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# The impact of money demand stability on the effectiveness of monetary policy in a context of financial innovation: Econometric evidence between 1990 and 2023

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## Abstract

This study investigates the stability of the money demand function in Morocco from 1990 to 2023, focusing on the impact of financial innovation and its implications for monetary policy effectiveness. The research integrates key macroeconomic and financial variables GDP, financial development, financial innovation, inflation, interbank interest rates, and financial inclusion within the monetary framework of Bank Al-Maghrib. Using the Autoregressive Distributed Lag (ARDL) and Error Correction Model (ECM) approaches via EViews, the study examines both short- and long-run dynamics. Results show that in the long run, financial innovation and interbank interest rates destabilize money demand, while GDP, financial development, financial inclusion, and inflation enhance its stability. In the short run, GDP, financial development, and inclusion remain supportive, whereas innovation, inflation, and interest rates exert downward pressure. The study concludes that while financial innovation improves system efficiency, it also disrupts traditional monetary control mechanisms. As such, monetary authorities must modernize tools to adapt to evolving financial environments. Strategic recommendations include enhancing regulatory oversight of financial innovations, promoting financial inclusion, and integrating innovation into forecasting models. Financial literacy and technological innovation are also emphasized as levers for maintaining monetary stability. Despite some data limitations and model constraints, the study provides strong theoretical, methodological, and empirical contributions. It also opens future research avenues, particularly in non-linear modeling, cross-country comparisons, and the role of emerging technologies like blockchain and cryptocurrencies. This work offers valuable insights for developing economies navigating financial digitalization and monetary policy adaptation.

**Keywords:** ARDL, Bank Al-Maghrib, ECM, Financial innovation, Monetary policy, Money demand stability.

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## 1. Introduction

Stability in the demand for money has long been a recurring issue in economic history, as fluctuations in money demand often lead to unexpected shocks and losses in economic output. These fluctuations tend to intensify during periods of major financial innovation, when technological and institutional developments disrupt traditional monetary dynamics. Historical examples, such as the 1929 stock market crash triggered by speculative credit expansion, illustrate these phenomena [1, 2] and the 2007–2008 global financial crisis, caused by complex derivative instruments like mortgage-backed securities and CDOs [3], illustrate how innovation can undermine monetary stability. More recently, the emergence of decentralized digital currencies such as Bitcoin [4] as well as the 2010–2012 sovereign debt crisis [5] have shown that financial innovation, while enhancing efficiency, can also create new risks that challenge the capacity of monetary policy to maintain stability.

In this evolving global landscape, Morocco faces its own set of challenges. The country has undergone significant financial transformations, including rising digitalization, increased financial inclusion efforts, and structural reforms within its monetary institutions. External shocks such as the COVID-19 pandemic, inflationary pressures, the war in Ukraine, and volatility in global financial markets have further tested the resilience of monetary frameworks. In this context, the central bank, Bank Al-Maghrib, is confronted with the dual need to ensure monetary stability while adapting to ongoing financial innovation. However, the impact of these innovations on money demand remains insufficiently explored in the Moroccan context, and the existing literature shows mixed evidence regarding whether financial innovation contributes to or undermines the stability of money demand.

This research aims to address the gap by examining the stability of the money demand function in Morocco from 1990 to 2023, with a particular focus on the role of financial innovation. It seeks to evaluate how such innovations influence the effectiveness of monetary policy in maintaining stable money demand and to offer policy recommendations suited to the Moroccan economic context. The central research question is therefore: to what extent does the stability or instability of the money demand function impact the effectiveness of monetary policy in an environment influenced by financial innovation?

The originality of this study lies in its contextualized and policy-oriented approach, linking financial innovation to monetary dynamics in a developing economy undergoing digital and structural transformation. By analyzing the relationship between financial development, innovation, and money demand through an econometric lens, this work contributes both theoretically and empirically to the existing literature.

To address these objectives, the study first reviews the theoretical foundations of money demand and relevant empirical findings. It then outlines the methodological framework, employing ARDL and ECM models to analyze the short- and long-run dynamics between key variables. The empirical results are then discussed in light of Morocco's financial environment. Finally, the study concludes with practical recommendations for policymakers and proposes avenues for future research.

## 2. Theoretical Framework

In this section, we will present the theoretical developments in money demand by examining different approaches, from the classical school to the monetarist school. We will utilize the theories of money demand in the context of financial innovations, as these innovations modify some of the principles underlying classical theories.

### *2.1. Theories of the Stability of Money Demand*

The demand for money refers to the quantity of money that individuals and businesses wish to hold at a given time. This demand is influenced by various economic factors such as income, interest rates, and the price level [6]. It reflects a preference for holding a certain monetary reserve. However, this definition varies across different schools of thought and economic theories—whether classical, neoclassical, or monetarist. As a result, the demand for money remains a complex function, shaped by a wide range of interacting factors such as economic growth, financial and economic liberalization, inflation, and financial innovation. This complexity has attracted the attention of economists since the early development of monetary theory.

Theoretical developments regarding the function of money have spanned centuries, shaping our current understanding. As early as the 16th century, the writings of Bodin [7] clarified the impact of precious metals on prices, while mercantilists emphasized the beneficial effects of an increase in money on industry and trade [8].

Indeed, several theories and schools of thought have emerged, such as the classical, neoclassical, Keynesian, and monetarist schools. These different theories have generated a wealth of literature on the subject. Money demand models, such as those formulated by Fisher [9], Friedman [10] and Keynes [8] have been widely used to analyze the demand for money.

According to Heymans and Heymans [11] the first school, with figures such as Adam Smith and David Ricardo, developed the quantitative theory of money, linking the demand for money to economic transactions. According to this theory, an increase in the money supply leads to a rise in prices, linked to the facilitation of trade and economic transactions. The classical approach to the demand for money, based on the quantitative theory of money, states that the demand for money is directly linked to economic activity, measured by real income, and to interest rates, which reflect the opportunity cost of holding money rather than other assets. This approach has been widely adopted in empirical analyses for developed economies, but also for some developing economies.

The Keynes [12] focuses on the preference for liquidity, where the demand for money is also influenced by economic uncertainties and the expectations of economic agents. This approach has also been used to analyze developing countries, including Morocco. It introduces the transaction, precautionary, and speculative motives that influence the demand for money.

Keynes introduced the speculative demand for money. This theory, which assumes that individuals hold only money or bonds, was criticized for being unrealistic, giving rise to the portfolio approach to money demand developed by Tobin, Baumol, and Friedman, which considers the diversity of financial assets in the holding of wealth, including money, bonds, and shares.

The model proposed by Tobin [13] incorporates financial innovation and recognizes that individuals seek to optimize their portfolios according to expected returns and risks. Indeed, Tobin argues that rational individuals maintain diversified portfolios comprising both bonds and money. He highlights the crucial issue for investors of determining the optimal proportion of money to bonds. Tobin also notes that the portfolio can include riskier assets such as equities. Tobin also incorporated the notion of investor risk aversion. Individuals diversify their portfolios by balancing safe and risky assets and prefer a lower risk for a given return.

Monetarist theory, centered on the famous theory of monetary demand developed by Friedman [14] occupies a distinctive position in the economic panorama. This school of thought has exerted considerable influence on economic debates, particularly regarding the stability of money and the management of the money supply. The monetarist approach emphasizes the influence of the money supply on prices and economic activity. Friedman [15] proposed that the demand for money is mainly determined by permanent income and the real interest rate.

