End of Studies Project

Topic :

Asset And Liability Management

CPA Case

Presented and defended by: *Supervised by:*

ABDERREZAG Ahmed   *Haykel KHADRAOUI*

Student belonging to : Minister of Finances

معهـــد تمويــلُ التنميــة
للمغــرب العــربي

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Dedication

To My Dear Parents Who Have Always

Supported Me

Acknowledgements

My first thanks are to "ALLAH" Glorified and Sublime be He, who gave me the strength, courage and determination to carry out this work.

I would like to express my deepest gratitude to Haykel KHADRAOUI, who supervised this work and whose remarks, advices and encouragements were crucial for the accomplishment of this work. I express to him all my gratitude and my most sincere thanks for the trust and privilege granted me by accepting to be my supervisor.

Also, my gratitude goes to the honorable members of the jury who honored me for evaluating.

I cannot forget all those who have supported and encouraged me at critical times.

Finally, my thoughts go out to my family and friends to whom I have an infinite love. May they find in this work my deepest gratitude for their precious support.

Contents

List of tables

List of figures

List of abbreviations

Abbreviation	French	English
ALCO	Asset And Liability Commitee	Asset And Liability Commitee
ALM	Asset Liability Management	Asset Liability Management
BDC	Bons De Caisse	Cash Vouchers
BDL	La Banque De Développement Local	The Local Development Bank
CCP	Comptes Courants Postaux	Postal Current Accounts
CPA	Crédit Populaire D'Algérie	Popular Credit Of Algeria
DAT	Le Dépôt A Terme	The Term Deposit
DAV	Dépôts A Vue	Overnight Deposits
FCC	Fond Commun Des Créances	Common Debt Fund
GAP	Gestion Actif-Passif	Asset-Liability Management
MLT	Moyen Et Long Terme	Medium And Long Term
OAT	Obligations Assimilables Du Trésor	Assimilable Treasury Bonds
PEL	Le Plan D'épargne Logement	The Housing Savings Plan
SMES	Petites Et Moyennes Entreprises	Small And Medium Enterprises
TCI	Taux De Cession Interne	Internal Assignment Rate

List of appendices

Abstract

Nowadays banking activity is under enormous pressure, which is accompanied by an increase in the level of risks, particularly financial risks (liquidity risk, interest rate risk and exchange rate risk), due to the nature of the activities carried out by banks, essentially the transformation of resources with short maturities into expenditure with long maturities.

Monetary authorities, as overseers and protectors of the banking system, have always sought to minimize losses and optimize the risk/return trade-off by implementing risk management systems, including Asset and Liability Management (ALM).

ALM is the asset-liability risk management technique that consists of obtaining a balance sheet structure that complies with the requirements of the banking system in order to maximize profits and avoid risky situations. It can be achieved through two lenses: the static and the dynamic lenses.

Asset and Liability Management is based on three steps: identification, measurement and coverage of risks.

The identification of risk is a very important step, the purpose of which is to identify any element that could generate a risk on the bank's activity. Measurement is the second step, it consists in assessing the bank's exposure to various risks, namely liquidity, interest rate and exchange rate risk, using several tools.

In our work we have used ALM to study liquidity risk and for its measurement we have taken the gap method (impasses) and liquidity indices (liquidity coefficient and transformation index) as calculation tools.

Finally, hedging can be done through several instruments and must be adequate in terms of risk, including the back-to-back method and derivatives.

Our case study looked at the balance sheet of the Crédit Populaire d'Algérie (CPA) over the short term (three years) to determine its liquidity position. After the results, we noticed that the bank was in excess liquidity over the entire period studied and for its coverage we proposed to make an investment/borrowing. In other words, make a loan corresponding to the amount of the surplus and reuse it so as not to lose and make a profit.

Throughout our brief we have tried to answer the following problematic:

How can liquidity risk be managed using the ALM approach?

Résumé

De nos jours l'activité bancaire connait une énorme pression, qui s'accompagne d'un accroissement du niveau des risques particulièrement les risques financiers (risque de liquidité, risque de taux d'intérêt et risque de change). Tout ça du a la nature des activités que pratiquent les banques, essentiellement la transformation des ressources aux échéances courtes en emplois avec des échéances longues.

Les autorités monétaires en tant que surveillants et protecteur du système bancaire cherchent depuis toujours à minimiser les pertes et à optimiser le couple rentabilité/risque, en mettant en place des systèmes de gestion des risques, notamment la gestion des risques actif-passif (Asset and Liability Management), l'ALM.

L'ALM est une technique de gestion des risques actif-passif qui consiste à obtenir une structure du bilan conforme aux exigences du système bancaire afin de maximiser les profits et éviter toute situation risquée. Elle peut être réalisée par deux optiques : l'optique statique et l'optique dynamique.

L'ALM (Asset and Liability Management) se base dans son travail sur trois étapes qui sont : l'identification, la mesure et la couverture des risques.

L'indentification du risque est une étape très importante qui a pour but de repérer tout élément pouvant générer un risque sur l'activité de la banque. La mesure est la deuxième étape, elle consiste à évaluer l'exposition de la banque face aux différents risques à savoir : le risque de liquidité, de taux d'intérêt et de changes, en s'aidant de plusieurs outils.

Dans notre travail on a utilisé l'ALM pour étudier le risque de liquidité et pour sa mesure on a pris la méthode des gaps (impasses) et les indices de liquidité (coefficient de liquidité et indice de transformation) comme outils de calcul.

Enfin la couverture, elle peut se faire par plusieurs instruments et elle doit être adéquate au niveau des risques. Parmi ces instruments on trouve la méthode des adossements et les produits dérivés.

Notre cas pratique a traité le bilan du crédit populaire d'Algérie (CPA) sur le court terme (trois ans) afin de déterminer sa position de liquidité. Après résultats on a remarqué que la banque était en surliquidité sur toute la période étudiée et pour sa couverture on a proposé de faire un placement/emprunt. En d'autres termes faire un emprunt correspondant au montant du surplus et le réemployer pour ne pas perdre et réaliser un profit.

Tout au long de notre mémoire on a tenté de répondre à la problématique suivante :

Comment peut-on gérer le risque de liquidité par l'approche ALM ?

General Introduction

General introduction

Risk is always present and has always been part of the financial system, and as a major component of the financial system, the bank faces a multitude of risks as a direct result of its various activities and services. These risks are mainly financial risks including: liquidity risk, interest rate risk and market risks.

A bank is exposed to risk from the minute it decides to lend money, including the risk of not repaying the loan and its interest. It is also in permanent risk because of its role as an intermediary that confronts it with the threat of transformation, in other words, fluctuations in interest rates.

In our research we focused primarily on liquidity risk. For a bank, liquidity risk means the inability to meet its commitments at a given time and also the risk that an asset cannot be sold at its fair value. Liquidity risk was neglected and classified as a secondary risk until 2007, when it caused the SUBPRIME crisis, a crisis that gradually spread to all financial markets and eventually affected the entire global economy, proving that if a bank is in loss or bankruptcy it can drag the entire financial system down the path. Whether because of its size, its degree of interdependence with financial institutions, or the nature of the services it provides, a bank can pose serious risks to an entire economy.

After the increased level of risk and the damage to banks, the stability and soundness of banks has become a major concern for governments and monetary authorities in any country. To limit these risks, banking risk management systems have been put in place. These systems are designed to protect any bank and maintain its stability and soundness in order to minimize any losses. One such method is Asset Liability Management (ALM).

ALM (Asset Liability Management) or Asset and Liability Management is often assimilated to a global balance sheet management, it aims to identify risks, measure them and ultimately cover them in order to optimize profitability while respecting regulatory constraints and the institution's objectives and also to keep an acceptable level of risk.

In Algeria, the will to introduce modern risk management techniques is not recent. Algerian regulations have been concerned with this aspect and this was seen with the promulgation of Law 90-10 of 14 April 1990 on currency and credit, text which is in the wake of the Bale I agreements. Also, with the introduction of Order 10-04 of 26 August 2010 on internal control, testimony of a desire to have this type of management at the level of banks.

In spite of all the efforts made by the Algerian banking system in terms of regulations, particularly standards relating to the control and management of risks affecting liquidity and especially the solvency of credit institutions, asset-liability management is not yet commonplace and remains little used in our banks. This is why we have set ourselves the objective of explaining the approach to liquidity risk management and we have insisted on its importance and its usefulness. We have tried to answer the following problematic:

How can liquidity risk be managed using the ALM approach?

This issue raises a number of questions:

- What does cash and liquidity mean for a bank? What are its sources and its different forms?
- What is asset-liability management? What are the risks of ALM and what are its tools?

- What is liquidity risk? How can it be identified, measured and how is it hedged?
- How does Crédit Populaire d'Algérie put this approach into practice?

In order to guide our work, we have set the following assumptions:

➢ H1: ALM is a risk management technique used by the CPA to forecast its liquidity situation.
➢ H2: changes in interest rates and the liquidity position have an impact on the bank's profitability.

In our work we have been satisfied with the static approach, which is carried out either by the durations method or the deadlock and liquidity indicators method, and we have found it useful to do it by the second method in order to better show the gaps between assets and liabilities on the balance sheet.

We were able to do this work thanks to an internship at the Crédit Populaire d'Algérie (CPA) and from data corresponding to this institution.

In order to refuse or confirm our hypotheses and better explain our work, we have divided our work into three chapters, the first two are theoretical and the last one is entirely devoted to the practical case.

In the first chapter we presented the treasury and identified its objectives, functions and tools. Finally, we defined liquidity, how it is held by the banks and we presented the liquidity risk and its typology.

The second chapter examined the ALM, its objectives, mission and tools. It then explained how to identify and measure liquidity risk and ended with methods for hedging it.

The last chapter has detailed the case study in which, after having presented our structure of reception during the internship, we have analyzed our balance sheet and determine the risks to which they can be exposed, all this after a careful calculation of the profits of maturity and dead ends and a static forecast of three years, in order to come out with indications and recommendations for the Crédit Populaire d'Algérie (CPA).

Chapter 01: Liquidity and Liquidity Risk

Chapter 01: Liquidity and Liquidity Risk

Introduction

The proper functioning of any economy and banking system depends on the health of banks and financial institutions, which in turn depends on the degree of control of risks inherent in banking activity.

Indeed, in the course of their activities; banks incur a range of risks that need to be identified and managed to reduce the potential losses they may cause.

In this chapter, the focus will be on the bank treasury and its role, as well as the important risks faced by banks, including liquidity risk.

In order to do so, we have found it useful to divide this chapter into three sections:

- Section 1: Bank liquidity.
- Section 2: Generality on banking risks.
- Section 3: Liquidity and liquidity risk.

Section 01: Bank treasury

The treasury department is an intermediary within the bank and its role is to link the fundraising department with the credit granting department. But in addition to this, it is responsible for representing the bank in the financial markets, whether for hedging programs decided by the ALM (Asset Liability Management) committee or on behalf of the bank to make profits.

Therefore, in this first section will be defined the bank's treasury, the functions of the treasury department, and its objectives.

Definition

In theory, in financial analysis, cash flow is defined as the difference between working capital and working capital requirement;

It represents a simple intermediary between two departments of the bank: the "deposit collection" department and the "lending" department. "The treasury department can (and generally must) use a wide range of products to optimize the management of its portfolios"[1]

Figure N (1-1): Intermediation of the Treasury Department
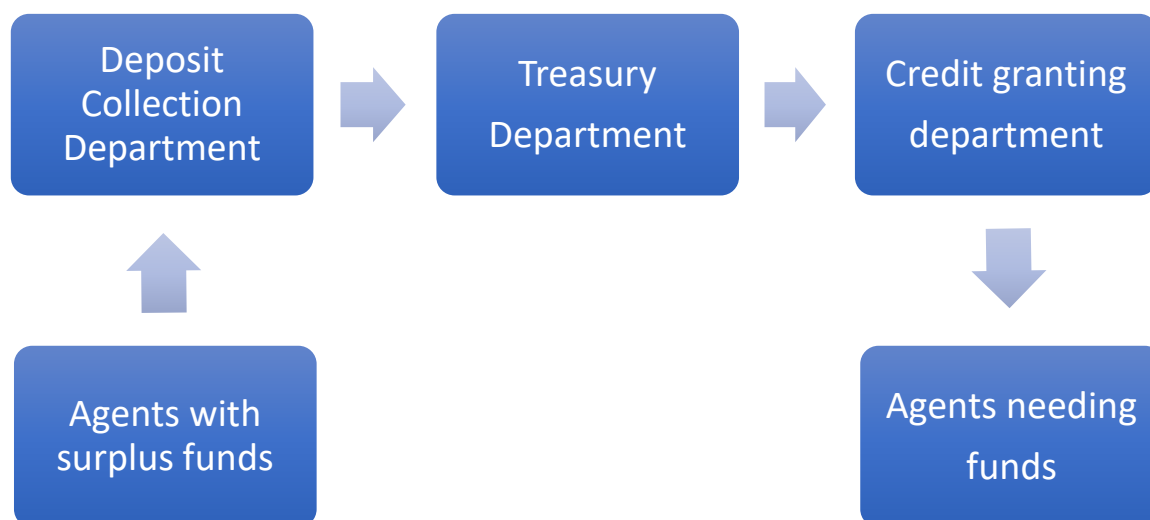
Source: Established by the student from the definition.

Treasury Objectives

The objectives of the treasury are:

- ✓ Management of the bank's assets and liabilities;
- ✓ The purchase and sale of securities;
- ✓ Liquidity management and assurance;
- ✓ Monitoring of liquidity gap positions;
- ✓ Hedging foreign exchange positions;

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[1] BERNARD ,P. al., **Market risk measurement and control**, ECONOMICA, Paris, 1996, P. 30.

✓ The coverage of risks by equity capital.

Treasury Functions

In a bank, the treasury department can exercise two functions, the social function and the autonomous function.

❖ Social Treasury

It is "the armed wing of Asset and Liability Management"[2], its role is to represent the institution in the financial markets and to carry out financing programs proposed by the ALM (Asset Liability Management) unit. It is considered as a functional unit.

❖ Autonomous cash flow

It enjoys greater independence in these market operations. It intervenes either on behalf of the institution by taking cash shortages, taking foreign exchange positions or selling derivatives (swaps, caps, etc.) on behalf of customers in order to make a profit, in other words it plays the role of a market maker.

In general, a single treasury can perform both corporate and autonomous treasury functions, however, these two functions may be separated in order to identify the persons responsible for each one and to avoid conflicts of interest.

Treasurer's duties and qualifications[3]

The treasurer has four main tasks:

a) Ensure and manage liquidity

The treasurer is the person best placed to monitor the evolution of bank liquidity, which means the bank's ability to meet its maturities. As a result, it must at all times ensure that it has the necessary funds to meet its financial commitments;

b) Managing risks

Each decision taken may involve a risk that needs to be controlled, essentially liquidity risk and counterparty risk (risk of default by a counterparty), in addition to interest rate risk and foreign exchange risk.

Once the risk is measured, its importance should be reduced, mindful of the cost constraint, which can be confused with one of the treasurer's main objectives of minimizing financial costs;

c) Increasing margins

As a financial specialist and above all a multi-product specialist, the treasurer must participate in improving the bank's financial result.

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[2] DUBERNET.M, **Asset-Liability Management and Banking Services Pricing**, ECONOMICA, 1997, p.281.
[3] SION.M, **Manage the Treasury and the Banking Relationship**, 5th edition, DUNOD, Paris, 2001, P.28.

To do so, it must increase the return on assets and decrease the cost of resources; this can only be achieved if the treasurer negotiates the fairest financing and investment terms;

d) Ensuring the security of transactions:

The treasurer must have at his disposal a series of tools that can be defined through the different means of payment and secure banking circuits to deal with fraud attempts, as well as take corrective measures.

Treasury tools[4]

Since all treasury departments have the same hierarchical position, the treasurer does not have to impose his choices regardless of the transaction, amount, currency or maturity.

However, it can have control over the departments that lend and borrow funds through the following tools:

➢ Direct tools: ALCO committee (Asset and liability committee) and the transfer rate.
➢ Indirect tools: direct market intervention.

The direct tools

Direct treasury tools can be classified as follows:

5.1.1 The ALCO Committee (Asset and Liability Committee)

This committee usually takes the form of a balance sheet management committee, where the treasurer can influence the prices determined by the other departments. It decides on action plans based on short-term forecasts (maximum one month). Its members meet once a month and more frequently during periods of crisis or high market volatility. The members of this committee are:

✓ The General Manager of the bank;
✓ The head of treasury;
✓ The salesman;
✓ An economist;

In addition, the Committee may, if necessary, include a director of accounting, an auditor, a financial expert and a head of financial control, depending on the specific features and choice of each bank.

5.1.2 The transfer pricing rate

The transfer price rate, also known as the transfer price interest rate, is the price at which cash is transferred from one department to another. It is the interest rate at which business units place their resources and expenditure with a centralized unit (this function is performed by the treasury department).

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[4] Amaouche Sihem, **Management of liquidity risk by ALM method**, thesis, Higher Banking School, Algiers,2015, P.20.

Chapter 01: Liquidity and Liquidity Risk

In order to better understand its mechanism, we propose the following diagram:

Figure N (1-2): Transfer rate (TCI) mechanism
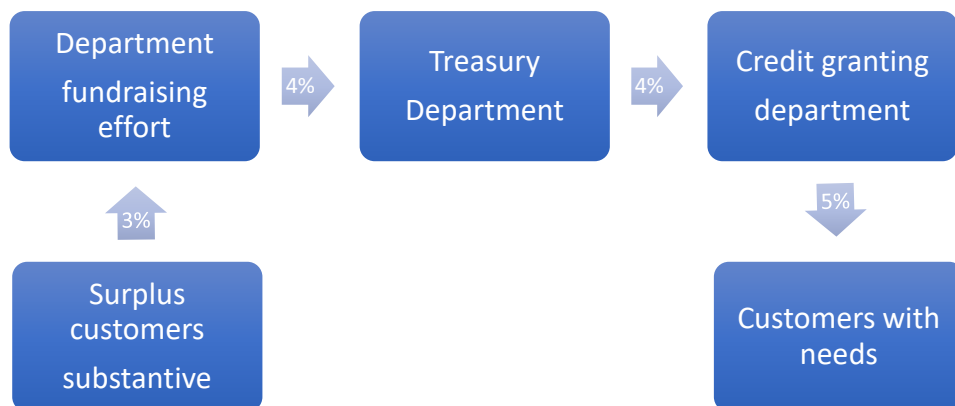
Source: Elaborated by students from the definition.

We assume that an institution remunerates the funds deposited by surplus agents with interest equal to 3%. Therefore, the head of the "fundraising department" will lend these funds to the treasury at a rate of 4% with a gain of 1%. This internal transfer rate concerns the resources, it is called: "ICT of resources".

Then, the head of the "credit granting department" borrows the necessary funds from the Treasury, the latter asking him for a rate equal to 5%, called: "TCI of liabilities".

The internal rates for the transfer of funds must take the market price as a reference, since the rate paid by the treasurer for the use of the funds must be less than or equal to the borrowing rate on the market.

❖ Transfer pricing targets

The implementation of a transfer pricing system allows:

- Allocate an interest margin to each business unit.
- Eliminate financial risks (liquidity and interest rate risks) and centralize them at the level of ALM (Asset Liability Management) in order to cover them by market operations.

