Revue Française d'Economie et de Gestion
ISSN : 2728-0128
Volume 4 : Numéro 5

Determinants of money demand and its stability in Morocco

Déterminants de la demande de monnaie et sa stabilité au Maroc

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Date de soumission : 19/01/2023

Date d'acceptation : 03/04/2023

Pour citer cet article :

EL HAMIDI. N. et KARBOUB. Y. (2023) «Determinants of money demand and its stability in Morocco», Revue Française d'Economie et de Gestion «Volume 4 : Numéro 5 » pp : 462 – 481 .

Abstract

This research paper aims to investigate the determinants and stability of money demand in Morocco, based on monthly data from January 2004 to December 2020. We employ the ARDL methodology to analyze the long-term and short-term determinants of money demand in Morocco. Additionally, we use CUSUM and CUSUMSQ tests to examine the stability of the demand for money. The cointegration evidence obtained from the data during the study period suggests a long-term relationship of real money balances to the variables considered, which include real GDP, inflation, interest rates, and financial innovation. These long-term and short-term findings are consistent with the theory of money demand. Moreover, the stability tests for CUSUM and CUSUMSQ provide evidence of a stable real money demand function during the analyzed period.

Keywords: Money demand; Stability of money demand; ARDL; Monetary economy ; Morocco.

Résumé

Ce papier de recherche vise à étudier les déterminants et la stabilité de la demande de monnaie au Maroc, en se basant sur des données mensuelles allant de janvier 2004 à décembre 2020. Nous utilisons la méthodologie ARDL pour analyser les déterminants à long terme et à court terme de la demande de monnaie au Maroc. En outre, nous utilisons les tests CUSUM et CUSUMSQ pour examiner la stabilité de la demande de monnaie. Les preuves de cointégration obtenues à partir des données durant la période étudiée suggèrent une relation à long terme entre les encaisses monétaires réelles et les variables considérées, qui incluent le PIB réel, l'inflation, les taux d'intérêt et l'innovation financière. Ces résultats à long terme et à court terme sont cohérents avec la théorie de la demande de monnaie. En outre, les tests de stabilité pour CUSUM et CUSUMSQ mettent en évidence la stabilité de la fonction de demande de monnaie réelle au cours de la période analysée.

Mots clés : Demande de monnaie ; Stabilité de la demande de monnaie ; ARDL ; Economie monétaire ; Maroc.

Introduction

Central bankers, economists, and policy makers agree that one of the fundamental aims of monetary policy is to ensure a balance between high economic growth and low inflation. To achieve this objective, BAM, the central bank of Morocco, has prioritized maintaining price stability, exchange rate stability, and a secure financial system. BAM has also strived to foster favorable conditions for the country's economic growth. The central bank has pursued these goals by using the reserve currency as a nominal anchor and focusing on the broad money supply (M2) as the intermediary target, which should expand in line with nominal GDP growth. The Moroccan economy faces a number of policy-related challenges, such as a low domestic savings rate, a limited industrial base, vulnerability to shocks, a negative trade balance and other related constraints. These constraints are interlinked and mutually reinforcing. For example, while imports continue to rise, the slowdown in exports of goods and services has exacerbated the country's external vulnerabilities, which were further exacerbated by the COVID-19 pandemic. Despite the importance of this issue, little research has been done on the factors determining the demand for money in Morocco. Therefore, the objective of this paper is to examine the stability of the money demand function and to identify and its main determinants in Morocco between January 2004 and December 2020. This article is organised as follows: First, we briefly summarise the theoretical framework and research hypotheses. Second, we outline the data and methodology used in the research. Third, we discuss the empirical findings and interpretations. Finally, we conclude with some observations and concluding remarks.

1. Theoretical framework and hypothesis building

1.1 Theoretical framework

Classical and post-Keynesian monetary theories focus on different motivations for money holding. For Keynes, economic agents hold a proportion of the money in order to use it as a means of exchange, i.e. to carry out transactions (Kaltenbrunner, 2015; Bonizzi and Kaltenbrunner, 2018). This motive is regarded as income-related. Cash balances are also used to cover the gap in income and payments. This purpose, called precautionary by Keynes, is again income-dependent. Speculative purposes are the third reason for holding money in Keynesian theory. Individuals, according to Keynes, hold money for the sake of investment or speculation. Speculative money demand is assumed to be driven by the anticipation of interest rates (Mishkn, 2010 ; Valadkhani, 2006; Iftekhar, Mamoon, and Hassan, 2016 ; Dou, 2018). As well as a deeper insight into the role of the interest rate in determining the quantity of money demanded, post-Keynesians have noted that this holding motive is also income-elastic (Tobin;

1956). In the Baumol-Tobin model, holding money is explained by the demand for transactions. As income rises, transaction money demand grows at a lower rate. Among the post-Keynesian demand for money the stock theory approach (Sriram, 1999) is mentioned. Real money demand rises with levels of income and falls with the interest rate.

