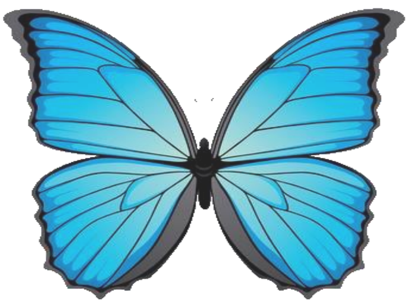
01/12/2016

The new standard for IRRBB

Understanding the complementarity of approach in estimating the variation in Economic Value of Equity (EVE) and the sensitivity of Net Interest Margin (NIM) – A case study



Serge MOULIN
ALM-VISION – SERGE.MOULIN@ALM-VISION.COM

The new standard for IRRBB:

Understanding the complementarity of approaches in estimating the variation in Economic Value of Equity (EVE) and the sensitivity of Net Interest Margin (NIM) – a case study

Table of contents

Introduction

The April 2016 Basel Committee directive d368 "*Interest Rate Risk in the Banking Book*" ("IRRBB") translates into the regulation the necessity of implementing a dual approach between the static valuation of the existing balance sheet (the "EVE") and the modeling of Net Interest Margin ("NIM") through a dynamic approach.

This d368 directive seeks to avoid a repeat of the mistakes of the past, which were observed with the use of the simple "static gap" analysis method. It is fundamental to understand the significance of the two methodologies, their complementarity and the motivation of the regulator. It is the only way to implement a proper Asset and Liability Management (ALM) strategy, to adapt limits to the characteristics of each institution, and to avoid some major errors.

D368 enters into effect by January 2018. Therefore, institutions have only 12 months to implement the new regulation. This is a short amount of time compared to the massive work of modeling and documentation that the new regulation requires.

Static versus dynamic gaps

Up to recently, ALM was often divided into two schools of thought: the school pushing for static gaps and the school of thought pushing for dynamic gaps:

- Proponents of the **dynamic gap** approach simulate the balance sheet and income statements by taking into account the new production of loans and by assuming steady business activity for the bank for years to come. Proponents of this approach consider the analysis to be closer reality. They further adopt the view that it is the only approach that provides an answer to management's core question "if interest rates shift by X% and projections of the business plan in terms of production and deposit collection are met, by how much income will be affected?"
- Proponents of static gap approach consider the methodology used by **dynamic gap** to be built on too many assumptions. A bank's balance sheet is commonly and almost always entirely renewed after five years. The efficiency of the dynamic gap methodology is further questioned by adherents of the static gap method due to the complexity of its implementation. Indeed, the renewal of each credit line results in the production of new loans that have each their own amortization schedule. Proponents of **static** gap analysis assume that since future loan production is unknown, it does not have to be taken into account. They consider that it can be hedged at a later stage. Proponents of this approach operate in a "compartmentalized bank" approach and define a convention of amortization for deposits without maturity (mainly current accounts). Proponents of dynamic gap analysis criticize static gap analysis for being far removed from reality as well as for transferring part of interest rate risk from loan production onto commercial business lines. It also disapproves of the static gap methodology because of inaccurate liquidity analysis, excessive arbitrary use of amortization conventions and inaccurate interest rate risk analysis methodology.

However, the two methods can be reconciled in a simple manner. To reconcile them, one needs to process new business separately. This way, the effects of reinvestments, of new business growth, and of the potential new reinvestment assumptions can be defined and monitored separately. The lack of activation of new business gives rise to "gross" static gaps, that is to say static gaps before any convention on the disposal of assets or of liabilities of indefinite duration. Static gap analysis allows for an initial insight into liquidity risk whereas dynamic gap anlysis provides an opportunity to anticipate reinvestment risk (yield / interest rate, spread…).

We get the standard static gap analysis by fixing runoff conventions for indefinite term assets or liabilities. This analysis can then be completed with dynamic analysis by using the reinvestment rules for new business from funds of indefinite term.

Static gap analysis does differentiate between yield gaps and liquidity gaps. It is thus possible to reconcile the two methods. This requires discipline in modeling it. It can become quite a complex if one takes into account the whole evolution of the balance sheet:

- Liabilities that run off according to conventions - for instance current accounts - must roll over onto themselves (that is to say that fall-off is reinvested into a new production of the same product) so that stock progress can be traced when outstanding amortization of new business is taken into account.
- In interest rate gaps, floating assets and liabilities are removed after the renewal of the coupon. Also, a quarterly floating rate credit duration of 24 months should be modeled just as a 3 months fixed credit rate that is replaced by a new 21 months loan at floating rate, a model that is heavy in terms of implementation.
- In liquidity gap analysis, one must not roll over floating rates in a manner that is different to rolling over fixed interest rates.

We get static gaps by freezing new business. By integrating new business to the model, the hold on new business is lifted and we get dynamic gap analysis. Liquidity and yield effects on these rollovers are clearly different to stock run-off. The concept may seem somewhat abstract.

In a certain way, the new D368 regulation closes the debate between the proponents of one or the other of these two schools since it now requires both[1]. As we mentioned, this does not mean that we have to develop two different systems as we will see in the following example.