Indirect tools

They are classified as follows:

Direct market intermediation

It is obvious that the transfer pricing system is not sufficient to influence the bank's commercial sectors to obtain the desired amounts, maturities and currencies. Indeed, it becomes necessary for the treasurer to intervene directly on the "capital market", i.e. the money market to lend or borrow funds, just as he can intervene on the foreign exchange market to open or close a foreign exchange position.

These two possibilities allow the treasury structure to influence the rates offered by the bank's other departments since they are obliged to align their rates with those of the market.

Figure N (1-3): Formation of capital markets
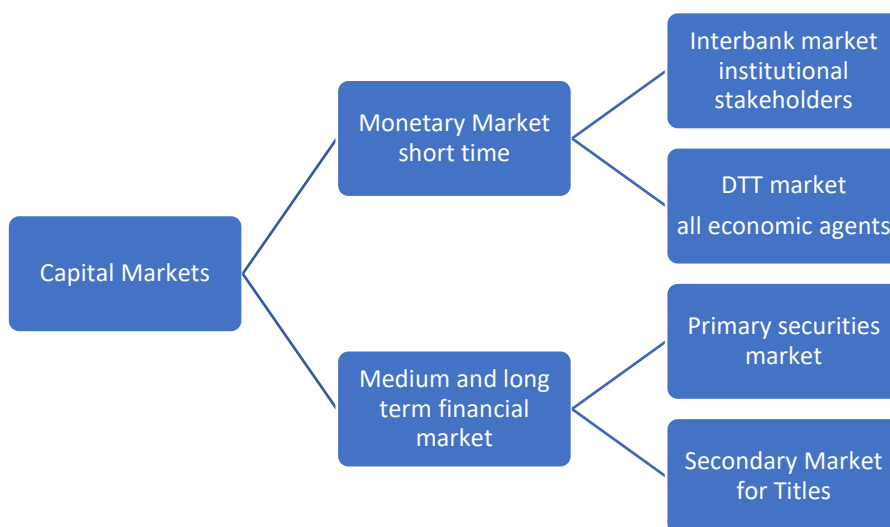
Source: Developed by students from the definition

The Treasury Department's intervention in the money market

Banks are among the most active participants in the money and foreign exchange markets and this is mainly due to the large volume of transactions carried out by the treasury department in these markets.

The monetary market

It is a meeting place for supply and demand of short-term capital. It is subdivided into two compartments:

- Interbank market: intended exclusively for banks and financial institutions.
- Negotiable debt securities market: open to all economic agents.

The interbank market

It is an over-the-counter market where financial institutions exchange their liquidity directly or indirectly (with or without the intervention of the Central Bank).

- The speakers:

There are two categories of players, lenders and borrowers on the one hand and intermediaries and the central bank on the other.

- ✓ Lenders and borrowers: banks and financial institutions, which hold an account with the Central Bank.
- ✓ Lenders only: called institutional investors, these are insurance companies, pension funds, generally having surplus cash and seeking to make them profitable, they Therefore

contribute to the fluidity of the interbank market in the case where the majority of banks are in deficit in terms of liquidity.

✓ The central bank: acts as a market authority, ensuring the regularity and smooth functioning of the market.

✓ Intermediaries: have the role of bringing lenders and borrowers together. In the interbank market.

The market for negotiable debt securities

"These are securities issued at the issuer's option and traded on a regulated market, each of which represents a claim for a fixed period of time.[5] Both financial borrowers (Treasury, financial institutions) and non-financial borrowers (companies) are involved in this market. Negotiable debt securities issued by borrowers include:

✓ Securities issued
  ➢ Negotiable Treasury Bills: These are short-term securities issued by the State to cover its financing needs.
  ➢ Certificates of deposit: "Are fixed or variable rate securities issued by credit institutions to finance their liquidity needs. Their maturity ranges from ten days to seven years.

  ➢ Commercial paper: "are fixed-rate securities issued directly by large companies on the money market (the absence of an intermediary usually constituted by banks makes it possible to obtain capital at lower rates than bank loans)"[6]. They Therefore enable companies to cover their working capital requirements.

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[5] DOVOGIEN, **Practice Of Financial Markets**,Edition DUNOD, Paris, p.115.
[6] TEULON Frédéric, **capital markets**,Edition SEUIL, Paris, p.20.

Section 02: generality on banking risks

"Risk refers to the uncertainty of results and losses that may arise when changes in the environment are adverse. [7]

"Risk is an exposure to a potential hazard inherent in a situation or activity; this well-identified hazard is associated with an event or series of events that is fully describable, not known to occur, but known to be likely to occur. In finance, risk is defined as the uncertainty about the future value of a current input (financial asset). It corresponds to a possibility of monetary loss due to an uncertainty that can be quantified"[8].

1. Liquidity risk

It is the risk for a bank, not to be able to face, at a given moment, its commitments or not to be able to finance the development of its activity."[9] It also refers to the risk that an asset cannot be sold at its real value, in this case we speak of market liquidity risk.

Figure N (1-4): Diagrams of the risks to which a bank is exposed
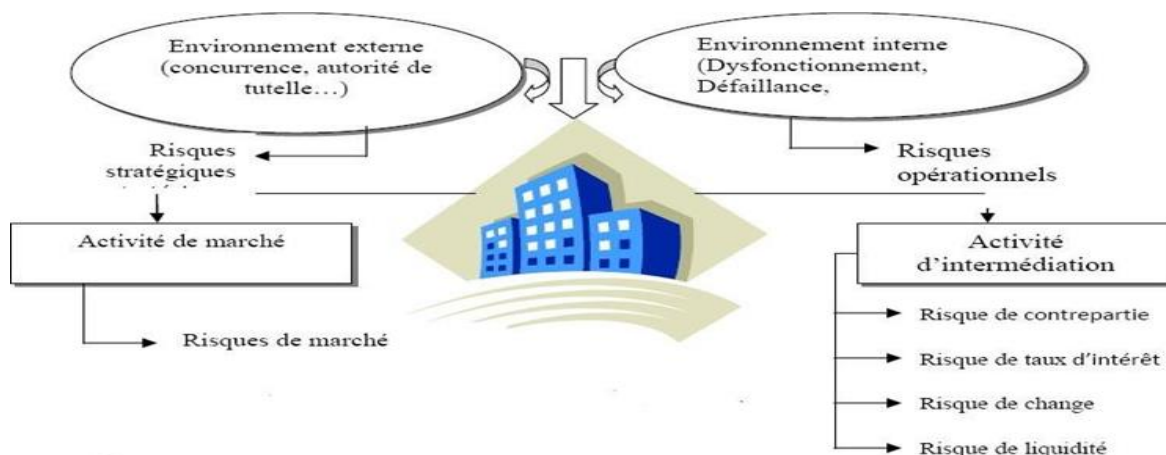
Source: Annual Report of the French Banking Commission, 2007, p2.

2. The risk management process

Risk management is the set of tools, techniques and organizational arrangements for identifying, measuring and monitoring risks. A distinction is made between internal management and global management. The first relates to risks taken individually and according to their nature (market risk, liquidity risk, credit risk, etc.). Whereas global management is a holistic process, which implies a consolidation of all risks and consideration of their interdependencies. Risk management is a logical process, generally comprising six steps[10]:

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[7] BESSIS J., **Risk Management and Asset-Liability Management of Banks**,DALLOZ, Paris, 1995, p. 2.

[8] www.wikimemoires.com/definition-risque-bancaire-types-bancaires/ consulted: 28/08/2020,12H.

[9] DEMEY Paul,Antoine FRACHOT. Gaël RIBOULET**, Introduction to Asset-Liability Management**, ECONOMICA, Paris, 2003, p.9.

[10] JACOB H. , SARDI A., **Bank Risk Management**, AFGES, Paris, 2001, p.22

Chapter 01: Liquidity and Liquidity Risk

1. Identification of risks
2. Risk assessment and measurement
3. Analysis, decision and action planning
4. Operational risk management
5. Risk monitoring
6. Risk reporting.

2.1 Identification of risks

Risk identification is an ongoing exercise because risks evolve with changes in the internal or external environment.

2.2 Risk assessment and measurement

It consists of quantifying the probability that an event or action may have an adverse effect on the activity.

2.3 Analysis, decision and planning of measures[11]

Only after analysis of the variables that create the risk will decisions be made.

Indeed, the bank's sustainability and success depend largely on its ability to identify and measure the risks it encounters in the course of its business. In order to deal with all of the above-mentioned risks, four strategies can be undertaken, depending on the objectives and regulatory limits:

- Avoid the risk: by renouncing the operations that generate it. This can be justified by the fact that this risk cannot be reduced and its level is higher than the risk appetite set by the bank;
- Transfer risk: by setting limits that the bank will not allow itself to exceed. These limits may be expressed in terms of volume, value at risk, amounts of committed capital or maximum losses;
- Limit the risk: Reduce the risk since the bank cannot bear it as it stands. Risk is reduced through internal control procedures (e.g. operational risk) or through hedging (e.g. interest rate risk);
- Pay the risk: i.e. bear its cost directly out of equity or reserves. (Its level is low and even if it is realized, the loss it could generate is not significant. The level of risk here is less than or equal to - the limit set by the bank).

2.4 Operational risk management

In this stage, plans, strategies and means are implemented. Each risk is managed by the unit designated for this purpose.

2.5 Risk monitoring

Risk management requires regular monitoring of risks, information on the likelihood and significance of risks that can be refined to ensure that decisions taken are always optimal and that the limits set are always respected.

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[11] DARMON J., **Banking Strategies and Balance Sheet Management**, ECONOMICA, Paris, 1998, p 67.

2.6 Risk reporting:

The reporting system is the logical outcome of the whole process. The results of risk management are assessed in reports that are intended for the bank's various responsibility centers (General Management, Board of Directors, Risk Committee, etc.).

Section 03: Bank liquidity and liquidity risk

This third section will be devoted to liquidity and liquidity risk, which is one of the most important risks affecting the organization of the balance sheet.

The first part will deal with the basic concepts of liquidity, i.e. its definition, the different types of bank liquidity, the reasons for holding it, its sources and its factors.

A second section will discuss liquidity risk, its definition and the origin of this risk.

1. Bank liquidity

Liquidity is at the heart of the bank's concerns, as it is the dynamic driver of all operations carried out. We will therefore devote this section to getting closer to the notion of liquidity through its definition, the reasons why it is held, its function and its sources.

1.1 Definition[12]

A bank's liquidity will be considered as the ability to fund the bank's assets and repay the commitments made (the liabilities) at the time such funding and repayments occur. This definition corresponds to the definition in the Basel Committee documents: "Liquidity is the ability of a bank to fund increases in assets and meet obligations as they came due, without incurring unacceptable loss ".[13] Liquidity or illiquidity risk is fundamental from a bank's perspective.

As the definition suggests, poorly controlled liquidity can lead to:

• Either a loss of opportunity due to the inability to finance the development of the activity;
• Either a liquidity crisis due to an inability to honor commitments made.

1.2 Reasons for holding liquidity[14]

According to the economist Keynes, there are three reasons for the preference for liquidity: the reason for trading, precaution and speculation.

1.2.1 Transaction

It corresponds to the need for money to make current personal and business payments.

This is an income motive for households that are required to hold cash to bridge the gap between the receipt and disbursement of their income. And as a business reason for firms that need to hold cash to bridge the gap between the time when expenses are incurred and the time when they receive the proceeds of sales.

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[12] DEMEY.P al. **, Introduction to Asset-Liability**, ECONOMICA, Paris, 2003, P.15
[13] Settlements, **Principales for Sound Liquidity Risk Management and Supervision**, September 2008, P.1
[14] BAILLY. J-L al., **Economy Macroeconomics**, BREAL, Paris, 2006, P. 102.

1.2.2 Caution

The precautionary motive is generated by the concern of households or businesses to prepare for future contingencies. As a result, they keep an amount of liquidity for their unpredictable expenses.

1.2.3 Speculation

Speculation consists of anticipating a rise in the price of a security by buying it with a view to reselling it when the rise has taken place in order to realize a capital gain.

The motive for speculation is directly related to the capital market and more specifically to the market for interest-bearing financial securities. The demand for money for this motive will depend directly on agents' expectations of interest rate developments.

1.3 The functions of liquidity

The functions of liquidity are:

1.3.1 Ensuring the ability to lend against commitments

A certain liquidity must be provided by the banker in order to cope with certain operations: withdrawals of funds, unexpected loan requests, particularly in the context of firm lines of credit that he grants to his clients.

1.3.2 Avoiding forced sales of assets

The bank may find itself, unwillingly, in a situation where it has to sell its assets in order to rebuild its liquidity when it cannot renew its loans at maturity.

1.3.3 Repaying loans

Allows the bank to self-assure itself that it is able to repay its debts without having to renew them.

1.3.4 Avoid recourse to the central bank

Banks tend to refer to the central bank for the purpose of borrowing and this allows them to make additional gains (rediscount rate lower than the borrowing rate on the interbank market). That said, these banks have to comply with the conditions set by the central bank when they find themselves in an illiquid situation.

1.3.5 Reassuring creditors

The main objective of liquidity is to alleviate the concerns of fund providers, as they are more concerned about the risk of not getting their funds back than about compensation.

1.3.6 Preventing high interest payments

Liquidity allows the bank to avoid going to the market with a borrowing position and Therefore avoid paying high interest rates.

1.4   Sources of liquidity[15]

There are four sources:

1.4.1   Liquid or quasi-liquid assets

- Cash balances: the bank's primary source of liquidity, being immediate, they are highly liquid;
- Substantially mature assets: Assets that are close to maturity include several components:
- Easily marketable short-term assets: these assets may include maturing long-term securities, but the bulk of them are monetary instruments, which are short-term instruments by definition. These assets are a secure source of liquidity when interest rates are stable, and do not generate a significant loss of capital when they are sold.

1.4.2   Ability to borrow

This refers to the bank's ability to raise funds on the market as well as the ease with which it can access the various capital markets. It depends on its reputation, size and profitability, the quality of its shareholder base and its reputation.

1.4.3   Ability to drain new savings

A very advantageous source since it is free, we are talking here about the ability of business units to attract new savings in the form of deposits.

1.4.4   Lines of credit with banks and the central bank

Banks may apply for standby credits (known as "stand-by credit lines") from other banks in order to meet their liquidity needs. These lines are often requested and granted by foreign banks to each other. They may also be provided by the Central Bank, which acts as lender of last resort.

1.5   Types of bank liquidity

The bank has a multitude of sources of liquidity that can be classified into three categories[16]:

-     Central Bank Liquidity;
-     Market Liquidity;
-     Funding liquidity.

1.5.1   Central Bank Liquidity

This liquidity corresponds to the Central Bank's ability to provide liquidity to the banking system. It is a sure source for second-tier banks because the Central Bank is the lender of last resort.

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[15] ATTAR Khaoula, **Management of liquidity risk by the ALM approach**, thesis , Higher Banking School, Algiers, 2016, P. 6.

[16] AZZOUZI IDRISSI, MADIES P, **Bank Liquidity Risks: Definitions, Interactions and Regulations**, Revue d'économie Financière, 2012, n°: 107, p.316

Access to this source is regulated by the supervisory authorities according to the country's monetary policy objectives and situations of excess or shortage of global liquidity.

1.5.2   Market Liquidity

This type corresponds to the liquidity that a bank can hold through the sale of its liquid assets. It refers to the liquidity of marketable assets, i.e. monetary assets or assets that can be converted into currency quickly and without excessive loss of capital.

However, this source is conditioned by the liquidity of the secondary market where liquid assets are traded.

1.5.3   Funding liquidity

According to DREHMANN and NIKOLAOU, the funding liquidity of banks can be defined as "...a cash position where they [banks] are able to meet their obligations on time". It is, therefore, an internal source that includes liquid and quasi-liquid assets, a bank's ability to borrow, etc.

However, it should be noted that there is an interaction between these types of liquidity. This link is rooted in the relationship between depositors, the banking system and capital market participants, which sometimes affects the liquidity of banks.

1.6   Liquidity factors[17]

Bank liquidity is influenced by a set of elements that act on leakages and payment flows out of the banking circuit by causing banks to demand central bank money. These so- called liquidity factors can be divided into two distinct categories:

- Autonomous factors;
- Institutional factors.

1.6.1   Autonomous factors

These are factors linked to certain operations, the development of which depends directly on the behavior of non-financial agents, therefore directly influencing the level of liquidity:

- Banknote transactions: withdrawals of banknotes reduce the bank's holdings of central bank money while deposits increase them;

- Transactions with the Treasury: settlements made between banks on the one hand and the Treasury or its correspondents (Postal Current Accounts (PCA) and Special Funds). On the other hand, have an influence on the accounts of commercial banks opened with the Central Bank. Indeed, bank liquidity is affected by fiscal policy;

- Foreign exchange transactions: any purchase or sale of foreign exchange made by a bank on behalf of its customer with the Central Bank reduces or increases the liquidity of the bank in

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question. Therefore, changes in banks' net foreign exchange assets influence the liquidity of the banking sector.

1.6.2   Institutional factors

This is the set of instruments and rules that the Central Bank sets for the implementation of its monetary policy in order to manage the overall situation of bank liquidity. It focuses mainly on:

- Reserve requirements**:** Banks are required to hold central bank money in reserve in their accounts with the Central Bank.
- The mobilization of claims**:** the possibility of a bank to mobilize its claims determines to a large extent the liquidity of its assets;
- Open market operations**:** these make it possible to control market liquidity by influencing interest rates through:
  - ✓ outright transactions: The Central Bank may buy or sell securities outright in order to supply or drain part of the market's liquidity,
  - ✓ reverse repo transactions: these correspond to reverse repurchase or repurchase agreements,
  - ✓ Fine-tuning operations: these are operations linked mainly to a over-liquidity situation. Banks are encouraged to place their liquidity in the form of deposits with the Central Bank.

Ultimately, several factors can affect the liquidity of the bank and the banking system as a whole. This makes liquidity management all the more necessary, especially since the raw material of banking activity is deposits.

1.7   Liquidity and profitability[18]

Liquidity and profitability are not independent concepts. In the case of a positively sloped yield curve where the transformation allows for positive carry, the search for profitability often results in an increase in the volume of transformation at the expense of liquidity.

Conversely, maintaining a liquid situation leads to the acquisition of low-margin assets and Therefore to a reduction in the rate of return. Or, in the event of tight liquidity, the search for new resources by selling assets before their maturity dates may result in a capital loss in the event of unfavorable interest rate movements. In other words, the more liquid a bank is, the less profitable it is. Its choice between these two criteria depends on its utility function and its assessment of risk.

Liquidity risk

"Liquidity risk is the risk that a credit institution may not be able to meet its commitments or maturities at a given point in time, even if it were to mobilize its assets.

1.3 Liquidity risk factors

Liquidity risk is essentially linked to three factors:

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[18] ATTAR Khaoula , **Liquidity Risk Management through ALM approach**, thesis , Higher Banking School, Algeria, 2016, P.10.

1.3.1 A balance sheet risk

The bank-specific continuous maturity transformation function leads to an intrinsic balance sheet liquidity risk that is compounded both by market volatility and by banks' concern to actively manage their balance sheets.

Previously, deposits were passively received in the network and the search for assets constituted the bulk of banking activity. The main liquidity risk at that time was related to the risk of withdrawal of deposits.