The monetarist school of Friedman has evolved the modern quantitative theory of money, which analyses factors affecting the quantity of money held by individuals under varying conditions (Friedman, 1972; Mayer, 1978, 1998). The money demand is thereby driven essentially in the same way as any other asset demand, which means that the money demand is dependent on the means at the disposal as well as the expectations regarding the yield of money. The factors driving the money demand might be categorized broadly as under the following headings:

- Scale variable: Scale variable in the money demand function provides a benchmark for the level of transactions undertaken in economic activity. Asset-based theories tend to emphasize wealth as the scale variable. Transaction-based theories of money demand focus on the level of income.

- Opportunity cost variables: There are two components to the cost of holding money: the cost of holding money itself and the cost of holding alternative assets to money.

Many empirical studies have attempted to identify the various determinants of money demand and its stability using different models. The empirical review of the literature suggests that the primary drivers of the demand for money are scale variables and opportunity costs of money holding, represented by various alternative assets. Omitted independent factors are shown to lead to instability in the estimation of money demand, while their inclusion leads to stability (Ogbonna, 2015; Osei, 2016; Gholizadehkivi, 2013, Nautz and Rondorf, 2011; Valadkhani, 2008). Recently, questions have been raised about the time series characteristics of money demand functions. The lack of persistence in the demand for money, as well as its cointegration with other macro variables, has diminished confidence in broad measures of money as an efficient policy instrument.

Macroeconomic shocks such as financial, fiscal and inflation shocks, as well as monetary targeting changes, impact on the stability of monetary demand models. This can be explained by financial innovation and the destabilization caused by liberalization measures taken in various economies. Deregulation of financial markets, inflationary policies and monetary policy changes account for some of the volatility observed in the monetary aggregate function. Modern monetary theorists accordingly support targeting policies on the basis of the often unstable IS-LM model. The marked monetary developments led to the establishment of country

specific demand for money functional forms via dependency relations and specification of the context. The demand for money matters for how a monetary policy influences the level of investment expenditure by way of the interest rate (Iftekhar, Mamoon and Hassan, 2016; Foresti and Napolitano, 2013). Since financial liberalization has implications for both the elasticity of interest rates across monetary policy aggregates and the balance of funds held at the respective level of interest rates, the aggregate implications are not entirely clear. Generally, financial development is expected to reduce the degree of income elasticity of money demand, allowing for more stable consumption expenditure and portfolio choices.

1.2 Theoretical construction of the hypotheses

Despite the fact that today's monetary policies ignore broad monetary aggregates, the statistical importance of money in national variations in production and inflation is growing. Money's role is still emerging and empirical studies on this topic are indispensable for conducting a proper policy. The following research hypotheses are derived from the literature review:

H1: There exists a significant and positive association between the GDP growth and the demand for money in Morocco.

This assumption is supported by the fact that there is a direct link to money demand on the one hand and output on the other. Some recent papers can be listed that have looked at real incomes in the demand for money in different countries (Asongu, Folarin, and Biekpe, 2020; Tule, 2020). The income is usually considered among the major drivers of the money demand (Gholizadehkivi, 2013; Nautz and Rondorf, 2011;Dou , 2018; Hussaini and Yusuf, 2019). In line with theory, Bahmani-Oskooee and Bahmani (2015) demonstrate the existence of a significant positive correlation between the demand for money and real income. The greater the income, the greater is the demand for money.

H2: There exists a significant negative correlation between the money demand and the interest rate in Morocco.

Consequently, it is necessary to consider the interest rate in order to correctly evaluate the monetary policy's impact on the economy (Sidik, Achsani and Pasaribu, 2018; Valadkhani, 2008). According to Osei (2016), the money demand functions are employed as a way of specifying medium-term targets for the growth of the monetary supply as well as a way of managing the interest rate and money in reserve. The goal is to help regulate the flow of inflation as well as liquidity in the economy. Rising rates of interest also increase the opportunity cost of holding money and therefore reduce money demand (Gholizadehkivi, 2013; Foresti and Napolitano, 2013; Iftekhar, Mamoon, and Hassan, 2016). Interest rate variable in

the demand for money was originally implemented by Baumol (1952), yet the causality relationship is ambiguous if different time horizons are taken into account. Regarding long- and short-term interest rates, our approach follows Ericsson (1998), who recommends not to include long-term interest rates in a narrow form of monetary models.