A simple example

For clarity of explanation, we take the example of a very conventional bank, observed almost everywhere across the world. We then develop this example using both methodologies.

The retail bank has the following characteristics:

Assets	amount	duration	Rate	Liabilities	amount	duration	Rate
Treasury & investments	8,000	0.5	E3M+0.1%	Current accounts	30,000	no maturity	0
Fixed rate loans	60,000	4	CMS+1%	Savings accounts	20,000	no maturity	6 month average E3M - 0.1% with floor at 0.05%
Variable rate loans	30,000	2	E3M+1%	Short-term times deposit	20,000	0.25	E3M - 0.05%
immobilization	2,000	no maturity	0	Issuances	20,000	1.7 (5Y linear)	Fixed rate, new issuances at CMS 5Y + 0.2%
Total assets	**100,000**			Capital	10,000	no maturity	0
				Total liabilities	**100,000**		

It has a simple balance sheet, focused on its customer banking business. The proportion between long-term mortgage loans, equipment loans and short-term loans was chosen, in order to represent as much as possible most of the retail banks in Europe. Indeed, retail banks in Europe are characterized by limited corporate business and significant mortgage activity.

[1] We were one of the first to emphasize the complementarity of both approaches, cf “modélisation de gestion financière d’une banque commerciale”, S. Moulin, 2012, ALM-Vision.

We also initially assume that there is no business growth and that the bank simply renews its balance sheet (which is the assumption of the regulator under IRRBB d368). We will then later see the impact of growth of assets and liabilities (which sometimes is key).

Assets

The main activity of the bank is to produce loans, mostly mortgages at fixed rate. The rest of its activity consists of variable rate loans: treasury loans, consumer loans, equipment loans. The proportion is relatively conventional, close to what is observed in most of the countries.

Of course, the bank also has some fixed assets: premises, material…

Liabilities

Like every retail bank, its main source of funding is customers' current and savings accounts. Savings accounts bear interest at a proxy of the average of the 6 last months observed Euribor 3 Month interest rate (E3M) with a floor at 15 basis points (bp), minus 10 basis points of commercial margin. In the current European context, this floor is key[2]. Even though rates on savings accounts are defined by the banks themselves, they usually can not be negative if current accounts are not also invoiced. In our simulations, we reach the floor. This means that these savings account will not reprice for a decrease in interest rates (IR). But they would reprice in case of an increase in IR.

In addition, the bank pays a little more than E3M to get some time deposits and it uses its stock of mortgages as collateral to issue covered bonds. Actually, it is a well-capitalized bank.

First qualitative analysis: the bank is exposed to a decrease in Interest Rates (IR).

It is fundamental in ALM to begin with a qualitative analysis of the balance sheet and income statement. Far from being a waste of time, it provides key insights on the exposures of the bank.

Effect of an IR move on the Net Interest Margin (NIM)

Simply by observing the structure of the balance sheet in our example, it is clear that if interest rates decrease, the NIM of the bank will be under stress:

- 38 000 in assets at E3M and 40 000 in liabilities will adjust, giving a small profit to the bank if savings accounts are not at their floor. However, if they are at their floor, the net exposure is around 18 000 and the bank is exposed to a decrease in IR also on its assets and liabilities at variable rate.
- More importantly, the new production of loans on the massive fixed rate loans portfolio will be affected. The first few years, the issuances having also to renew, the blow will be slightly compensated but it will then gradually develop into what is referred to as the "Noria effect[3]", on a massive scale.
- Symmetrically, there is no impact in term of income statement on the current accounts and since they pay no interest (there may be an indirect impact in case of variation of volumes of the current accounts, due to arbitrages between M1 and M2, as observed in big IR moves).

Inversely, if interest rates increase, the bank will face a slight loss on its variable assets since savings accounts will reprice. Yet, the Noria effect will gradually prevail and generate increased NIM, even though customers' loans prices are reacting slower than swap rates.

[2] In France, most popular savings accounts get an IR defined by the government with a target of inflation plus 0 or 25 bp. However, during the crisis, the government did not follow the rule and left the IR at 75 bp far above its theoretical limit.

[3] We call Noria effect the gradual renewal of the loan books with new loans produced at new market conditions. These new loans progressively impact the revenues of the book, each new one adding to the previous ones.

If the curve flattens, the NIM will gradually be affected: the 60 000 of fixed rate loans will progressively reprice whereas only the 20 000 issuances will adjust in the liabilities.

Indeed, our example is typical and the bank is conventionally exposed to:

- A decrease in interest rates,
- A flattening of the yield curve,
- The time lag of adjustment of assets and liabilities,
- The correlation risks between IR and customers' behaviors (for both assets and liabilities, but mainly on the asset side for IR, the liability side is mostly for liquidity risk and moves are usually less massive)

Effect on the Net Asset Value (NAV) and market value of the bank

Obviously, if the NIM is decreasing, the market value of the bank will also be under pressure. To value a bank, investors look traditionally at two elements:

- The Price Earnings Ratio (P/E Ratio or PER): with the NIM going down, the income of the bank will be under stress and assuming a constant PER, its market value will decease.
- The Price to Book ratio (P/B ratio or PB ratio): this indicator uses a book value that is not valuing each line of the balance sheet marked to market. Subsequently, an interest rate shift that does not generate an accounting loss in the books of a bank does not affect instantly its book value. And the PB ratio is usually decreasing because of the impact on the income, and therefore on the price of the bank.