Today, with the evolution of the markets and the numerous opportunities to find profitable assets. To optimize their profitability, banks use sources of financing other than customer deposits, i.e. the markets: interbank, bond, etc.

Therefore, liquidity is no longer a situation suffered as a result of the bank's transformation activity (deposits, loans) but the result of complex management aimed at optimizing the content of the balance sheet.

Therefore, by seeking profitable assets from resources collected on the markets, the bank increases its liquidity risk.

1.3.2 Lender confidence

The confidence that the institution inspires enables it to carry out its operations, to refinance itself under the best conditions and Therefore to generate profitability that further improves its image on the market.

On the other hand, as soon as confidence is eroded, the cost of resources is automatically increased, access to new markets is limited and the resulting or anticipated deterioration in results can only contribute to a further erosion of confidence. In addition, two points must be stressed, which influence the notion of trust:

-Rating agencies: the markets attach excessive importance to the assessments of rating agencies, markets where lenders no longer know borrowers directly.

-The supervisory authorities: which, by exercising supervision over institutions that give them cause for concern or even by imposing accounting (provisioning) or management (change of management) prudence measures, are sufficient to alert the markets and Therefore aggravate a dangerous situation that their intervention was supposed to control.

1.3.3 The institutional context in which the bank operates

A liquidity crisis may arise, no longer as a result of the bank's own difficulties, but as a result of a general market liquidity crisis. This general lack of liquidity may result from the interplay of supply and demand on the markets, from voluntary intervention by the monetary authorities on overall liquidity, or from changes in the monetary policy framework. regulatory disincentives for investors to intervene in any segment of the market.

1.4 Types of liquidity risk

There are two types of liquidity risk:

1.4.1   The funding liquidity risk

The question that arises in this type of risk is: "Do I have enough liquidity to meet my current and future maturities? "» [19]. This is the risk that a bank will be unable to meet its current and future needs without putting its financial position at a disadvantage.

1.4.2   Market liquidity risk

The question that arises in this type of risk is Can I realize my balance sheet assets quickly and cheaply?

This is the risk that a bank cannot sell an asset, to meet its liquidity needs, at market price. This leads to a devaluation of the asset's price.

1.5 Materialization of liquidity risk[20]

Liquidity risk depends on the situation of the bank and its environment (the markets).

Liquidity risk can arise in the event of:

1.5.3   The crisis of lender confidence

This phenomenon results in massive withdrawals of deposits or savings, which may be due to:

• Mismanagement;
• A counterparty default;
• Competition in the markets leading to a loss of competitiveness;
• Fraud and technical incidents.

1.5.4   Maturity transformation

This is the result of two elements:

• The contradiction of counterparties

Lenders and borrowers have different preferences, the former deposit their funds for a short period of time, while the latter request long-term loans, in such situations the adaptation of resources to expenditure is difficult.

• The increase in its interest margin:

The increase in the interest margin through the transformation mechanism may increase liquidity risk, because in the case of a rising yield curve (long-term rate higher than short-term rate),

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[19] BOUDGHENE.Y and DE KEULENNER.E, **Banking practices and techniques**, LARCIER, Brussels, 2012. P.177.
[20] DUBERNET.M, **Asset-Liability Management and Banking Services Pricing**, ECONOMICA, Paris, 2000, P.71.

the transformation of maturities from short-term to long-term seems beneficial for the bank, but this is to the detriment of its liquidity.

1.5.5 The market liquidity crisis

It is a crisis that is exogenous to the bank, which may arise depending on market supply and demand, a tightening of regulatory constraints on investors, intervention by the monetary authorities who manage global liquidity, it may also result from a liquidity crisis linked to a global economic crisis.

Conclusion

Liquidity is the dynamic driving force behind any operation carried out by the bank. Having liquidity enables the bank to honor its commitments at all times. Indeed, the bank could not survive even a few hours without liquidity.

Liquidity risk arises as a result of several factors: massive withdrawal of deposits, a crisis of market confidence in the bank, poor control of the timing of cash inflows and outflows, global liquidity crisis, etc.

To this end, Asset and Liability Management (ALM) is entrusted with the mission of controlling the possible negative consequences of financial risks, mainly liquidity risk, which is the subject of our next chapter

Chapter 02: Asset and Liability Management

Chapter 02: Asset and Liability Management

Introduction

In recent years, risk management has become one of the major concerns of banks. Indeed, new management models and techniques have been put in place to this end.

ALM, an intellectual approach that is constantly being developed, has become a conceptual framework for bank's financial management in order to respond to their concerns in terms of risk management and strategic steering. This practice was first introduced in the United States in the years 1970.

It focused on financial risks: foreign exchange risk and liquidity risk. The latter has become one of the major concerns of banks, particularly after the SUBPRIME crisis that hit international banks in 2007.

The purpose of this chapter is to present this discipline through the regulatory framework in which it evolves and its use in practice as a tool for managing liquidity risk and, ultimately, for hedging liquidity risk.

With this in mind, we have found it useful to divide this chapter into three sections:

- Section 1: Asset-Liability Management.
- Section 2: Identification and measurement of liquidity risk.
- Section 3: Hedging liquidity risk.

Section 01: Asset-Liability Management.

Risk-taking is inherent in banking activity and is directly reflected in the profitability of operations. Management must therefore have the necessary tools to measure, assess and ensure controlled management of these risks.

Asset and Liability Management (ALM) is one of the tools used to strategically manage the bank's activities.

1. Definition of the concept of asset-liability management

ALM is concerned with the management of financial risks, by controlling the possible threats emanating from them, while ensuring the optimization of the profitability/risk ratio. It is a set of techniques and management tools that enable the bank to assess and control risks in a systematic and efficient manner.

- **For Mr. Dubernet**

"Asset-liability management aims to confine the possible negative consequences of financial risks, mainly liquidity risk, interest rate risk and exchange rate risk, within consciously determined limits. It seeks to achieve this objective under the best conditions of profitability. To do so, it measures and analyses financial risks and makes recommendations for action"[21].

- **For DEMEY. P**

"Asset-Liability Management refers to all the techniques used to control liquidity, interest rate and exchange rate risk within the scope of a banking network's commercial activities. "[22]

Objectives of asset-liability management

Asset-liability management should initially contribute, for the elements that concern it, to the definition of the general management objectives that the institution has chosen to apply. It will do so in conjunction with other departments, such as management control, strategy, etc. It will take into account the requirements of shareholders and creditors in this process.

These general objectives may relate to the following points:

- Profitability and the level of equity capital;
- Balance sheet or market share growth;
- Smoothing of business volumes and results.

Secondly, the asset-liability management department will have to define the management objectives and principles that directly concern its area of intervention in financial risk management

- Management principles and counterparty risk limits in the financial sphere.
- Management principles and financial risk limits (interest rates, liquidity, foreign exchange).

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[21] Dubernet M., **Asset-Liability Management and Pricing of Banking Services**, ECONOMICA, Paris, 1997, P. 64.
[22] DEMEY. P,al. , **Introduction to Bank Asset-Liability Management**, ECONOMICA, Paris, 2003, P.10.

- The mechanisms for the rate of internal transfers and the allocation of equity capital.

All of these elements constitute the internal management constraints of the establishment.

The most rigorous institutions have set out these management rules in a reference document, the broad outlines of which are explained in the annual report and in the various documents. These constraints are determined in relation to the institution's position (shareholder requirements, competitive positioning, dependence on the market for refinancing, etc.).

They must also take into account regulatory constraints. Depending on its position, the institution will choose to stick to strict compliance with the regulatory minimum (institution with customer resources), or to go beyond it (institution dependent on the markets).

These two elements (internal constraints and external regulatory constraints) will determine the institution's financial management policy, which will depend on its risk aversion: interest rate, exchange rate and liquidity risk management policy. Once the constraints have been determined, formalized in the form of a set of rules, disseminated within the company and to the supervisory authorities, asset-liability management will ensure that they are respected in their day-to-day operational implementation and enforced when there are several decision-making centers involved in the process.

Missions and approach of the ALM[23]

We start with his missions:

1.1 Asset-liability management missions

In view of the multitude of factors involved in the bank's balance sheet and off-balance sheet structure, several tasks are assigned to the ALM:

- The management of balance sheet balances, which consists in forecasting and ensuring consistency between the major components of the institution's balance sheet;
- Forward-looking management of interest rate, foreign exchange and liquidity risks to ensure that the risks assumed are consistent with the Bank's risk preferences;
- The forward-looking management of financial ratios imposed by prudential regulations, whether national or international. This involves verifying compliance with prudential ratios;
- Optimization of the profitability/risk ratio, by allocating equity capital to the various banking activities according to the risks they generate and the profitability they generate.
- Contribution to the pricing of operations and the determination of conditions to be applied to new production;
- The evaluation of hidden options, which consists of the evaluation of risks not apparent on the balance sheet (for example: the early repayment of a loan);
- The ALM may be called upon to make recommendations on the main orientations of the overall financial management policy: risk management, commercial orientations, return on equity, balance sheet growth, market shares, etc. The ALM may also be asked to make recommendations on the main orientations of the overall financial management policy:

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[23] ATTAR Khaoula, **Liquidity Risk Management By The ALM Approach**, thesis , Higher Banking School, Algeria, 2016.P.26.

risk management, commercial orientations, return on equity, balance sheet growth, market shares, etc.

1.2 The asset-liability management approach

There are two guys:

1.2.1 A global approach

Indeed, it takes a global approach since the entire balance sheet and off-balance sheet is concerned by decisions aimed at achieving the optimal structure, and it must to be an autonomous structure maintaining close relations with the different structures of the bank.

1.2.2 A forward-looking approach:

This approach is known as forward-looking because it involves making decisions in the present to manage a future situation. It is an approach that involves several steps:

- **Step 1: Identification and measurement of risks**

It involves identifying and measuring risks through liquidity, interest rate and foreign exchange positions, which provide a measure of the bank's exposure to the various risks over a one-year time horizon.

- **Step 2: Interest and exchange rate forecasts**

It involves forecasting interest and exchange rates by making assumptions about future interest and exchange rate developments.

- **Step 3: Simulations**

It consists of carrying out simulations by calculating the forecast interest margin according to the various assumptions envisaged. Then by taking the most adverse scenario, the estimated amount of losses is compared with the bank's own funds.

This will enable the governing to judge whether the amount of risks assumed is acceptable given the risk aversion of shareholders.

- **Step 4: Decisions**

Indeed, it will be necessary to choose among the various simulations the most realistic and also the one that will generate the highest profitability for a given level of risk aversion and the one that will be the most in line with the bank's strategic options in terms of business lines, products and size.

The ALM forecasting approach can be simplified by the following diagram:

Figure N (2-1): The ALM approach
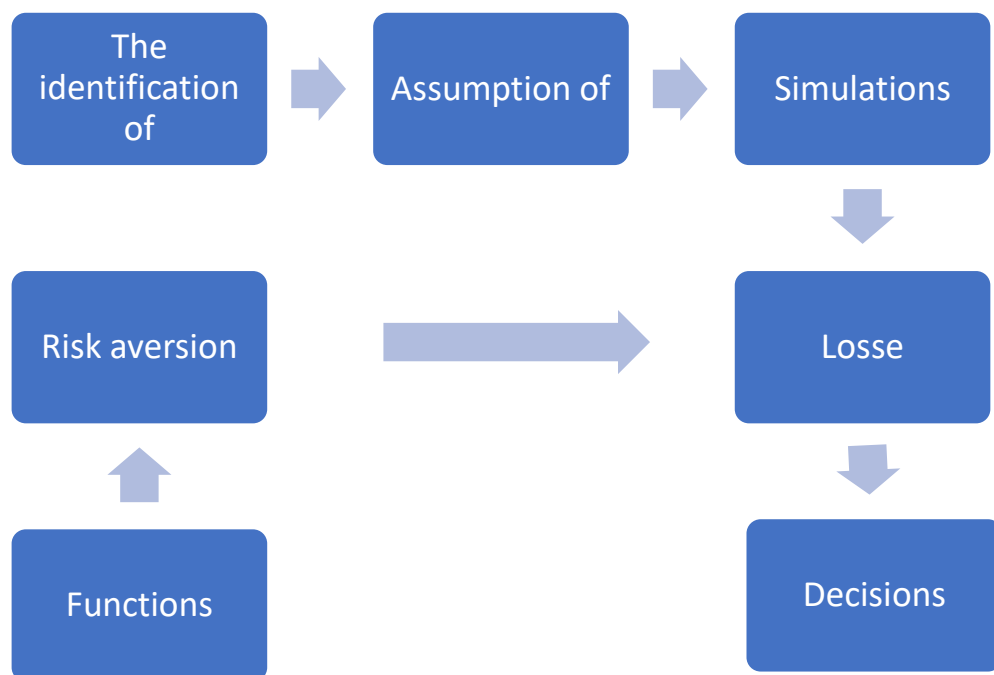
Sources: S. DE COUSSERGUES, Management of the Bank, DALLOZ, Paris, 1995, page 187

Intermediation role of the ALM

The main function of banks and financial institutions is financial intermediation, to ensure the balance of balance sheet items, which involves studying the structure of the balance sheet from the customer relationship angle (operational sphere, financial sphere).

1.3 Financial sphere[24]

Concerns relations with institutions (banks, insurance companies, large companies). The players in the financial sphere are the trading room and the finance department. Products include loans, money market and bond securities, equities and derivatives. The market activity that the bank carries out for its own account or on behalf of third parties is comparable to the financial sphere, as is portfolio activity.

1.4 The operational sphere

Includes transactions with individual and business customers. The stakeholders in the operational sphere are the network and the commercial management of the institution. The products distributed are loans and savings products such as deposits and passbook accounts.

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[24] DUBERNET M., **Asset-Liability Management and Pricing of Banking Services**, DALLOZ, Paris, 1995, p. 21.

Chapter 02: Asset and Liability Management

The commercial activity that generates the risks within the banking institution is part of the operational sphere, and the instruments of the financial sphere are the tools to cover these risks when they are of a financial nature (liquidity, interest rate and foreign exchange).

The implementation of the ALM

1.5 A hierarchical organization

The organization must allow for a combination of information feedback, financial analysis and the development of the institution's strategy. To this end, a distinction is made between the decision-making bodies and the teams dedicated to asset-liability management tasks.

1.5.1   The decision-making bodies:

- The board of directors, management board: Form of "supreme bodies" composed of the group's managers and possibly subsidiaries; it is responsible for making strategic choices, setting the main principles of ALM, as well as the planning of the various financing or hedging operations must be submitted for approval.
- Asset/Liability Management Committee: determines the bank's short-term orientation in the areas of asset/liability management in accordance with the strategy laid down by the Executive Board, therefore playing a decision-making role and making tactical choices.

The composition of the committee is specific to each institution and, in particular, the relative weight of each of its activities, its size and its organization.

- The Counterparty Risk Committee: endorses the limits on institutional counterparty intervention proposed by the Counterparty Risk Management team.

1.5.2   The teams dedicated to asset-liability management

- The ALM unit: is responsible for the asset-liability management policy, i.e. the group of rules and management limits that the institution imposes on itself in the management of financial risks.

It is responsible, not a decision-maker. It must contribute to the definition and implementation of the notional breakdown of the balance sheet, the notional allocation of own funds and the transfer rates. It is responsible for determining market intervention volumes, which is the tactical area. It acts as an interface between operating entities and the trading room.

Its main role is to gather and analyze the information needed by the latter, to recommend financing and investment actions to them, and to implement the decisions taken there.

➢ The treasury: is in a way of ALM[25], since it is in charge of carrying out

the   market   transactionsrelating   to   its tactical   choices. The Treasury's objectives are the management of the bank's assets and liabilities and the sale or purchase of securities for:

- Ensure liquidity.

- Manage gap positions.
- Open foreign exchange positions.
- Cover the capital.

➢ Counterparty risk team: The team dedicated to this management will have to study the financial situation of counterparties in order to assess their ability to meet their commitments.

➢ The securitization team: is in charge of setting up securitization operations, carrying out the necessary simulations to measure the risk taken on the defined portfolios, choosing the appropriate structure, negotiating with the rating agencies, etc. until the operation is launched on the market.

➢ Decentralized asset-liability management teams: The mission of this team is to manage the intermediation margin of its sector, i.e. general expenses, commercial or financial risks, and the operating margin, making it possible to achieve the return on equity objectives. It may be responsible for planning its sector.

Once the allocation of respective responsibilities has been defined, the ALM assumes that an indispensable working tool is the information system.

1.6 The information system:

The information system allows the rapid circulation and transmission of information between the different entities of the institution.

Before the maturity profile can be created, information on these transactions from their entry to the balance sheet to their exit must be extracted.

The information, once reorganized and processed, allows the calculation of all the indicators making up the risk management dashboard, which are used by the bank to monitor the bank's strategy and to assess the impact of tactical choices through simulations. The accuracy and relevance of these tools depend on the quality of the Information System.

1.7 Internal audit:

The audit is responsible for independently reporting on the proper implementation, validity and operation of risk management procedures.

This includes, in particular, the construction of models, the relevance and reliability of risk management systems and their compliance with the regulator's expectations.

Strategic tools of the ALM

The ALM uses two strategic tools to define the financial relationships between these different centers. These are the transfer price ratio (TCI) and the allocation of economic equity.

1.8 The transfer price (TCI)

It is a rate that values internal cash flows within the bank. It connects the different responsibility centers and enables the calculation of the transformation margin and the setting of objectives.

This rate is calculated on the basis of the yield curve and the bank's conditions of access to the capital markets. It must reflect the reality of refinancing costs as it represents the cost that the branches would have to pay if they could intervene directly on the market.

The purpose of the TCI is to eliminate the interest rate and liquidity risk of the business units and to centralize them at ALM level. This centralization of risks enables banks to intervene in the financial market for partial and total hedging.

Allocation of economic equity

Whatever measures are taken, there will always be risks that result in losses. The current profit of the activity can amortize these expected losses, but it may be insufficient if the losses take on an abnormal "unexpected" dimension.

It is therefore the role of own funds to cover them in order to avoid the failure of the institution.

Capital is divided into regulatory capital, which represents regulatory capital requirements, and economic capital. The latter is allocated to the different banking activities or business lines based on estimated losses.

As the counterparty for taking risks, the ALM is responsible for allocating this equity capital in order to cover liquidity, interest rate and exchange rate risks.

The necessary conditions for the implementation of ALM management

To implement Asset-Liability Management, a number of conditions must be met:

1.9 A developed capital market:

The implementation of asset-liability management requires the bank to intervene on the capital market, because for dynamic balance sheet management, these markets must be open, liquid and diversified.

- Decompartmentalization: market compartments are accessible to all operators.
- Liquidity: enabling stakeholders to settle their transactions quickly and without loss of capital.
- Diversification: this includes diversification of transactions (purchases, sales, etc.), diversification of securities, diversification of maturities (day-to-day, from the short term to the long term).

1.10   An adapted risk management policy

The bank must adopt an appropriate risk management policy in order to ensure a balance sheet balance in both normal and crisis situations.

The approach adopted by the ALM is to examine the risks incurred by the bank more specifically financial risks such as liquidity risk and how to identify and measure this risk. This last point will be the subject of the next section.

Section 02: Identification and measurement of liquidity risk

After having reviewed the theoretical and regulatory framework of ALM, we will try through this section to present it as an identification and measurement technique for liquidity risk management.

