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Essay on the determinants of liquidity risk in participatory banks in Morocco

Essai sur les déterminants du risque de liquidité dans les banques participatives au Maroc

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Abstract

Liquidity management in the context of Islamic finance has gained increasing importance in recent years. As a result, Islamic banks are facing a growing challenge due to the nature of Islamic financial operations, as well as the fundamental guiding principles of Sharia law. In such a context, second-tier banks are confronted with liquidity management issues, particularly in the short-term dynamics. Through this research, we aim to highlight the determinants of liquidity risk in Moroccan participatory banks. To conduct this research, we will attempt to build our empirical analysis using statistical modeling through the ARDL model, in order to determine the parameters that may impact the level of liquidity in Moroccan participatory banks, and also to explore the most appropriate solutions suited to the Moroccan context.

Keywords: Liquidity risk; ARDL model; Monetary market; Monetary policy; Morocco.

Résumé

La gestion des liquidités dans le cadre de la finance islamique a pris ces dernières années une ampleur de plus en plus grandissante. De ce fait la banque islamique se trouve face à ce défi qui ne cesse de s'accroître en raison de la nature des opérations financières islamiques, ainsi que les principes fondamentaux directeurs de la charia. Dans un tel contexte, les banques de second rang se retrouvent face à une problématique de gestion des liquidités surtout dans la dynamique à court terme. A travers ce travail de recherche, nous allons essayer de mettre le point sur les déterminants du risque de liquidité dans les banques participatives marocaines. Afin de mener ladite recherche, nous allons essayer de construire notre analyse empirique à l'aide de la modélisation statistique en utilisant le modèle ARDL, et ce pour statuer sur les paramètres pouvant impacter le niveau de liquidités dans les banques participatives marocaines, mais aussi explorer les solutions les plus adéquates adaptées au contexte marocain.

Mots clés : risque de liquidité ; modèle ARDL ; marché monétaire ; politique monétaire ; Maroc.

Introduction

This study is part of our work aimed at deepening the analysis of the causes and determinants of liquidity risk in participatory banks in Morocco. The specific context of Islamic finance in the country, as well as the challenges faced by participatory banks, have led us to consider that the liquidity levels of these banks are influenced by a set of both internal and external variables, which we have chosen to address in this article.

We assume that these variables include, among others, the internal management of resources, Sharia-compliant financing policies, macroeconomic conditions, and liquidity regulations imposed by the central bank. However, given the relatively modest size of participatory banks in Morocco, their still young level of experience in this field, and the current economic climate marked by rapid changes in the global financial sector, we have chosen to work with consolidated data. This data includes not only the results of the participatory banks themselves but also those of the participatory windows within conventional banks, which provides a more comprehensive and representative view of the sector. This choice is mainly explained by the limited number of participatory banks currently operational in Morocco and their relatively recent launch.

In this particular context, our main objective is to answer the following question: what are the variables that significantly influence the liquidity risk of participatory banks in Morocco? And what solutions can be adopted to better manage this liquidity risk?

To address this issue, we have chosen the ARDL modeling method, covering the period from October 2018 to July 2023. This methodological choice is justified by the ability of this approach to manage time series, taking into account both short-term and long-term relationships between variables.

Our study will begin with a review of the existing literature, which will allow us to contextualize the challenges and specificities of liquidity risk in participatory banks. Then, we will present the methodology used for the empirical analysis, as well as the results of our descriptive data analysis. Finally, in the last part, we will reveal the results of our ARDL econometric model and discuss the conclusions that emerge, offering concrete solutions to better understand and manage liquidity risk in Moroccan participatory banks.

1. Liquidity Risk in Participatory Banks: Literature Review

Liquidity risk refers to a bank's inability to meet its obligations. While banks generally have resources that match their uses, the callability of these resources often does not align with the liquidity of their uses. In Islamic finance, banks face heightened liquidity risk due to the nature

of their contracts and limited access to money markets, stemming from the prohibition of interest-based transactions.

Research on liquidity risk management in Islamic finance highlights its distinct challenges. Studies show that liquidity risk is the most significant risk for Islamic banks, largely due to the scarcity of instruments, such as financial securities, and limited access to purely participatory money and interbank markets (Ghenimi & Omri, 2018). Empirical studies reveal a positive and significant relationship between liquidity risk and credit risk in Islamic banks. As noted by Ghenimi & Omri (2018), "Our results suggest that there is no major difference between Islamic and conventional banks in terms of the determinants of liquidity risk. Consequently, they tend to manage this risk similarly, while maintaining compliance with Sharia."

Additionally, liquidity and credit risks are considered the most critical risks for Islamic banks, especially given the nature of Islamic financial operations, which prohibit riba (interest) and gharar (excessive uncertainty) (Abu Hussain & Al-Ajmi, 2012). Empirical studies on second-tier Islamic banks in Bahrain confirm that their liquidity risk management practices are underdeveloped compared to conventional banks, which benefit from broader access to money and interbank markets unimpeded by interest rate restrictions.

