

Interactions Between the Financial Sector and the Real Economy in Algeria : An Empirical Modeling Approach (ARDL) for the Period 2000 - 2022

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Abstract :

This study aims to examine the impact of the financial sector on economic activity in Algeria, using key determinant variables, through a cointegration approach employing an Autoregressive Distributed Lags (ARDL) model over the period 2000-2022. The findings reveal a long-term cointegration relationship between the liquidity ratio, credit to the private sector, trade openness, and economic growth. Additionally, the presence of an error correction mechanism has been detected, which adjusts economic growth following short-term shocks. Furthermore, it is worth noting that the financial sector in Algeria plays a significant role in influencing economic growth, as evidenced by the cointegration results. This suggests that the financial sector's policies and practices can have substantial implications for the overall economic performance of the country.

Keywords: The financial sector, economic activity, liquidity ratio, credit to the private sector, trade openness.

Jel Classification Codes: C50, C10, E52, D20

Introduction :

The financial sector is an economic sector that encompasses all activities related to finance. It includes, in particular, the banking sector and the insurance sector, often collectively referred to as the "Banking and Insurance Sector."²

One topic of particular interest to economists is studying the relationship between the financial sector and economic activity. The role of the financial system is to allocate capital by channeling savings towards financing needs. However, the preferences of savers for their assets differ from those of borrowers³.

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² Ahmed, A. D. (2007). Potential impact of financial reforms on savings in Botswana: an empirical analysis using a VECM approach. *The Journal of Developing Areas*.

³ Ang, J. B., & McKibbin, W. J. (2007). Financial liberalization, financial sector development and growth: evidence from Malaysia. *Journal of Development Economics*.

The theorists of endogenous growth show that capital accumulation is a source of economic growth (through productivity gains, positive externalities, and the self-sustaining dynamics of capital accumulation)⁴. Indeed, the existence of a developed financial system is a crucial condition for economic development. Thus, an efficient financial system can have a positive impact on a country's growth rates.

In other words, financial systems facilitate the exchange of goods and services. Money and financial innovations reduce transaction and information costs, promoting specialization, technological innovation, and growth⁵.

Financial development can have a positive impact on the income of the poor in two ways. Firstly, financial development stimulates economic growth, and growth is beneficial for the poor⁶.

Unlike the real sector, which includes governments, non-financial companies, individuals, etc., the financial system primarily comprises financial institutions and stock markets. In other words, the financial system is the set of financial and near-financial institutions that, through markets, match the supply and demand for financing. An efficient financial system is necessary for the functioning of the real economy⁷.

Like other countries, the Algerian financial system was heavily regulated, with administered interest rates, selective credit policies, and a monopoly of state-owned banks. However, this policy hindered the country's economic growth and led to a challenging economic situation⁸. In response, Algeria initiated financial reforms to strengthen the role of market mechanisms in credit allocation, enhance the capacity of financial institutions, improve the effectiveness of monetary policy, and promote competition among financial institutions. Additionally, budgetary spending can have a stimulating effect on the economy and boost growth. When the government spends, it can stimulate private production by providing outlets, which accelerates growth and reduces unemployment.

The overall objective of this article is to empirically study the relationship between the financial system and economic activity and to examine the empirical contribution of financial activities to economic growth in Algeria. The estimation is based on the empirical approach of the ARDL model during the period from 2000 to 2022.

In light of the above, we pose the following question: What is the contribution of the financial sector to economic activity in Algeria during the period 2000 - 2022?

To answer this question, we will divide the article into two sections. The first section reviews some theoretical and empirical studies on the link between the financial system and economic activity. The second section is devoted to the econometric study (presentation and estimation of the model and discussion of the results).

2. Literature Review on Theoretical and Empirical Studies on the Relationship Between the Financial System and Economic Activity

⁴ Smith, A. (2020). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Modern Library.

⁵ Mishkin, F. S., & Eakins, S. G. (2021). *Financial Markets and Institutions*. Pearson.

⁶ Bandiera, O., Caprio, G., Honohan, P., & Schiantarelli, F. (2000). Does financial reform raise or reduce saving? . *Review of Economics and Statistics*.

⁷ Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature*, 35(2), 688-726.

⁸ BOUYACOU, B. (2021). Structure Financière, économique Et Croissance économique : Analyse Empirique Appliqué Au Cas Algérien (2000-2019). *Al Bashaer Economic Journal*.