1. Identification of liquidity risk

1.1 Identification of liquidity risk on the asset side

Liquidity risk can be revealed on the asset side from the bank's business and market activities:

➢ **Market activities**

These activities relate to the bank's securities portfolio, which provides it with liquidity through:

- ✓ The sale of securities on the secondary market, which allows the bank to realize capital gains;
- ✓ The maturity of a security;
- ✓ The temporary use of securities as collateral to obtain liquidity loans.

Deteriorating asset prices lead to a decline in important sources of liquidity. Indeed, this deterioration in prices will affect liquidity loans whose prices will be below their nominal values.

➢ **Banking activities**

Receivables held by the bank from its customers and financial institutions carry a liquidity risk in the event of credit default resulting from the failure of a counterparty or a crisis in the sector.

The bank prepares forecasts to assess its liquidity situation, these forecasts must take into account the "hidden options" that a bank's balance sheet contains:

✓ **The Housing Savings Plan (PEL)[26]**

The PEL is a product that combines both a deposit and a loan, is a blocked savings deposit that produces interest and allows you to obtain a home loan at a preferential rate.

The PEL has an optional character which offers the customer the possibility of using this option in the event that the market rates for credit are not advantageous. It is this optional character which will distort the bank's liquidity forecasts, since the loans granted within this framework have maturities, amounts and realization which are difficult to predict.

✓ Prepayment options

The holder of a credit has the possibility of repaying his loan early for various reasons and compensation may be requested by the bank to offset his losses. Early repayments therefore influence the bank's forecasts of future cash flows.

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[26]Asset M., Management And Pricing Of Banking Services, ECONOMICA, Paris, 2000., P.32.

Chapter 02: Asset and Liability Management

1.2 Identification of Liquidity Risk in Liabilities

Liquidity risk on the liabilities side is generated by the maturity of deposits and the use of credit lines. As it can be generated by funding risk and funding concentrations

➢ **Financing risk**

It represents the risk of sudden depletion of external sources of liquidity. These sources come from customer deposits (overnight deposits, term deposits and savings bonds, etc.) or from resources on the capital market (mainly from other banks, institutional investors, commercial and industrial companies). The financing risk may arise from:

✓ Possibilities of massive withdrawals of deposits, since deposits have become very sensitive to changes in their rate of remuneration, as well as to the degree of confidence placed in the institution, so that these resources can be withdrawn at any time and leak to another institution offering more favorable conditions
✓ The closure of a credit line on the interbank market, following a downgrading by the rating agencies or following the announcement by the bank of any information negatively affecting its results or market position.

➢ **Concentration of funding:**

Concentration risk is the risk for a bank to concentrate on a category of customers, an economic sector or a geographical area for the financing of its expenditure. It materializes when a single decision is capable of causing a massive or unexpected withdrawal of deposits and changing the bank's financing strategy.

1.3 Identification of liquidity risk in the off-balance sheet

Off-balance sheet items consist of commitments received or given in favor of customers. The occurrence of these transactions may lead to a liquidity risk following a significant outflow of funds.

The commitments are subdivided into:

➢ **Funding commitments**

These are commitments given in favor of a credit institution (credit lines), as well as commitments given to the bank's customers (credit cards, cash credit, etc.).

These commitments are capped and may result in an outflow of funds as soon as the bank fulfils its promise, hence the occurrence of liquidity risk.

➢ **Guarantee commitments**

These are transactions in which the bank acts as guarantor in favor of a third party; if the latter fails to meet its commitments in whole or in part, they include sureties, endorsements and other guarantees.

The customer's default results in an outflow of funds for the bank, which subsequently translates into liquidity risk.

> **Commitments on securities:**

They relate to transactions in securities to be delivered or received, which are recorded off-balance sheet on the trade date and then on the value date in the balance sheet.

> **Commitments relating to currency transactions**

These are spot purchases of foreign currency, not recorded on the Bank's balance sheet, or forward purchases.

2. Measuring liquidity risk

Once liquidity risk is identified, it must be measured to enable the bank to assess its ability to meet its commitments.

We will present the different techniques used by the assets and liabilities manager to measure liquidity risk. First, the maturity profile and liquidity impasses, which are basic tools for managing the liquidity risk. Next, we will present the transformation indicators, (the liquidity index and the basic surplus).

2.1 First generation tools

The steps are:

- The due date profiles.
- Dead ends in liquidity.
- Liquidity risk management indicators.

2.1.1 The schedule line profile

The first liquidity risk measurement technique used in ALM consists in highlighting the maturity mismatches between resources and expenditure by determining the maturity profile.

2.1.2 Definition

"The maturity profile is a table that classifies assets and liabilities according to their remaining term to maturity and therefore represents the depreciation of expenditure and resources.

The maturity profile shows, at a given point in time, the liquidity position of the balance sheet on all future dates by classifying the individual items according to their residual maturity. It is established either on the assumption that the balance sheet has been "melted down"[27], or on the assumption that new production is estimated.

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[27] excluding any new inflow or outflow of funds.

In order to measure immediate liquidity risk, the bands in this profile should cover small periods (days, weeks, months) for short-term forecasts and longer-term forecasts over longer periods (years).

This definition is illustrated in the table below on the basis of the following simple data:

Table N (2-1): Maturity profile[28]

Maturity classes	Assets (in millions of $)	Liabilities (in millions of $)
At sight - 7 days	2 400	2 100
From 7 days to 1 month	3 200	2 500
From 1 month to 3 months	4 300	2 700
From 3 months to 6 months	2 900	2 100
From 6 months to 1 year	1 000	1 200
From 1 year to 3 years More	500	1 700
than 3 years	700	2 700
Total	15 000	15 000

Source: S. DE COUSSERGUES, Bank management, DALLOZ, Paris, 1995,

page 123.

Based on this maturity profile, a depreciation schedule for assets and liabilities can be drawn up by subtracting the outstanding amounts for each period from the forecast depreciation.

Based on the previous table, the profile of outstanding assets and liabilities obtained is as follows:

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[28] BESSIS J. DE COUSSERGUES, **Bank management**, DALLOZ, Paris, 1995, p.123.

Table N (2-2): Profile of outstanding assets and liabilities

Period	1	2	3	4	5	6	7	8
Outstanding assets	15000	12600	9400	5100	2200	1200	700	0
Outstanding liabilities	15000	12900	10400	7700	5600	4400	2700	0

Source: S. DE COUSSERGUES, Bank management, DALLOZ, Paris, 1995, page 123.

In order to better visualize the rate of amortization of these outstanding amounts, it is useful to translate the above table into a graph:

Figure N (2-2): Maturity schedule of assets and liabilities
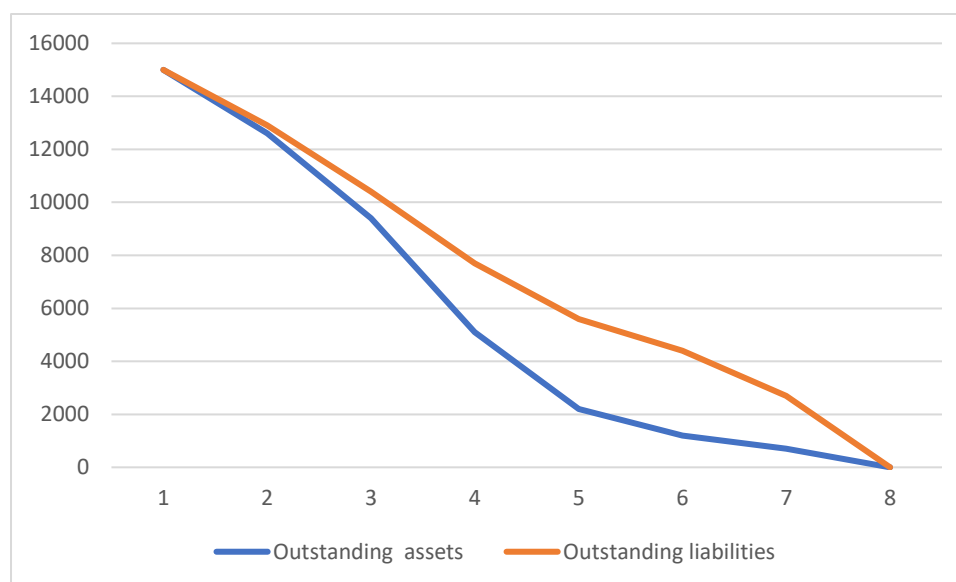
Source: On our own; from Table 02

We note in this graph that assets depreciate faster than liabilities in all periods, indicating an over-consolidation of the balance sheet.

Problems in determining maturity profiles[29] :

In order to build a maturity profile for an institution, it is essential to know the amounts outstanding and their maturities. However, some outstanding cannot be determined accurately, hence the need to adopt conventions, make assumptions or choose maturities based on statistical analyses, and these are generally as follows:

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[29] COUSSERGUES s., **Management of the Bank from Diagnosis to Strategy**, 5th edition, DUNOD, Paris, 2007, p.189.

> ➤ **Assets and liabilities without stipulation of the term:**

These are certain balance sheet items such as: cash, overnight deposits and shareholders' equity.

Overnight deposits have no contractual maturity, which makes movements in these accounts unpredictable. Nevertheless, statistical analyses show that a fraction of these outstanding remains stable over time. Since they are spread among a large number of depositors, the determination of the maturities of these outstanding amounts is based on certain assumptions, namely:

- ✓ The prudent view, which is based on the lack of contractual maturity of deposits, which makes them intrinsically volatile because they can disappear overnight and must therefore be invested in the closest and most immediate maturity. This view is mainly adopted by accountants and treasurers.
- ✓ The second is to use modelling methods, which allows us to make projections of overnight deposits based on explanatory variables such as economic growth, interest rates, etc....
- ✓ The third most commonly used approach is to distinguish between the stable deposit base over a period and the volatile base. The stable core can be assimilated to resources of distant maturities, and the volatile part is therefore considered as short- term debt.

Unlike overnight deposits, own funds are considered to be resources with a theoretical indefinite or "infinite" maturity. They are subject to regulatory constraint, which creates additional capital requirements if the balance sheet is growing.

> ➤ **Assets and liabilities with legal maturities different from their practical maturity:**

Some loans, such as overdrafts granted to companies, have a short maturity but are regularly renewed, so they commit the banks as much as loans with longer maturities; others include early repayment clauses that modify the actual maturity of the loan and contradict the established projections. Also, some overnight interbank transactions are renewed daily. It is therefore the experience acquired by the bank in this area that will enable it to establish the most reliable maturity profile.

> ➤ **Valuation of off-balance sheet commitments:**

These are commitments whose realization is often uncertain. The flows arising from these transactions are estimated on the basis of past findings.

2.1.3   Dead-ends in liquidity

This is a very important step in asset-liability management.

2.1.4   Definition

"The liquidity gap represents the difference between the outstanding amounts of assets and liabilities for all future dates"[30].

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[30] DEMEY, A, FRACHOT and G, RIBOULET. **Introduction à la Gestion Actif-Passif**, ECONOMICA, Paris, 2003. p.33

Also known as "gaps". It is therefore the gap between cash outflows in the form of loan repayments and cash inflows following loan repayments "measure the foreseeable shifts, at different future dates, between all expenditure and resources"[31].

A positive deadlock means that the bank has surplus resources and is therefore in "excess liquidity". In such a case, the bank lacks the resources to finance its expenditure. It is in a situation of "illiquidity".

There are two approaches to calculating these impasses:

➢ Static approach: consists in determining the deadlocks within the limit of the assets and liabilities existing at the date of the calculation without integrating the new productions;
➢ Dynamic approach: consists in determining deadlocks on the basis of total cash flows, whether from existing stocks or new production.

2.1.5 Deadlock Calculation

There are dead ends in flow and in stock:

➢ **Dead ends in flux:**

For a maturity class, i.e. for a period, the flow impasse is "the difference between asset flows and liability flows. It is therefore the difference between cash inflows and outflows during that period. It defines the need or new financing for the period calculated at a given date by the difference between cash inflows (loan repayment) and cash outflows (loan repayment) for the period.

Flow impasse = cash inflow - cash outflow

Liabilities "fall" when the bank reimburses a lender, assets "fall" when a customer repays a loan. A positive flow impasse is a net inflow of funds, a negative flow impasse is a net outflow of funds.

Applying this formula to the data for the previous maturity profile (Table 01) will give the flow impasses and their totals as follows:

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[31] BESSIS J., **Risk Management and Asset-Liability Management of Banks**, DALLOZ, Paris, 1995, page 96

Table N (2-3): Flow dead-ends

Maturity classes	Assets ($ millions)	Liabilities ($ millions)	Dead ends in flow	Accumulated dead-ends
At sight - 7 days	2 400	2 100	300	300
From 7 days to 1 month	3 200	2 500	700	1 000
From 1 month to 3 months	4 300	2 700	1 600	2 600
From 3 months to 6 months	2 900	2 100	800	3 400
From 6 months to 1 year	1 000	1 200	-200	3 200
From 1 year to 3 years	500	1 700	-1 200	2 000
More than 3 years	700	2 700	-2 000	0
Total	15 000	15 000		

Source: S. DE COUSSERGUES, Bank management, DALLOZ, Paris, 1995, page 123.

➤ **Dead ends in stock:**

The inventory deadlock at a given date is the difference between the stock of liabilities and the stock of assets.

> **Impasse in stock = outstanding liabilities - outstanding**

The accumulation, in absolute value, of the deadlocks in flow makes it possible to bring out the deadlocks in stock.

Also, by applying this formula to the data from the already established profile of assets and liabilities outstanding (Table 02), the following stock impasses will be obtained:

Table N (2-4): Impasses in stock

Period	1	2	3	4	5	6	7	8
Outstanding Assets	15000	12600	9400	5100	2200	1200	700	0
Outstanding liabilities	15000	12900	10400	7700	5600	4400	2700	0
Dead end in stocks	0	300	1000	2600	3400	3200	2000	0

Source: On our own; from Table 02.

2.1.6 Liquidity risk management indicators

Other methods complement the impasse method for measuring liquidity risk. These are the synthetic indicators, notably the liquidity index (the numbers method) and the basic surplus, which measure the extent of the transformation carried out by the bank.

2.1.7 Liquidity index

The liquidity index: "measures the mismatch between the maturities of assets and liabilities and Therefore gives an indication of the transformation risk incurred by the institution"[32].

Also known as the transformation index, it is calculated using the numbers method, which consists of weighting the assets and liabilities of each maturity class by a weighting coefficient corresponding to the average number of days in that class. Then we calculate the ratio:

Index of transformation=

Σ Weighted liabilities/ Σ Assets weighted

If the index is greater than 1, the bank is in a situation of excess liquidity due to the fact that it borrows at a longer term than it lends. Otherwise, the bank is illiquid.

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[32] DARMON J., **Banking Strategies and Balance Sheet Management**, ECONOMICA, Paris, 1998, page 113.

Table N (2-5): The number method

Deadlines	Assets	Liabilities	Weightings	Weighted assets	Weighted liabilities
d ≤ 7 days	4200	4800	0.01	42	48
7 days ≤ d < 1 month	5000	6400	0.05	250	320
1 month ≤ d < 3 month	5400	8600	0.16	864	1376
3 months ≤ d < 6 month	4200	5800	0.37	1554	2146
6 months ≤ d < 1 year	2400	2000	0.75	1800	1500
1 year ≤ d < 2 years	3400	1000	1.50	5100	1500
2 years ≤ d < 5 years	2900	1400	3.50	10150	4900
> 5 years	4000	1500	7.50	30000	11250
Total	31500	31500		49760	23040

Source: DE COUSSERGUES, "Bank management". DUNOD, PARIS, 2007, Page188.

From this table, the following result will be obtained:

Transformation index= 23040 / 49760 ≈ 0,46

As the index is low, the bank runs a high transformation risk because it finances long expenditure with short resources.

In order to reduce this risk, the bank can act either on its assets by replacing part of its long expenditure with short expenditure, or on its liabilities by transferring short resources and exchanging them for longer resources.

2.1.8 The basic surplus:

The main surplus measures the liquidity cushion provided by liquid assets to cover funding needs. It is obtained by subtracting current liabilities from liquid assets.

✓ Liquid assets: are all assets that can be quickly converted into cash without generating capital losses. Example: cash on hand, the balance of the Central Bank account, government securities, reserve surpluses, etc.

✓ Current liabilities: includes short-term debts, i.e. overnight loans, repurchase

agreements, loans from the Central Bank and deposits maturing in less than one month.

> Base Surplus = Liquid Assets - Current Liabilities

There are two possible scenarios:

- A positive basic surplus: this means that the bank has a liquidity cushion resulting from the financing of part of the liquid assets with longer-term resources;

- A negative basic surplus: this means that the bank lacks liquidity because part of its long-term uses is financed by its current liabilities. Illustrating all this with an example of basic surplus calculation:

Table N (2-6): Calculation of basic surplus Unit: Millions

Liquid assets (A)	Amount
Receipts and balances with the Central Bank	300
Central Bank balance net of reserves	700
Securities of the government and its agencies	8000
Position of the Department of Government Securities Trade	2000
Advances to subsidiaries	500
Short-term advances	6000
Loans to investment dealers	7000
Reserve surpluses sold on a long-term basis	2000
Total	26500
Current liabilities (B)	Amount
Central Bank	100
Excess reserves purchased	13000
Repurchase agreements	7000
DAT	400
Excess long-term purchased reserves	2000
Total	33500
Basic surplus (A) - (B)	4000

Source: H,Gouslisty . "Liquidity management in banks. *Revue Banque,* **No. 533, 1992, p.64.**

The basic surplus is 4,000, which enables it to cope with daily liquidity fluctuations

➢ **Weaknesses of first-generation tools:**

These different tools have some weaknesses that can be summarized as follows:

- The outstanding amounts and their maturities are the basic data required to construct deadlock profiles, and some of the outstanding amounts have no maturities, or are of uncertain maturity. In such cases, conventions have to be adopted, assumptions have to be made, or the choice of maturities has to be based on additional (statistical) analyses. These are mainly overnight deposits, off-balance-sheet commitments, own funds, interest flows, etc. However, the formulation of these assumptions is generally not entirely realistic;

- Liability flows are not generally fixed but depend on customer behavior and the bank's commercial policy.

2.2 The Second generation Tools

The first-generation tools could not keep pace with the level of risk, so second-generation tools were developed, among which are the following:

2.2.1 Scenarios and stress tests

Stress tests are used to simulate major deteriorations in the economic environment and then to ensure that banks can cope with these periods of poor economic conditions.

Stress tests therefore become essential to assess the robustness and reliability of a liquidity management system.

2.2.2 Simulations[33]

Simulations make it possible to measure the impact of uncertain parameters such as interest rates on "target" variables; interest margins, balance sheet structure, etc. Their objective is to optimize the risk/return ratio and strengthen financing and hedging.

2.2.3 Profit-Risk combinations

Using the two tools mentioned above, matrices are generally created containing the results according to the different hypotheses. These matrices are called margin matrices. The latter are characterized by an average of the margin values the average margin/volatility ratio, also known as the Sharpe ratio.

This report provides a risk-adjusted measure of profitability. It represents compensation per unit of volatility.

It allows to prioritize the different results obtained and Therefore to have the best profitability-risk ratio.