Given the structure of Islamic financial intermediation, which links investment deposits to Murabaha financing, establishing an Islamic money market is essential for better liquidity risk management. Another approach is asset remuneration, through which banks utilize profits and gains from their investments to mitigate liquidity risk (BEN JEDIDIA & JLASSI, 2013).

Research on 25 international participatory banks from 2006-2015 indicates that Islamic banks aim to maintain higher liquidity levels to ensure operational fluidity and flexibility, aligning with their goals for profit generation (Masood & Javaria, 2017). Furthermore, an empirical study involving 188 banks across 28 countries found that Islamic banks generally exhibit higher liquidity risk but lower credit risk compared to conventional banks, reflecting their focus on participatory rather than credit-based financing. The study also shows that solvency risk is lower in Islamic banks than in conventional ones (Safiullah & Abul Shamsuddin, 2018). Despite these differences, Islamic and conventional banks share a similar level of exposure to operational risks

More recently, (Mai M. Abdo; Ibrahim A. Onour, 2018) stipulated that banks with a large volume of deposits are more exposed to massive withdrawals of liquidity, therefore they are obliged to have assets that are easily or fluidly convertible to liquidity (concept of liquidity of assets on the balance sheet of the bank concerned).

However, the relationship between the profit coefficient and liquidity risk is positive but not significant. Moreover, the combination of liquidity risk and profits implies that more substantial profits can be generated by short-term investments, and more precisely in pure and hard Murabaha operations.

Additionally, (Ibrahim & Hamim Syahrum Ahmad Mokhtar (2010) focused on liquidity risk management in the context of Islamic finance in Malaysia. As a result, the authors confirm that interbank money markets remain underdeveloped and that despite recent innovation in the design of new financial instruments, the Islamic financial system is still described as young and has not yet reached the peak of maturity in terms of development and management. This observation shows that state intervention in the Islamic finance industry is an inevitable reality, through the central bank.

2. Main Causes of the Liquidity Problem in Participatory Banks in Morocco

2.1. The Volume of Investment Deposits

Although investment deposits are a fundamental component of the balance sheet structure of Islamic banks, they require additional efforts from banks to effectively present and market them to customers. In reality, customers are often hesitant about this type of deposit, with cultural and behavioral factors playing a crucial role. The most significant factor is the depositor's risk-taking culture, as investment deposits adhere to the principles of profit and loss sharing (PPP). This means that investors need to be well-informed and financially capable individuals or organizations, able to choose between placing funds in investment deposits with an Islamic Financial Institution (IFI) or opting for conventional mutual funds (OPCVM) that offer predetermined returns.

Therefore, banks should focus their marketing efforts on attracting these clients and encouraging them to invest within the framework of ethical finance, despite the high level of risk inherent to the nature of the financing. In Morocco, investment deposits are primarily linked to participatory financing, particularly Murabaha. As a result, credit and default risks pose the main challenges to their growth, even though, in practice, it is the market risk—shaped by real economic conditions—that should influence investor returns.

Furthermore, the liquidity problems of Islamic Financial Institutions (IFIs) in Morocco stem from the imbalance between weak deposit levels and the amount of financing granted, as well as the volume of term deposits vulnerable to immediate mass withdrawals. Some participatory banks in Morocco have raised the minimum threshold for investment deposits from the initial

10,000 MAD to 300,000 MAD. This increase, intended as a client filtering measure, also hinders the development of investment deposits.

This situation supports the notion that investment deposit products are primarily designed for a specific clientele—those who are knowledgeable, accustomed to risk, and familiar with the business world

2.2. The Volume of Demand Deposits:

Representing 26% of the consolidated balance sheet assets of participatory banks, these deposits remain relatively low compared to the volume of granted financing. This observation is explained rather by the consumer behavior of depositors as well as financed clients.

In reality, an individual or a company only calls upon the participatory bank in the case of a potential financing. As a result, the account opened with IFIs is used solely to pay periodic fees, and it is funded only to avoid default.

This problem finds its origins in the clients' perception of the bank's role, considering that the participatory bank serves only to comply with religious rules and avoid Riba (Usury, Interest), and that the conventional bank is in some ways the real bank for current operations and bank deposits.

This psychological effect can be explained as follows:

- Lack of advertising from Islamic banks
- Convenience: Number of existing branches in Morocco
- Word of mouth regarding the high cost of financing from participatory banks
- A large presence of the informal sector, and clients tend to opt for hoarding
- Lack of trust in the bank as a recently created organization

However, these current account deposits are considered by Sharia as a kind of Amana, which is guaranteed in capital but provides no remuneration to depositors.

2.3. Refinancing from Parent Banks

As subsidiaries of conventional banks in Morocco, Islamic Financial Institutions (IFIs) currently lack the size and experience needed to independently manage liquidity risk. This task becomes even more challenging in the absence of Islamic money markets, making autonomous refinancing nearly impossible. In practice, IFIs rely on their parent banks for the necessary liquidity to sustain their operations, typically through a product known as Wakalah b'il Istithmar.

