific dynamics, particularly the dominance of public banks, would offer further insights into the structural challenges facing Algerian-banking system.

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