The correlation between the financial system and the real economy has captivated the attention of numerous researchers. This intricate and mutually influential connection plays a crucial role in the development and prosperity of nations across the globe. The financial system of a country, encompassing its banking institutions, financial markets, and various regulatory mechanisms, wields a significant influence on the economic performance of that country⁹.

When the financial system operates efficiently, it can facilitate the mobilization of financial resources, optimal capital allocation, and risk reduction, thus contributing to economic growth (Bagehot, 1873). Conversely, a failing or mismanaged financial system can hinder growth by restricting access to credit, limiting investments, and triggering financial crises (Goldsmith, 1969)¹⁰.

Furthermore, two strands of thought intersect in the literature: one emphasizes the positive effects of financial development on growth (King & Levine, 1993)¹¹, while the other suggests that this beneficial relationship cannot be generalized to all countries, sometimes even being non-existent or negative (Ram, 1999)¹². Consequently, we will examine here the main theoretical and empirical studies focusing on the relationship between these two economic phenomena.

As early as 1873, Bagehot put forward the idea that increased savings mobilization could have a substantial impact on capital accumulation and efficient resource allocation, thus stimulating technological innovation¹³.

In 1969, Goldsmith contributed to this line of thinking by conducting an in-depth empirical study linking economic growth to indicators of financial system performance, underscoring the importance of this relationship¹⁴.

McKinnon (1973) later revisited Bagehot's concepts, particularly highlighting the importance of external financing in promoting the technologies necessary for economic growth¹⁵.

The work of King and Levine (1993) deepened the understanding of the relationship between the financial system and growth, bolstering the argument for the significant impact of the financial system on economic growth¹⁶.

Greenwood and Jovanovic (1990) emphasized the crucial role of financial intermediation, highlighting its potential to reduce economic risk while stimulating investment returns, thus contributing to sustained economic growth¹⁷.

⁹ Güryay, E., Şafakli, O. V., & Tüzel, B. (2007). Financial development and economic growth: evidence from northern Cyprus. *International Research Journal of Finance and Economics*.

¹⁰ GOLDSMITH, R. (1969). *Financial Structure and Development*. National Bureau of Economic Research.

¹¹ King, R. G., & Levine, R. (1993). Finance and Growth: Schumpeter Might Be Right. *The Quarterly Journal of Economics*, 108(3), 717-737.

¹² Ram, R. (1999). Financial Liberalization and Economic Growth: A Quantitative Exploration. *Economic Letters*, 62(2), 235-241.

¹³ JOVANOVIĆ, B. G. (1990). Financial Development, Growth, and the Distribution of Income. *The Journal of Political Economy*.

¹⁴ Goldsmith, R. W. (1969). *Financial Structure and Development*. Yale University Press.

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¹⁷ Greenwood, J., & Jovanovic, B. (1990). Financial Development, Growth, and the Distribution of Income. *Journal of Political Economy*, 98(5), 1076-1107.

Rajan and Zingales (1998) closely examined financial sector indicators, such as the credit-to-GDP ratio, and confirmed a positive relationship between the financial sector and the real economy¹⁸.

Raghuram Rajan (2003) explored the impact of financial regulation on financial stability and, by extension, economic growth, emphasizing the effects of regulation on these complex dynamics.

T. Beck and R. Levine (2002) advanced that the development of the banking system and the financial market could promote economic growth, provided certain conditions, such as efficient financial system operation, reduced transaction costs, and optimal resource allocation, were met.

Simultaneously, studies such as that of G. M. Caporale, P. G. A. Howelles, A. M. Soliman (2004) highlighted the positive impact of a well-functioning financial market on economic growth.

Subsequent research by Braun and Raddatz (2007)¹⁹, Ranciere et al (2007)²⁰, Jung (1986)²¹, and Roubini and Sala-I-Martin (1992)²² provided additional support for the critical importance of financial intermediation as an estimator of economic growth and the financial sector as a major determinant of this growth.

However, it is important to note that study results may vary depending on national contexts (Ang, 2008). Indeed, Ang (2008) added an empirical dimension to this discussion by demonstrating that the development of a sophisticated financial system was linked to increased economic growth through greater private savings and investments²³.

Finally, Baltagi (2009) underscored that the banking sector, facilitated by financial liberalization, could potentially be a significant mechanism for long-term economic growth, both in developing and developed countries. These studies, despite sometimes yielding divergent results, attest to the complexity of the relationship between the financial system and economic growth, while highlighting its crucial role in economic development²⁴.