Although Wakalah b'il Istithmar offers a simplified structure without the need for intermediaries, the challenge lies in meeting the parent bank's requirements for investment

returns. These demands have become increasingly stringent, particularly because, in Morocco, most investments are tied to Murabaha contracts. This scenario significantly impacts the overall cost of financing that the end customers of the bank must bear.

The stringent investment requirements stem from the fact that these parent banks are conventional institutions that refinance themselves using traditional interest-based instruments and then provide funds to participatory banks in the form of Wakalah. Additionally, this type of refinancing accounts for 65% of the resources of participatory banks in Morocco, as indicated by the latest data from Bank Al-Maghrib (BKAM), highlighting the substantial dependence of IFIs on their parent banks

2.4. Customer Conversion and Marketed Products

A survey conducted by the Moroccan Capital Market Authority in 2012 indicated that 97% of respondents intended to open accounts or use the services of Islamic Financial Institutions (IFIs) for financing. However, field observations following the actual launch of IFIs reveal some reluctance among clients, primarily due to the higher cost of financing compared to conventional banks.

Trust in the bank as an institution also plays a critical role, influenced by the lack of information about the operations of participatory banks, their recent establishment in Morocco, and a psychological tendency for clients to stay within their comfort zones. Additionally, advertising and marketing efforts by participatory banks are weak or nearly nonexistent compared to conventional banks, despite the ethical and moral advantages grounded in Islamic principles that could attract consumers to IFI services.

Another significant obstacle to the development of financing activities in IFIs is the challenge related to human resources. The training of bank executives, understanding of participatory finance, and the time required to master the operations of a participatory bank are critical issues. In practice, nearly all executives in participatory banks come from professional conversions, predominantly sourced from conventional finance backgrounds. This shift poses a substantial challenge, as many of these executives perceive that the two banking models are almost identical, especially since Murabaha closely resembles traditional mortgage loans in structure and characteristics.

2.5. Nature of Liquid Assets of Participatory Banks

With granted financing primarily based on Murabaha, the latter represents 87% of Islamic banks' assets in Morocco according to 2022 figures.

However, Murabaha itself is mainly related to real estate assets, which are difficult to convert into liquidity immediately or in the short term. Therefore, according to the balance sheet structure of IFIs, liquid assets are considered to be IFI deposits with the central bank and other financial institutions.

On another aspect, Sukuk certificates held by the bank, which are supposed to present a high level of liquidity, are currently non-negotiable. Therefore, in the current situation, the fact that an IFI in Morocco possesses Sukuk securities has no significant impact on liquidity risk management.

However, these Sukuk securities correspond to sovereign Ijara sukuks issued in 2018 by the Moroccan State to initiate the issuance of Islamic financial securities. This operation saw the subscription of several economic actors, namely insurance companies, mutual funds, as well as participatory banks.

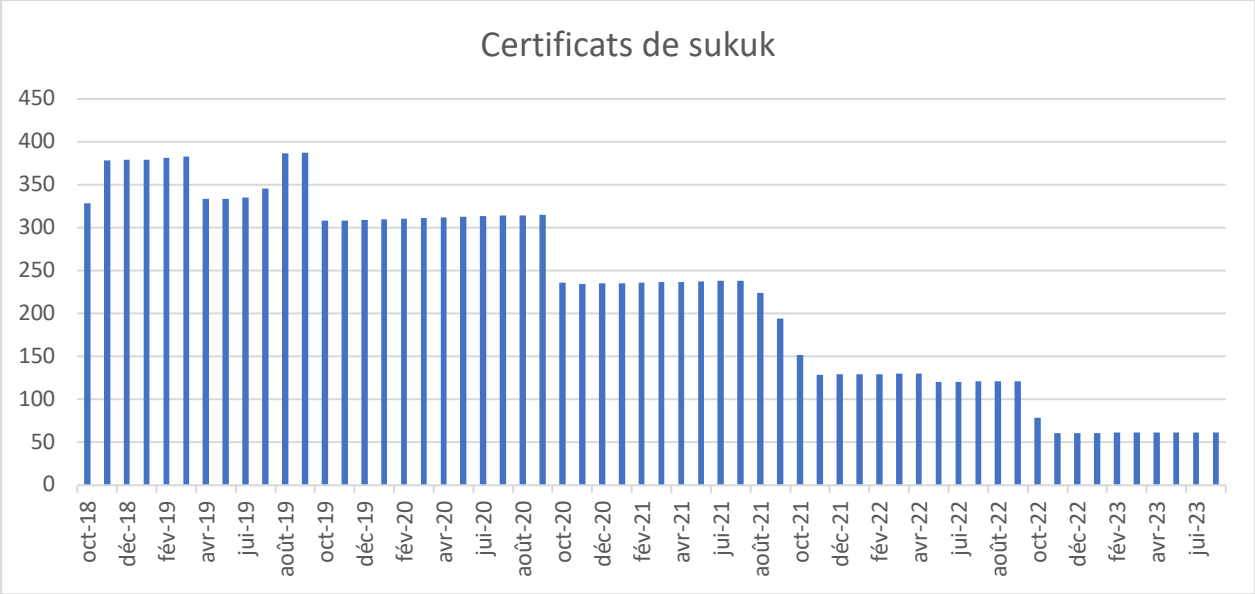
Such an issuance, being the only one in Morocco, is deemed an insufficient initiative to encourage participatory banks to issue corporate sukuk securities. This is explained by the size of the banks, but also by the role played by parent banks in filling the liquidity needs of second-tier banks.