However, for the regulator, the vision is different. Imagine that the regulator takes over the management of the bank in order to unwind it (for a reason that is unrelated to the IR situation). Its main issue will be to sell the fixed rate loans book and the customer deposits.

- If interest rates are going down just after the regulator takes over the bank, the fixed rate loans book will see its price increase. Inversely, if interest rates are going up, the price of the fixed rate loans book will decrease.
- The price of savings accounts will be relatively stable due to the savings accounts being indexed on E3M. Only the current accounts will be a challenge for the unwinding regulator: obviously, if these accounts represent real customers, there will be banks to buy them with a premium. If the IR are going up, the value of the current accounts will go up and the potential buyer will be ready to pay more. Inversely, if IR are going down, their value will shrink. But if, for any reason, there is no buyer, the regulator will just have to give their money back to the depositors and ask them to transfer their accounts to another bank.

For the regulator, the exposure of the bank will highly depend on the value of the current accounts. At worse, if it just has to pay back their money to the customers, the liquidator will be at risk of an increase in interest rates. In case of central bank intervention, this scenario is obviously very likely considering that the bank just faced such a dramatic situation that the regulator had to step in (usually regulators step in only in case of a run to the bank[4]).

In a "normal" situation (that is without a run to the bank), the regulator will be at risk in case of a decrease in interest rates. In both cases, the regulator seeks to minimize its risk and the one of its shareholders, the country's people.

[4] A run to the bank refers to a situation where customers withdraw massively their assets, following the announcement of a situation which they consider to be seriously jeopardizing the safety of their money.

Duration and modeling of the fixed rate loans book of a commercial bank

Regulation d368 IRRBB point IV paragraph 11.5 defines a cap on the average maturity of core deposits between 5 years (retail/transactional) and 4 years (wholesale). Some bankers expressed concern that this figure was too low to allow for a reasonable ALM management.

Actually, this kind of convention is obviously not the result of some econometric model on current and savings accounts (because current accounts are the core of the monetary mass M1 and as a stock with constant input and output, they can not be modelled in run-down. Historically M1 has always been growing, outperforming inflation by 2 to 4 points depending on IR and on the velocity of money). The convention is a target in term of reinvestment and, from a regulator point of view, a conventional value of core deposits.

Therefore the question is rather whether or not this convention matches the characteristics of the current assets of European banks.

Let us assume a bank producing every year 100 of 20 years constant monthly payments on loans, with 5% constant prepayment rate (CPR). Interest rate paid on loans is 2.5% at market price. After 20 years, its stock would be stable, with an outstanding nominal of 9 480 and the duration of the stock would be of 5.3 years (initial duration of a loan is 6.9 years).

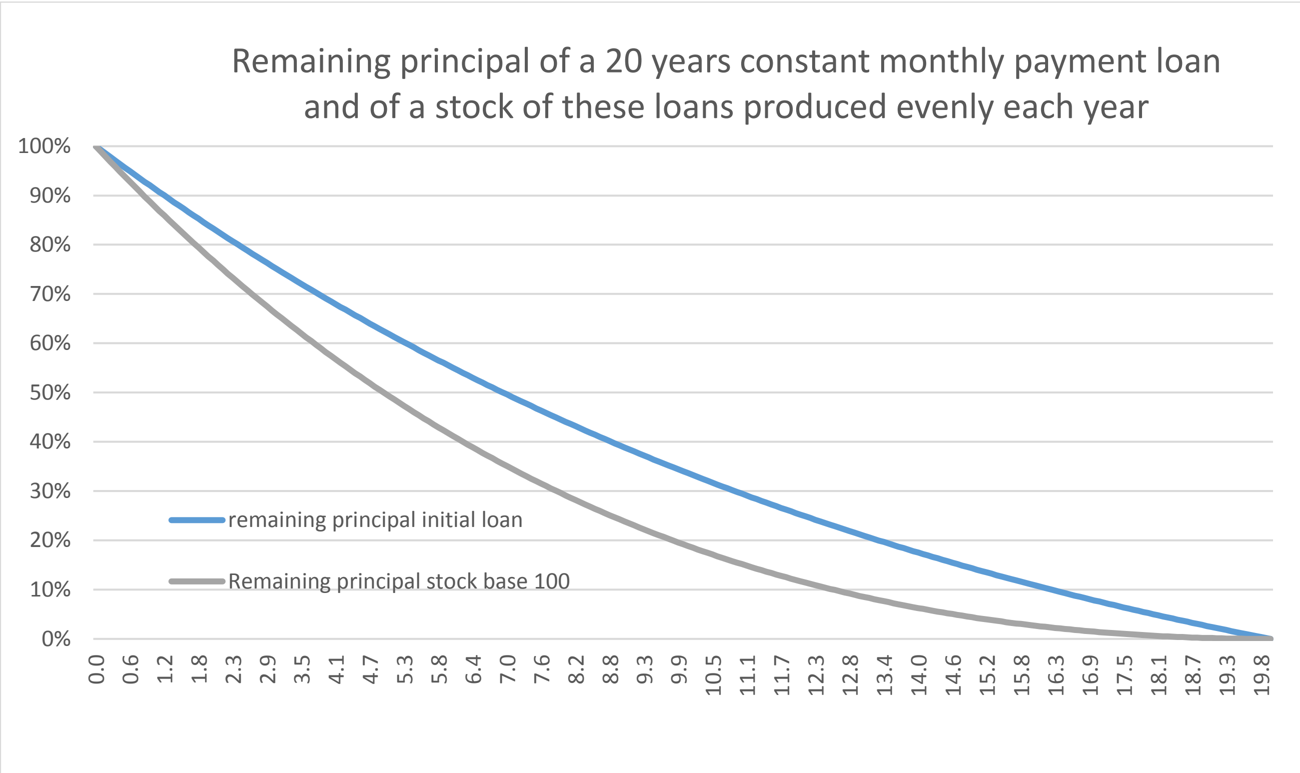
Obviously, for lower initial duration and/or higher CPR, the duration of the stock would be lower.