3. The Empirical Modeling

The AutoRegressive Distributed Lag (ARDL) model is a widely used econometric model for analyzing long-term relationships among time series (Enders, 2015). It is often employed to study cointegration relationships between different economic

¹⁸ Rajan, R. G., & Zingales, L. (1998). Financial Dependence and Growth. *American Economic Review*, 88(3), 559-586.

¹⁹ Braun, M., & Raddatz, C. (2007). Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinean Firms. *World Bank Policy Research Working Paper*, (4384).

²⁰ Rancière, R., Tornell, A., & Westermann, F. (2007). Decomposing the Effects of Financial Liberalization: Crises vs. Growth. *Journal of Banking & Finance*, 31(2), 333-354.

²¹ Jung, W. S. (1986). Financial Development and Economic Growth: International Evidence. *Economic Development and Cultural Change*, 34(2), 333-346.

²² Roubini, N., & Sala-I-Martin, X. (1992). Financial Repression and Economic Growth. *Journal of Development Economics*, 39(1), 5-30.

²³ Ang, J. B. (2008). What Are the Mechanisms Linking Financial Development and Economic Growth in Malaysia? *Economic Inquiry*, 46(2), 310-320.

²⁴ Baltagi, B. H. (2009). Financial Development and Economic Growth: Evidence from a Panel of 26 Emerging Market Economies. *Economics Letters*, 104(2), 66-69.

variables, which means it allows for the analysis of long-term relationships between time series that evolve together (Pesaran & Shin, 1999).

The general structure of an ARDL model is as follows:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \dots + \beta_p X_{t-p} + \delta_0 Y_{t-1} + \delta_1 Y_{t-2} + \dots + \delta_q Y_{t-q} + \varepsilon_t$$

where:

- Y_t is the dependent variable.
- X_t is the independent variable.
- $\beta_0, \beta_1, \dots, \beta_p$ are the coefficients associated with the independent variables.
- $\delta_0, \delta_1, \dots, \delta_q$ are the coefficients associated with the lags of the dependent variables.
- ε_t is the error term.

The ARDL model is used to model the short and long-term effects of independent variables on the dependent variable (Hamilton, 1994).

The β coefficients measure short-term effects, while the δ coefficients measure long-term effects, which are persistent effects that continue to influence the dependent variable over time.

The ARDL model is often employed to test the hypothesis of cointegration between time series, indicating that the series move together in the long term (Maddala & Kim, 1998). If the δ coefficients are statistically significant, it indicates the existence of a cointegration relationship.

3.1. Presentation of Macroeconomic Variables:

The central objective of this study is to undertake an empirical analysis aimed at evaluating the influence of the financial sector on economic activity over a period from 2000 to 2022.

To achieve this objective, we have adopted a methodological approach based on the ARDL model. In this process, we have included four crucial variables within our analytical model, namely the liquidity ratio, the volume of credit allocated to the private sector, the degree of trade openness, and the economic growth variable.

This study holds particular significance in the global economic context as it seeks to shed light on the complex relationships that can exist between the financial sector and economic activity. The indicators selected for our analysis have been carefully chosen due to their pivotal role in the transmission mechanism of financial effects to the real economy.

For instance, the liquidity ratio is an indicator that measures the ability of financial institutions to cope with potential liquidity crises. It can have a significant impact on financial stability and, consequently, on economic growth.

The volume of credit allocated to the private sector, on the other hand, is a central element in understanding how financing for businesses and households can influence investment, consumption, and, by extension, economic growth.

Trade openness, as a measure of the degree of trade liberalization, can play a crucial role in integrating national economies into the global economy, which can have major implications for economic growth.

Finally, the economic growth variable constitutes the primary indicator of economic activity itself. Its inclusion in the model will allow for an assessment of how the considered financial variables influence overall economic performance.

3.2. Sources of Data for the Empirical Model:

The data used in this empirical study are extracted from the Bank of Algeria and the World Bank. Moreover, the estimation period of our empirical model spans from 2000 to 2022, with data expressed annually, resulting in 23 observations.