This situation continues to worsen with the non-negotiability of these sukuk securities held by participatory banks, and over time, participatory banks in Morocco have renounced sukuk securities through their sale.

Indeed, the fact that Sukuk certificates appear on the balance sheet of participatory banks without being negotiable constitutes a loss of liquidity for these banks, and the money invested in Sukuks, in this case, should be directed towards participatory investment and financing generating a profit margin for the bank.

Moreover, considering the above, the evolution of the outstanding amount of sukuks held by banks has significantly decreased between 2021 and 2022, with a rate of around 53%.

Figure N°1 : Evolution of IFI Sukuk Outstanding



Source: By the author based on the asset account of banks and participatory windows (BKAM monetary statistics).

3. Empirical Evidence on the ARDL Model

The ARDL model is a statistical model developed by Pesaran in the 1990s, and unlike other statistical models, it has the particularity of qualifying long-term and short-term relationships between explanatory and explained variables. Therefore, the choice of ARDL for our study originates from the nature of the expected results from it.

On the other hand, the model presents a primordial advantage compared to previous models, that is, there is always the possibility of including in a statistical test variable that do not have the same degree of integration

3.1. The Econometric Model

The ARDL (AutoRegressive Distributed Lag) modeling is a combination of autoregressive models AR (models where among the explanatory variables we find past values of the variable to be explained) and distributed lag models DL (models that have as explanatory variables: Xt and its past values).

This ARDL modeling allows us to test cointegration and estimate short-term and long-term relationships when the series are not integrated of the same order.

In order to verify the link between the evolution of liquidity risk of participatory banks in Morocco, we have retained as variables:

1. Liquidity risk: measured by the ratio of liquid assets to total assets, liquid assets are mainly composed of deposits from second-tier banks with the central bank, as well as deposits with other banks and Sukuk certificates.
2. Current account and checking account deposits (DC)
3. Investment deposits: investment deposits correspond to the sums deposited in participatory banks in order to have a return on investments made by the bank itself while respecting the rules of sharing losses and profits. WAKALA BIL ISTHITHMAR are excluded from investment deposits because they are based exclusively on Murabaha contracts, which in turn have a very low level of liquidity (Real Estate Murabaha Contract) (DI)
4. The inflation rate: Considered as the main indicator of price increases, inflation can affect the level of bank liquidity through massive withdrawals of money in order to cope with an upward trend in prices. As a result, economic agents tend to make up for the shortfall in purchasing power by using the money available in their current bank accounts. (INF)
5. Money supply: Like inflation, an increase in the M3 aggregate, in other words a greater circulation of fiduciary money, can impact the level of bank liquidity. (M3)

The general form of this relationship is as follows:

$$RL_t^s = f(EX_t^s) \qquad EX = \{DC, DI, INF, M3,\} \tag{1}$$

The data used correspond to the consolidated balance sheet of all participatory banks and windows in Morocco for a period spanning from October 2018 to July 2023. (source: BANK AL MAGHRIB)

Equation (2) is estimated using ARDL modeling. Schematically, it can be divided into three stages. First, we test for the existence of a long-term relationship by applying the "bounds tests" approach. Then, we estimate the following error correction models using the ordinary least squares (OLS) method:

$$\Delta RL = \beta_0 + \beta_1 RL_{t-1} + \beta_2 EX_{t-1} + \sum_{i=0}^{n} a_{1,i} \Delta RL_{t-1} + \sum_{i=0}^{k} a_{2,i} \Delta EX_{t-1} + \varepsilon_t$$

Where Δ represents the first difference operator.

The third and final step consists of estimating the long-term relationship and short-term dynamics of the ARDL models using OLS

3.2. Descriptive statistics

The descriptive study provides a brief overview of a time series of data in order to analyze them better.

Table N°1: Descriptive statistics

	Liquidity risk	Current account deposits	Investment deposits	Money supply	Inflation
Mean	0.079808	4309.764	1183.673	1489433.0	0.027926
Median	0.073866	4199.655	1182.528	1485794.0	0.013500
Maximum	0.185835	7763.369	2727.326	1730701.0	0.101000
Minimum	0.045920	1320.977	0.000000	1299671.0	-0.007000
Std.Dev	0.028232	1840.338	889.7819	133425.8	0.031883
Skewness	1.492599	0.217567	0.078312	0.164410	0.871126
Kurtosis	5.534795	1.867426	1.588308	1.805241	2.227317
Jarque-Bera	37.06343	3.557491	4.875400	3.710966	8.778493
Probability	0.000000	0.168850	0.087362	0.156377	0.012410
Sum	4.628876	249966.3	68653.06	86387094.0	1.619728
Sum sq. Dev.	0.045431	1.93E+08	45127571.0	1.01E+12	0.057940

Source: Authors

The descriptive study shows that the variables "Liquidity risk & inflation" are normally distributed as the probability value of Jarque-Berra is greater than 5%, while the other variables do not follow a normal distribution.