Modified duration (in years) of a stock of constant monthly loans payments produced regularly (constant stock)

CPR \ initial duration	20	15	12	Portfolio composed of 50% of 20Y / 40% of 15Y / 10% of 12Y
3%	5.6	4.5	3.7	5.0
4%	5.5	4.4	3.6	4.8
5%	5.3	4.3	3.5	4.7
6%	5.1	4.2	3.5	4.6
7%	5.0	4.1	3.4	4.5
8%	4.8	4.0	3.3	4.3
Loan rate	2.5%	2.3%	2.1%	2.38%

A bank usually offers mortgage loans of initial duration between 12 years and 20 years. Under reasonable market conditions, its mortgage book should have naturally a duration of around 5 years, slightly lower if interest rates are higher (duration decreases when IR increase – see the example of the portfolio above).

Actually, this means that the regulator allows banks to refund their mortgage books with core deposits (from an IR point of view, the liquidity exposure being defined through its adequate limits). This is a very powerful result and clearly shows that banks should not worry about this limit set by the regulator. Indeed, it sounds reasonable to limit excessive transformation that is above 20 years. Furthermore, considering the fact that loans books of banks have also a significant portion of shorter-term loans, the requirement sounds very reasonable and is not really a constraint.



It is very interesting to look at the stock amortization curve. Most institutions still use linear convention of amortization of their current accounts, sometimes adding a 3 years bullet period. Actually, using the natural curve of the loans' book would allow naturally to get a static gap hedged position, especially for a long-term bucket.

Furthermore, this inversed exponential curve has the great advantage of being stable, it is even the only shape of amortization[5] where the amortization of the stock matches the amortization of the new loans production[6], which justifies its use it for no maturity deposits (NMD).