3.3. Specification of the Empirical Model:

To estimate our model, it is necessary to specify it in the following form:

$$\text{GDP} = F(\text{RPSC}, \text{LR}, \text{Trade_openness})$$

Where:

- GDP: Gross Domestic Product.
- RPSC: Rate of Private Sector Credit.
- LR: Bank liquid reserves to bank assets ratio.
- Trade_openness: Trade openness.

3.4. Studying the Stationarity of the Time Series

During this phase of our analysis, we pay special attention to the stationarity of the time series related to the educational (or health, depending on the model) variables using the Augmented Dickey-Fuller Test (ADF). The primary objective of this step is to assess whether the series exhibit stationary characteristics. Stationarity in a series is essential to ensure the validity of many econometric analysis methods. Once the Augmented Dickey-Fuller Test is applied, we can conclude that all four examined series exhibit stationary properties. The table below summarizes the different steps of our stationarity analysis for these series.

Table 1. ADF Stationarity Test Results

UNIT ROOT TEST RESULTS TABLE (ADF)

Null Hypothesis: the variable has a unit root

		<u>At Level</u>			
		GDP	RPSC	LR	TRADE_OPENESS
With Constant	t-Statistic	-1.9946	-2.7209	-3.8318	-3.9842
	Prob.	0.2866	0.0910	0.0095	0.0082
		n0	*	***	***
With Constant & Trend	t-Statistic	-2.3032	-1.6329	-3.5807	-2.2914
	Prob.	0.4091	0.7425	0.0591	0.4146
		n0	n0	*	n0
Without Constant & Trend	t-Statistic	-1.4652	0.5404	-1.2571	1.0002
	Prob.	0.1296	0.8241	0.1848	0.9079
		n0	n0	n0	n0
		<u>At First Difference</u>			
		d(GDP)	d(RPSC)	d(LR)	d(TRADE_OPENESS)
With Constant	t-Statistic	-3.9322	-2.8405	-4.5162	-3.5164
	Prob.	0.0081	0.0714	0.0026	0.0216
		***	*	***	**

Source: Personal design using Eviews 12 software.

The conclusions drawn from the results presented in the table are as follows:

- Regarding the series "Trade_openness" and "RPSC," as well as the series "LR," they exhibit stationary properties after the first differencing.
- As for the "GDP" series, it displays stationary properties after being differenced once, as indicated by the Augmented Dickey-Fuller Test (ADF).

3.5. Pesaran Cointegration Test

As previously noted, the bounds cointegration test proposed by Pesaran et al. (2001) is an appropriate method for our time series. It is important to recall that the application of the Pesaran cointegration test involves two distinct steps:

The first step involves determining the optimal lag to apply to the series before continuing the analysis. This step is crucial to ensure the accuracy of the results.

Several criteria can be used to choose the best lag, including the AIC (Akaike Information Criterion) and the SIC (Schwarz Information Criterion). The choice of these criteria will depend on the specific characteristics of your data and your analysis objective.

The second step involves using the Fisher test to assess cointegration between the time series. This test helps determine whether these series share a significant long-term relationship, which is essential for understanding the underlying economic links. Cointegration suggests that there is a long-term equilibrium between the series, even though they may exhibit short-term variations.

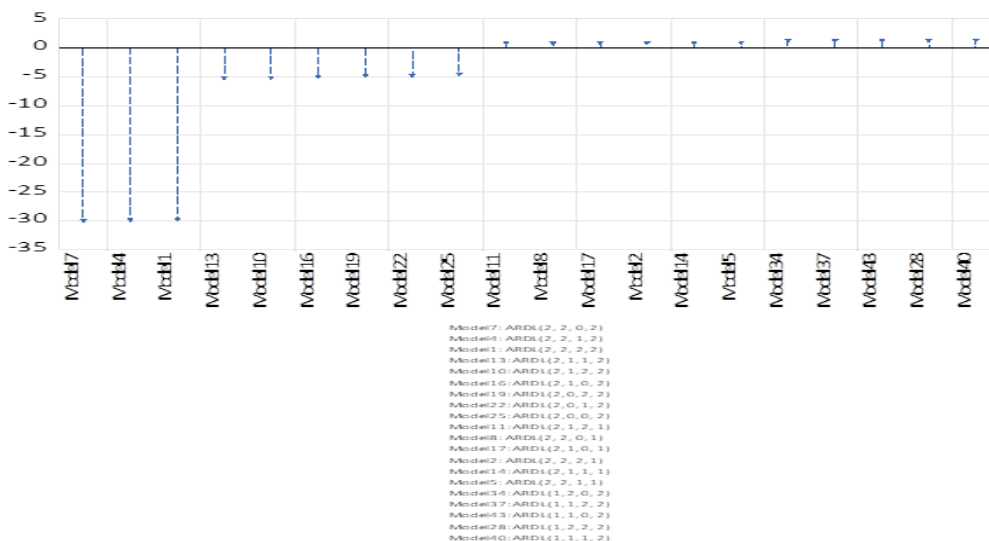
By following these steps, we can rigorously evaluate the potential presence of cointegration among the series and thus gain a better understanding of the underlying economic relationships.