The value of the Skewness coefficient reveals a rightward asymmetry for all variables in our study, which means that the variables present regularity, in other words, a uniform distribution. Regarding the "Kurtosis" coefficient, we have no value greater than 3, therefore, the variables are no more flattened than the normal distribution, except for the dependent variable.

3.3. Results of the unit root test: PHILLIPS-PERRON

Before testing for the existence or absence of cointegration relationships between the different variables, it is necessary to ensure that the data used are not integrated of order 2. To do this, we opted for the PHILLIPS-PERRON unit root test and the results are summarized in the following table:

Table N°2: Unit Root Test Philips-Perron

Study variables	Niveau du test	Intercept	Trend & Intercept	None	P-value	Nombre de retard	Degré de Stationnarité
Liquidity risk	Level	-4.567255	-4.828431	-3.013791	0,0005	2	I(0)
	First Difference	-11.23782	-11.77235	-10.83709			
CC Deposits	Level	0.782244	-1.949256	6.885019	0,0000	1	I(1)
	First Difference	-8.829334	-8.907324	-5.003392			
Investment deposits	Level	1.017903	-3.132486	4.827072	0,0000	1	I(1)
	First Difference	-8.010150	-8.146169	-4.991068			
Money supply	Level	0.845910	-3.271115	6.674213	0,0000	5	I(1)
	First Difference	-9.077707	-9.300798	-6.640681			
Inflation rates	Level	-0.874060	-1.838374	-0.243322	0,0000	1	I(1)
	First Difference	-5.998330	-5.938228	-6.012760			

Source: Authors

According to the results of the stationarity test, we do not have any study variable integrated of order 2, therefore, the variables fit well within the specifications of the test using the ARDL approach.

4. The cointegration test

4.1. Bounds cointegration test

To avoid the existence of a cointegration risk and to study the existence of a long-term relationship between the variables, we conducted a cointegration test using the new ARDL

bounds testing procedure, which amounts to a Fisher test of joint significance of the coefficients.

The table below presents the value of the Fisher statistic and the theoretical values of the bounds for thresholds of 1%, 5%, and 10%.

Comparing the Fisher statistics to the critical bound values allows us to reject the null hypothesis of no long-term relationship and to conclude that there is a long-term relationship between the different variables. Therefore, there is a cointegration relationship between the variables.

Table N° 3: Results of the Bound Test

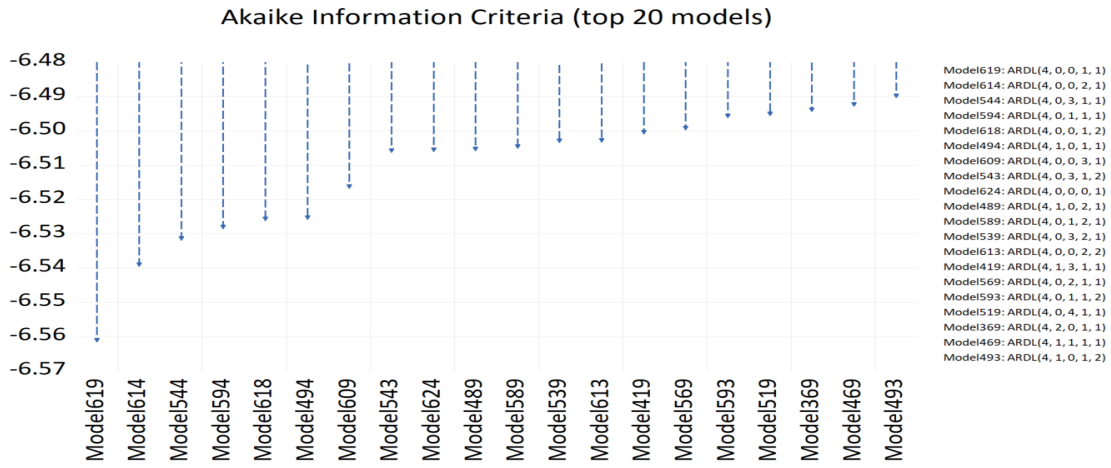
F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
F-statistic	5.878210	**Asymptotic: n=1000**		
k	4	10%	2.2	3.09
		5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Authors

4.2. Estimation of the optimal model

The optimal model according to the chosen statistical test corresponds, based on the basic rule, to the shortest model, in other words, the smallest number of parameters that can give the best results.