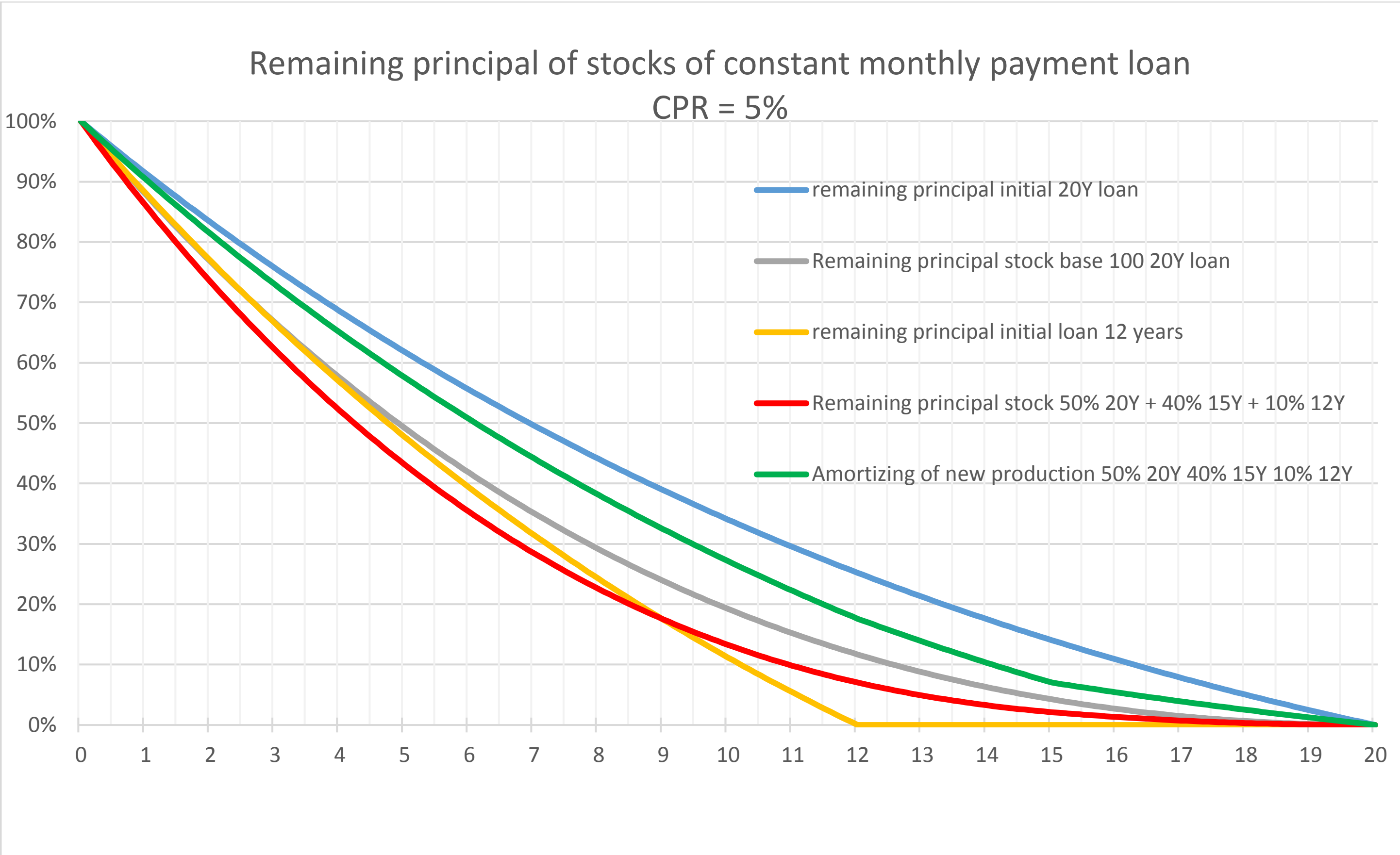
This point is important since banks sometimes define limits per bucket. The longest buckets are pretty sensitive to conventions and a linear convention may generate swings in the longest buckets, even beyond limits. Obviously, these over-limits have to be analyzed in a very cautious manner because most of the time they are just the result of conventions. In general, it is recommended to hedge properly the 3 following years, to have acceptable hedge from year 3 to 5 (the duration of the balance sheet) and then some remaining position from year 7 to year 10. The longer buckets have only to be analyzed to make sure that there is no massive issue to address. If not, then no action should be taken[7] since they ca not be justified objectively and may expose the bank to major risks.

Another important element linked to the natural curve of the constant monthly payment loans is the fact that a significant portion of the loans amortize the following year: here more than 10% the first year. This fact is often forgotten whereas it means that the "Noria" effect is pretty fast with 50% of the balance sheet renewing before 5 years.

[5] Cf Antoine Frachot, Paul Demey, Gael Riboulet « méthodologie de gestion actif-passif bancaire », groupe de recherche opérationelle, Crédit Lyonnais, janvier 2003, chap. 4.3.3

[6] Finally, the nominal of the stock is equal to the modified duration of the initial loan, c.f. "modeling and pricing prepayments", ALM-Vision research papers, June 2016

[7] This means that very long term positions, especially through forward swaps, are most of the time a complete non-sense and cannot objectively qualify as macro-hedging. In our example, they would be just highly leveraged speculative positions.



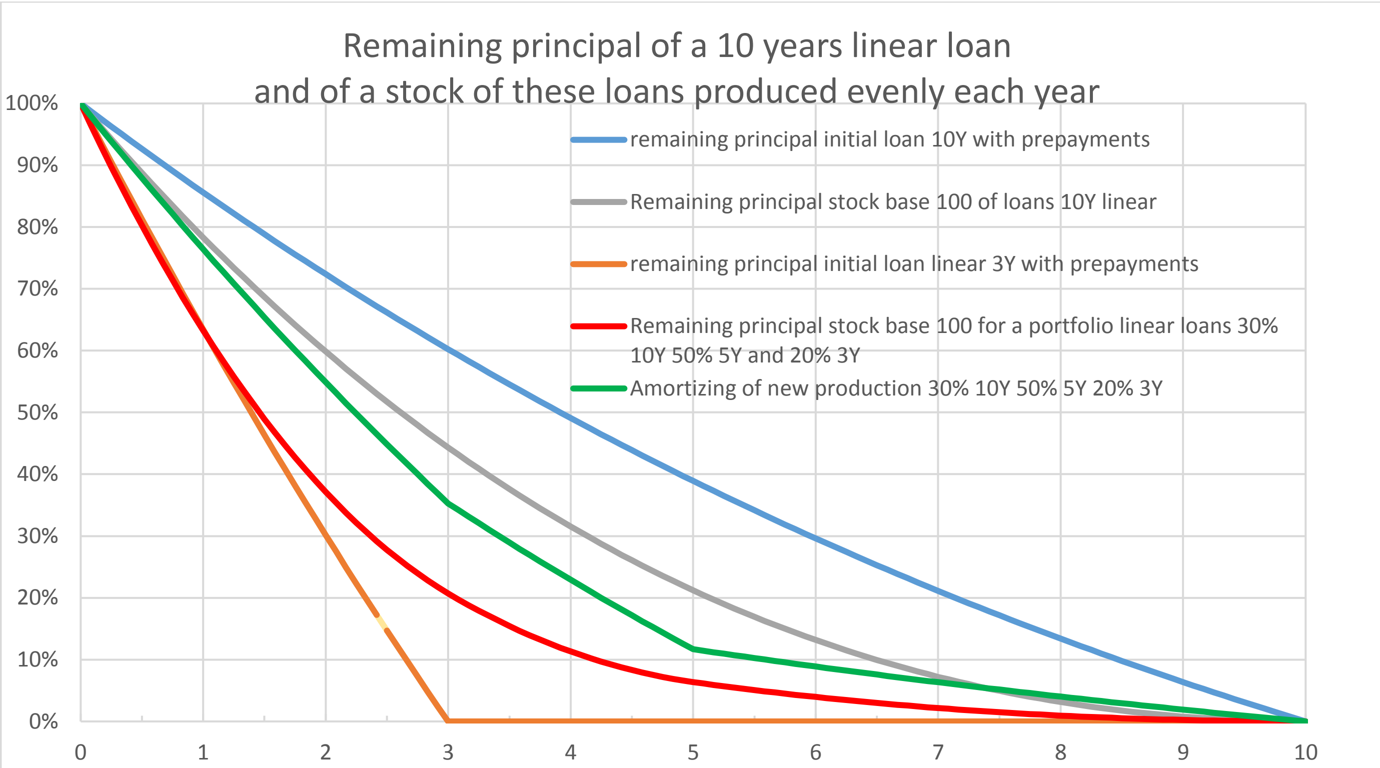
In addition, the bank's loan books include consumer and equipment loans, which have shorter duration. We assume a portfolio generated evenly each year with 5% prepayments made of:

- 30% of 10 years linear loans,
- 50% of 5 years linear loans,
- 20% of 3 years linear loans.

<u>Duration of the linear loans book – equipment loans</u>

CPR \ initial duration	10	5	3	Portfolio 30%/50%/20%
3%	3.08	1.64	1.03	1.95
4%	3.03	1.63	1.02	1.93
5%	2.98	1.62	1.02	1.91
6%	2.93	1.60	1.01	1.88
7%	2.88	1.59	1.01	1.86
8%	2.84	1.58	1.00	1.84
rate of loan	2.0%	1.8%	1.6%	1.82%

The loans being shorter term, prepayments have a lower effect and duration of the stock is low. The "Noria" effect occurs fast.



Let us assume that the final portfolio of the bank is made of 75% of mortgages loans (the ones with constant monthly payments) and 25% of equipment loans (the ones with linear amortization).

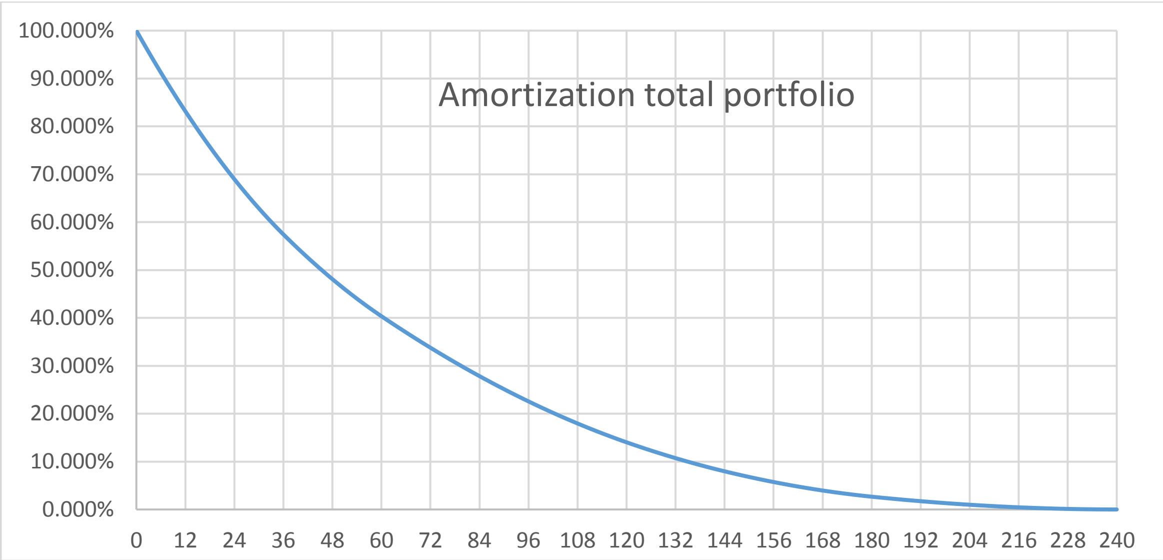
	weight	**amount**
mortgages	75%	45,000
linear	25%	15,000
Total	**100%**	**60,000**

The bank is indeed enjoying a significant mortgage portfolio representing 50% of its loans book. Still the total duration of the fixed rates loans portfolio (made of mortgages plus equipment loans) appears low:

CPR	**total portfolio**
3%	4.2
4%	4.1
5%	**4.0**
6%	3.9
7%	3.8
8%	3.7

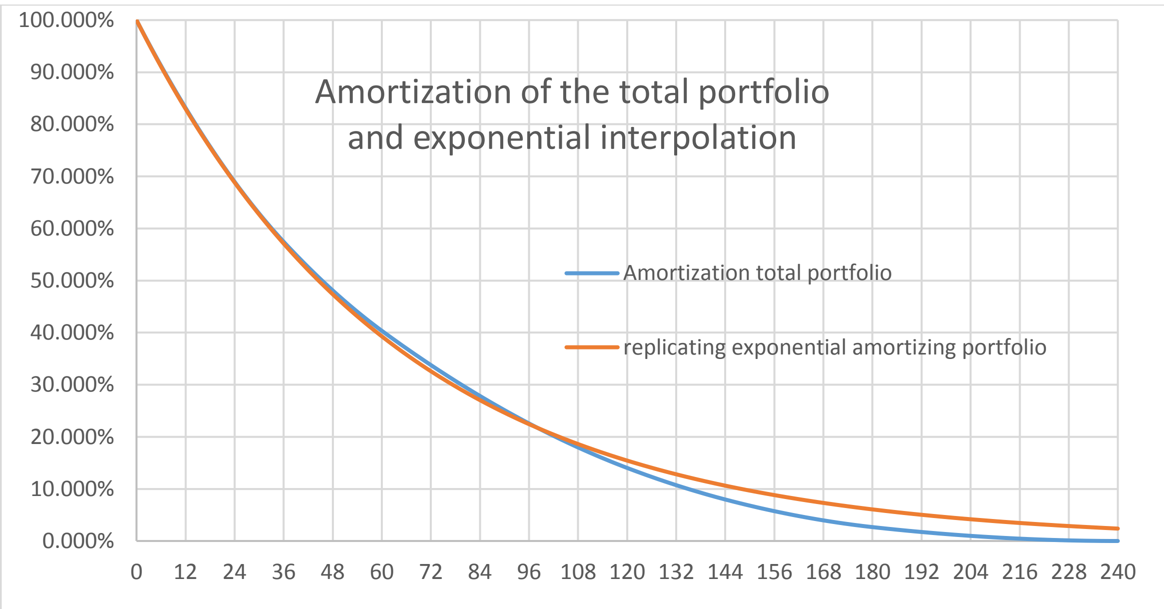
<u>This is a key point. Even for banks producing 100% of mortgage loans, it is relatively rare to observe durations after prepayments above 5 years. This can happen in a configuration where there is low interest rates (but not decreasing because then prepayments soar) and aggressive very long-term new production, which unbalances the average duration of the stock because of these additional long duration recent loans</u>.

It means also that in our example, the “Noria” effect will occur fast, with 20% of the fixed rate portfolio amortizing in year one – that is 12 000 - as the graph of stock amortization shows:



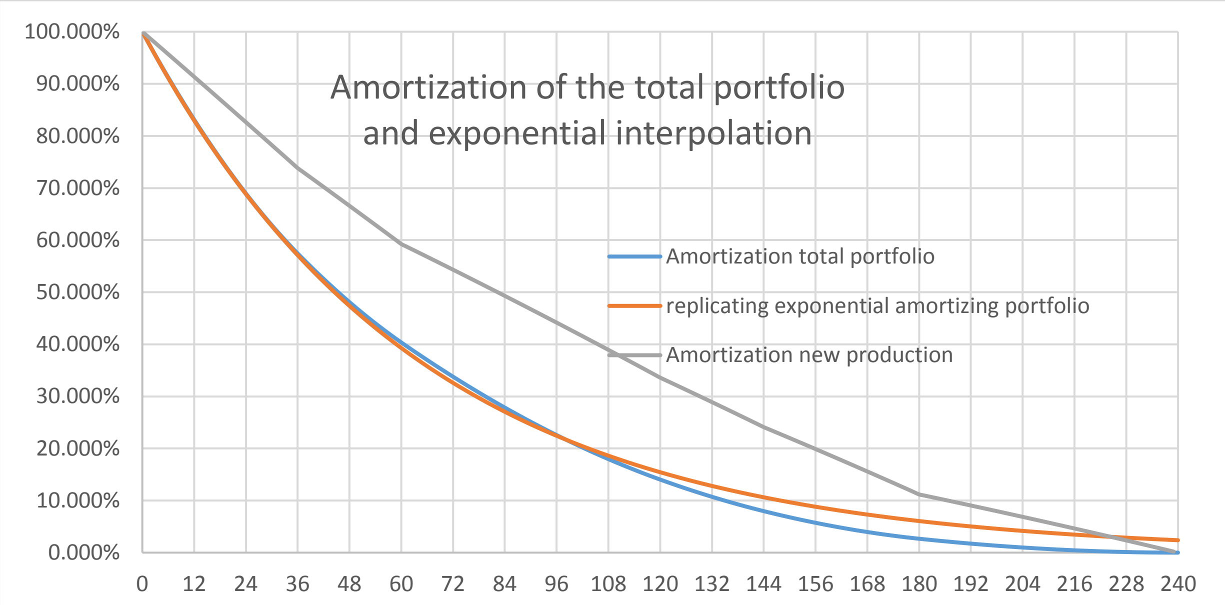
The first analysis that we made on the short-term exposure of the bank to IR has indeed improved: the "Noria" effect should take place fast enough so that the bank would take quickly advantage of increasing IR (and inversely would be quickly affected if IR were going down). In our example, the time lag effect that we mentioned will remain minimal. This is key because it means that the ALM managers must focus solely on their main exposure which is a decrease in the IR. It is the case in most of the banks that we have observed over the past few years.