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[33] BESSIS J., **Risk management and asset-liability management of banks**, Edition DALLOZ, Paris, 1995, p.199.

➢ **Weaknesses of second-generation tools:**

✓ The availability of information and its quality are key points for making usable simulations. This is not easy to envisage with information system failures.

✓ The difficulty of interpreting the results of many simulations.

Section 3: Hedging liquidity risk.

Based on the profile of deadlocks, the bank implements techniques to cover liquidity risk. The latter consists in managing funding that fills the gaps between resources and uses, taking into consideration regulatory constraints and the bank's ability to refinance itself on the market.

1. Liquidity risk hedging techniques

1.1 The leaning:

1.1.1 Definition

Leveraging is a basic concept for hedging liquidity and interest rate risk. It is carried out when the amortization profiles of expenditure and resources are similar and when the reference rates are the same.

1.1.2 The realization of the backing[34]

Liquidity matching is achieved when the depreciation profiles of expenditure and resources are similar. There are two ways in which matching can be carried out:

➢ **A global liquidity backstop**: simply cancel future inventory shortfalls on all dates. All impasses in flows, and therefore all future financing requirements, are cancelled.

➢ **Individual matching**: this means refinancing each asset on the balance sheet with a resource with the same characteristics of the original amount and depreciation profile. Individual matching is not desirable, as a new operation may be partly backed by existing liabilities or by other new operations.

In the case of a positive liquidity deadlock, the banker may decide to grant a new credit backed by the excess resources of that period, or to drain a new resource at that date if the deadlock is negative.

1.1.3 Advantages of backing

The back-to-back operation has a double advantage:

- A liquidity advantage, as the gap between resources and expenditure disappears as they are depreciated.
- An advantage in terms of rates, due to the stability of the margin of the operation, because the customer pays the bank's refinancing cost plus the margin, and this in the case where the rates are of the same nature (fixed over a given horizon or variable with indexation to the same reference).

1.2 Consolidation

The degree of consolidation of a balance sheet reflects its overall liquidity position. It is given by the impasse profile, in the absence of matching two scenarios may arise:

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[34] http://media.scotiabank.com/ consulted : 19/08/2020,10H.

> ➢ **Over-consolidation**: A balance sheet is over-consolidated when existing assets depreciate faster than existing resources. Surplus resources are used to finance new uses.
> ➢ **Sub-consolidation**: A balance sheet is under-consolidated when expenditure depreciate more slowly than resources. New funding is provided to bridge the gap between resources and uses.

2. Funding policies:

There are two methods of financing which are:

2.1 Financing according to the liquidity constraint

Liquidity coverage consists of setting up financing to rebalance the balance sheet, while taking into account liquidity needs in terms of amount and maturity.

The amount of financing required depends on the impasses at each period of a possible safety cushion that the bank wishes to maintain.

Maturities depend on the target profile of the minimum resources set by the bank, as well as its liquidity objectives:

- ✓ Matching assets to liabilities;
- ✓ Respecting the volume of periodic funding;
- ✓ Comply with regulatory liquidity constraints.

2.2 Financing according to the rate constraint

In turn it also splits in two:

➢ **Short-term financing[35]**

This approach consists of contracting short funding from period to period, i.e. "vertical strata". Only the first impasse is financed at the current rate, the others will be financed later as needs arise. This situation is favorable when rates are later falling, as the deferred tranches are financed at lower rates.

This method of covering financing needs remains imperfect, as the bank will always have to renew its financing, which constantly generates a liquidity risk and an interest rate risk.

➢ **Long-term financing**

This approach consists of setting up long term financing, covering the entire impasse, with the rate set at the first financing.

In this case, funding is established in "horizontal strata" from the origin to the end of the horizon in the first place, then the second stratum falls before the first, and the third is shorter.

[35] DARMON.J, **Banking Strategy and Balance Sheet Management**, ECONOMICA, Paris, 1998, P 116

3. The technique of securitization:

Securitization is the financial technique of transforming a pool of non-negotiable receivables into financial securities that can be sold on the financial market.

Given its complexity, the securitization transaction involves several players:

The credit institution "the assignor" sells its receivables to a co-ownership entity called the Fonds Commun des Créances (FCC); the latter issues representative shares on the receivables acquired in one go. These units are generally listed on the stock exchange.

Figure N (2-3): Securitization mechanism
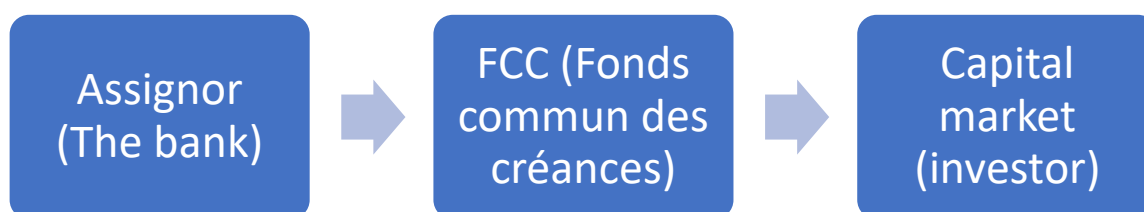
Source: Elaborate per student

➤ **The interests of the assignor "the bank"[36] :**

This mechanism offers several advantages to the transferring institution in particular:

✓ **Securitization is a factor in improving the liquidity situation:**

Securitization enables the bank to sell the financing of loans to investors who have purchased FCC units, thereby improving its liquidity position.

✓ **Securitization makes it possible to externalize risks and Therefore improve solvency:**

Securitization enables the bank to avoid certain risks, such as early redemption risk and interest rate risk, by transferring these risks to the investors acquiring the units issued by the SPV.

However, securitization primarily improves the bank's solvency by increasing its Cooke ratio while reducing the Cooke denominator.

✓ **Securitization as a factor in improving capital**

By securitizing its receivables, the bank reduces the amount of equity used to finance these receivables; this can be done either by distributing exceptional dividends, buying back its own shares

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[36] DUBERNET.M, **Asset-Liability Management and Pricing of Banking Services**, ECONOMICA, Paris, 2000, P.246.

or any other means leading to a reduction in its share capital. The bank's results are almost identical; the equity capital is reduced, therefore the return on equity necessarily increases.

✓ **Securitization as a factor in improving management**

Assigned receivables must be subject to sound management in order to be securitized, the same principle applies to their management procedures (granting, recovery).

Securitization also improves the bank's level of knowledge of the credit portfolio and its production and management costs.

Conclusion

ALM or asset-liability management, as its name suggests, is a discipline that deals with the two parts that make up the balance sheet: assets and liabilities.

Its purpose is to establish and ensure a balance between the two so that the bank has the resources to cover its expenditure and meet its commitments.

In addition, ALM seeks to reduce the negative impacts of risk-taking by providing tools to measure financial risks, including interest rate risk, foreign exchange risk and liquidity risk.

The measurement of liquidity risk consists of evaluating the transformation carried out by the bank and therefore the future financing requirements. For this purpose, the impasse method makes it possible to visualize the differences between flows received and paid. In addition, synthetic indicators, such as the transformation index and the basic surplus, measure the extent of this transformation and serve as management tools insofar as the bank can set values for these indicators as limits or targets to be achieved.

This brings us to the end of our theoretical part, through which we have attempted to shed light on the main theoretical concepts relating to liquidity risk management using the ALM approach.

Chapter 03: Liquidity risk management by ALM at the CPA

Chapter 03: Liquidity risk management by ALM at the CPA

Introduction

After having presented the banking risks, the liquidity risk and their regulatory framework, as well as the different steps of ALM (Asset Liability Management) for liquidity risk management (identification, measurement, and hedging).

It therefore seems to us necessary and interesting to put into practice the theoretical concepts we have just developed. In this chapter, we therefore try to present in a first section some generalities about our host structure, namely the CPA (Crédit Populaire d'Algérie) and its Treasury and Market Department. In a second section, we try to analyze and measure the exposure of CPA's balance sheet to liquidity risk and to apply a hedging tool against it.

And we will conclude with comments on the results and recommendations to contribute to the success of ALM at our bank.

Plan:

Section 01: Introduction to the CPA

Section 02: Analysis and measurement of liquidity using the ALM method.

Section 03: Analysis of results and recommendations.

Chapter 03: Liquidity risk management by ALM at the CPA

Section 01: Introduction to the CPA

Our internship was carried out in the CPA Crédit Populaire d'Algérie, treasury department. This is the organization for which we are going to assess the liquidity risk, that is why we deemed it necessary to present this Algerian banking institution before starting the analysis, as well as the evolution of its activity and its results.

1. Presentation of Crédit Populaire D'Algérie (CPA) :

First of all, the history of the Crédit Populaire D'Algérie (CPA) was discussed. Then we determined its activities and presented its organizational chart.

1.1 History of Crédit Populaire D'Algérie (CPA) :

The Crédit Populaire d'Algérie (CPA) is a commercial bank created by order No. 66-36 of 19/12/1966 and registered in the Algiers trade register under No. 84 B 803 with an initial capital of 15 million dinars.

In 1985, Crédit Populaire d'Algérie (CPA) created the Banque de Development Local (BDL) by selling 40 branches, transferring 550 employees and managers and 89,000 customer accounts.

Defined by its statutes as a universal bank, the Crédit Populaire d'Algérie (CPA) has the mission of promoting the development of the building, public works and hydraulic engineering, the health and medicine sectors, trade and distribution, the hotel and tourism industry, Small and Medium-Sized Enterprises/Small and Medium-Sized Industries and the craft industry. In accordance with the regulations in force in Algeria, the Crédit Populaire d'Algérie (CPA) deals with credit and banking operations; it may receive deposits, grant credit in all forms, take equity stakes in the capital of any company, and mobilize on behalf of third parties any credit granted by other institutions.

Following the promulgation of the law on the autonomy of enterprises in 1988, Crédit Populaire d'Algérie (CPA) became a public economic joint-stock company whose capital is wholly owned by the State.

Since 1996, under the Ordinance on the Management of State Market Capital, public banks have been placed under the supervision of the Ministry of Finance.

The initial capital of the bank, set at 15 million dinars, has evolved as follows:

- 1966: 15 million DZD
- 1983: 800 million DZD
- 1992: 5.6 billion DZD
- 1994: 9.31 billion DZD
- 1996: 13.6 billion DZD
- 2000: 21.6 billion DZD
- 2004: 25.3 billion DZD
- 2006: 29.3 billion DZD
- 2010: 48 billion DZD

After meeting the eligibility conditions laid down by the provisions of the law on currency and credit (Law 90-10 of April 1990), Crédit Populaire d'Algérie (CPA) obtained approval from the

Currency and Credit Council on 7 April 1997, therefore becoming the second bank in Algeria to be approved.

As of December 31, 2019, the operating network employs 75% of the bank's workforce and comprises:

- 145 agencies supervised by 15 operating groups.
- Customer accounts: 2,256,000. DZD
- Net Banking Product: 66 billion. DZD

1.2 Its activities:

Crédit Populaire d'Algérie, as a commercial bank, operates in the banking and financial intermediation market. As such, it handles all banking and financial operations, in particular the receipt of deposits from the public, the granting of credit in all its forms, the mobilization of external credit and subscribes to shareholdings in subsidiaries and companies.

The range of banking products and services offered by Crédit Populaire d'Algérie has grown in recent years through the strengthening of electronic banking activities, introduced since 1990, and the launch of new products such as financing for SMES and micro- enterprises, real estate loans and loans for individual customers.

In a difficult economic environment, Crédit Populaire d'Algérie improved its market position in terms of collecting resources and distributing credit to the economy. These efforts, combined with the measures taken by the Treasury to clean up the debt portfolio, resulted in net banking income of 5,180 million DZD and a net profit of about 261 million DA, an increase compared to the 1997 financial year.

As a commercial bank, Crédit Populaire d'Algérie cooperates at the level of the banking and financial intermediation market. As such it:

-Collection of resources.

-Manages the means of payment.

-Ensures the security of financial transactions.

-Gives credit.

-Drains savings.

-Advisory.

1. General Treasury Department

This department is responsible for the day-to-day management of the central treasury and central treasury accounts. Its tasks are to:

✓ Monitor the bank's cash position on a daily basis on the basis of information from the branches;
✓ Ensuring the supply of cash to agencies and responding to calls for funds;

- ✓ Keeping and monitoring central accounts (BA, CCP, Treasury and primary banks);
- ✓ Execute money market investment transactions;
- ✓ Borrowing on the money market;
- ✓ Managing the treasury bill portfolio.

Manage the bank's bills of exchange portfolio. In the event of a deficit, it will present the bills of exchange for rediscount.

Figure N (3-1): Organization chart of the Treasury Department
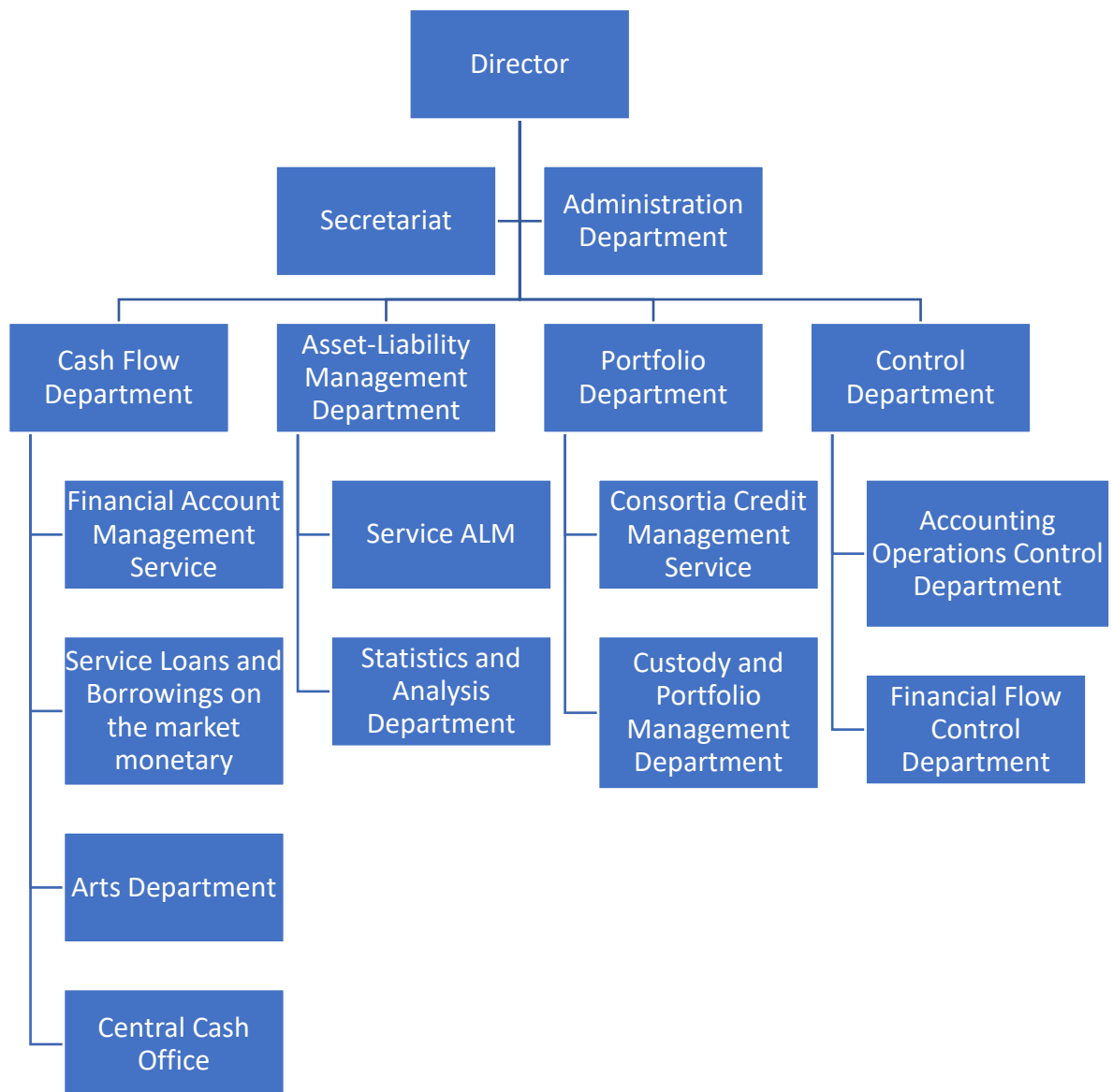
Source: CPA.

Section 02: Liquidity Measurement and Analysis by ALM Methods

After having presented Crédit Populaire d'Algérie, it would be very enriching to apply ALM techniques in terms of measuring and analyzing liquidity at the CPA level.

Our analysis will consist of projecting the CPA's fiscal 2019 balance sheet on maturities ranging from short-term (less than 7 days) to long-term (3 years at most).

This requires the prior adoption of assumptions regarding the maturities of certain balance sheet items.

The approach will be as follows:

- ✓ Drawing up the maturity profile for each asset and liability item.
- ✓ Determine impasses and liquidity risk management indicators based on the established maturity profile. These are as follows:
  - ➢ Dead ends in flow and stock.
  - ➢ The liquidity index.
  - ➢ The liquidity ratio.
- ✓ Establish liquidity risk coverage.
- ✓ Establish the stress sensitivity test, through scenarios, to see their impact on bank liquidity.

1. The working hypotheses

The aim of our end-of-cycle work is to apply the ALM method within CPA, which requires the prior adoption of assumptions concerning the maturities of certain balance sheet items that require special treatment. We make a few assumptions that make up for the lack of data at the CPA level or their confidentiality when they are available:

- ✓ new productions will not be taken into consideration (absence of a strategic plan), as these involve more elaborate assumptions about their entry into the balance sheet and their depreciation profiles. (Static approach).
- ✓ The non-inclusion of off-balance sheet transactions (due to lack of data).

2. Measuring liquidity risk
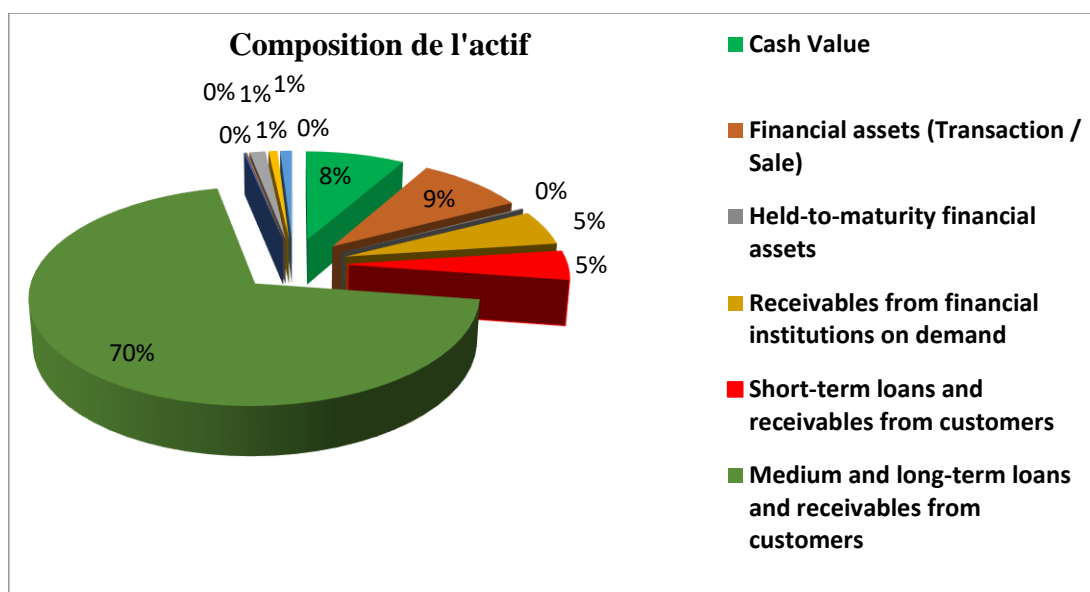
The ALM, in its measurement of risk, proceeds as follows:

2.1 Analysis of the CPA balance sheet

Each item on the bank's balance sheet was analyzed separately.