H3: In Morocco, there is a significant negative association between the inflation rate and the money demand.

This is explained by the quantity theory of money, which defines the connection between the amount of money and the rate of inflation. A rise in the rate of inflation is expected to reduce the money demand and lead to an investment in an alternatives asset in order to maintain assets value (Kjosevski, 2013; Gholizadehkivi, 2013; Nautz and Rondorf, 2011). In developing countries, inflation is a major driver of the demand for money (Bitrus, 2011). A significant and negative association has been reported between the demand for money and inflation. In this regard, Samimi et al. (2013) show that the price level has a negative relationship with the demand for money. In addition, Akosah (2017) employs structural VAR model as the methodology to investigate the transmission mechanism of money demand growth to inflation, as well as other factors. He shows that inflation has a significant negative impact on money demand.

H4: There exists a significant positive or negative correlation between the Moroccan exchange rate and the money demand.

By incorporating the exchange rate into the estimation of money demand, it becomes possible to view the currencies of different countries as interchangeable. Mundell (1963) has already pointed out the presence of a relationship between the demand for money and the exchange rate. Incorporating official exchange rates into the analysis of money demand yielded significant results in the study conducted by Sanya (2019). An exchange rate increase increases wealth, since the foreign assets of domestic households increase in value. This results in an increased demand for money (Sanya, 2019). But according to Bahmani-Oskooee and Pourheydarin (1990), when the currency depreciates, expectations would have the opposite effect. Expectations of continued depreciation would prompt holders of assets to reallocate their holdings in foreign currency and decrease demand for money. Consequently, the effect of the foreign currency exchange rate on the monetary demand might be either negative or positive, according to the reaction of the individual (Kjosevski, 2013; Foresti and Napolitano, 2013).

H5: There exists a significant negative link between money demand and financial innovation in Morocco.

In a study, Columba (2009) investigated the impact of transactional financial innovation on narrow money in Italy. The findings are that financial innovation has a significant negative impact on the money demand. The impact of financial technology, however, is positive. In many developing countries, financial markets are underdeveloped and undiversified, lacking financial sector instruments and payment technologies, so that transactions mostly use narrow money (Dunne and Kasekende, 2016; Shiva and Durai, 2017; Aliha, Sarmidi and , 2018). Consequently, the elasticity of demand for money with respect to income is likely to be approaching or marginally above unity. According to Mannah-Blankson and Belnye (2004), the financial innovation variable has an impact on the demand in the long run, whereas financial innovation has an impact on the demand for M1 in the short run. In addition, the study by Dunne and Kasen (2016) examined financial innovation development and its implications for the demand for money in the Sub-Saharan African region. They found that the development of financial innovation is an instrumental factor in determining money demand.

H6: The demand for money in Morocco is stable.

One common thread in most studies on money demand functions is to examine the stability of the function (Sanya, 2019; Sidik, Achsani and Pasaribu, 2018). When the money demand is shown as unstable, then researchers specify what the missing variables are in the specification and indicate that the inclusion of these variables leads to stability. Several recent research papers present empirical results showing that economic uncertainty plays an important role in forming the demand for money and the stability of the demand for money function (Hossain, 2015; Hossain, 2019; Hossain and Arwatchanakarn, 2020). When testing the demand for money in the United States, for example, researchers such as McNown and Wallace (1992) determined that in order for the aggregate money demand, M1, to stabilize, a specification allowing for substitution of money across the United States and abroad would have to include the nominal effective exchange rate. Given that we have correctly identified the demand for money, we shall therefore attempt to establish its stability and the relative influence of each of the variables included in the model.

2. Empirical analysis and results

2.1. Specification of the long-term empirical relationship

Many empirical models that investigate money demand rely on real GDP as the scale variable, although income is also important for the precautionary motive. Meanwhile, speculative motivations tend to be driven by a preference for liquidity, especially in low-interest-rate environments. In developing countries where financial assets and money are not easily

interchangeable, the expected inflation rate is often used as an indicator of the opportunity cost of holding money.