3.6. Optimal Lag and ARDL Model Estimation for Education Variables

Using the Schwarz Information Criterion (SIC) to select the optimal ARDL model is a prudent approach aimed at identifying a model that provides both statistically significant results and parameter parsimony.

Below, we present the estimation results of the selected optimal ARDL model:

Table 2. SIC Values Graphical Representation
Akaike Information Criteria (top 20 models)



Source: Personal design using Eviews 12 software.

Indeed, as the results show, the ARDL model (2,2,0,2) stands out as the optimal model among the 20 other models presented because it displays the smallest Schwarz Information Criterion (SIC) value.

This selection suggests that this model strikes a balance between the quality of data fit and parsimony, using the minimal number of parameters while retaining statistical significance.

Furthermore, it is reassuring to observe, through diagnostic tests applied to the estimated ARDL model, that several important aspects of model quality are met. The absence of error autocorrelation indicates that the residuals do not exhibit serial dependence, which is essential for reliable coefficient interpretation. The absence of

heteroskedasticity suggests that the variance of errors is constant, reinforcing the robustness of the estimates.

The normality of errors is another crucial element, as it ensures that the assumptions underlying statistical tests are satisfied. Finally, the model specification is considered appropriate, meaning that the explanatory variables have been correctly specified and significantly contribute to explaining the variation in the dependent variable.

Overall, these results validate the choice of the ARDL model (2,2,0,2) as the most suitable for your analysis, providing a solid foundation for interpreting the underlying economic relationships you seek to explore.

3.7. Bounds Cointegration Test

Following the automated procedure in Eviews 12, the bounds cointegration test by Pesaran et al. (2001) requires the prior estimation of the ARDL model.

Table 3. ARDL Bounds Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic k	2.646410 3	Asymptotic: n=1000		
		10%	2.01	3.1
		5%	2.45	3.63
		2.5%	2.87	4.16
Actual Sample Size	20	1%	3.42	4.84
		Finite Sample: n=30		
		10%	-1	-1
		5%	-1	-1
		1%	-1	-1

Source: Personal design using Eviews 12 software.

The results obtained from the bounds cointegration test procedure indicate that the Fisher statistic ($F=2.64$) exceeds the upper bound for various significance levels (10% and 5%). This observation leads to the rejection of the null hypothesis H_0 , which posits the absence of a long-term relationship between the different variables. Consequently, we can confidently conclude the existence of a significant long-term relationship between the variables considered in the analysis. This discovery suggests that, even though these variables may exhibit short-term fluctuations, they nonetheless share a stable and enduring long-term relationship, which can have significant implications for understanding underlying economic dynamics.

These results strengthen the notion that the examined variables are cointegrated, meaning that they move together in the long term despite their short-term fluctuations. This conclusion can be crucial for the formulation of economic policies and strategic decision-making, as it implies that long-term adjustments may be necessary to maintain a stable equilibrium between these variables.

3.7. Long-Term Coefficients and Short-Term Dynamics

Regarding the short-term results, it is evident that the growth rate is positively dependent on its past value, and there is a favorable impact of the credit rate allocated to the private sector on economic growth.

Furthermore, the liquidity ratio and the trade openness rate for the year (t) exert a positive influence on the economic growth of the same year (t). Therefore, it appears

that the variables RPCS (Rate of Credit Allocated to the Private Sector), LR (Liquidity Ratio), and trade openness have no short-term effect on economic growth. These findings highlight the dynamic relationship between these variables. In the short term, economic growth seems to depend on its recent history, while the positive impact of the credit rate allocated to the private sector becomes evident. Additionally, the liquidity ratio and the trade openness rate for the current year contribute positively to economic growth. It is important to note that the RPCS, LR, and trade openness variables do not appear to have immediate effects on short-term economic performance.