In short, the demand for money remains a complex and essential concept in economics, influenced by various factors such as economic growth, inflation, financial liberalization, and monetary advances. Several schools of thought, such as classical, neoclassical, Keynesian, and monetarist, have developed theories that have helped to deepen our understanding of this phenomenon over time. Economists such as Irving Fisher, John Maynard Keynes, Milton Friedman, and James Tobin have made significant contributions, leading to the creation of more complex models that take into account not only economic transactions but also risk management, agents' expectations, and the particularities of the economic field. Theoretical research into the demand for money continues to progress, particularly in the era of financial advances.

### *2.2. Money Demand in a Context of Financial Innovation*

The demand for money refers to the amount of money that economic agents wish to hold at a specific moment. In a context where financial innovations are influencing economic practices, it is crucial to understand the effects of these innovations on the demand for money. Traditional economic theories and models regarding the demand for money have evolved to include new dimensions introduced by technological advances, such as the digitization of payments, derivative financial instruments, cryptocurrencies, and the emergence of financial technologies (FinTech).

These innovations are changing some of the principles underlying traditional theories. Innovations such as electronic wallets, mobile payment applications, and bank cards have made money more accessible and reduced the need to hold cash. This has decreased demand for cash while increasing demand for digital forms of money. Additionally, the emergence of cryptocurrencies such as Bitcoin, Ethereum, and other forms of virtual money has created an alternative demand for money, whose stability and acceptance may be less tied to traditional monetary policies. These new forms of money are often perceived as stores of value or means of speculation. Like derivatives, investment funds, and financial securities, they allow economic agents to substitute the use of money with other financial assets, which affects the demand for money for saving and speculative purposes.

In an environment of financial innovation, traditional models of money demand are often adapted to reflect new economic realities. Modern models of money demand, such as those proposed by Milton Friedman and Robert Lucas, take into account the effects of asymmetric information and rational expectations on the decisions of economic agents.

According to Friedman and Schwartz, the demand for money can be analyzed in terms of preferences for financial assets and the way in which economic agents judge the returns on these assets in relation to the liquidity of money. Rational expectations and the influence of economic policies on price and interest rate stability play a major role in the way individuals and companies adjust their demand for money.

In an environment marked by financial innovation, traditional theories and models of money demand need to be rethought to account for the new dynamics introduced by digitization, cryptocurrencies, and other financial products. This requires monetary policies to evolve to accommodate new forms of liquidity and changes in the behavior of economic agents. The challenges of integrating these innovations into traditional economic models underline the need for in-depth analysis and appropriate regulation to ensure long-term economic stability.

*2.3. Literature Reviews*

On the basis of the previous discussion, it has been shown that the theoretical literature does not provide a coherent view of the determinants of the stability of money demand in the context of financial innovations, but previous empirical studies present contradictory results concerning the constancy of money demand in such a situation. Consequently, researchers have been divided concerning the constancy of money demand, particularly when financial innovations are introduced in the context of monetary policy. Researchers such as Tobin [13], Mishkin and Mishkin [16], Jacopo and Alencar [17], Di Maggio and Scharfstein [18] and Peter et al. [19], as well as Bindseil [20] have addressed this issue.

This research examines the interaction between the demand function and financial innovation, offering unique insights into how these two elements interact. Woodford [21] discusses changes in the demand for money in an increasingly digitized environment, where the introduction of new means of payment influences the way individuals and firms demand money. It also analyzes the implications for monetary policy. Andrés and Hernando [22] explore how financial innovations influence the demand for money. They highlight changes in the liquidity and savings behavior of economic agents, notably through the rise of electronic payments and cryptocurrencies.

Similarly, Mishkin [23] looks at the conventional factors that influence monetary demand and explores the influence of financial innovation on these determinants. In contrast, Tobin focuses on the correlation between interest rates and monetary demand, highlighting its importance in the context of financial innovation. Narayanan and Narayanan [24] conclude that increased financial innovation has a direct effect on the liquidity held by economic agents. Similarly, Scharfstein and Scharfstein [25] focus on the aggregate consequences of financial innovation, offering insights into how new financial practices and products can influence the demand for money.

The article by Bordo and Bordo [26] provides a review of research on the impact of financial innovations on money demand, focusing on how these innovations can either stabilize or disrupt money demand, depending on economic structures and regulations. In addition, Chiu and Koeppl [27] specifically it examine the impact of cryptocurrencies on the demand for traditional money, providing in-depth insights into the influence of financial innovation on liquidity preferences. Peter et al. [19] explore the impact of financial technologies (FinTech) on various aspects of finance, including money demand.

Furthermore, You and Liu [28] explore how the introduction of central bank digital currencies (CBDCs) could affect money demand and economic stability. It examines the implications for monetary policy and liquidity dynamics in an environment of financial innovations. Also, Wong [29] was able to examine how digital payment systems, such as e-wallets and money transfer apps, influence money demand and monetary policies. They highlight the implications for the management of the money supply by economic authorities.

Finally, the paper by Liao and Liao [30] focuses on the impact of financial innovations in a low-interest-rate environment, where traditional asset returns are limited. The study highlights how changes in the financial landscape, including the adoption of new technologies, affect the stability of money demand.

**Table 1.**
Summary table of the main studies conducted in Morocco on the demand for money.

| Reference | Objective of the study | Methodology and variables |
|---|---|---|
| Alaoui and Benomar [31] | Analyze money demand in Morocco and test the stability of long-term relationships. | Ordinary Least Squares method.<br>M1, M2, M3, real GDP, interest rate, inflation. |
| | Examine the demand for money in Morocco using a VAR model to identify dynamic relationships. | VAR Model (Vector Autoregression).<br>M1, M2, M3, real GDP, interest rates, inflation. |
| Mouhoud and M. [32] | Study the stability of the money demand function in the Moroccan context. | Cointegration tests, time series.<br>M3, real GDP, interest rates, inflation. |
| | Analyze the factors influencing the demand for money in Morocco, with a focus on the impact of interest rates. | Cointegration model, causality tests.<br>M1, M2, real GDP, interest rates, exchange rates, inflation. |
| Bouzar and Bouzar [33] | Study the relationship between the M2 money supply and real GDP in Morocco, considering inflation and interest rates. | Econometric VAR model.<br>M2, real GDP, interest rates, and inflation rate. |
| | Test the stability of the money demand and the effects of monetary policy on monetary aggregates. | Ordinary Least Squares (OLS) method.<br>M3, real GDP, interest rates, and inflation rate. |
| Saïd [34] | Analyze the determinants of money demand and test the relationship between money supply and the economy. | Multiple linear regression.<br>M1, real GDP, interest rates, inflation, and exchange rate. |

Studies of the stability of the money demand function in Morocco primarily focus on econometric tests to determine whether the relationship between the money supply and the explanatory variables remains constant over time. Based on an analysis and a literature review, we have compiled a summary Table 1 of the main studies conducted in Morocco on money demand, covering different approaches, the variables examined, the methodologies used, and the results obtained:

A review of the literature on money demand, particularly in the Moroccan context, highlights several key elements:

money demand is influenced by factors such as real gross domestic product, the interest rate, and the inflation rate. Classic theoretical work and empirical research have shown that a stable relationship exists in the long term between these variables. However, this stability can be disrupted by external shocks, economic policies, and global economic conditions. In the Moroccan context, the study of the stability of money demand needs to take into account economic specificities and policy adjustments to ensure a valid model over the long term, especially with the emergence of new forms of payment and financial innovations.

## 3. Methodology

To counter the research problem and empirically verify our hypotheses, we have adopted a robust research methodology. First, we undertake a theoretical analysis to circumscribe the concepts of our study, with the aim of arriving at an attempt at theorization. Next, we conduct a statistical analysis of the evolution of the various variables in our work, based on reliable data made available to us by credible sources such as the World Bank, Bank Al-Maghrib, the Ministry of Finance, the High Commission for Planning, and the International Monetary Fund.