Figure N°2: Estimation of the optimal model



Source: Authors on Eviws

4.3. Estimates of the ARDL model coefficients

Table N° 4: Estimation of the ARDL model coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RL(-1)	0.358935	0.125808	2.853048	0.0066
RL(-2)	0.166161	0.128660	1.291473	0.2034
RL(-3)	-0.156049	0.125997	-1.238511	0.2222
RL(-4)	0.294850	0.103929	2.837043	0.0069
M3	2.25E-07	8.47E-08	2.659355	0.0110
INF	0.217244	0.079334	2.738356	0.0089
DI	2.31E-05	2.12E-05	1.088304	0.2825
DI(-1)	-3.90E-05	1.91E-05	-2.041038	0.0474
CC	1.68E-05	1.12E-05	1.495772	0.1420
CC(-1)	-3.13E-05	1.13E-05	-2.761188	0.0084
C	-0.241556	0.101678	-2.375694	0.0220

Source: Authors

4.4. Estimation of the long-term and short-term relationship

- **Short-term relationships**

Table N° 5: Short-term relationships

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.241556	0.101678	-2.375694	0.0220
RL(-1)*	-0.336103	0.104609	-3.212959	0.0025
M3**	2.25E-07	8.47E-08	2.659355	0.0110
INF**	0.217244	0.079334	2.738356	0.0089
DI(-1)	-1.59E-05	1.23E-05	-1.292969	0.2029
CC(-1)	-1.45E-05	6.32E-06	-2.294877	0.0267
D(RL(-1))	-0.304961	0.123390	-2.471522	0.0175
D(RL(-2))	-0.138801	0.117437	-1.181913	0.2437
D(RL(-3))	-0.294850	0.103929	-2.837043	0.0069
D(DI)	2.31E-05	2.12E-05	1.088304	0.2825
D(CC)	1.68E-05	1.12E-05	1.495772	0.1420

Source: Authors

Based on the results of the short-term relationships table, we can conclude that the significant variables are as follows:

- Inflation, which is positively correlated with liquidity risk, meaning that with each increase in the inflation rate, liquidity risk increases, which aligns with classical monetary thought.
- Like inflation, the money supply shows the same results.
- As for current account deposits, they are significant and negatively correlated with the dependent variable, which shows that the more deposits are collected, the more liquidity risk is reduced.

- **Long-term relationships**

Table N° 6: Long-term relationships

Variable	Coefficient	Erreur standard	Statistique t	Probabilité (P-Value)
M3	6.70E-07	2.73E-07	2.456410	0.0181
INF	0.646361	0.297189	2.174913	0.0352
DI	-4.74E-05	3.09E-05	-1.533210	0.1325
CC	-4.32E-05	2.38E-05	-1.813138	0.0768
C	-0.718695	0.330069	-2.177407	0.0350

EC=RL−(0.0000∗M3+0.6464∗INF−0.0000∗DI−0.0000∗CC−0.7187)

Source: Authors

For long-term relationships, the significant variables are inflation and the money supply, which shows that these variables and the macroeconomic context significantly affect the level of liquidity risk.

5. Diagnostic of the ARDL model

5.1. Error Autocorrelation test

Autocorrelation is the phenomenon where observation errors in a time series are correlated, leading to an underestimation of the standard error of coefficients. Therefore, it is crucial that the errors of a model, particularly ours, are independent.

To prove the non-correlation of errors, we chose to work with the Breusch-Godfrey test because it allows for statistically testing autocorrelation of any order.

Figure N° 3: Error Autocorrelation test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.268738	Prob. F(2,41)	0.7657
Obs*R-squared	0.698736	Prob. Chi-Square(2)	0.7051

Source: Authors on Eviews

Since the probability (F) is greater than 5%, autocorrelation of errors is absent for our ARDL model

5.2. Heteroscedasticity test

Unlike homoscedasticity, heteroscedasticity is the phenomenon where observations in a sample do not have the same error variance. Indeed, this is one of the essential assumptions for validating a model. Therefore, to verify if the variances are homogeneous and the errors are identically distributed, we used the White test (Breusch, Pagan, and Godfrey).

Figure N°4: Heteroscedasticity test (White test)

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.014421	Prob. F(10,43)	0.4474
Obs*R-squared	10.30757	Prob. Chi-Square(10)	0.4139
Scaled explained SS	7.581652	Prob. Chi-Square(10)	0.6696