2.1.1   Analysis of Asset Items

Figure N (3-2): Analysis of Balance Sheet Assets

Source: Our own, based on the CPA 2019 balance sheet

It can be seen from this graph that Medium- and Long-Term Loans and Receivables (MLT) represent the most important part of the bank's expenditure, with a percentage of 70%, as well as 09% for Financial Assets (transaction/sale).

a. Cash value:

This item contains the banknotes and coins held in cash, assets with the Central Bank, the Treasury and the Postal Cheque Centre.

This item by its nature makes the funds very liquid, the assets at the Bank of Algeria (excluding Mandatory Reserves) can be available within 24 hours, therefore, they are classified at the earliest maturity, i.e. less than 7 days, while the amount of Mandatory Reserves will be classified at the latest maturity.[37]

The amount of this item is: 107 565 022 263 DZD represents 8% of the total assets.

b. Financial Assets (transaction/sale):

These are assets that can be traded on a regulated market (shares, bonds, treasury bills) that the bank can sell in the event of liquidity concerns.

-   Assets that are considered as financial assets held for trading are:
  ✓ 13- and 26-week CTM (short-term Treasury bills) classified according to their contractual maturities.
-   Available-for-sale assets are:

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[37] www.bank-of-Algeria.dz./ consulted : 07/09/2020,15H

✓ 1-year, 2-year, 3-year and 5-year treasury bills (BTAs).

7-year, 10-year and 15-year OATs (French government bonds). The amount of this item in the 2019 balance sheet is: 117,467,034,620 DZD

Table N (3-1): Maturity profiles of financial assets (Transaction/Sale). Unit: DZD

Classes	Outstanding	Cash inflows
1-7 days	117 467 034 620	0
7-30 days	112 228 560 000	5 238 474 620
1-3 months	103 158 720 000	9 069 840 000
3-6 months	94 944 864 000	8 213 856 000
6-12 months	93 307 152 000	1 637 712 000
1-3 years old	62 428 896 000	30 878 256 000
>3 years old	0	62 428 896 000

Source: Own design based on data

c. Held-to-maturity financial assets:

This item includes financial assets with fixed payments and maturities fixed.

The amount of this item is: 2,372,728,378. DZD

Their maturity profile is as follows:

Table N (3-2): Maturity profile of held-to-maturity assets

Classes	Outstanding	Cash inflows
1-7 days	2 372 728 378	0
7-30 days	1 636 896 000	735 832 378
1-3 m	1 636 896 000	0
3-6 m	820 896 000	816 000 000
6-12m	820 896 000	0
1 -3 years old	0	820 896 000
>3 years	0	0

Source: Own design based on data

d. Receivables from financial institutions at sight:

This item includes money market transactions as well as loans and claims on banks and other financial institutions.

The amount of this item is: 69,208,378,079 DZD which represents 5% of the assets of the CPA in 2019.

    e.   Loans and advances to customers:

This item comprises credits offered by the Bank to economic agents other than financial institutions in the form of short, medium and long-term loans. It represents 75% of total assets.

    f.   Current Loans and Receivables (CT): It represents 5% of total assets,

The amount of this item is: 56,423,609,189 DZD Their due date profile is shown in the table below

Table N (3-3): Maturity profile Loans and advances to customers Short-term. Unit: DZD

Classes	Outstanding	Cash inflow
1-7 days	56 423 609 189	0
7-30 days	46 610 719 747	9 812 889 442
1-3 m	23 134 451 897	23 476 267 850
3-6 m	20 319 209 606	2 815 242 291
6-12m	18 427 780 770	1 891 428 836
1-3 years old	0	18 427 780 770
>3 years old	0	0

Source: Own design based on data

    g.   Medium and long-term loans and receivables (MLT):

This item represents 70% of total assets. It is a very important part of the bank's activity. The amount of this item is: 897,532,323,322 DZD Their due date profile appears as follows:

Table N (3-4): Maturity profile Loans and advances to customers at MLT. Unit: DZD

Classes	Outstanding	Cash inflow
1-7 days	897 532 323 322	0
7-30 days	896 470 456 626	1 061 866 696
1-3 m	890 597 886 811	5 872 569 815
3-6 m	872 659 427 988	17 938 458 823
6-12m	834 482 604 011	38 176 823 977
1-3 years old	646 907 819 926	187 574 784 085
>3 years old	0	646 907 819 926

Source: Own design based on data

h. Current taxes - Assets:

This item includes advances and down payments made periodically to the Treasury in the form of income tax. The amount of these taxes is provisioned on the basis of the tax due for the previous year.

It should be mentioned that at the close of the financial year, if the advance payments made are greater than the tax due, the excess payment will be carried forward to the next financial year for the final calculation of the accounting result. In fact, the item "Current tax assets" did not have any significant impact on the Group's financial statements. no impact on the bank's liquidity as it does not represent an actual inflow of funds. The amount of these current taxes which amounts to 1,971,615,936 DZD in 31/12/2019.

a. Deferred tax assets:

This item records the income tax amounts resulting from differences between the accounting and tax plans. These amounts are recoverable in future years.

Therefore, as for the previous account, this item, which amounts to 1,350,128,304 DZD as at 12/31/2019.

b. Other Assets:

This item includes advances, provisions and other assets not included in other items. The amount of this item is: 17,127,360,985 DZD.

c. Investments in subsidiaries and joint ventures:

This item covers all of the Bank's holdings in financial institutions, as well as the equity interests it holds in the capital of other companies in the banking and financial system.

At the close of the 2019 financial year, investments in subsidiaries, joint ventures or associates amounted to 9,690,920,938 DZD.

d. Property, plant and equipment:

These are the assets in which the bank has invested, i.e. land, buildings, IT equipment.

This item amounted to 12,622,628,112 DZD at the close of the financial year 31/12/2019.

e. Intangible fixed assets:

Intangible assets are identifiable, non-monetary and intangible assets controlled and used by the reporting institution in the course of its ordinary activities. This item includes brands, computer software, etc., which are not identifiable. The amount of this item is: 98,980,797. DZD

2.1.2   Analysis of Liability Items:

Figure N (3-3): Analysis of liability items
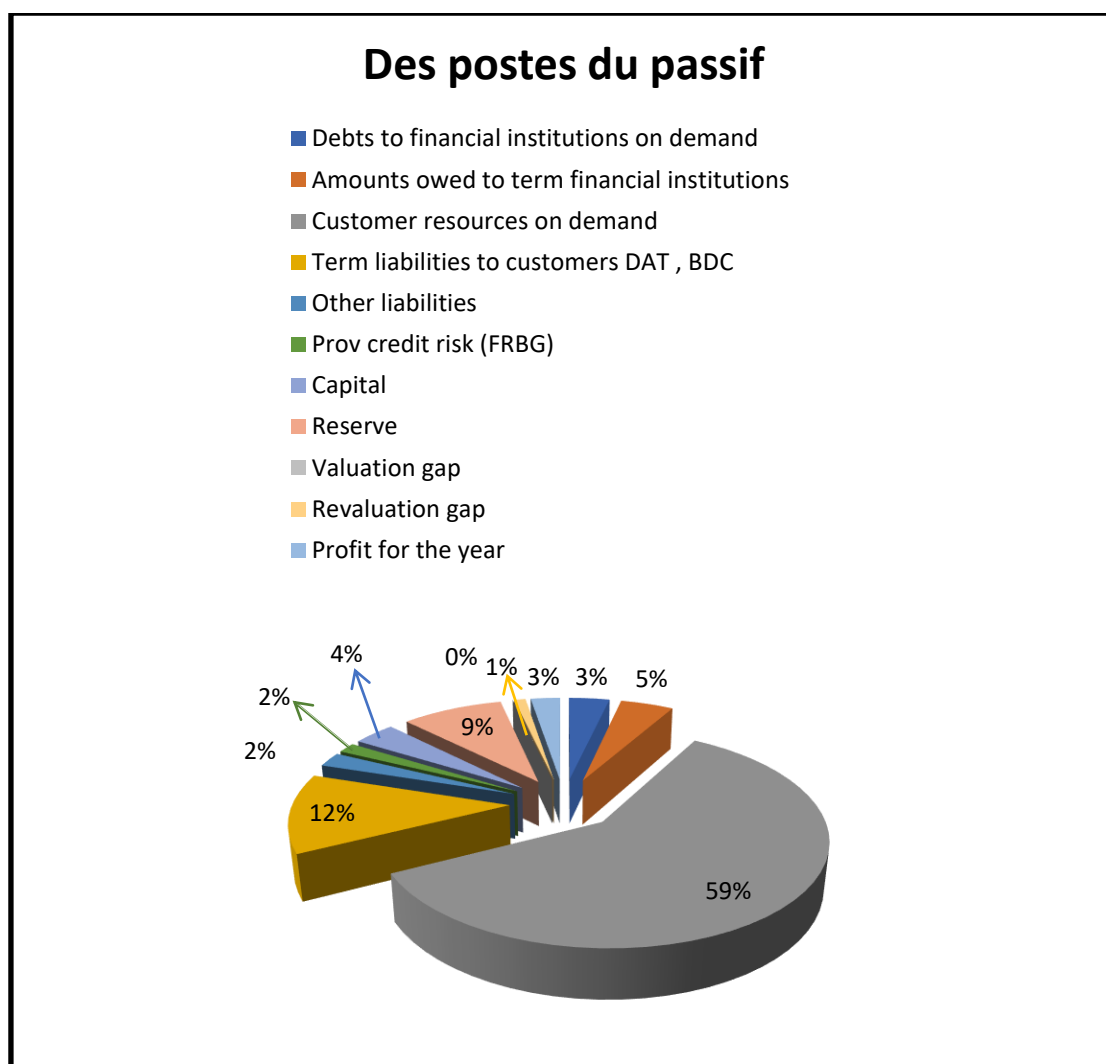
Source: Our own, based on the CPA 2019 balance sheet

From this graph, it can be seen that customer resources represent the most important part of the bank's resources (balance sheet liabilities), with a percentage of 59%, as well as 12% for debts to customers on DAT, BDC.

a.   Amounts owed to financial institutions on demand:

This item covers liabilities in respect of banking transactions with financial institutions in the form of postal cheques and accounts.

The amount of this item is: 46,211,032,405 DZD

b.   Amounts owed to term financial institutions:

This item includes liabilities in respect of banking transactions with financial institutions that are represented by a loan.

The cash flow statement for the item "Payables to term financial institutions" is as follows:

Table N (3-5): Maturity profile Debts owed to financial institutions at term.Unit: DZD

Classes	Outstanding	Cash outflow
1-7 days	60 274 366 034	0
7-30 days	58 278 987 430	1 995 378 604
1-3 m	53 849 488 855	4 429 498 576
3-6 m	53 439 316 076	410 172 778
6-12m	53 072 081 629	367 234 447
1-3 years old	45 074 652 004	7 997 429 625
>3 years old	0	45 074 652 004

Source: Own design based on data.

c. Sight customer resources:

These deposits have no contractual maturities, and can be withdrawn by depositing customers at any time.

The most realistic approach to dealing with overnight deposits in deadlocks is to separate the stable (long-term) part of the deposits from the variable (short-term) part. To determine these two parts, stable and volatile, we considered a series of 36 monthly overnight deposit observations (from 31/01/2017 to 31/12/2019), assuming that these observations follow a normal law of a mean and a standard deviation to be calculated on the basis of these same observations.

The Central Limit Theorem will then be used to determine the planar threshold (stable part) of overnight deposits.

The calculations are made below:

❖ Statistical method:

This method is used to calculate the two parts of the overnight deposits, the stable part and the volatile part on the basis of the mean and standard deviation.

Table N (3-6): Determination of the stable and volatile portion of overnight deposits

Calculation aggregates	Value
Overnight deposits at 31/12/2019	767 444 910 022
Observation period	2017-2019
Number of observations	36
Average	790 951 141 799
Standard deviation	58 792 657 739
Threshold of significance	95%
Normal distribution value at 95%.	1,645
The stable part	694 237 219 818
The volatile part	73 207 690 204

Source: Own design based on data

The floor threshold is considered a stable resource and is calculated as follows:

Minimum amount = mean - 1.645 × standard deviation

= 790 951 141 799 -1,645× 58 792 657 739

= **694,237,219,818 DZD**

The value 1.645 is the value taken by the centered normal distribution and reduced to the 95% confidence level, and can be read directly from the table of this distribution. By applying the Central Limit Theorem, we obtain:

- ✓ A stable part in the amount of 694,237,219,818 DZD.
- ✓ A volatile portion in the amount of 73,207,690,204 DZD.

- ❖ Graphic Method:

It is based on a charisma that traces the evolution of the historical series of overnight deposits over a time horizon (from 31/01/2017 to 31/12/2019).

The graph of the evolution of visual deposits shows that a fairly large fraction of these deposits shows a certain stability over the period considered.

We can conclude that the value of 694,237,219,818 DZD is the minimum amount that the variable can take. Consequently, this value represents the stable portion of overnight deposits

Figure N (3-4): Evolution of overnight deposits at CPA
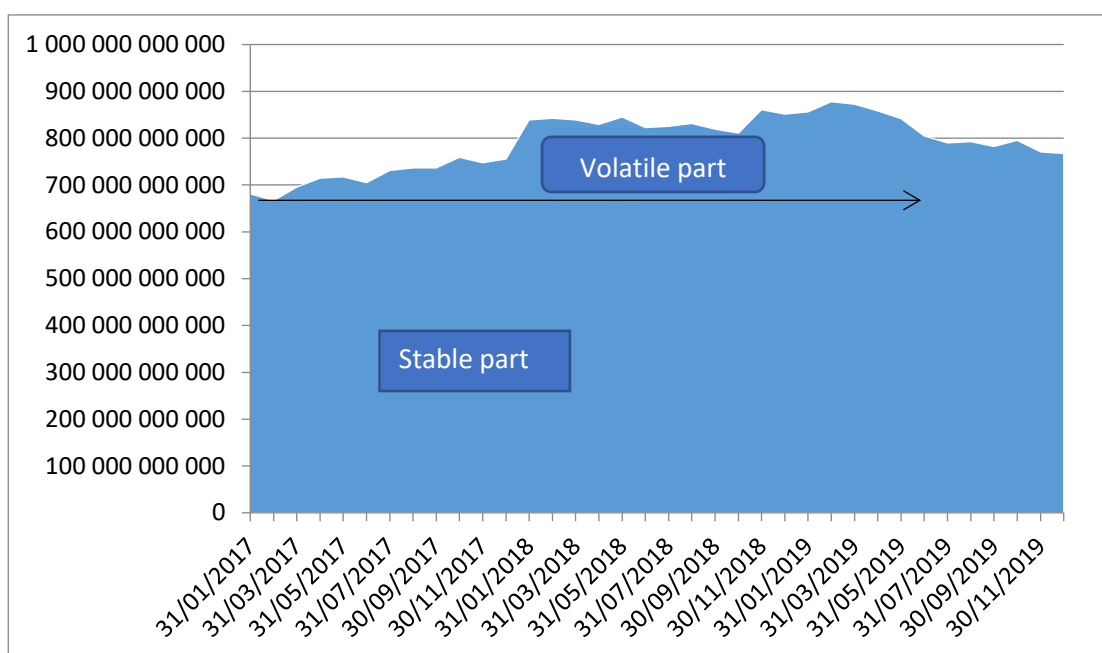
Source: Ourselves from 2017-2019 data

This stable part of 694,237,219,818 DZD will be classified in the longest maturity, namely "more than 3 years", as for the volatile part, which represents 73,207,690,204 DZD,

the volatile portion will be allocated to the maturity classes as follows:

Table N (3-7): Maturity profile of overnight deposits. Unit: DZD

Classes	Outstanding	Cash outflow
1-7 days	765 980 756 218	1 464 153 804
7-30 days	763 784 525 512	2 196 230 706
1-3 m	760 124 141 002	3 660 384 510
3-6 m	749 142 987 471	10 981 153 531
6-12m	734 501 449 430	14 641 538 041
1-3 years old	694 237 219 818	40 264 229 612
>3 years	0	694 237 219 818

Source: Own design based on data

d. Term loans to customers DAT, BDC:

These are interest-bearing deposits with a predefined contractual maturity. However, depositors have the option of requesting early redemption.

They represent the minimal contribution of these resources in the bank's balance sheet (12% of liabilities).

The amount of these deposits which amounts to 160,158,564,727 DZD The maturity profile of this item is as follows:

Table N (3-8): Maturity profile Debts due to customers at term DAT BDC Unit: DZD

Classes	Outstanding	Cash outflow
1-7 days	160 158 564 727	0
7-30 days	157 260 898 694	2 897 666 033
1-3 m	149 014 005 173	8 246 893 521
3-6 m	134 553 688 641	14 460 316 532
6-12m	116 959 956 523	17 593 732 118
1-3 years old	85 176 624 217	31 783 332 306
>3 years old	0	85 176 624 217

Source: Own design based on data

e. Other liabilities:

This item includes debts to third parties not shown in the other liability accounts, such as personnel costs, intermediation debts, etc., which are not included in the other liability accounts. The amount of this item is: 29,297,158,152 DZD

f. Provisions for credit risk (FGBR):

This item covers provisions for losses that are likely to be incurred as a result of events that make their occurrence probable and whose amount and timing cannot be precisely determined.

g. Capital:

This is the nominal value of the shares, members' shares and other securities making up the bank's share capital. The latter is 48,000,000,000. DZD

h. The Reserves:

This item is made up of legal and optional reserves set up by drawing on the profits of previous years.

i. Revaluation surplus:

This item includes differences arising from the revaluation of balance sheet items. This item represents 12,991,319,149. DZD

j. Result for the year:

It includes the profit or loss for the financial year. This item represents 33,463,728,355 DZD.

2.2 Development of maturity profile

The development of the maturity profile is the first step in asset-liability management and requires a detailed analysis of each balance sheet item, in order to allocate each item by period (maturity class) taking into account those that require special treatment such as overnight deposits, and off-balance sheet (Due to the unavailability of data we were unable to include off-balance sheet transactions in our calculations).

This step is very important in the ALM approach to liquidity risk management.

Our work starts from the balance sheet of the People's Credit of Algeria at the date 31/12/2019 and projects it over a time horizon covering very short term (less than 7 days), until the medium term (3 years and more).