Table 4. ARDL Cointegration Test and Long-Term Form

ARDL Error Correction Regression				
Dependent Variable: D(GDP)				
Selected Model: ARDL(2,2,0,2)				
Case 1: No Constant and No Trend				
Date: 06/23/23 Time: 17:24				
Sample: 2000 2022				
Included observations: 19				
ECM Regression				
Case 1: No Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	0.583137	0.065063	8.962613	0.0000
D(RPSC))	10.09496	0.977316	10.32927	0.0000
D(LR)	0.064648	0.033265	1.943415	0.0780
D(TRADE_OPENESS)	0.998253	0.052291	19.09036	0.0000
CointEq(-1)*	-1.072469	0.093178	-11.50992	0.0000
R-squared	0.970364	Mean dependent var		0.021734
Adjusted R-squared	0.961897	S.D. dependent var		1.533486
S.E. of regression	0.299338	Akaike info criterion		0.646445
Sum squared resid	1.254442	Schwarz criterion		0.894982
Log likelihood	-1.141227	Hannan-Quinn criter.		0.688507
Durbin-Watson stat	2.017636			
* p-value incompatible with t-Bounds distribution.				

Source: Personal design using Eviews 12 software.

Furthermore, based on the results obtained in EVIEWS, the following observations can be made:

- The coefficients are significant.
- The coefficient of CointEq(-1) (-1.07, t-stat=-11.50), has the correct (negative) sign, indicating the presence of an error correction mechanism.

The results from our econometric estimations highlight the substantial role played by financial sector variables, namely credit allocated to the private sector, the liquidity ratio, and the trade openness rate, in explaining variations in economic growth in Algeria.

Specifically, concerning credit allocated to the private sector, our findings reveal a positive and significant relationship with economic growth. In other words, an increase of one unit in credit allocated to the private sector leads to a 10.09-fold increase in GDP.

An increased volume of credit allocated to the private sector can stimulate economic growth in Algeria. It enables businesses to finance their investments and increase production, contributing to overall economic growth. However, it's important that this credit is allocated efficiently and responsibly, as excessive credit expansion can lead to imbalances and long-term financial issues.

Similarly, our analysis demonstrates a positive and significant relationship between the liquidity ratio and economic growth, indicating that an increase of one unit in the liquidity ratio results in a 0.06-fold increase in GDP.

A high liquidity ratio in the Algerian financial system can have mixed effects on economic growth. On one hand, a high liquidity ratio can be beneficial by ensuring financial stability and enabling banks to cope with potential financial crises. This can create a safer financial environment, promoting investment and economic growth. However, an excessively high liquidity ratio may also indicate underutilization of financial resources, potentially hindering growth by limiting credit availability to businesses and households.

Additionally, our results also confirm a positive and significant relationship between the trade openness rate and economic growth, where an increase of one unit in the trade openness rate leads to a 0.99-fold increase in GDP.

A high degree of trade openness can have positive effects on economic growth in Algeria. Opening up to international trade can promote the export of Algerian goods and services to other markets, stimulating production and economic growth. However, it can also make the Algerian economy more susceptible to international market fluctuations, requiring prudent trade policy management to minimize risks.

Conclusion

After conducting an in-depth analysis of theoretical and empirical literature regarding the relationship between the financial sector and the real economy, this study focused on an empirical analysis of this relationship, specifically in the context of Algeria. To achieve this, we employed ARDL modeling by examining data for the period spanning from 2000 to 2022.

The results stemming from our econometric estimations shed light on the substantial role played by financial sector variables, namely credit allocated to the private sector, the liquidity ratio, and the trade openness rate, in explaining variations in economic growth in Algeria.

Therefore, it is legitimate to conclude that the financial sector exerts a positive influence on the real economy in Algeria, thereby contributing to stimulating economic growth. However, it is important to note that this contribution remains relatively modest compared to other neighboring countries. This situation can be attributed in part to the orientation of the Algerian banking system, which focuses more on short-term investment financing and low-profitability projects.

In order to promote more robust economic growth, financial reforms and policies aimed at optimizing the role of the financial sector could be considered in the Algerian context. This could include measures to encourage long-term investment, improve the efficiency of credit allocation, and promote greater openness to international markets. Such initiatives could help strengthen the financial sector's contribution to Algeria's economic growth and position it more competitively on the global economic stage

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