*3.1. Research Methodology and Epistemology*

This study requires the creation of statistical and econometric structures. We use statistical methods to analyze the interactions between the parameters of the econometric model. Additionally, we perform an econometric analysis on the series to assess the links between the demand function, financial innovation, and monetary policy.

To validate our econometric model, we use Eviews software with the collected data to examine whether the hypothesized relationships are corroborated by empirical evidence. Our approach is not limited to standard econometric analysis, but we also assess the stationarity of the variables using the two tests: the augmented Dickey-Fuller test and the Phillips-Perron test to determine the integration orders I(0) and I(1). Next, we select the ARDL approach for co-integration, estimating an optimal autoregressive staggered lag model, followed by significance and stability tests. We also examine the normality of residuals and their heteroscedasticity before investigating the long-term relationship with the co-integration bounds test and analyzing the associated error-correction model to understand short-term dynamics.

At the same time, our methodological approach draws its robustness from our epistemological choice, which combines post-positivism and deductive reasoning with a quantitative approach. As our main objective is to solve the problem posed, we adopt a hypothetico-deductive methodology, which consists of empirically testing the hypotheses deduced from the literature on the basis of empirical data.

By adopting a multi-criteria methodological approach and integrating the econometric model, we will conduct an in-depth exploration of the relationships between financial innovation, money demand, and the effectiveness of monetary policy in the Moroccan context from 1990 to 2023.

*3.2. Population Sample*

For this study, we opted for a quantitative approach. The selected sample concerns the Moroccan territory, and the data analyzed cover the period from 1990 to 2023. We used a set of variables based on theoretical foundations and previous empirical research.

*3.3. Data and Variables*

In the context of financial innovation, the analysis of the correlation between the stability and instability of the money demand function and the effectiveness of monetary policy makes it possible to determine the variables to be taken into account in empirical studies.

*3.3.1. Endogenous Variable to be Explained*

We define money demand, measured by the monetary aggregate $M_1$ as the endogenous variable to be explained. The preceding literature review justifies this choice on the grounds that the majority of studies have used the $M_1$ aggregate to study the money demand function. For this aggregate, we used the Bank Al Maghrib and World Bank databases.

*3.3.2. Exogenous Variables to Explain*

We identified six exogenous variables (we have excluded the exchange rate from our modeling due to the unavailability of data for all the series studied since 1990) to explain money demand, namely gross domestic product (GDP), financial development (FD), financial innovation (IVF), inflation rate (INF), interbank money rate (R), and financial inclusion (IFI).

For gross domestic product (GDP), the inflation rate (INF), and the interbank money rate (R), we used a database collected from World Bank databases and data from several reports on the Moroccan economy, drawn up by various public bodies, notably the Ministry of the Economy and Finance, the High Commission for Planning, and Bank Al-Maghrib.

Financial development (FD) is measured by the International Monetary Fund's Financial Development Index. We will use the database developed by the International Monetary Fund.

Financial innovation (FVI) is measured by the $\frac{M_2}{M_1}$. This ratio is the most widely used in the literature. In fact, the $M_2$ and $M_1$ aggregates are used from the Bank Al Maghrib and World Bank databases.

For financial inclusion, to calculate the financial inclusion index (IFI), as an indicator of the degree of financial inclusion, we will use the approach of Sarma and Pais [35] and Sarma [36] for the construction of the inclusion index.

*3.4. Development of Research Hypotheses*

H1: Determinants influence the stability of money demand in the context of financial innovation. This hypothesis suggests that factors such as GDP, inflation, financial development, and inclusion play a role in stabilizing money demand when financial innovations are present.

H2: Financial innovation influences money demand. It proposes that advancements in financial technology and products, such as digital payments, affect the demand for money by making transactions more efficient and increasing liquidity needs.

H3: Monetary policy affects long-term money demand, considering financial innovations and other factors. This hypothesis claims that long-term monetary policy decisions (interest rates, financial instruments) impact money demand, especially when influenced by financial innovations.

H4: Monetary policy affects short-term money demand, considering financial innovations and other factors. It suggests that monetary policy has immediate effects on money demand, and adjustments are necessary to stabilize the economy, especially with new financial innovations.

*3.5. Model Specification*

This study employs the ARDL (Autoregressive Distributed Lag) model and the Error Correction Model (ECM) using data from 1990 to 2023, estimated via EViews. The ARDL approach is particularly suited for analyzing both short-run and long-run dynamics among variables with mixed integration orders (I(0) and I(1)). Unlike previous studies that often relied on linear or static models, this methodology captures the evolving nature of the money demand function in the context of financial innovation. It also allows for robust inference in small sample sizes, making it more appropriate for the Moroccan case. This analytical framework provides a more comprehensive understanding of the stability of money demand and the effectiveness of monetary policy under changing financial conditions.

In this study, the money demand function is derived with reference to the money production function, which is modeled using a Cobb-Douglas specification. Accordingly, the demand for money M1M_1M1 is expressed as a function of GDP, financial development (FD), financial innovation (IVF), financial inclusion (IFI), inflation (INF), and the interest rate (R), as shown in the following equation:

Equation 1. Money demand $M_1$as a function of the variables (GDP), (FD), (IVF), (INF), (R) and (IFI)

$$M_1 = \alpha_0 GDP^{\alpha_1} FD^{\alpha_2} IVF^{\alpha_3} IFI^{\alpha_4} INF^{\alpha_5} R^{\alpha_6} \qquad (1)$$

Using the logarithmic function, we will transform this relationship into a log-linear relationship defined by the following Equation 2:

Equation 2. The logarithmic function of money demand $M_1$

$$\begin{aligned} ln\,(M_1) = ln(\alpha_0) + \alpha_1\, ln(GDP) + \alpha_2\, ln(FD) + \alpha_3\, ln(IVF) \\ +\alpha_4\, ln(IFI) + \alpha_5\, ln(INF) + \alpha_6 ln\,(R) \end{aligned} \qquad (2)$$

Consequently, we can formulate the ARDL model as follows:

Equation 3. The ARDL model formulation of the logarithmic money demand function $M_1$

$$\begin{aligned} \Delta lnM_{1,t} = \mu + \sum_{i=1}^{n} \beta_i \Delta lnM_{1,t-i} + \sum_{i=1}^{q} \varphi_i \Delta\, ln(GDP)_{t-i} + \sum_{i=1}^{p} \theta_i \Delta\, ln(FD)_{t-i} + \sum_{i=1}^{r} \gamma_i \Delta\, ln(IVF)_{t-i} \\ + \sum_{i=1}^{S} \delta_i \Delta\, ln(IFI)_{t-i} + \sum_{i=1}^{l} \pi_i \Delta\, ln(INF)_{t-i} + \sum_{i=1}^{m} \omega_i \Delta\, ln(R)_{t-i} \\ + c_0 lnM_{1,t-1} + \alpha_1\, ln(GDP)_{t-1} + \alpha_2\, ln(FD)_{t-1} + \alpha_3\, ln(IVF)_{t-1} \\ + \alpha_4\, ln(IFI)_{t-1} + \alpha_5\, ln(INF)_{t-1} + \alpha_6 ln\,(R)_{t-1} + \varepsilon_t \end{aligned} \qquad (3)$$

The error correction model is defined by the following Equation 4:

