TITRE :   ASSET LIABILITY MANAGEMENT - ALM
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Asset liability management is to manage the Balance Sheet of a Financial Institution. Historically ALM covers mainly risks: interest rate risk and liquidity risk. It now extends to all risks as defined by regulators. Similarly, revenues are managed via ALM at the lowest level of books, with a complexity introduced by IFRS accounting norms. Revenues and Risks are very dependent with each other. An understanding of the concepts presented in this document is enough to have a good understanding of ALM.

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1–Definitions

The object of a financial institution is to lend funds to its customers, so that they use it in projects whose operational profitability is higher than banking costs. In order to manage its financial activities, accounting information is not enough. One must set up an auxiliary or analytical information system. This is the ALM system.

Definition of the 3 fundamental levels for ALM :

1-Credit Outstanding :
These are credits granted and drawn by customers. These amounts are recorded as assets in the balance sheet of the bank. By symmetry, we have deposits or loans as liabilities. These commitments are observable at all times through outstanding credit positions.

2-Outstanding and Duration:
A credit is a financial contract with a maturity date, and then with a duration. The longer the credit, the riskier it is. The risk is indeed proportional to the duration. Here, the duration is defined as the remaining period until maturity because we are only interested in future risk.

The exposure at risk (EAR) is defined as the following product:

$$EAR = \text{Exposure x Duration} \qquad (1.1)$$

Depreciation reduces the risk, because the Exposure is decreasing. To model the amortized credit, it is easier to split them 'horizontally', all partial credit beginning at the same date.
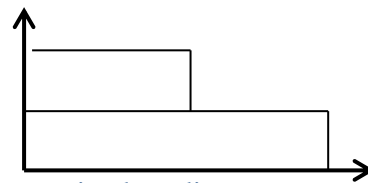

Fig1 – amortized credit.

The outstanding amounts are replaced by the amortized cash-flows. The **interest rate gap**, is the sum of these cash-flows occurring during a future period.

We define the capital intensity (CI), as the present value of future amortized cash flows: This aggregate number takes into account the amortized amounts and the duration through the discount factor.

$$CI = \sum_{k=1}^{T} \frac{A_k}{(1+tx_k)^k} \qquad (1.2)$$

The capital intensity (CI) is a measure of the cost of capital for the Bank.

Note: the duration of the credit, initial or remaining, are not present in the General Ledger. This is the reason why ALM tools are required.

3-Outstanding, Duration and Rates.
The combination of these three parameters is homogeneous to an interest. Indeed, interest is calculated as the product of three terms:

$$\boxed{\text{Interest} = \text{Outstanding. Duration. Rates} \quad (1.3)}$$

If the duration is based on a past period, the interest is said to be accrued, if the duration is based on a future period, the interest is an interest forecast.

Level 1 Outstanding	Outstanding		
Level 2 Risk	Outstanding	Duration	
Level 3 Income	Outstanding	Duration	Rate

Fig2-The three levels of ALM

2-Funding

A P&L (Profit and Loss) is complete and correct if you take into account the funding. This funding is provided by the Treasurer, or by the ALM Committee which sets refinancing rates with FTP (Funding Transfer Price).

There are three methods for funding:

- funding with an explicit transaction with same amount, same duration and same rate type,
- Fixed financing without hedging, for example with a variable rate for a rate credit financing.
- Internal financing, via FTP: only the FTP information is filled in. This means that all the other features of the credit are the same between the hedging transactions and the initial credit, namely: amount, duration and amortization.

Of course, it is also possible not to hedge a transaction: we do not keep this hypothesis, because as part of the ALM management, we always have a FTP that allows refinancing of fixed interest credit as well as floating rate credit.

3 – Risk Management.

Managing a credit portfolio implies risk management too. Risk covers:

- Interest rate risk,
- Credit risk,
- Liquidity risk,
- Early redemption risk (ER).

Historically, credit risk is not an ALM risk, but we will retain it as such in order to have a full understanding of the risks. On the other hand, events of default of course have a direct impact on other risks and the P&L. However we will not take into account operational risk here.

Interest rate and liquidity risk:
Central tools of ALM are the interest gap and the liquidity gap. As presented previously, the gaps are crossing outstanding and duration. The gaps are split in duration slices called buckets: such as one week, the remaining month, every month of the current year, each future year.