In our study, we use real GDP as the scale variable and include four other explanatory variables - the Treasury bill rate, opportunity cost of inflation, exchange rate, and financial innovation - in the long-run money demand equation. We adopt a multiplicative approach to model the relationship between money demand and these variables. The econometric model is outlined below :

$$RMD_t = C_t * {RGDP_t}^{\alpha_1} * (1 + TBR_t)^{\alpha_2} * (1 + INF_t)^{\alpha_3} * (1 + EXR_t)^{\alpha_4} * (FININ_t)^{\alpha_5}$$

The log transformation of the above expression gives the following formula :

$$LNRMD_t = c_t + \alpha_1 * LNRGDP_t + \alpha_2 * LNTBR_t + \alpha_3 * LNINF_t + \alpha_4 * LNEXR_t + \alpha_5 * LNINFIN_t + \varepsilon_t$$

RMD is the demand for money in the broad sense expreced as M3. This includes time deposits and money market funds with a maturity period exceeding 24 hours and is expressed in terms of MDH. RGDP, on the other hand, refers to real gross domestic product, which is also expressed in MDH. TBR is the interest rate on 91-day Treasury bills and is measured as a percentage. INFL refers to inflation, which is expressed as a percentage change in the consumer price index. The EXR is the MDH exchange rate in US dollars. Lastly, FININ is a measure of financial innovation, calculated as the ratio of M2 to M1.In the following table we list the variables, the assumptions and the correlation direction expected based on the literature review.

Table 1: Hypothesis, variables and expected correlation signs

Research hypothesis	Variable	Sense of correlation
RGDP	H l	Positive
TBR	H2	negative
INFL	H3	Negative
EXR	H4	positive or negative
FININ	H5	Negative

2.2 Type and source of data

This study has used monthly data for the period from January 2004 to December 2020, given that the work on the money demand needs high frequency data. The time period selected for the study was determined by the accessibility of the monthly data. Time series of national variables were obtained from the Ministry of Finance through its statistical platform MANARSTAT.

2.3 Data analysis methods and estimation techniques

In order to assess the presence of cointegration, the study employs the ARDL bounds testing technique, which integrates the autoregressive distributed lag (ARDL) model with the bounds

testing methodology introduced by Pesaran et al. (2001). The approach to ARDL bounds testing employs the estimation of an unconstrained error correction model using ordinary least squares, which is then used to evaluate whether cointegration exists between the variables of interest. The ARDL bounds testing method entails using ordinary least squares to estimate an unrestricted error correction model represented by:

$$LNRMD_t = c_t + \sum_{0}^{P1} \alpha_1 * \Delta LNRGDP_{t-i} + \sum_{0}^{P2} \alpha_2 * \Delta LNTBR_{t-i} + \sum_{0}^{P3} \alpha_3 * \Delta LNINF_{t-i} + \sum_{0}^{P4} \alpha_4 * \Delta LNEXR_{t-i} + \sum_{0}^{P5} \alpha_5 * \Delta LNFININ_{t-1} + \alpha_1 * LNRGDP_t + \alpha_2 * LNTBR_{t-1} + \alpha_3 * LNINF_{t-1} + \alpha_4 * LNTEXR_t + \alpha_5 * LNFININ_{t-1} + \varepsilon_t$$

The presence of co-integration is assessed by testing the null hypothesis of zero cointegration, where the lagged level variables in the equation are constrained to zero:

H0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$

The existence of cointegration is examined through the use of an F-statistic, which is derived by imposing the constraint of zero lagged level variables. The validity of the null hypothesis of zero cointegration is examined through a comparison of the F-statistic obtained and two asymptotic critical values. Upper critical value assumes that all regressors have an order of integration equal to 1, lower critical value assumes that all regressors have an order of integration equal to 0. If the F-statistic is greater than the upper critical value, the variables are considered to be co-integrated. Conversely, if the F-statistic is less than the upper critical value, the variables are not co-integrated. In the event that cointegration is detected, the long-run coefficient can be obtained using the following formula :

$$LNRMD_t = c_t + \sum_{0}^{P1} \alpha_1 * LNRGDP_{t-i} + \sum_{0}^{P2} \alpha_2 * LNTBR_{t-i} + \sum_{0}^{P3} \alpha_3 * LNINF_{t-i} + \sum_{0}^{P4} \alpha_4 * LNEXR_{t-i} + \sum_{0}^{P5} \alpha_5 * LNFININ_{t-i} + \varepsilon_t$$

After establishing the presence of a long-term relationship, the next step is to use the error correction model (ECM) to calculate the rate at which the system returns to its long-term equilibrium level following a short-term shock.