Table N (3-9): Maturity profile Asset-Unit: DZD

Position/Class	7J	7J-1M	1M-3M	3M-6M	6M-1Yeas	1Yeas-3Years	≥ 3Ans	Total
Cash Value		443252221 79	33 354 920 927	13 812501 856	10 124 863 712	4 144 763 218	1 802 750 371	107 565 022 263
Financial Assets (Transaction /Sale)		5 238 474 620	9 069 840 000	8 213 856 000	1 637 712 000	30 878 256 000	62 428 896 000	117 467034 620
Financial Assets held-to-maturity		735 832 378		816 000 000	-	820 896 000	-	2 372 728 378
Receivables from institutions demand financing	7375 91 26	16 478 126 479	15 001 475 681	8 824 573 612	5 503 780 694	6 024 730 587	-	69 208 378 079
Loans and receivables on the custome rs to ct		9 812 889 442	23 476 267 850	2 815 242 291	1 891 428 836	18 427 780 770		56 423 609 189
Loans and receivables on customers at MLT		1 061 866 696	5 872 569 815	17 938 458 823	38 176 823 977	187 574 784 085	646 907 819 926	897 532 323 322

Current taxes – active		874 296 735	-	685 736 125	-	365 782 145	45 800 931	1 971 615 936
Deferred tax assets	-	-	-	-	156 842 973	403 478 645	789 806 686	1 350 128 304
Other Assets	84 153 687	2 790 063 752	1 565 413 458	1 537 852 942	889 147 589	509 039 943	1 251 689 614	17 127 360 985
Investments in subsidiaries, joint ventures and joint ventures companies	-	-	-	-	-	-	9 690 920 938	9 690 920 938
Property, plant and equipment	-	-	-	-	-	-	12 622 628 112	12 622 628 112
Intangible fixed assets	-	-	-	-	-	-	98 980 797	98 980 797
Total	5 959 84 4 713	81 316 772 281	88 340 487 731	54 644 221 649	58 380 599 781	249 149 511 393	735 639 293 374	1 293 430 730 922

Source: CPA.

Table N (3-10): Maturity profile Liabilities

Position/Class	7J	7J-1M	1M-3M	3M-6M	6M-1Years	1Years-3Year s	≥ 3Ans	Total
Debts to demand financial institutions	-	-	-	-	-		-	46 211 032 405	46 211 032 405
Amounts owed to financial institutions at term		1 995 378 604	4 429 498 576	410 172 778	367 234 447	7 997 429 625	45 074 652 004	60 274 366 034

Customer Resources at Sight DAV	464 153 804	2 196 230 706	3 660 384 510	10 981 153 531	14 641 538 041	40 264 229 612	694 237 219 818	767 444 910 022
Debts owed to the DAT term customers, BDC		2 897 666 033	8 246 893 521	14 460 316 532	17 593 732 118	31 783 332 306	85 176 624 217	160 158 564 727
Other liabilities	04563 82	2 218 977 578	1 445 873 296	1 483 297 543	2 288 679 243	3 031 849 554	16 723 917 156	29 297 158 152
Prov f/credit risk (FGBR)	-	-	-	-	-	-	20 402 702 588	20 402 702 588
Capital	-	-	-	-	-	-	48 000 000 000	48 000 000 000
Reserves	-	-	-	-	-	-	115 219 514 714	115 219 514 714
Valuation difference	-	-	-	-	-	-	32 565 223	32 565 223
Revaluation difference	-	-	-	-	-	-	12 991 319 149	12 991 319 149
Profit for the year	-	-	-	-	-	-	33 463 728 355	33 463 728 355
Total	56871 586	9 308 252 921	17 782 649 903	27 334 940 384	34 891 183 849	83 076 841 097	1 117 468 145 182	1 293 430 730 922

Source: CPA

Chapter 03: Liquidity risk management by ALM at the CPA

2.1 Analysis of the overall liquidity situation

A study of the flow of each balance sheet item enables us to draw up a depreciation table for all the resources and expenditure of the CPA as shown in the following table:

Table N (3-11): Amortization profile of assets and liabilities. Unit: DZD

Classes	Active	Liabilities
31/12/2019	1 293 430 730 922	1 293 430 730 922
<=Seven days.	1 267 470 886 209	1 289 862 013 336
7 days-1 month	1 186 154 113 928	1 280 553 760 415
1-3 m	1 097 813 626 197	1 262 771 110 512
3-6 m	1 043 169 404 548	1 235 436 170 128
6-12m	984 788 804 767	1 200 544 986 279
1-3 years old	735 639 293 374	1 117 468 145 182
>3 years old	0	0

Source: Ourselves from the Data.

In order to provide more information on the rate of outflow of the bank's assets and liabilities, we have tried to transform the figures in the table into a graph:

Figure N (3-5): The Amortization Profile of Assets and Liabilities
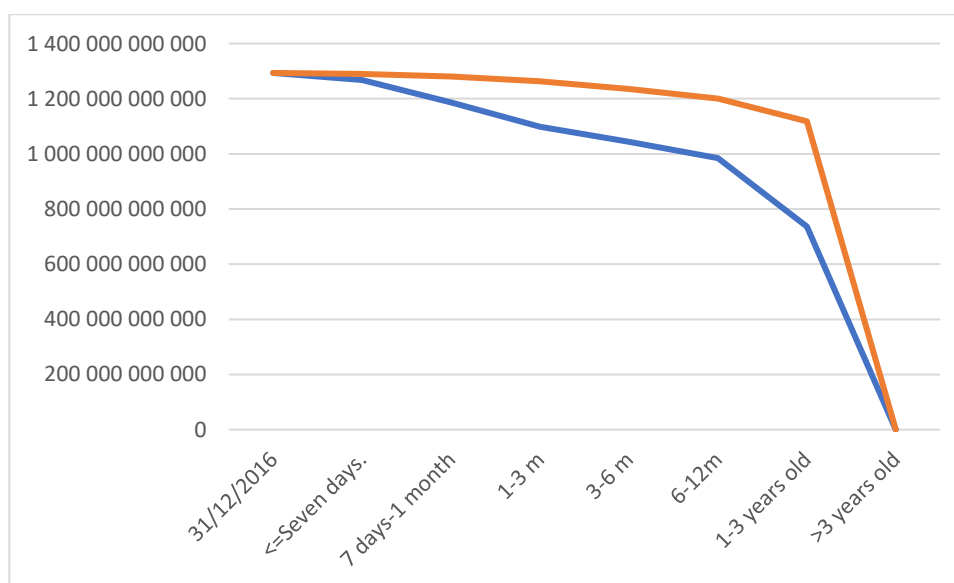
Source: Own design from Table N 11.

From the graph above, we can see that the bank's expenditure are depreciating faster than its resources over the study period.

While the bank's balance sheet is over-consolidated, it has to generate surplus resources to finance new expenditure.

This indicates a positive gap between liabilities and assets, which may lead us to conclude that the bank is over-liquid.

The evolution of the liquidity situation of the balance sheet can be better explained by calculating the level of consolidation for each period using the following formula:

Consolidation level at time $t = \frac{outstanding\ liabilities\ at\ t}{assets\ outstanding\ at\ t}$

We can find three cases:

➢ a higher level of consolidation means that the balance sheet is "over-consolidated" i.e. expenditure are depreciated more quickly in relation to resources (over-liquidity situation)
➢ A level of consolidation equal to unity means equality between the two.
➢ a lower level of consolidation means that the balance sheet is "under-consolidated" i.e. resources are depreciated more quickly in relation to expenditure (illiquidity situation). The depreciation area of the consolidation level is as follows:

Table N (3-12): Assessment of the Level of Consolidation

Time t	0	1	2	3	4	5	6	7	8
NC in %	100	101,76	107,95	115,02	102,84	118,43	121,9	151,9	-

Source: Own design based on Table 11.

Based on this table, we see that the bank's expenditure is depreciating faster than its resources in each period. So, the surplus liquidity situation.

After establishing the maturity profile and the amortization schedule for the assets and liabilities on the balance sheet and assessing the level of consolidation, we will proceed to measure the liquidity within Crédit Populaire d'Algérie (CPA).

2.2   Measuring liquidity risk using the ALM method

This measure includes the determination of liquidity bottlenecks and the calculation of management indicators.

2.2.1   Dead-ends in liquidity:

Is a method that makes it possible to determine the foreseeable mismatches between the bank's resources and expenditure at different future dates and gives a forecast picture of the liquidity situation.

Deadlocks can be calculated in two different ways (in stock or in flow).

2.2.1.1   Dead ends in flux:

This is the difference between the cash inflow and outflow. It is used to determine the bank's liquidity situation during the period under review.

It is also possible to cumulate the deadlocks for each class to determine the amount and the period in which the maximum cash requirement occurs.

They are given in the table below. And the graph completes it:

Table N (3-13): Dead ends in flow.Unit: DZD

Classes	Fallen Assets	Fallen Liabilities	Deadlock in flow	Dead ends in flow cumulated
<=Seven days.	25 959 844 713	3 568 717 586	22 391 127 127	22 391 127 127
7 days-1 month	81 316 772 281	9 308 252 921	72 008 519 360	94 399 646 487
1-3 m	88 340 487 731	17 782 649 903	70 557 837 828	164 957 484 315
3-6 m	54 644 221 649	27 334 940 384	27 309 281 265	192 266 765 580
6-12m	58 380 599 781	34 891 183 849	23 489 415 932	215 756 181 512
1-3 years old	249 149 511 393	83 076 841 097	166 072 670 296	381 828 851 808
>3 years old	735 639 293 374	1 117 468 145 182	-381 828 851 808	0

Source: Own design.

Figure N (3-6): Dead-ends in flow.
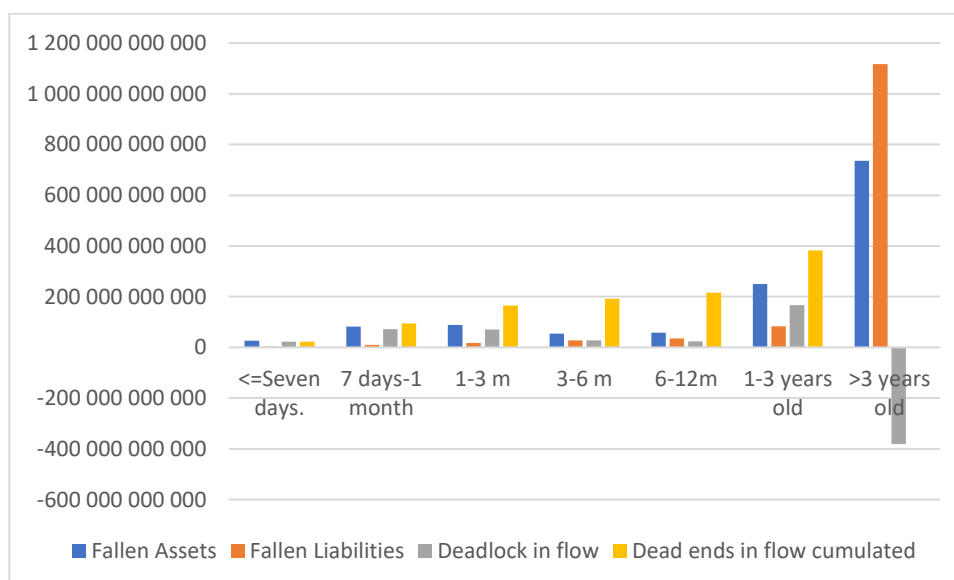
Source: Own design based on Table 13.

We notice that the impasses in flows are positive from the first period up to 3 years which means the inflow of funds and which corresponds to the cash fall (Cash Value and Financial Assets (transactions and sales) and claims on financial institutions).

And for the seventh period (> 3 years) the deadlocks are negative which reflects the cash outflow i.e. there is a need for funds.

These liquidity needs originate from:

> ➢ Maturities of term deposits and the stable portion of overnight deposits.
> ➢ Maturities of long-term resources such as share capital and reserves.

These funding requirements are covered by accumulated surplus earnings from the following periods Previous.

2.2.1.2   Dead ends in stock:

It is the difference between outstanding liabilities and assets at a given maturity.

Inventory shortfalls represent the accumulated forecast deficits (or surpluses). results: It should be noted that the cumulative flow impasses are equal to the stock impasses. By applying this criterion to the CPA balance sheet, we obtained the following

Table N (3-14): Dead ends in stock. Unit: DZD

Classes	Outstanding Assets	Outstanding Liabilities	Dead end in stock
31/12/2019	**1 293 430 730 922**	**1 293 430 730 922**	**0**
<=Seven days.	**1 267 470 886 209**	**1 289 862 013 336**	**22 391 127 127**
7 days-1 month	**1 186 154 113 928**	**1 280 553 760 415**	**94 399 646 487**
1-3 m	**1 097 813 626 197**	**1 262 771 110 512**	**164 957 484 315**
3-6 m	**1 043 169 404 548**	**1 235 436 170 128**	**192 266 765 580**
6-12m	**984 788 804 767**	**1 200 544 986 279**	**215 756 181 512**
1-3 years old	**735 639 293 374**	**1 117 468 145 182**	**381 828 851 808**
>3 years old	**0**	**0**	**0**

Source: Own design

In order to better reflect these results, we have found it useful to transform these figures into graph:

Figure N (3-7): Dead ends in stock.
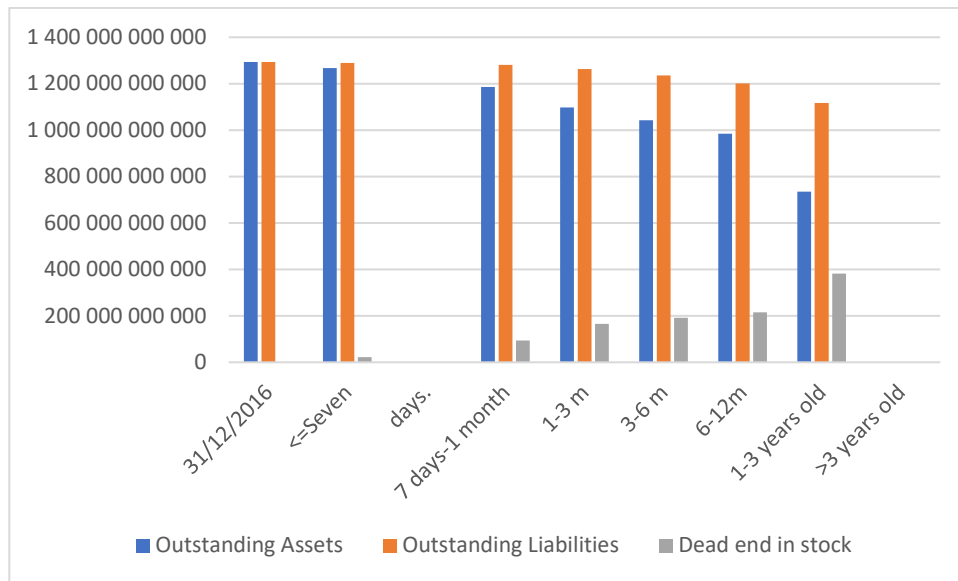
Source: Own design based on Table 14

We note that the first and last deadlocks are zero, Therefore the balance sheet's liquidity balance.

The impasses in stocks correspond to the impasses in cumulative flows, they are positive and increasing over the entire period under consideration, which means that the bank has a surplus of resources over uses, the bank must therefore find new expenditure for these surplus resources.

➢ The impact of the interest rate:

The impact of a 1% increase in the interest rate on profitability can be studied from the bank by calculating the change in the interest margin for each period according to the following formula:

Change in margin = deadlock in inventory* change in rate * duration.

Duration $=\dfrac{t \ on \ days}{365}$

Table N (3-15): The impact of a 1% increase in rates on the bank's profitability. Unit: DZD

Class	Gaps	Duration	Δ Marge
1-7 days	22 391 127 127	7/365	4 294 189
7-30 days	94 399 646 487	30/365	77 588 751
1-3 m	164 957 484 315	90/365	406 744 482
3-6 m	192 266 765 580	180/365	948 164 871
6-12m	215 756 181 512	1	2 157 561 815
1-3 years old	381 828 851 808	3	11 454 865 554
>3 years	0		0
Total			15 049 219 662

Source: Own design

If the interest rate increases by 1%, the bank records a total gain of 15,049,219,662 DZD This amount will be a loss for the bank in the event of a 1% drop in the interest rate.

The analysis of liquidity impasses shows that the bank is over-liquid throughout the observation period, since the cumulative flow impasses remain positive throughout the period.

This is reflected in the fact that the bank is cautious about the transformation of its resources. To better judge this, liquidity management indicators are calculated.

2.2.2 Liquidity management indicators:

There are two indicators of liquidity management, which are:

2.2.2.1 The transformation index:

This index measures the degree of transformation achieved by the bank.

It corresponds to the ratio between liabilities and assets weighted by the average number of days in each period, which is equal to a:

Transformation index =∑liabilities weighted / ∑assets weighted.

Table N (3-16): Calculation of the processing index. Unit: DZD

Classes	Fallen Assets	Fallen Liabilities	Weightings	Weighted assets	Weighted liabilities
<=Seven days.	25 959 844 713	3 568 717 586	0.01	259 598 447	35 687 176
7jo-1 month	81 316 772 281	9 308 252 921	0.05	4 065 838 614	465 412 646
1-3 m	88 340 487 731	17 782 649 903	0.16	14 134 478 037	2 845 223 984
3-6 m	54 644 221 649	27 334 940 384	0.375	20 491 583 118	10 250 602 644
6-12m	58 380 599 781	34 891 183 849	0.75	43 785 449 836	26 168 387 887
1-3 years old	249 149 511 393	83 076 841 097	2	498 299 022 786	166 153 682 194
>3 years	735 639 293 374	1 117 468 145 182	$4^{.558}$	3 310 376 820 183	5 028 606 653 319
Total	1 293 430 730 922	1 293 430 730 922		3 891 412 791 021	5 234 525 649 850

Source: Own design

The transformation index = $\frac{(Risk-weighted\ liability)}{(Risk-weighted\ asset)} = \frac{5\ 234\ 525\ 649\ 850}{3\ 891\ 412\ 791\ 021} = 1.345147876 > 1$

This index is greater than 1, which means that the bank is liquid and is not subject to transformation risk since it has more weighted resources than weighted uses.

2.2.2.2 Liquidity Coefficient:

This ratio requires the bank to have assets that can be realized within one month to meet its liabilities. Its calculation is subject to weightings to take into account the degree of liquidity of the assets and the eligibility of the liabilities.

The report serving as a basis for calculating the liquidity ratio must be sent to the Central Bank within 30 days of the end of the quarter in question. From (Annex)

Minimum liquidity ratio (A/B)	(361 782 145/247 994 841) =1,4588
Excess liquidity (A-B) (over more)	(361 782 145-247 994 841) = 113 787 304

The ratio stands at 1.45, even above the regulatory limit of 1. This means that the bank can fully cover its liabilities due in one month with its liquid assets and generate a surplus of 45.88%.

Therefore, the bank finds itself in a situation of short-term over-liquidity due to the surplus it realizes, which amounts to 113,787,304 DZD.

3. Hedging of liquidity risk

As mentioned in Chapter 2, liquidity risk is covered by several methods (back-to-back, securitization, etc.). Due to the inexistence of a computerized software at the level of the DTM that allows assets to be backed by liabilities with the same characteristics in terms of liquidity and rates, it seems difficult to us to make a liquidity backing manually. Also, in the absence of a developed financial market, the securitization technique is very little used on the Algerian market.