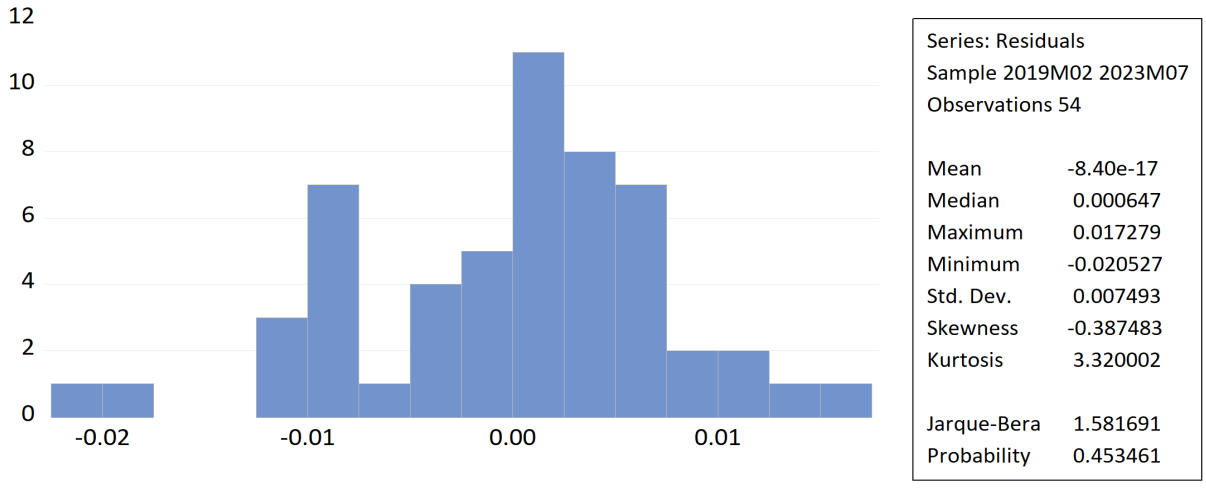
Source: Authors on Eviews

The table above allows us to conclude that the variance of the residuals in our model is homogeneous and stable because the probability value of the F-statistic is greater than 5%. Therefore, the errors are not heteroscedastic but rather homoscedastic.

5.3. Test of normality of errors

Normality tests aim to examine whether the errors associated with a statistical series follow a normal distribution or not. Below is the result of the test performed on Eviews:

Figure N° 5: Histogram of the Error Distribution



Source: Authors on Eviews

According to the results of the normality test, the errors do follow a normal distribution, which confirms that they are Gaussian white noise, given that the probability value of Jarque-Bera is greater than 5%.

5.4. Model stability test

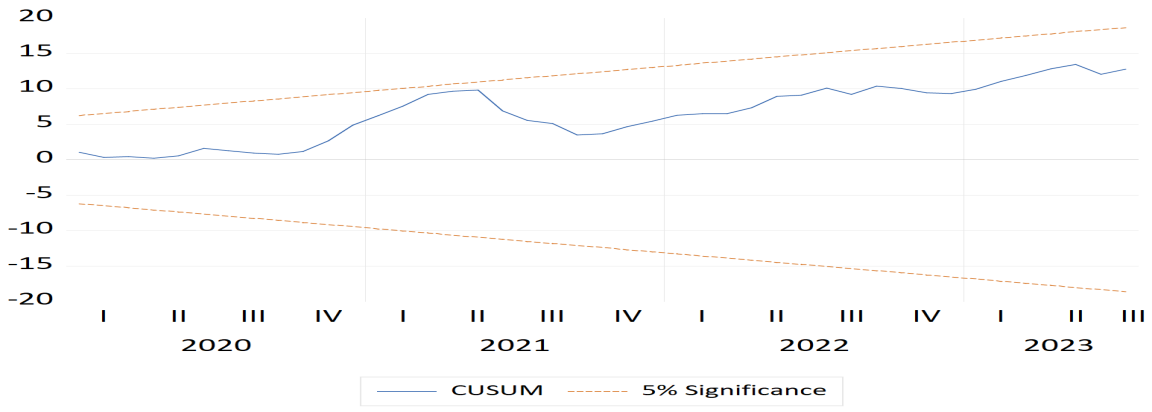
The model stability tests, namely CUSUM and CUSUMQ, are tests conducted to qualify the relationship between the dependent variable and the explanatory variables.

For CUSUM: This test is based on calculating the cumulative sums of the residuals from the ARDL equation, which are represented in the form of curves.

For CUSUMQ: This is a test based on calculating the sums of the model's residuals.

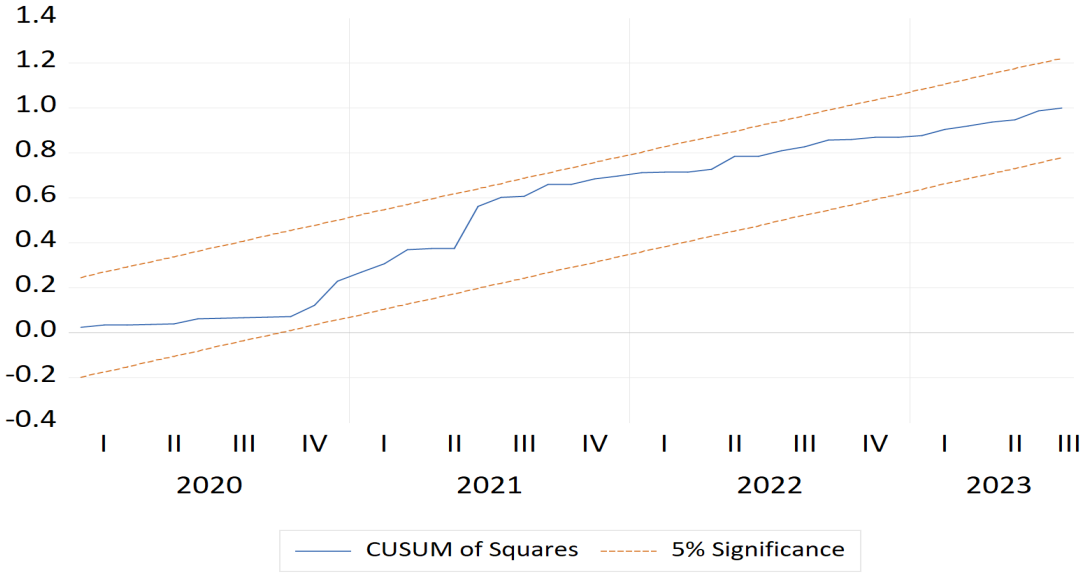
Our model is considered stable if the lines of both tests fall between the two bounds of the interval.