Equation 4. The error correction model

$$\begin{aligned} \Delta lnM_{1,t} = \mu + \mu + \sum_{i=1}^{n} \beta_i \Delta lnM_{1,t-i} + \sum_{i=1}^{q} \varphi_i \Delta\, ln(GDP)_{t-i} + \sum_{i=1}^{p} \theta_i \Delta\, ln(FD)_{t-i} \\ + \sum_{i=1}^{r} \gamma_i \Delta\, ln(IVF)_{t-i} + \sum_{i=1}^{S} \delta_i \Delta\, ln(IFI)_{t-i} + \sum_{i=1}^{l} \pi_i \Delta\, ln(INF)_{t-i} \\ + \sum_{i=1}^{m} \omega_i \Delta\, ln(R)_{t-i} - \rho V_{t-1} + \varepsilon_t \end{aligned} \qquad (4)$$

$$\begin{aligned} With: \; V_{t-1} = lnM_{1,t-1} + \tau_1\, ln(GDP)_{t-1} + \tau_2\, ln(FD)_{t-1} + \tau_3\, ln(IVF)_{t-1} \\ + \tau_4\, ln(IFI)_{t-1} + \tau_5\, ln(INF)_{t-1} + \tau_6 ln\,(R)_{t-1} - cte \end{aligned}$$

In this step, we will identify the optimal ARDL model (the model that produces statistically significant results with the minimum number of parameters). We refer to the Akaike Information Criterion (AIC) to select the appropriate model. Processing on Eviews has generated the graph below Figure 1 which highlights the optimal model:

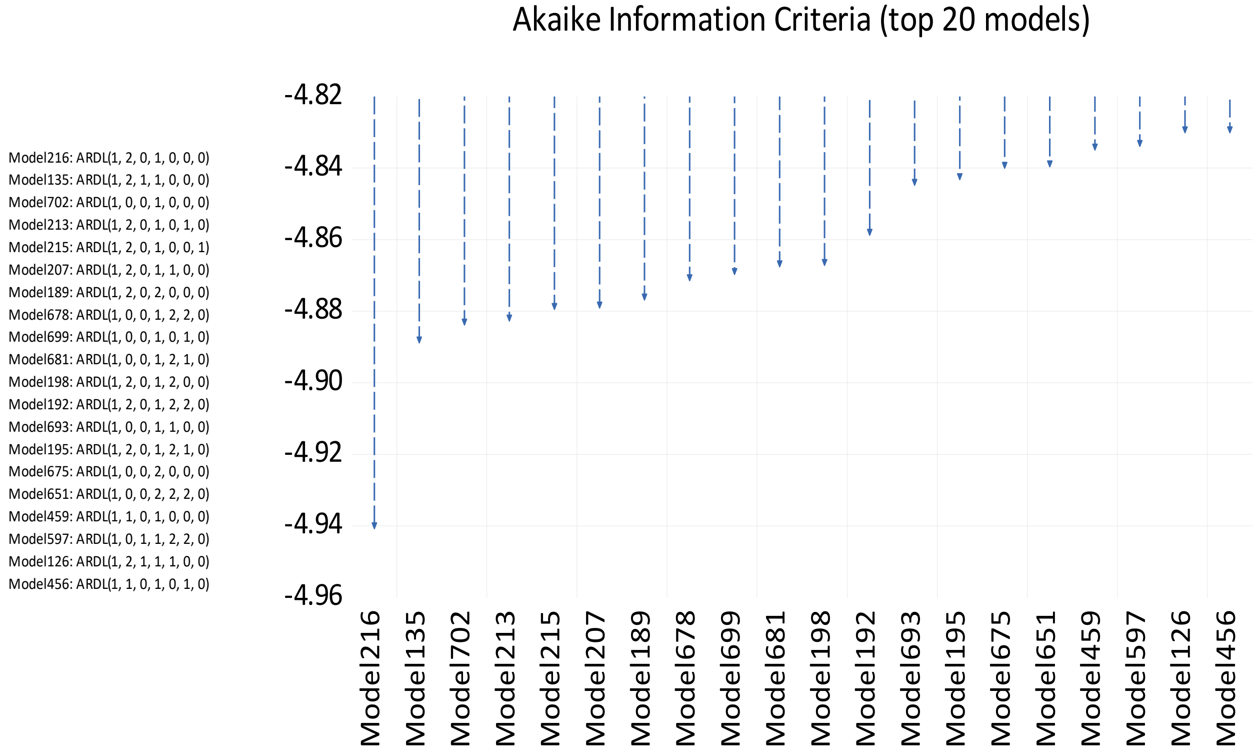


**Figure 1.**
Optimal ARDL Model.

Figure 1 shows that the optimal ARDL model is the ARDL (1,2,0,1,0,0,0), which minimizes the AIC criterion. As a result, this model will be retained for the remainder of this study, as it provides statistically significant results with the minimum number of parameters. However, the study of the model revealed its inability to accurately model the relationship between the selected variables. Consequently, we used the ARDL (3,1,1,1,1,1,1) model, even though it does not meet the minimum AIC criterion. Consequently, the estimation of the model, with ln $(M_1)$ as the dependent variable, is given by Eviews and presented in the following Table 2

**Table 2.**
ARDL parameter estimation (3,1,1,1,1,1,1).

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| $LNM1(-1)$ | 0.690879 | 0.216928 | 3.184828 | 0.0066 |
| $LNM1(-2)$ | -0.093596 | 0.223737 | -0.418329 | 0.6821 |
| $LNM1(-3)$ | 0.271314 | 0.168257 | 1.612494 | 0.1292 |
| $LNGDP$ | 0.288254 | 0.171601 | 1.679793 | 0.1152 |
| $LNGDP(-1)$ | -0.183402 | 0.182543 | -1.004707 | 0.3321 |
| $LNFD$ | 0.135675 | 0.079343 | 1.709993 | 0.1093 |
| $LNFD(-1)$ | -0.019530 | 0.077811 | -0.250986 | 0.8055 |
| $LNIVF$ | -5.162191 | 0.727751 | -7.093349 | 0.0000 |
| $LNIVF(-1)$ | 4.055456 | 1.324321 | 3.062292 | 0.0084 |
| $LNIFI$ | 5.484099 | 6.624979 | 0.827791 | 0.4217 |
| $LNIFI(-1)$ | 5.388820 | 6.497150 | 0.829413 | 0.4208 |
| $LNINF$ | -0.002658 | 0.008890 | -0.299013 | 0.7693 |
| $LNINF(-1)$ | 0.013259 | 0.009332 | 1.420857 | 0.1772 |
| $LNR$ | -0.037375 | 0.025056 | -1.491643 | 0.1580 |
| $LNR(-1)$ | -0.020045 | 0.025866 | -0.774957 | 0.4513 |
| $C$ | -0.649088 | 5.147800 | -0.126090 | 0.9015 |

The ARDL (3,1,1,1,1,1,1) model is defined by the following Equation 5:
Equation 5. The ARDL (3,1,1,1,1,1,1) model.

$$\begin{aligned} LNM1 = \; & C(1) * LNM1(-1) + C(2) * LNM1(-2) + C(3) * LNM1(-3) \\ & + C(4) * LNGDP + C(5) * LNGDP(-1) + C(6) * LNFD \\ & + C(7) * LNFD(-1) + C(8) * LNIVF + C(9) * LNIVF(-1) \\ & + C(10) * LNIFI + C(11) * LNIFI(-1) + C(12) * LNINF \\ & + C(13) * LNINF(-1) + C(14) * LNR + C(15) * LNR(-1) + C(16) \end{aligned} \tag{5}$$

The model parameters are estimated by Eviews. The estimation results are summarized in equation 6 below:

Equation 6. Results of model parameter estimation by Eviews

$$LNM1 = 0.6908 * LNM1(-1) - 0.0935 * LNM1(-2) + 0.2713 * LNM1(-3) + 0.2882 * LNPIB - 0.1834 * LNGDP(-1) + 0.1356 * LNFD - 0.0195 * LNFD(-1) - 5.1621 * LNIVF + 4.0554 * LNIVF(-1) + 5.4840 * LNIFI + 5.3888 * LNIFI(-1) - 0.0026 * LNINF + 0.0132 * LNINF(-1) - 0.0373 * LNR - 0.0200 * LNR(-1) - 0.6490 \quad (6)$$

The Cointegration equation is written:

Equation 7. The Cointegration equation of the model

$$D(LNM1) = -0.131402877457 * (LNM1(-1) - (0.79794022 * LNGDP(-1) + 0.88389075 * LNFD(-1) - 8.42245820 * LNIVF(-1) + 82.74490279 * LNIFI(-1) + 0.08067339 * LNINF(-1) - 0.43697580 * LNR(-1) - 4.93967682)) \quad (7)$$

## 4. Results and Discussions

### *4.1. Descriptive Analysis*

In this section, we provide a descriptive analysis of the endogenous and exogenous variables used. We will describe the characteristics of the time series, including the mean, standard deviation, kurtosis coefficient, and skewness coefficient of the different series. The database comprises 33 observations for each variable, covering the period from 1990 to 2023. For descriptive statistics, Table 3 below summarizes the characteristics of each series:

**Table 3.**
Descriptive analysis

| Series | Mean | Median | Standard deviation | Kurtosis | Skewness |
|---|---|---|---|---|---|
| $Ln(M_1)$ | 12.7162 | 12.861 | 0.8358 | 1.5999 | -0.1698 |
| $Ln(GDP)$ | 27.18012 | 27.2260 | 0.5202 | 1.7462 | -0.2403 |
| $Ln(FD)$ | -1.3348 | -1.2560 | 0.3030 | 2.2852 | -0.8124 |
| $Ln(IVF)$ | 0.1620 | 0.1660 | 0.0152 | 3.0234 | -0.6301 |
| $Ln(IFI)$ | -0.0026 | -0.0020 | 0.0015 | 2.0065 | -0.4733 |
| $Ln(INF)$ | 0.5878 | 0.4910 | 0.8557 | 2.1758 | 0.0591 |
| $Ln(R)$ | 1.3152 | 1.1720 | 0.5612 | 2.4515 | 0.6096 |

The mean money supply is approximately 12.72, and the standard deviation of 0.8358 indicates a moderate dispersion of the data around this value. The slight negative skewness (-0.1698) and low kurtosis suggest an almost normal but slightly flattened distribution.

The mean gross domestic product is approximately 27.18, and the relatively low standard deviation (0.5202) indicates low dispersion of the data. The distribution exhibits a slight negative skewness and a kurtosis below 3, suggesting a slightly flattened shape.

The mean of the financial development is negative (-1.3348), and the dispersion is relatively low (standard deviation of 0.3030). The marked negative skewness (-0.8124) and high kurtosis (2.2852) indicate a distribution that leans strongly to the left.

Financial innovation has a mean close to zero (0.1620), with low dispersion (standard deviation 0.0152). The high kurtosis (3.0234) and negative skewness indicate a moderately flattened distribution, slightly skewed to the left.

Financial inclusion has a mean very close to zero (-0.0026), and a low dispersion (standard deviation of 0.0015). The distribution is slightly skewed to the left, with a skewness of -0.4733, but remains close to a normal distribution.

The mean inflation rate is 0.5878, and the relatively high standard deviation (0.8557) indicates some volatility in inflation rates. The distribution is slightly skewed to the right, with a skewness of 0.0591 and a lower kurtosis, suggesting a flattened shape.

The interest rate has a mean of 1.3152, with moderate dispersion (standard deviation of 0.5612). The positive skewness (skewness of 0.6096) and kurtosis below 3 indicate that the data are slightly skewed towards higher values, with a relatively flattened distribution.

### *4.2. Correlation Matrix and Correlogram*

With regard to the correlation between the different variables, the correlation matrix is defined in Table 4 below:

**Table 4.**
The correlation matrix.

| | $Ln(M_1)$ | $Ln(GDP)$ | $Ln(FD)$ | $Ln(IVF)$ | $Ln(IFI)$ | $Ln(INF)$ | $Ln(R)$ |
|---|---|---|---|---|---|---|---|
| $Ln(M_1)$ | 1 | 0.9938 | 0.9458 | 0.2219 | -0.5196 | -0.5225 | -0.8949 |
| $Ln(GDP)$ | 0.9938 | 1 | 0.9554 | 0.3156 | -0.4981 | -0.5558 | -0.8921 |
| $Ln(FD)$ | 0.9458 | 0.9554 | 1 | 0.4126 | -0.3228 | -0.6387 | -0.908 |
| $Ln(IVF)$ | 0.2219 | 0.3156 | 0.4126 | 1 | 0.128 | -0.6115 | -0.321 |
| $Ln(IFI)$ | -0.5196 | -0.4981 | -0.3228 | 0.128 | 1 | 0.1523 | 0.3035 |
| $Ln(INF)$ | -0.5225 | -0.5558 | -0.6387 | -0.6115 | 0.1523 | 1 | 0.6202 |
| $Ln(R)$ | -0.8949 | -0.8921 | -0.908 | -0.321 | 0.3035 | 0.6202 | 1 |

The variable correlation matrix reveals several significant relationships. In particular, it highlights a strong positive correlation between money demand, gross domestic product, and financial development. This correlation suggests that when GDP and financial development increase, money demand also tends to grow significantly. Conversely, the correlation matrix also shows a strong negative correlation between money demand and the interbank interest rate. This negative correlation indicates that an increase in the interbank interest rate is generally associated with a decrease in money demand. This reflects a dynamic in which higher interest rates can discourage borrowing and thus reduce the demand for money in circulation. These observations underline the importance of economic variables such as GDP, financial development, and interest rates in determining money demand levels in the economy under study.

For the time series correlogram, we will present the correlograms at first difference. Analysis of the correlograms shows that the first autocorrelation is significant for $Ln(M_1)$, $Ln(GDP)$, $Ln(FD)$, $Ln(IVF)$, $Ln(IFI)$ et $Ln(R)$ which means they are of the order of $I(1)$. On the other hand, the variable $Ln(INF)$ does not have autocorrelation that is significant, meaning that it is integrated of order $I(0)$. These observations will be confirmed by the stationarity test presented in the next paragraph.

*4.3. Series Stationarity Tests*

To study the stationarity of the series, we will use the Augmented Dickey-Fuller test and the Phillips-Perron test. These tests involve estimating the three models:

$$[1]: X_t - X_{t-1} = D(X_t) = (\varphi_1 - 1)X_{t-1}$$
$$[2]: X_t - X_{t-1} = D(X_t) = (\varphi_1 - 1)X_{t-1} + c$$
$$[3]: X_t - X_{t-1} = D(X_t) = (\varphi_1 - 1)X_{t-1} + c + bt$$

The results of these two tests are shown in Table 5.

**Table 5.**
Series stationarity tests.

| Series | Test | Ordre of integration |
|---|---|---|
| Ln(M1) | ADF | I(1) |
| | PP | |
| Ln(GDP) | ADF | I(1) |
| | PP | |
| Ln (FD) | ADF | I(1) |
| | PP | |
| Ln( IVF) | ADF | I(1) |
| | PP | |
| Ln(IFI) | ADF | I(1) |
| | PP | |
| Ln(R) | ADF | I(1) |
| | PP | |
| Ln (INF) | ADF | I(0) |
| | PP | |

The results of the Augmented Dickey-Fuller and Phillips-Perron unit root tests indicate that most of the series analyzed, namely the M1 aggregate, GDP, financial development, financial innovation, financial inclusion, and the interbank interest rate, are non-stationary at the level. However, they attain stationarity after an initial differentiation, meaning they are integrated of order 1, i.e., I(1).