Interest rate gap sourcing :
The interest rate gap is filled with the flow of future capital for operations at fixed rates. A non-amortized credit with fixed rate feed the gap in its maturity bucket.
For a variable rate credit, the current period is always fixed; we apply the last fixing date as the maturity date of the credit.
In case of amortized credit, as explained earlier, we split the credit 'horizontally', as a consequence, we use amortized amounts and amortized dates to fill the gap.
In the case of an interest rate swap, which is equivalent to a fixed leg and a variable leg, we are feeding two opposite amounts, one at maturity of the swap, the other on the next fixing date.

Liquidity gap sourcing :
The liquidity gap is different from the interest rate gap only for variable rate credit. In this

case, we replace the next fixing date (as mentioned above) by the maturity date.

Applied to a swap, both legs cancel out; indeed a swap has no liquidity risk. A line of credit not drawn will also amend the liquidity gap.

Products without maturity:

For example, current accounts and some saving accounts. These products generate a problem because they have no maturity date that could to used to fill the gaps. It is therefore necessary to make assumptions based on 'flow laws', issued from statistical data.

Static and dynamic gap.

The static gap corresponds to the current portfolio based on the previous rules without any other assumptions. These gaps have a maximum maturity that corresponds to the credit having the greater maturity. All the capital is amortized, and the net total of the gaps are identical to the balance sheet outstanding.

This vision is unrealistic, because the bank will grant new credit and a number of current credits will be repaid in advance. For this reason, the dynamic gap is based on a set of assumptions to simulate the future credit production. These assumptions rely on:

- Hypothesis on the new credit production based on marketing campaign and rate forecasting,
- Hypothesis to define the Early Redemption rate: correlations with economic and social indexes, and rate forecasting too.

And many more assumptions that make ALM an art.

Early redemption risk (ER).

Life accidents and economic accidents are now quite frequent in daily lives: as a consequence, credits rarely go to maturity. It is important to take into account the early redemption impact on the gaps. The analysis is to get the rate of ER annually, based on statistical data, possibly correlated to economic, sociologic and market data. These rates are annual and should be capitalized on future years. Their impact on gaps, is a switch of refunds, and therefore a decrease in capital intensity (CI). This also interfere with credit risk, in the sense shown below.

Credit risk.

Credit risk pricing is based on the credit spread, used to cover losses due to counterparty defaults. The gaps must take into account these defaults that decrease the duration and the amount of the flows (and capital intensity too). There is no need to cover the risk of credit which will not be refunded and to expect the cash flows in the liquidity gap of defaulting credits. With the IFRS09 standard, the new calculation of the provision for credit risk, called 'cost of risk', is calculated as an average: ECR (Expected Credit Risk). It becomes now reasonable to insert this negative amount in the gaps. The ECR formula is :

$$ECR = EAD \times DP \times LGD \times DF \quad (2.1)$$

With :
EAD: Exposure at Default,
DP: Default Probability,
LGD : Loss Given Default,
DF : Discount Factor

Credit Spread = Default Probability.
The Bank lends 1000 usd to 1,000 persons, for a total amount of 1,000,000 usd. A single person out of the 1000 is defaulting. The default rate is then 1 per thousand (1°/°°). The Bank lost 1000 usd. She asked therefore 1 usd to each customer. This amount corresponds to a rate of 1 in 1,000 (1°/°°). We just show that the credit spread is equal to the probability of default: 1 per thousand (1°/°°).

It is interesting to draw a parallel between ER and PD rates. These two rates correspond to probability rates related to customers, and applied to contracts in order to get an amount

when multiplied by the exposure: However, their implications are completely different:

- The ER rate generates a translation of the future cash flows, while
- The PD rate generates a net loss of future cash flows.

So their impacts on the gaps are very different.

4 – P&L and FTP

The FTP allows the transfer of interest and liquidity risks. But we can also add to this rate, the credit risk as an additional credit spread in order to take into account the credit risk as mentioned earlier. What matters is the strategic way of defining the analytical P&L: what belongs to who? Who pays for a defaulting customer? Certainly not the Treasurer.

The FTP rates are defined by the ALM Committee, in order to fix the refinancing costs of all departments of the Bank. This allows to assess analytical results for the different players. If instead of the FTP, a real internal refinancing operation is implemented (directly with the Treasurer of the Bank), the refinancing will become a real operation with proper accounting. Then the P&L becomes simply an accounting P&L and this makes the use of an ALM system obsolete. This is what all major banks tend to do now, because the IT systems can afford it in terms of technology. This also should be the path taken by emerging countries.