The standard approach for the ECM involves estimating the equation:

$$LNRMD_t = c_t + \sum_{0}^{P1} \alpha_1 * \Delta LNRGDP_{t-i} + \sum_{0}^{P2} \alpha_2 * \Delta LNTBR_{t-i} + \sum_{0}^{P3} \alpha_3 * \Delta LNINF_{t-i} + \sum_{0}^{P4} \alpha_4 * \Delta LNEXR_{t-i} + \sum_{0}^{P5} \alpha_5 * \Delta LNFININ_{t-i} + \varepsilon_t$$

The ARDL model is subjected to diagnostic and stability tests to verify its accuracy. The diagnostic tests assess the model's performance by analyzing its normality, serial correlation, functional form, and heteroscedasticity. The structural testing of the model is done using CUSUM and CUSUMSQ tests to ensure the stability of the money demand functions and the robustness of the model.

3. Presentation and analysis of data

3.1. Data description

Table 2 displays the descriptive statistics of the money demand function model variables from January 2004 to December 2020. The Jarque-Bera statistic is used to assess the data's goodness of fit, revealing that most of the data is non-normally distributed. The skewness of the data suggests that real money demand, exchange rate, inflation, interest rate, GDP and financial innovation are symmetrical. Thus, it can be concluded that the time series does not have any outliers and has a relatively symmetrical distribution.

Tableau N °2 : Statistiques descriptives

	LNRMD	LNRGDP	LNINF	LNTBR	LNEXR	LNFININ
Mean	13.69569	12.20085	0.010107	0.027435	0.107785	0. 168210
Median	13.76463	12.21646	0.007446	0.026106	0.108438	0. 168536
Maximum	14.2 1 100	12.46059	0.050948	0.038932	0.1287 10	0. 185880
Minimum	12.93986	1 1 .97607	-0.0 15866	0.014593	0.094 149	0. 147048
Std. Dev.	0.349424	0.161103	0.011446	0.005948	0.008171	0.009789
Skewness	-0.47 1484	-0.102849	0. 122815	0.000449	0.289975	-0. 138393
Kurtosis	2.424239	1.598374	3.547320	1.9381 89	2.331724	2.00465 1
Jarque-Bera	10,37585	17,05837	3,059092	9,583265	6,654945	9,072306
Probability	0,005583	0,000 197	0,216633	0,008298	0,035883	0,010714
Sum	2793.922	2488.974	2.06 1928	5.596758	2 1.98810	34.31482
Sum Sq. Dev.	24.78573	5.268670	0.026597	0.007183	0.013552	0.019453
Observations	204	204	204	204	204	204

The correlation matrix for the variables have been presented in Table 3. The covariance matrix examines the strength and direction of the linear relationship between the variables. The results of the correlation matrix reveal that there is a positive correlation between real money demand and real GDP, inflation, and exchange rate, indicating that an increase in these variables will

lead to an increase in real money demand. However, the correlation between real money demand and the treasury bill rate and financial innovation is negative, implying that an increase in these variables will result in a decrease in real money demand.

Table 3: Correlation matrix

	LNRMD	LNRGDP	LNINF	LNTBR	LNEXR	LNFININ
LNRMD	1					
LNRGDP	0.5455	1				
LNINF	-0.2230	0. 1406	1			
LNTBR	-0.2819	-0.4267	0.2618	1		
LNEXR	0.4201	-0.5743	0. 1 195	0.3555	1	
LNFININ	-0.3780	0.5890	-0.0255	-0.3901	-0.4533	1

3.2 unit root test

We need to investigate if the time series data is stationary or not. To achieve this, we performed the augmented Dickey Fuller (ADF) test on the data. The purpose of this test is to determine if the series under examination contains a unit root and, if so, to determine the order of integration. The null hypothesis of the ADF test is that the series contains a unit root.

The results of the ADF test for both the level and first difference variables can be found in the table below :