In contrast, the inflation series is stationary at the level, indicating that it is integrated of order 0 (I(0)), meaning that it does not require differentiation to be stationary. These results confirm the correlogram diagnoses and justify the use of an ARDL model, which is particularly suitable for handling mixed series (I(0) and I(1)) without the need for differentiation of level-stationary series.

*4.4. Diagnostic Tests*

Diagnostic tests include the residual white noise test, the error autocorrelation test, the heteroscedasticity test, the residual normality test, and the model stability test. These tests are designed to validate the fundamental assumptions of the regression and ensure the reliability of the results obtained, making them suitable for prediction and economic policy analysis.

*4.4.1. White Noise Test of Residuals*

The white noise test aims to verify that the residuals of the model, representing the difference between the observed values and the estimated values, form white noise. The null hypothesis $H_0$ is « no autocorrelation of residuals up to order $k$ » versus the alternative hypothesis $H_1$ of « presence of autocorrelation of residuals to order $k$ », using the Ljung-Box Q-statistic test. In terms of decision, the test uses the sum of the series' autocorrelations, which is distributed according to a chi-square distribution with m degrees of freedom. If the associated probability is less than 0.05, we reject the null hypothesis $H_0$ : « no autocorrelation » and accept the alternative hypothesis $H_1$ : « autocorrelation of residuals to order $k$ ».

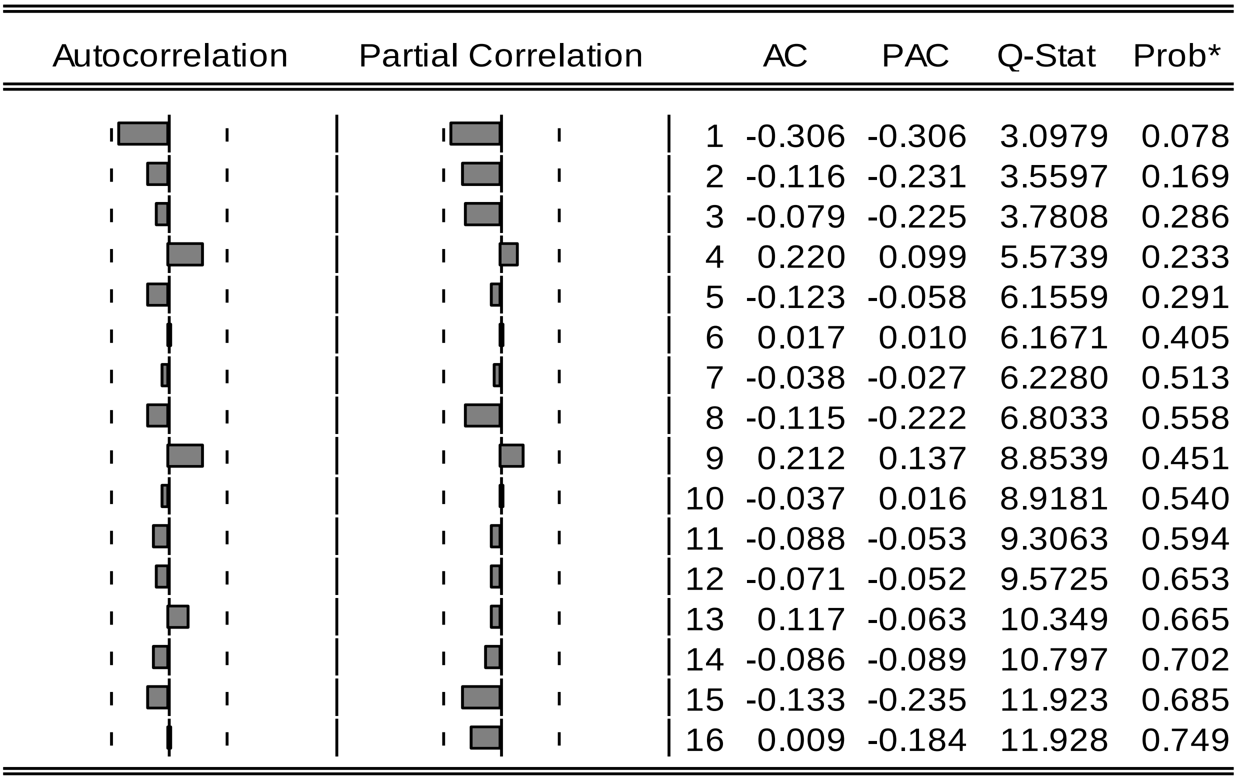


**Figure 2.**
White noise test of residuals.

Analysis of the correlogram shows that the probabilities for all orders are greater than 5%, meaning that the null hypothesis (H0) of «no autocorrelation» cannot be rejected. Thus, the model's residuals behave like white noise.

*4.4.2. Autocorrelation Test*

The Breusch-Godfrey LM serial correlation test indicates the absence of serial correlation in the model, as shown by the results in Table 6 below. The probability value of the F statistic confirms that the residuals are not serially correlated.

**Table 6.**
Breusch-Godfrey LM serial correlation.

| | | | |
|---|---|---|---|
| F-statistic | 3.440118 | Prob. F (2,12) | 0.0659 |
| Obs.*R-squared | 10.93244 | Prob. Chi-Square (2) | 0.0042 |

As the test probability is greater than 5% (critical threshold), the residuals are not autocorrelated.

*4.4.3. Heteroscedasticity Test*

The heteroscedasticity test is used to determine whether the residuals have constant variance (error homoscedasticity). For this purpose, the Breusch-Pagan-Godfrey heteroscedasticity test is employed. The results of this test are shown in Table 7 below:

**Table 7.**
Breusch-Pagan-Godfrey heteroscedasticity test.

| | | | |
|---|---|---|---|
| **F-statistic** | 0.920453 | Prob. F (15,14) | 0.5640 |
| Observation R-squared | 14.89578 | Prob. Chi-Square (15) | 0.4590 |
| Scaled explained SS | 3.684811 | Prob. Chi-Square (15) | 0.9986 |

The p-value is greater than 5%, which means that the hypothesis $H_0$: « heteroscedasticity of errors » cannot be rejected.

*4.4.4. Normality Test*

The Jarque-Bera test assesses the normality of residuals based on kurtosis and skewness. The $H_0$ hypothesis: «normality of observations » is rejected if the p-value is less than 5%. For model errors, the $H_0$ hypothesis cannot be rejected because the p-value is equal to 0.8483, which is above the critical value of 0.05. Thus, the Jarque-Bera test confirms that the residuals follow approximately a normal distribution, as detailed in the following. Figure 3:

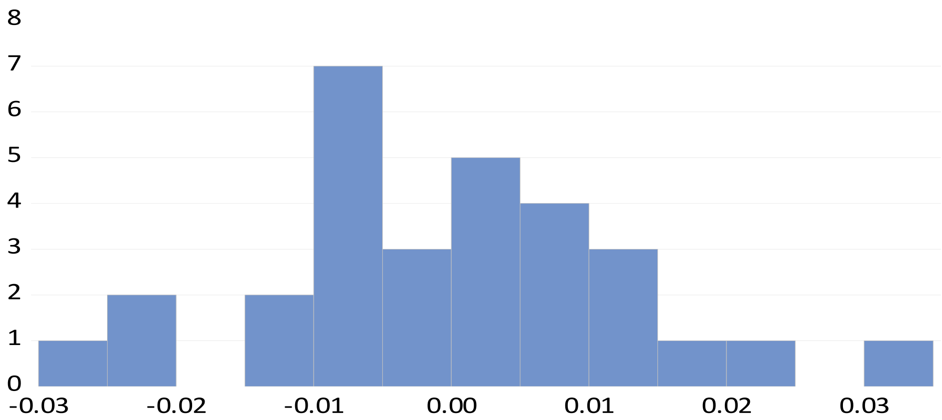


**Figure 3.**
Normality of errors

*4.5. Model Stability Test*

Model stability is tested using the CUSUM of squares test. This test is based on the cumulative sum of the squares of the recursive residuals and is the most relevant to the hypothesis « $H_0$ : stability of the relationship between two straight lines representing the bounds of the interval». Applying these tests to Eviews, the results are as follows:

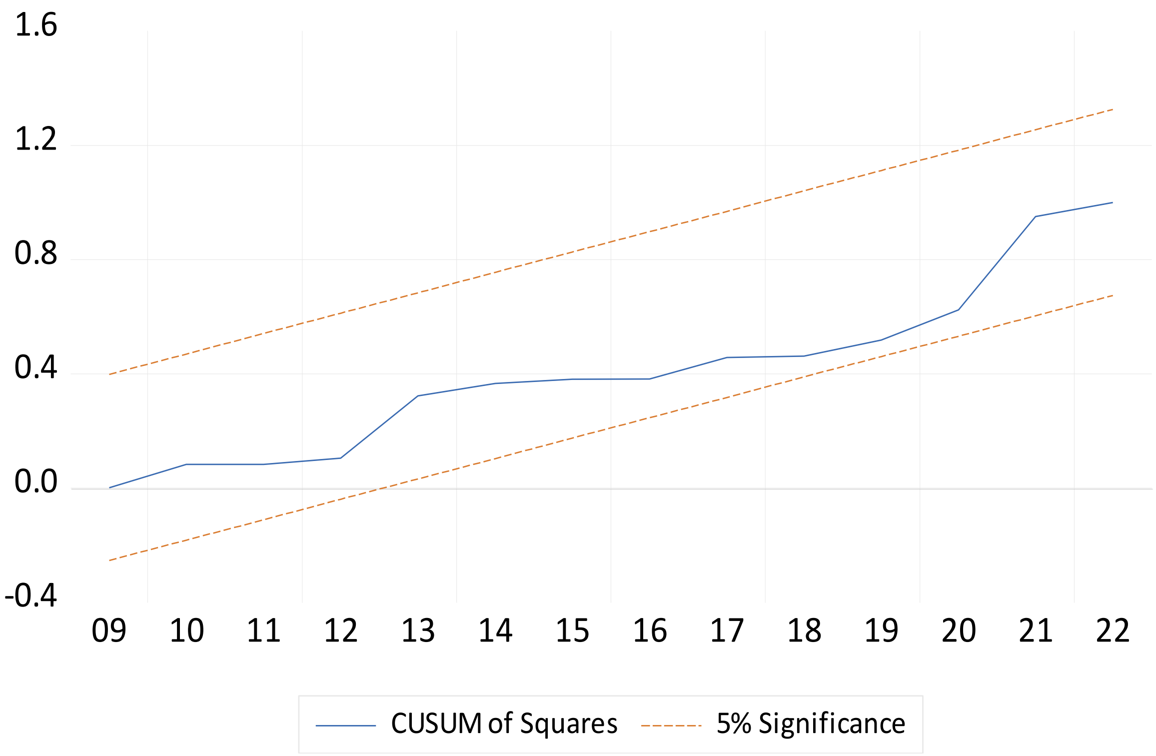


**Figure 4.**
CUSUM of squares test.

Figure 4 shows that the curve remains within the dotted corridor, indicating that the model coefficients are stable at the 5% level over time. In summary, all the diagnostic tests applied confirm the validity of our estimated ARDL model (3,1,1,1,1,1,1). This model stands out for its reliable estimates, demonstrating the absence of autocorrelation, heteroscedasticity, and residual non-normality, as well as the stability of the coefficients over the periods studied.

### 4.6. Co-Integration Test

In this section, we present the co-integration test between money demand $Ln(M_1)$, and the explanatory variables Ln(GDP), Ln(FD), Ln(IVF), Ln(IFI), Ln(INF) and Ln(R). The Pesaran boundary co-integration test used is based on the comparison of the calculated statistical value with the critical values that define the bounds.

**Table 8.**
Boundary co-integration test.

| F-Bounds Test | | Null Hypothesis: No levels relationship | | |
|---|---|---|---|---|
| Test Statistic | Value | **Signif.** | I(0) | I(1) |
| F-statistic | 5.200532 | 10% | 1.99 | 2.94 |
| K | 6 | 5% | 2.27 | 3.28 |
| | | 2.5% | 2.55 | 3.61 |
| | | 1% | 2.88 | 3.99 |

The results of the co-integration test, presented in Table 8, show that the value of the F statistic (F = 5.200532) exceeds the upper threshold for several levels of significance. This observation leads us to conclude that there is co-integration between the variables in our model. This suggests that these variables share a long-term economic relationship, making it possible to estimate not only short-term effects but also long-term effects robustly and significantly.

### 4.7. Short-Term Relationship

The error correction model associated with the ARDL (3,1,1,1,1,1,1) model was estimated to determine the short-term relationship. The results are presented in Table 9:

**Table 9.**
The short-term relationship.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| $D(LNM1(-1))$ | -0.177718 | 0.115614 | -1.537164 | 0.1465 |
| $D(LNM1(-2))$ | -0.271314 | 0.107610 | -2.521263 | 0.0244 |
| $D(LNGDP)$ | 0.288254 | 0.082518 | 3.493222 | 0.0036 |
| $D(LNFD)$ | 0.135675 | 0.046074 | 2.944715 | 0.0107 |
| $D(LNIVF)$ | -5.162191 | 0.471738 | -10.94292 | 0.0000 |
| $D(LNIFI)$ | 5.484099 | 4.297179 | 1.276209 | 0.2226 |
| $D(LNINF)$ | -0.002658 | 0.004427 | -0.600392 | 0.5578 |
| $D(LNR)$ | -0.037375 | 0.014321 | -2.609795 | 0.0206 |
| $CointEq(-1)$ | -0.131403 | 0.016634 | -7.899771 | 0.0000 |
| R-squared | 0.899361 | Mean dependent var | | 0.082800 |
| Adjusted R-squared | 0.861022 | S.D. dependent var | | 0.042428 |
| S.E. of regression | 0.015817 | Akaike info criterion | | -5.212155 |
| Sum squared resid | 0.005254 | Schwarz criterion | | -4.791796 |
| Log likelihood | 87.18232 | Hannan-Quinn criterion. | | -5.077678 |
| Durbin-Watson stat | 2.573911 | | | |

Table 9 shows that the predictive power of the model, measured by the coefficient of determination $R^2$, is quite high, reaching 87%, which corresponds to a correlation coefficient of 94.83%.

The results also indicate that the interbank market rate and the inflation rate have a negative impact on money demand, with coefficients of -0.002658 and -0.037375, respectively. Thus, a 1% increase in these rates leads to a decrease in the money supply of 0.0026% and 0.0373%, respectively.

GDP, financial development, and financial inclusion have a positive impact on money demand, with coefficients of 0.288254, 0.135675, and 5.484099, respectively. This indicates that a 1% change in GDP leads to a change in money demand of 0.2882%, while a 1% change in the financial development index and financial inclusion leads to changes of 0.1356% and 5.48%, respectively.