The FTP also works well with assets as well as wih liabilities such as deposits and loans. The bank get cash 'for free' from deposits when cash accounts do not support interest rates. A FTP rate, allows the pricing of such deposits for the bank network. The same applies to structured products. The role of ALM is to ensure that the average FTP paid is higher than the average FTP received in order to provide a positive margin.

FTP Formula :

The FTP formula for fixed rate credit is :

$$FTP = \frac{K - \sum_{i=1}^{n}(OUT_i - OUT_{i+1}).DF_i}{\sum_{i=1}^{n}(OUT_i.ACC_i.DF_i)} \qquad (4.1)$$

Avec :

- K : Initial Capital,
- OUT_i : Outstanding at date i,
- $OUT_{i+1} - OUT_{i+1} = AMO_i$: Amortization on period i,
- ACC : Duration in years = duration in days/number of days in one year,
- DF : Discount Factor.

This formula is easier to understand in the following form :

$$K = \sum_{i=1}^{n}(AMO_i.DF_i) + TCI.\sum_{i=1}^{n}(OUT_i.ACC_i.DF_i) \quad (4.2)$$

This means that the capital (K) is equal to the discounted sum of amortized amounts and interests calculated with the fixed FTP. We observe in (3.1) that we have the payment schedule in the denominator and the amortization schedule in the numerator.

If we consider that the first flow of capital (K), is simply a negative amortized amount, (3.2) becomes:

$$FTP = \frac{\sum_{i=0}^{n}(AMO_i.DF_i)}{\sum_{j=1}^{m}(OUT_j.ACC_j.DF_j)} \qquad (4.3)$$

We call :

- The numerator : the capitalistic intensity (CI). That measure the real capital cost.
- The denominator multiplied by the FTP rate is the total cost of the credit equal to the discounted value of interests.

General proposition:

The cost of capital (CI) (for the bank) is always equal to the cost of credit (for the lender).

The FTP plays a central role in credit as an average fixed interest rate, The averaging occurs on the cash curve via the discount factors. This formula is quite general, and applies to all debt instruments with maturities.

The FTP rate then depend on
- the schedules of amortizations
- the schedule of the interests payments,
- the interst rate curve via the discount factors (DF).

The FTP rate can also be adjusted to take into account for example the early redemption options (ER). We must convert t he premium of an equivalent interest rate Cap into a spread rate to add to the basic FTP.

In the case of variable rate credit, the FTP formula (4.1) no longer applies. It must be replaced by an average margin M instead of an average rate such as the FTP:
The formula based on forward rates is the following:

$$(M + F_i).\sum_{i=1}^{n}(OUT_i.ACC_i.DF_i) = K - \sum_{i=1}^{n}(AMO) \ .DF_i \qquad (4.5)$$

The Forward rates Fi are calculated from the cash rate as the following ratio of DF:

$$1 + Fi = \frac{DF_i}{DF_{i+1}} \quad (4.6)$$

Valuation and P&L
Insofar as the FTP are calculated and recorded in the ALM tool, the analytical results can only be reported in the ALM system and not the general accounting system.
In most of the cases, credits belong to the Banking Book, and are therefore valued in accrued interest or amortized cost according to the IFRS standard. For credits, the difference between accrued interests and amortized cost are very small. This is not the case for bonds where the discount/premium of the bond price makes the calculations very different.

In terms of operating profit, it is important to estimate future results, either from a static gap, or a dynamic gap: in a static gap, we exclude the impact of new production, to get a result on each future period based on average rates and average margins. The evolution of these average rates and margins are essential indicators for the monitoring of the performance.

Note: Through the FTP rate, the risks are transferred to the central Treasurer of the Bank. The Treasurer has the choice to cover all or partially the risks with external operations (macro hedging). He must alto take into account the new Basel rules of liquidity management (NSFR, LCR) and any internal limitations. It should be noted, that covering positions, reduces the potential gains achieved with a rising interest rate curve: by lending long at higher rates and funding short at low rates. This is the ALM dilemma.

In case of no coverage, the Treasurer must isolate its open positions in a trading book valued at market value (the Trading Book as opposed to the Banking Book).

5–Conclusion.
The ALM management is the art of balancing the different risks, while generating sufficient margins within accepted limits. Today, the ALM tools are used because FTP are used to transfer risk while analytical P&L remains unreachable from the General Ledger .
If proper internal deals, based on FTP were materialized as real internal deals with the Treasurer, there would be no need for ALM systems. It would be a huge improvement in bank organisations.

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