Table N°4: Unit root test by augmented Dickey Fuller

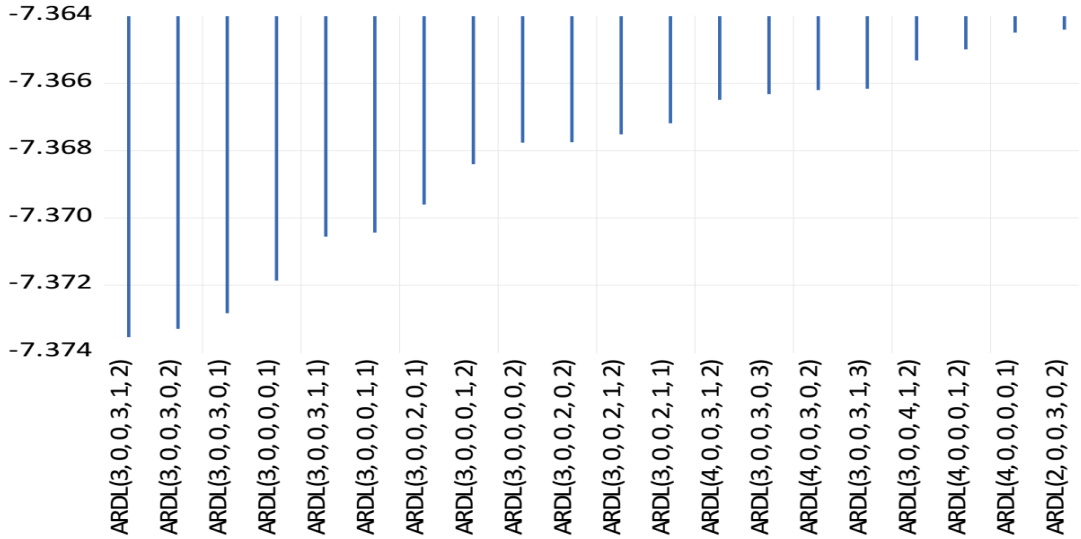
Variables	Intercept				Trend et intercept			
	t		P value		t		P value	
	niveau	1" difference	niveau	1" difference	niveau	1" difference	niveau	1" difference
LNRMD	-1,8480	-1,3613	0,3565	0,6005	-4,1354	-1,4523	0,0067	0,0423
LNRGDP	-1,6063	-1,8109	0,4774	0,3744	-0,2354	-1,9689	0,0919	0,0141
LNINF	-4,2666	-13,8614	0,0007	0,0000	-4,2106	-13,8459	0,0052	0,0000
LNTBR	-0,5081	-12,3507	0,8858	0,0000	-1,1550	-12,3859	0,9160	0,0000
LNEXR	-2,1365	-10,5752	0,2307	0,0000	-2,6715	-10,5478	0,2497	0,0000
LNFININ	-2,1785	-0,9603	0,2149	0,7669	-1,9924	-1,0474	0,0013	0,0038

According to the results presented in Table 4, we can observe that real money demand, real gross domestic product and financial innovation are integrated of order one (i.e., I(1)), whereas the Treasury bill rate, the exchange rate and inflation are integrated of order zero (I(0)). It can be inferred from the table that the last three variables are stationary at the level, while the first three are stationary at the first difference. It is worth noting that none of the variables in the regression are of order two (i.e., I(2)), which is not desirable when using the ARDL model.

3.3 Long-term ARDL boundary tests for cointegration

To begin the cointegration test, the first step is to identify the appropriate lag length of the variables to be included in the model. In time series analysis, the lags of the variables can affect the independent variables as well. To eliminate autocorrelation from the residuals of the cointegrated variables, lags are incorporated. The Akaike Information Criterion (AIC) is used to determine the optimal lag, and the ARDL model with the lowest AIC value is chosen. Based on the criteria graph, the optimal ARDL model is ARDL(3, 0, 0, 3, 1, 2), as presented in the figure below.

Figure 1: ARDL model selection criteria



Once the appropriate lag length is determined, the next step is to identify the number of cointegration vectors. The determination of cointegration depends on whether the calculated F-statistic is below, above or between the critical values. If the calculated F-statistic is lower than the critical value, we can conclude that there is no cointegration between the variables. Conversely, if the F-statistic exceeds the upper critical value, we can conclude that there is a cointegrating relationship between the variables.

Table 5: Boundary tests for cointegration

Test Statistic	Value	Signif.	1(0)	1(1)
F-statistic	14.08505	10%	2.08	3
k	5	5%	2.39	3.38
		1%	3.06	4.1 5

The computed F-statistic value of 14.08 is found to be higher than the upper bound critical value of 4.15 at a 1% significance level, based on the obtained results. As a result, we can reject the null hypothesis of no cointegration at a 1% significance level. Therefore, it can be concluded that there is cointegration among the variables in this study. Once the existence of a long-term

relationship between the variables is established, the subsequent steps involve determining and interpreting the long-term and short-term models.

3.4 Estimation of the long-term model

After confirming the existence of a long-term cointegration relationship between the variables, the long-term model results are presented in the following table:

Table N°6 : Long term coefficients of the ARDL regression

Variable	Coefficient	t-Statistic	Prob.
LNRGDP	0.93158***	2,61 142	0,0097
LNINF	-0.13129*	-1 ,69569	0,0915
LNTBR	-0.58786*	-1,76316	0,0794
LNEXR	0.21694	0,27304	0,7851
LNFININ	-0. 17338***	-2,79768	0,0056
c	-2.93860	-0.30599	0.7600

The results of the estimation for the long-term money demand using the ARDL model are presented in Table 6. All coefficients have the expected signs and are statistically significant. Real money demand has a positive and significant relationship with real GDP, as indicated by the 1% statistical significance level of the income elasticity. The coefficient for real income suggests a long-term income elasticity of 0.93 for real money supply. This means that a 1% increase in real income leads to a 0.93% increase in the demand for real money balances. The fact that the income elasticity is less than one supports the idea that the income elasticity of money demand decreases with the creation of monetary substitutes, financial liberalization and technological advancements in the payment system.