On the other hand, the inflation rate has a negative impact on money demand. A 1% change in the inflation rate generates a -0.002658% decline in money demand. These observations are based on the results of the estimation of the short-term relationship, which reveal a negative (-0.1314) and significant (P = 0.0000) error correction coefficient. This value indicates that the adjustment towards long-term equilibrium is corrected by 13.14% per year.

### 4.8. Long-Term Relationship

The long-term relationship between money demand Ln($M_1$) and the explanatory variables $Ln(GDP)$, $Ln(FD)$, $Ln(IVF)$, $Ln(IFI)$ and $Ln(R)$ is defined by Table 10 below:

**Table 10.**
The long-term relationship.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| $LNGDP$ | 0.797940 | 1.061676 | 0.751585 | 0.4647 |
| $LNFD$ | 0.883891 | 1.193629 | 0.740507 | 0.4712 |
| $LNIVF$ | -8.422458 | 4.502573 | -1.870588 | 0.0825 |
| $LNIFI$ | 82.74490 | 137.2373 | 0.602933 | 0.5562 |
| $LNINF$ | 0.080673 | 0.161856 | 0.498428 | 0.6259 |
| $LNR$ | -0.436976 | 0.548706 | -0.796375 | 0.4391 |
| **C** | -4.939677 | 32.72526 | -0.150944 | 0.8822 |

$$EC = LNM1 - (0.7979 * LNGDP + 0.8839 * LNFD - 8.4225 * LNIVF + 82.7449 * LNIFI + 0.0807 * LNINF - 0.4370 * LNR - 4.9397)$$

The results of the long-run relationship estimation show that the coefficients of financial innovation (LNIVF) and the interbank interest rate (LNR) are negative and significant. On the other hand, the coefficients of the other variables, namely gross domestic product (LNPIB), financial development (LNsFD), financial inclusion (LNIFI), and inflation (LNINF), are positive and significant. In concrete terms, a variation of 1% in the first variable leads to a decrease in money demand of 8.42% for financial innovation and 0.43% for the interbank interest rate. Conversely, a 1% variation in the last variables increases money demand by 0.79% for GDP, 0.88% for financial development, 82.74% for financial inclusion, and 0.08% for inflation.

*4.9. Granger Causality Test*

The results of the Granger causality test are presented in Table 11 as follows:

**Table 11.**
Granger causality test.

| Null hypothesis | F-Statistic | Prob. |
|---|---|---|
| $LN(GDP)$ does not cause $LN(M_1)$ in the Granger sense | 0.65607 | 0.5273 |
| $LN(M_1)$ does not cause $LN(GDP)$ in the Granger sense | 1.89345 | 0.1707 |
| $LN(FD)$ does not cause $LN(M_1)$ in the Granger sense | 1.77651 | 0.1892 |
| $LN(M_1)$ does not cause $LN(FD)$ in the Granger sense | 0.63164 | 0.5397 |
| $LN(IVF)$ does not cause $LN(M_1)$ in the Granger sense | 1.57722 | 0.2257 |
| $LN(M_1)$ does not cause $LN(IVF)$ in the Granger sense | 0.34945 | 0.7083 |
| $LN(IFI)$ does not cause $LN(M_1)$ in the Granger sense | 1.49976 | 0.2419 |
| $LN(M_1)$ does not cause $LN(IFI)$ in the Granger sense | 10.6225 | 0.0004 |
| $LN(INF)$ does not cause $LN(M_1)$ in the Granger sense | 3.37960 | 0.0496 |
| $LN(M_1)$ does not cause $LN(INF)$ in the Granger sense | 2.40191 | 0.1104 |
| $LN(R)$ does not cause $LN(M_1)$ in the Granger sense | 4.42902 | 0.0221 |
| $LN(M_1)$ does not cause $LN(R)$ in the Granger sense | 0.57930 | 0.5674 |

The results of the Granger causality test indicate that there is no bidirectional relationship between money demand $LN(M_1)$ and the variables $LN(GDP)$, $LN(FD)$, and $LN(IVF$. Indeed, the probabilities associated with these tests are all greater than 5%, meaning that we cannot reject the null hypothesis of no causality at the 5% significance level. These results suggest that neither variation in money demand significantly influences variations in the other variables, nor vice versa, within the model studied.

On the other hand, the test shows that there is a one-way causal relationship between money demand and financial inclusion, with a probability of 0.0004, which is below 5%. This indicates that money demand can have an effect on financial inclusion.

Similarly, for inflation, the table shows that there is a one-way Granger causal relationship between inflation and money demand with a probability of 0.0496, less than 5%, which indicates that inflation can have effects on money demand. Additionally, the table shows that there is a one-way Granger causal relationship between the interbank interest rate and money demand with a probability of 0.0221, less than 5%, suggesting that the interbank interest rate can influence money demand.

Our findings support recent research indicating that financial innovation can destabilize money demand by altering traditional monetary dynamics [37, 38]. However, these results contrast with other studies that argue financial innovation promotes monetary stability by enhancing financial inclusion and payment system efficiency [39, 40]. This divergence in the literature highlights the complex and context-dependent nature of financial innovation's impact. Differences in country-specific financial structures, model specifications, and periods studied may explain these contradictory outcomes. Therefore, our study contributes to this ongoing debate by providing empirical evidence from Morocco, a developing economy undergoing rapid financial digitalization.

## 5. Conclusion

This study has deepened our understanding of money demand in the context of financial innovations, particularly in Morocco, and highlighted the implications for the effectiveness of monetary policies. The results show that the stability of money demand is influenced by several macroeconomic factors, such as GDP, financial development, and inflation, as well as by financial innovations that modify traditional economic behavior. Monetary policies, although affected by these developments, remain essential levers for maintaining monetary stability in both the short and long term.

### *5.1. Implications*

Based on these findings, several strategic recommendations emerge to improve money demand management and enhance the effectiveness of monetary policies in Morocco. First, it is crucial to strengthen oversight of financial innovations by adopting advanced monitoring mechanisms within Banque Al-Maghrib (BAM) and integrating innovations into a flexible regulatory framework. Promoting financial inclusion is also vital, especially by expanding access to bank credit and encouraging savings among unbanked populations. Furthermore, monetary policy tools need adaptation to incorporate financial innovations into BAM's forecasting models, improving the responsiveness of interest rates and reserve requirements. Financial education should be prioritized to enhance understanding and trust in new technologies, while technological innovation must be supported under a regulatory framework that manages emerging risks. These actions will help ensure proactive and adaptable money demand management in a rapidly evolving financial environment.

### *5.2. Limitations*

Despite the significant contributions, several limitations must be acknowledged. Data quality and availability issues, especially regarding certain financial inclusion indicators, constrained the analysis. Although the ARDL model captured long-term relationships, it might not fully reflect all complex dynamics among variables. Additionally, the study's focus on Morocco limits the generalizability of results to other developing countries, particularly given the lack of comparative analysis. Finally, the fast pace of financial innovation implies that some conclusions may become outdated as new technologies and market structures emerge.

### *5.3. Future Research*

This research opens multiple avenues for future investigation. Advanced econometric techniques, such as nonlinear or simultaneous equation models, could better capture complex variable interactions. Incorporating more recent and granular financial inclusion data linked to emerging technologies would enhance analysis depth. Comparative studies with other developing economies could validate and extend the findings. Finally, examining the effects of cutting-edge financial technologies, like blockchain and cryptocurrencies, on money demand is increasingly relevant as these innovations reshape financial transactions. This study thus lays a solid foundation for advancing knowledge on money demand stability and monetary policy effectiveness in an era of rapid financial innovation.

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