Figure N° 6 : CUSUM Test



Source: Authors on Eviews

Figure N°7: CUSUMSQ Stability Test.



Source: Authors on Eviews

Conclusion

The econometric test conducted using the ARDL model to assess the determinants of liquidity risk in participative banks in Morocco revealed statistically significant long-term relationships between the study variables, particularly the inflation rate and the volume of the money supply. These results illustrate the extent to which macroeconomic fluctuations impact liquidity management within the specific framework of participative banks.

The test results indicate that inflation is the most significant variable affecting liquidity risk in participative banks in Morocco. This finding is particularly relevant given the unique structure of these institutions, which differentiate themselves from conventional counterparts by adhering to Sharia rules and principles, especially the prohibition of interest rates. Such a prohibition limits access to conventional mechanisms to mitigate the effects of inflation. Consequently, a higher inflation rate can create imbalances in the liquidity levels of Islamic financial institutions (IFIs), as it erodes the real value of deposits and may prompt customers to withdraw funds to avoid losing purchasing power.

In the Moroccan economic context, rising inflation can directly affect the costs of IFIs for two main reasons. Firstly, due to the Sharia-mandated principle of backing by tangible assets, particularly through Murabaha and Ijara contracts, which impacts the long-term profitability and solvency of IFIs. Secondly, due to the Moroccan participative interbank market, characterized by the presence of only one refinancing option: WAKALA.

On another level, the M3 money supply aggregate is also identified as significant in the long term by the ARDL model, highlighting the crucial role of money supply in managing liquidity risk within Moroccan IFIs. Theoretically, the relationship between money supply and liquidity levels is natural: an increase in money supply signals more money in circulation, thereby facilitating access to bank financing. However, in the context of participative banks, this relationship is more complex. Unlike conventional banks, which can respond to changes in money supply through interest rate adjustments, participative banks must find alternative ways to manage liquidity, often by turning to Islamic finance products or adapting their risk management strategies.

Moreover, a rapid and substantial increase in money supply can intensify inflationary pressures, further complicating liquidity management. A typical scenario is when money supply grows quickly, leading to a potential increase in deposits, which might appear advantageous in the short term. However, if this increase is not accompanied by a rise in liquid assets or improved

capacity of second-tier banks to provide financing, it could create imbalances in these banks' balance sheets, making liquidity risk management more challenging.

Another important aspect to consider is how changes in inflation and money supply interact with the structure of deposits in participative banks. Unlike conventional banks, participative banks heavily rely on profit-sharing deposits (Mudaraba), where depositors share in the profits (and sometimes losses) generated by the bank's financial activities. In a high-inflation environment, customers may become more reluctant to keep their funds in profit-sharing deposits, preferring safer investments or tangible assets, thus increasing the risk of significant withdrawals. This could lead to a liquidity shortage at a time when banks need it most to meet financing demands.

Additionally, an upward trend in money supply can impact depositor behavior, as an increase in the money supply at a faster-than-normal rate can lead IFIs to witness a rise in deposit volumes. However, these deposits remain volatile due to the presence of attractive investment opportunities, prompting depositors to withdraw their funds to protect against inflationary pressures. This introduces an element of uncertainty in deposit management, and consequently, in the overall liquidity management of banks.

Given the above, the liquidity risk problem in Moroccan participative banks, according to the econometric test results, could be addressed through government intervention via the central bank. This intervention would involve establishing the Islamic money market and ensuring macroeconomic stability. Through such action, the state, via the central bank, could establish a liquidity exchange platform by issuing tradable sovereign financial instruments.

Effective liquidity risk management in participative banks in a context of inflation and money supply growth requires innovative and tailored strategies aligned with Islamic finance principles. The introduction of new Sharia-compliant financial instruments could provide solutions to enhance liquidity management. The issuance of Sukuks (Islamic bonds) could be employed to raise additional short-term funds while adhering to Islamic finance principles.

However, another solution remains feasible, as demonstrated by international experience. The issuance of treasury bills through auction is a very common refinancing operation. International experience has shown that these securities are highly valued by the participative finance community, especially when they are linked to the commodities market.

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