The elasticity of real money demand with respect to inflation is negative, with a value of -0.13, and it is significant at the 10% level, confirming the theoretical assumptions. This implies that an increase in the inflation rate in Morocco leads to a decrease in the demand for real broad money. Specifically, a 1% increase in inflation in the long run reduces the demand for real money balances by 0.13%. As inflation increases, returns on alternative assets such as real estate and land investments also increase, leading to a reduction in the demand for money. These findings suggest that as inflation increases, individuals tend to substitute money with physical assets. The coefficient for nominal effective exchange rate is negative, but it is statistically insignificant.

The regression analysis shows a negative and statistically significant coefficient for financial innovation in Morocco, indicating that there is a significant relationship between real money demand and financial innovation at the 1% level of significance. The elasticity of real money

demand with respect to financial innovation is estimated to be -0.17 in the long run, suggesting that a 1% increase in financial innovation reduces the demand for real money balances by 0.17%. This finding suggests that advancements in financial technology and the development of alternative payment systems lead to a decrease in the demand for real money balances in Morocco. It highlights the role of financial innovation in transforming the traditional banking sector and reshaping the demand for money balances in the economy.

3.5 The short-term dynamic model (error correction)

After identifying the presence of a long-term association between the variables, the subsequent course of action involves setting up the error correction model or short-term dynamics. This can be achieved by calculating the variance between the reliant variable and its own lag, along with that of all the explanatory variables and their respective lags. Additionally, including a prior period's lagged error term from the long-term model estimation. The dynamic error correction regression linked to the previously stated long-term correlation using the ARDL method is presented in Table 7.

Table 7: Estimation of the short-term money demand model

Variable	Coefficient	t-Statistic	Prob.
D(LNRMD(-1))	-0.207341 ***	-2.912642	0.0040
D(LNRMD(-2))	-0.092045**	-2.083085	0.0386
D(LNRGDP)	0,201085 ***	2,671945	0,0081
D(LNINF)	-0, 159386**	-2,0333	0,0433
D(LNTBR)	-0.041046	-0.108163	0.9140
D(LNTBR(- 1))	0.674399*	1.772359	0.0780
D(LNTBR(-2))	0.701515*	1.831571	0.0686
D(LNEXR)	-O.O L4265	-0.062411	0.9503
D(LNFININ)	-3.469007***	- 18.50126	0.0000
D(LNFJNIN (-1))	-0.503102*	- 1.692378	0.0922
CointEq(- 1)*	0.053594***	10.08840	0.0000

As anticipated, the error correction term demonstrates a significant negative sign at a 5% level, confirming the presence of a cointegration between the variables. The magnitude of the error correction coefficient implies that roughly 51% of the inconsistency in real money demand gets adjusted every month in the short run. This suggests that the surplus money gets balanced out in the following period by a decline in the amount of money reserves. Therefore, it becomes crucial to gradually reduce the existing disparity in order to retain the equilibrium in the long run.

3.6 Model stability and diagnostic test

In order to ensure the long-term validity of the computed model, a diagnostic assessment is performed. To evaluate the model's reliability, several stability and diagnostic evaluations are conducted, such as the Ramsey's RESET test for functional form analysis, the Jarque-Bera test for normality testing, the Brush & Godfray LM test for testing serial correlation, the Breusch-Pagan-Godfrey test for testing heteroscedasticity, and the Wald test for assessing the significance of the coefficients as a whole.