The only method that can be used to reduce liquidity risk is to close the gaps one by one, starting with the first gap, by taking an inverse liquidity position. Therefore, the first impasse is positive (22 391 127 127 DZD), to make this gap zero, we must increase the debts of this period by the amount of the impasse of the same period, we will borrow at market conditions an amount of 22 391 127 127 DZD for one week, and we place it in the farthest maturity to maximize the gains. We will do the same to close the other gaps, however if the gap is negative, we must borrow the same amount in the shortest maturity of the maturity class and place it in the longest maturity in the same maturity class.

Table N (3-17): Closing flow gaps. Unit: DZD

Classes	Fallen Assets	Fallen Liabilities	Deadlock in flow	The new gap Closing
<=Seven days.	25 959 844 713	3 568 717 586 +22 391 127 127	22 391 127 127	0,00
7 days-1 month	81 316 772 281	9 308 252 921 +72 008 519 360	72 008 519 360	0,00
1-3 m	88 340 487 731	17 782 649 903 +70 557 837 828	70 557 837 828	0,00
3-6 m	54 644 221 649	27 334 940 384 +27 309 281 265	27 309 281 265	0,00
6-12m	58 380 599 781	34 891 183 849 +23 489 415 932	23 489 415 932	0,00
1-3 years old	249 149 511 393	83 076 841 097 +166 072 670 296	166 072 670 296	0,00
>3 years old	735 639 293 374 +381 828 851 808	1 117 468 145 182	-381 828 851 808	0,00

Source: Own design.

✓ Calculation of the closing cost:

The closing cost can be a gain (if positive) or a loss (if negative).

Closing cost = interest receivable on investments - interest payable on borrowings

Please note that the rates used to calculate interest are the money market rates communicated by our bank. For maturities of loans or borrowings that exceed two years, and given that the money market is a short-term market (from 1 d to 2 years), we have used the 3- year TCB rates for the 1 to 3-year maturity class and the 5-year TCB rate for the maturity class over 3 years.

3.1 Calculation of investment interest:

Table N (3-18): Investment interest .Unit: DZD

Duration	Amount	Placement rates	Investment interest
>3 years	381 828 851 808	4.5	1 718 229 833 1.36

Source: Own design

3.2 Calculation of the interest on the loan

Table N (3-19): Interest on the loan .Unit: DZD

Duration	Amount	Borrowing rates	Loan interest
7 days	22 391 127 127	0.875	19 592 236 2.36
1 Month	72 008 519 360	1.5	108 012 779 0.40
3 Months	70 557 837 828	1.75	123 476 216 1.99
6 Months	27 309 281 265	2.25	61 445 882 8.46
1 Year	23 489 415 932	2.75	64 595 893 8.13
3 Years	166 072 670 296	4	664 290 681 1.84
Total			1 041 413 689 3.18

Source: Own design.

The net gain: 1,718,229,833 1.36- 1,041,413,689 3.18= 676,816,143 8.18 DZD

4. Sensitivity test:

We will study the impact of high volatility in overnight deposits and a change in interest rates on liquidity.

4.1 Of a large overnight deposit volatility (VSD)

The above analysis assumes that a significant fraction of overnight deposits represents some stability. Indeed, we will now try to study the impact of a significant volatility of VADs.

We therefore assume a crisis of depositor confidence. Two cases are presented of massive VAD withdrawals. We start with a less dangerous case, namely, a request for a 10% withdrawal that occurs in the first period (scenario 01). Thereafter, we move on to a more serious scenario assuming 50% withdrawal (scenario 02).

> ➢ Withdrawal of 10% DAV for the first period:

Table N (3-20): The new flow and stock impasses of scenario 01 (10%) Unit: DZD

Class	Outstanding VAD	DAV output	Dead ends in flow	Impasses in stock
1-7 days	690 700 419 020	76 744 491 002	-52 889 210 071	-52 889 210 071
7-30 days	688 504 188 314	2 196 230 706	72 008 519 360	19 119 309 289
1-3 m	684 843 803 804	3 660 384 510	70 557 837 828	89 677 147 117
3-6 m	673 862 650 273	10 981 153 531	27 309 281 265	116 986 428 382
6-12m	659 221 112 232	14 641 538 041	23 489 415 932	140 475 844 314
1-3 years old	618 956 882 620	40 264 229 612	166 072 670 296	306 548 514 610
>3 years	0	618 956 882 620	-306 548 514 610	0

Source: Own design.

Comment: we can see in the first scenario, the 10% scenario, that the bank was not really impacted, despite its need in the first period. The latter could be met by the surplus from the second period.

> ➢ Withdrawal of 50% DAV for the first period:

Table N (3-21): The new flow and stock impasses of scenario 02 (50%) Unit: DZD

Class	Outstanding VAD	DAV output	Dead ends in flow	Impasses in stock
1-7 days	383 722 455 011	383 722 455 011	-359 867 174 080	-359 867 174 080
7-30 days	381 526 224 305	2 196 230 706	72 008 519 360	-287 858 654 720
1-3 m	377 865 839 795	3 660 384 510	70 557 837 828	-217 300 816 892
3-6 m	366 884 686 264	10 981 153 531	27 309 281 265	-189 991 535 627
6-12m	352 243 148 223	14 641 538 041	23 489 415 932	-166 502 119 695
1-3 years old	311 978 918 611	40 264 229 612	166 072 670 296	-429 449 399
>3 years	0	311 978 918 611	429 449 399	0

Source: Own design

On the contrary, in the 2nd scenario, the loss of confidence of CPA depositors would have fatal consequences on the bank's liquidity situation. Indeed, we note that the CPA is faced with an immediate liquidity need estimated at 359 867 174 080 DZD,

However, the bank improves its liquidity position for periods 2 to 6 thanks to an inflow of funds mainly due to the repayment of loans from financial institutions as well as from customers, but this surplus of resources is not sufficient to cover the deficit recorded in the first period.

4.2   The impact of the change in interest rates:

Study of the impact of an increase in interest rates in the event of a crisis (scenario 02). 1% interest rate increase.

Table N (3-22): Impact of a 1% increase in the interest rate on the bank's profitability (crisis case) Unit: DZD

Class	Gaps	Duration	Δ Marge
1-7 days	-359 867 174 080	7/365	-69 015 622
7-30 days	-287 858 654 720	30/365	-236 596 155
1-3 m	-217 300 816 892	90/365	-535 810 233
3-6 m	-189 991 535 627	180/365	-936 944 559
6-12m	-166 502 119 695	1	-1 665 021 197
1-3 years old	-429 449 399	3	-12 883 482
>3 years	0		0
Total			-3 456 271 249

Source: Own design.

Due to the negative impasses recorded following the massive withdrawal of overnight deposits, an increase in the interest rate will have a negative impact on the bank's profitability. Indeed, the bank will suffer a maximum loss of - 3,456,271,249DZD if the interest rate increases by 1%.

Section 03: Analysis of results and recommendations

In this section, we will comment on the results obtained in the analysis of the liquidity position of the CPA. We will then propose recommendations (like a conclusion for this chapter) that we felt were necessary.

Commentary

Our previous analysis of CPA's liquidity position has revealed structural excess liquidity on its balance sheet, with the following results:

- ✓ Deadlocks in inventory are positive in all periods. Indeed, the CPA records a maximum excess liquidity of 381,828,851,808 DZD within 3 years, thanks to the increase in the volume of debts to customers, particularly overnight deposits (DAV).
- ✓ The transformation index is equal to 1.345147876, it is higher than 1 which means that there is an excess of weighted resources over weighted expenditure.

  So, the CPA does not do processing (it does not turn short resources into long expenditure).

- ✓ The liquidity ratio is equal to 1.4588, which means that liquid assets cover all liabilities due with a surplus liquidity of 45.88%.

This situation exposes the Bank's balance sheet favorably to an increase in interest rates, if the interest rate increases the Bank's profitability also increases, since the return on assets increases following new operations to reuse surplus liquidity, while the cost of its resources remains fixed.

Although this excess liquidity is a safety margin for the bank, it necessarily remains a cost. Therefore, it is preferable to reuse this liquidity and bear its cost.

Following the non-development of the financial market in Algeria, we propose to close the liquidity bottlenecks by loan-borrowing operations on the money market or to make investments in the form of liquidity recovery at one week, 6 months, 9 months or in the form of a deposit facility.

Sometimes this solution is not profitable because the interest rates offered are low so in this case other solution such as:

- ✓ The granting of healthy new loans has its customers.
- ✓ The purchase of securities that can be easily converted into cash without capital loss.

The sensitivity test is confronted with the assumption that the massive withdrawal of overnight deposits will weigh heavily on the liquidity situation of the CPA, indeed, a massive withdrawal of 50% of overnight deposits from the first period causes the bank to suffer a lack of liquidity of DZD 359 867 174 080, which it must face.

Conclusion

We will now make a few recommendations to enable the CPA to put in place asset- liability management that would allow it to best manage its financial risks and optimize its profitability.

Optimal risk management must be based on several axes: the development of the information system, the creation of a structure responsible for managing its risks and the definition of a coherent risk management policy.

a. The development of the information system

It is essential to acquire computer software that makes it possible to obtain the schedules of the various capital flows generated by all balance sheet and off-balance sheet items in real time, or at least with the minimum possible time lag. Thanks to this system, it will be possible to estimate the surplus or need for future financing.

b. The definition of a risk management policy

The bank must define a liquidity management policy that makes it possible to limit gaps (the differences between expenditure and resources) and to optimize the structure of the balance sheet.

c. Follow risk management techniques

A risk management technique (identification, measurement, hedging) should be followed, which would allow a clearer vision of the bank's situation and optimal decision- making.

d. Assume crisis scenarios

This action aims to prevent certain catastrophic scenarios that could adversely affect the bank. To do so, the CPA must guard against possible risks that may result from these scenarios by putting in place the necessary means to ensure financial equilibrium at all times.

General Conclusion

General Conclusion

A bank is often exposed to a multitude of risks, which are the consequence of its role in transforming resources "money". These risks can cause huge losses and, in some cases, lead to the failure of the bank in question, and cost the entire banking system. Hence the need for risk management in any banking institution and more specifically asset-liability risk management (ALM).

ALM asset-liability risk management manages the various financial risks, in particular liquidity, interest rate and exchange rate risk, and control of the profitability/risk ratio within a bank. It is one of the components of overall balance sheet management, the aim of which is to set objectives and draw up a forward-looking plan.

Interest rate risk is the risk that earnings will be adversely affected by movements in interest rates. It can be measured by several methods, in particular: gap methods by measuring the sensitivity to interest rates, depending on the values that we want to preserve; it can have an impact on a bank's results, either positively in the event of a rise or negatively in the event of a fall in interest rates.

Our research has focused on liquidity risk management using the ALM approach, which in its work uses several tools such as transfer rates that create exchanges within the institution and simulate the activity of each entity or the allocation of equity capital that makes it possible to determine the riskiest areas to try to cover them.

Liquidity risk management involves three steps: identification, measurement and hedging of liquidity risk. This risk is traditionally measured by the impasse method, which is often supplemented by indicators such as the liquidity index and coefficient and the basic surplus. Based on flows to be received over a given period, this method makes it possible to identify any illiquidity problems.

To cover liquidity risk, the bank must manage funding that fills liquidity gaps with investments/borrowings. These operations seek to guide the choice of these assets and liabilities in order to change the structure of the balance sheet and make it adequate to the bank's needs. Other hedging techniques exist in developed countries using derivatives adapted to each type of risk. Despite the development of asset-liability management around the world, it remains little used in the In order to better adapt the Algerian banking system, it will have to be the subject of a major reorganization, through a serious strategy of human resources training, the introduction of efficient computer, office automation and electronic banking means, the definition of a risk management policy aiming at limiting gaps and optimizing the structure of the balance sheet, following a risk management technique which would allow to have a clearer vision and take optimal decisions, simulating crisis situations in order to test the performance and the resistance of banks.

Through our work, we have tried to see how the ALM approach can manage liquidity risk, at the level of an Algerian bank which is the Crédit Populaire d'Algérie and we have confirmed our first hypothesis. Our study showed that the CPA was in a situation of excess liquidity (over-liquidity) in the short term and a situation favorable to the increase of rates, which positively impacts the profitability of the bank (the second hypothesis is confirmed). We have tried to present the principles of this approach, which should be encouraged in the Algerian banking system.

Bibliography

➢ Books and articles

[1] Amaouche Sihem, **Management Of Liquidity Risk By ALM Method**, Thesis , Higher Banking School, Algiers,2015.

[2] Asset M., **Management And Pricing Of Banking Services**, ECONOMICA, Paris, 2000.

[3] ATTAR Khaoula, **Liquidity Risk Management By The ALM Approach**, thesis , Higher Banking School, Algeria, 2016.

[4] BAILLY. J-L and Autres, Economy Macroeconomics, BREAL, Paris, 2006 .

[5] BERNARD P.and Autres, **Market risk measurement and control**, ECONOMICA, Paris, 1996.

[6] BESSIS J., **Risk Management and Asset-Liability Management of Banks**, DALLOZ, Paris, 1995.

[7] BOUDGHENE.Y And DE KEULENNER.E, **Banking Practices And Techniques**, LARCIER, Brussels, 2012.

[8] DARMON J , **Banking Strategies and Balance Sheet Management**, ECONOMICA, Paris, 1998.

[9] DEMEY Paul. Antoine FRACHOT. Gaël RIBOULET, **Introduction to Asset-Liability Management**, ECONOMICA, Paris, 2003.

[10] DEMEY, A, FRACHOT and G, RIBOULET, **Introduction à la Gestion Actif-Passif**, ECONOMICA, Paris, 2003.

[11] DOVOGIEN, **Practice Of Financial Markets,**Edition DUNOD, Paris.

[12] Dubernet M. , Asset-Liability Management and Pricing of Banking Services, ECONOMICA, Paris, 1997

[13] SARDI A., **Bank Risk Management**, AFGES, Paris, 2001.

[14] SAIM Chahira, **Management of liquidity risk by the ALM approach**, Thesis BANKING STUDIES, Higher Banking School, Algiers, 2014.

[15] SION.M, **Manage the Treasury and the Banking Relationship**, 5th edition, DUNOD, Paris, 2001.

[16] Subramoniam**, K Basel III Framework on Liquidity Standards: The Challenges Before the Indian Banks on Liquidity Risk Management**, The IUP Journal of Bank Management, 2015.

➢ **website**

- http://media.scotiabank.com.
- www.bank-of-Algeria.dz.
- www.wikimemoires.com.

APPENDIX

Appendix 1: Elements for calculating the liquidity numerator

Calculation elements	code	Amount (1).	Weighting In %(2).	Amounts Weights=(1)*(2).
Cash on hand (dinars)	01	6 629 259	100,00%	6 629 259
Assets in foreign currency accounts held in equity accounts with the Bank of Algeria.	02	12 189 165	100,00%	12 189 165
Sight assets in dinars with the Bank of Algeria corresponding to the free reserve and term investments in dinars with the Bank of Algeria whose maturity does not exceed one year. (01) months.	03	0	100,00%	0
Deposits with the Public Treasury and Algérie Poste (deposits at the Centre des Chèques Postales).	05	103 046 765	100,00%	103 046 765
Demand accounts receivable on demand from banks and financial institutions and from foreign correspondents.	06	10 701 082	100,00%	10 701 082
Loans on the interbank money market with a maturity not exceeding one (01) month.	07	10 000 000	100,00%	10 000 000
Treasury bills negotiable on the secondary market for government securities.	08	143 926 647	100,00%	143 926 647
Treasury participating securities refundableto first request.	09	0	100,00%	0
Bonds and other fixed-income securities issued by the State and subject to a listing on an official market.	10	26 076 122	100,00%	26 076 122
The balance, when he is a lender, of the collection accounts.	11	0	100,00%	0

Competitions with a maximum of one (01) months to run granted to customers in the form of operating loans, investment loans, credit operations, etc., and to be used for the following purposes leasing, and operating leases.	12	63 854 189	75,00%	47 890 642
Bonds and other fixed-income securities issued by public and private undertakings and subject to a listing on an official market.	13	2 185 175	60,00%	1 311 105
The financing commitments received from banks and financial institutions approved in Algeria and respecting the conditions laid down in Article 6.	14	0	50,00%	0
Shares and other securities at	15	113 579	10,00 %	11 358
Variable income making up the object of a quotation a market				
Algerian official.				
Total current realizable available assets and financing commitments received (A)	16	378 721 983		361 782 145

Calculation elements	Code	Amount (1).	Weighted on In %(2).	Amounts Weights=(1) *(2).
Accounts payable on demand in dinarsdesbanks and financial institutions.	17	462 266	100,00%	462 266
Rediscounts with the Bank of Algeria and refinancing within the framework of monetary policy operations (repos, tenders) of which the maturity date does not exceed one (01) months.	18	0	100,00%	0
Money market borrowings interbank loans repayable within a period not exceeding one (01) month.	19	0	100,00%	0
Bonds, subordinated and convertible bonds other reimbursable in a delay of one year. (01) months.	20	1 251	100,00%	1 251
The unused portion of refinancing agreements given to other banks and establishments financiers not exceeding six (06) months.	21	0	100,00%	0
The balance, when borrowed, of the collection accounts.	22	0	100,00%	0
Term deposits (in dinars) and savings bonds with a maximum of one (01) month to run.	23	17 278 761	70,00%	12 095 133
Bank savings books.	24	209 744 818	30,00%	62 923 445
Overnight deposits (in dinars) of companies.	25	516 591 994	25,00%	129 147 999

	26	132 897 299	20,00%	26 579 460
The other deposits (in dinars).				
Housing savings books.	27	10 186 538	15,00%	1 527 981
Off-balance sheet commitments given in favour of banks and financial institutions other than 100%, and off-balance sheet commitments in favour or order of the customers.	28	305 146 139	5,00%	15 257 307
Total demand and current liabilities and commitments given (B)	29	1 192 309 066		247 994 841

Appendix 2: History of outstanding DAV over 3 years (January 31, 2017 - December 31, 2017) Unit: DZD

Date	Outstanding VAD	Date	Outstanding VAD
31/01/2017	681 047 568 026	31/07/2015	825 205 543 246
28/02/2017	666 829 255 541	31/08/2015	831 799 152 743
31/03/2017	695 713 739 346	30/09/2015	819 297 256 147
30/04/2017	714 602 778 792	31/10/2015	810 895 437 661
31/05/2017	717 209 563 940	30/11/2015	861 030 180 118
30/06/2017	704 743 523 385	31/12/2015	851 397 244 038
31/07/2017	731 000 097 898	31/01/2019	855 901 089 666
31/08/2017	736 723 470 704	29/02/2019	877 858 561 162
30/09/2017	736 758 065 340	31/03/2019	872 440 655 001
31/10/2017	759 062 035 911	30/04/2019	858 327 369 200
30/11/2017	747 709 212 773	31/05/2019	842 135 256 708
31/12/2017	755 622 098 939	30/06/2019	804 821 899 987
31/01/2015	839 226 056 869	31/07/2019	789 938 707 891

28/02/2015	842 352 333 457	31/08/2019	792 639 767 732
31/03/2015	838 851 350 251	30/09/2019	782 615 214 755
30/04/2015	829 749 438 819	31/10/2019	794 978 645 195
31/05/2015	844 897 495 707	30/11/2019	770 658 742 223
30/06/2015	822 757 429 255	31/12/2019	767 444 910 022

Table of Contents