Table 8: Diagnostics of the long-term ARDL (3, 0, 0, 3, 1, 2) model

Test statistique	F statistique	Probabilité
Corrélation des séries (test LM)	0.248400 ; (2, 184)	0.7803
Test de normalité	-	0.0960
Test de Ramsey Rest	1.027791 ; (1, 185)	0.3120
Test de Wlad	105910.9 ; (5, 186)	0.0000
Test d'hétroscédasticité	1.702842 ; F(14,1 86)	0.2980

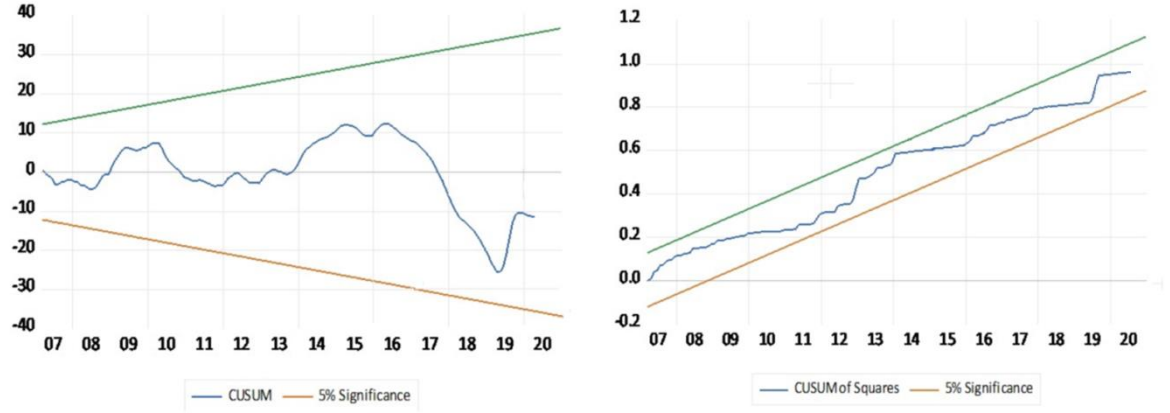
Based on the presented table, the long-term ARDL model used in this study passed all diagnostic tests. The p-values associated with each test statistic were not significant enough to reject the null hypothesis. The p-values associated with the test statistic for the Brush Godfray LM test were found to be higher than the standard significance level of 0.05. Therefore, we cannot reject the null hypothesis of no serial correlation. The results indicate that we cannot reject the null hypothesis of residual non-normality. The p-value for the Jarque-Berra normality test was 0.0960, which is higher than the standard significance level of 0.05. This means that we cannot reject the null hypothesis that the residuals are non-normally distributed. The null hypothesis of the Ramsey RESET test, which is used to determine whether an omitted variable bias exists in the model, was not rejected. The probability being 0.3120 greater than 0.05 indicates that the model is appropriately specified. The globally significant F-statistic of 1% in the Wald test, which determines the overall significance of the coefficients, confirms that the model is significant. Lastly, the Breusch-Pagan-Godfrey test of heteroskedasticity fails to reject the null hypothesis as the p-value associated with the test statistics is higher than the standard significance level (i.e. 0.2980 > 0.05).

3.7 Test of the stability of money demand

Testing the stability of real money demand function is crucial for the central bank to determine the appropriate monetary policy instruments. Traditional methods such as CUSUM and CUSUMSQ have been utilized to test stability. The null hypothesis can be accepted or rejected by evaluating the p-value associated with the test statistic. The test results are presented in a

graph, which allows for easy interpretation. Overall, these tests help to ensure that monetary policy decisions are based on reliable and stable data. A p-value below the established significance level (5%) indicates that the null hypothesis should be rejected. The graph displaying the results is presented below:

Figure N°2 : CUSUM and the CUSUM-SQ tests



The CUSUM and CUSUMSQ test plots indicate that there were no breaches of the critical limits for the 5% significance level. The critical limits are represented by red straight lines. These tests confirm the structural stability of the model parameters, as well as the stability of the real money demand. Hence, the long-run and short-run estimates are stable without any structural break. Therefore, it can be concluded that the demand for money in Morocco is stable..

Conclusion

The effectiveness and success of a monetary policy depends critically on a stable money demand function. In other words, if the money demand function is stable, the monetary authorities can take policy actions with a high degree of confidence about their impact on macroeconomic variables. This allows a policy change in monetary aggregates to have predictable influences on macroeconomic variables. Thus, the objective of this paper is to study the main factors that determine the demand for real money balances and its stability over the study period in Morocco using the ARDL framework with monthly data covering the period from January 2004 to December 2020.

The results showed that the variables were stationary at level and first difference. A cointegration test was then performed using the bound test for the cointegration approach, revealing the existence of long-term relationships between real money demand and its determinant variables included in the model. The ARDL models indicated a positive long-term relationship between real GDP and real money demand, while the exchange rate variable was not significant. The empirical results suggested that Treasury bill rates and inflation had a

negative effect on real money demand. Additionally, financial innovation had a negative impact on the demand for money in Morocco. The stability test of the CUSUM and the CUSUMSQ showed that the real money demand function remained stable throughout the study period, indicating no structural changes in the model.

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