Finally, notice that in the first approach, it is extremely reasonable to model the loans book using a simple exponential amortization curve. Many institutions make the mistake of refusing these fully justified approximations and go into time consuming processes of recalculating the amortization profile of each loan. This is most of the time useless and counter-productive since it slows the simulation in such a way that the ALM manager can not focus on their mission, which is mastering the key risks of the bank and testing their assumptions.



In our simulation, we use a similar approach but which may satisfy the ones concerned with the exactitude of the amortization profile of the stock: we calculate the exact profile for the fixed rate loans and then summarize them in one line. A better approach would be to have one line per vintage and type of loan because defaults and prepayments may differ, but this is not key for this paper focusing on the IRRBB.

For rolling the fixed rates loan into a new production, an elegant way is also to summarize in one line the profile of the resulting new production since this profile obviously differs from the stock (it is less convex). By doing so, we are precise on where we need to be, that is the 10 next years (and the following years, the error remains negligible), except that we do not distinguish prepayment behavior between subcategories.



Liabilities: focusing on the Non Maturity Deposits ("NMD")

The liabilities of the bank appear also extremely classical with time deposits, issuances, current accounts and savings accounts. Time deposits and issuance are dated, so they can be modeled in a standard way (with prepayments). The two last categories have no maturity and in static gap, the regulator allows the institution to choose the conventional profile of targeted reinvestment[8] as long as the average duration of the total remains below the following limits:

IRRBB d368 page 26 115. Banks should determine an appropriate cash flow slotting procedure for each category of core deposit, up to the maximum average maturity per category as specified in Table 2.

Table 2. Caps on core deposits and average maturity by category		
	Cap on proportion of core deposits (%)	*Cap on average maturity of core deposits (years)*
Retail/transactional	*90*	*5*
Retail/non-transactional	*70*	*4.5*
Wholesale	*50*	*4*

There is a degree of interpretation in the term "average duration". Indeed, duration can be considered as the modified duration, that is after taking into account or not the actualization factors. This will have to be clarified by regulators, since it has a significant impact on results.

[8] See "financial modeling of a commercial bank", ALM-Vision.

Still in our example, whatever the definition, the average duration of the loans book remains below the cap of 5 years.

CPR	modified duration	average duration
3%	4.2	5.1
4%	4.1	4.9
5%	4.0	4.8
6%	3.9	4.6
7%	3.8	4.5
8%	3.7	4.4

The additional element to take into account is the fact that the limit in average maturity applies to "core deposits":

112. page 26 d368 "Banks should distinguish between the stable and the non-stable parts of each NMD category using observed volume changes over the past 10 years. The stable NMD portion is the portion that is found to remain undrawn with a high degree of likelihood. Core deposits are the proportion of stable NMDs which are unlikely to reprice even under significant changes in the interest rate environment. The remainder constitutes non-core NMDs…

114…. Non-core deposits should be considered as overnight deposits and accordingly should be placed into the shortest/overnight time bucket or time bucket midpoint."

Core deposits are actually extremely stable and well known in most countries since they constitute M1, the monetary mass and one of the key indicator of the central banks. M1 is directly linked to inflation, usually over-performing it by 2 to 4 points, which depends on:

- Interest rates: when IR are low, people leave their savings in their current accounts. When IR increase, they start to arbitrate and seek better protection against inflation by transferring into their savings accounts or by investing into time deposits. Most of the time, this phenomenon does not lead M1 to decrease but to increase at a slower rate, yet at a rate that is usually faster than inflation. Indeed, core deposits are extremely stable assets.
- Cyclicality: the cyclicality of core deposits varies according to key events of the year – end of summer vacation, end of year, tax period… Even depending on the days of shopping and vacation. These phenomena are also well mastered.

To summarize the new regulation, NMD ("No Maturity Deposits") should be split between:

- Non-stable: the part of the stock that varies,
- Stable: the stable part of the stock, that will be again split between the part of the stock that is:
  - Sensitive to IR: the part which may disappear in case of increase in IR or which pays a coupon sensitive to the variation of the IR,
  - Insensitive to IR: this constitutes the "core deposits"

<u>The non-core deposits are the sum of the non-stable deposits and those stable deposit that are sensitive to IR</u>.

For our example, we have translated the fact that the IR paid on savings accounts is an average of the Euribor over the last 6 months by assuming 10% of real core deposits, that is a target duration of reinvestment below 6 months. We also consider cyclicality to impact 5% of our stock which means that in total, our core deposit will be seen as over-night for a massive amount:

	Amount	Non stable		Stable sensitive		Real Core deposit		Cap on core (%)	Benchmark Total		Max. Duration	
		%	amount	%	Amount	%	Amount		JJ	Long term	For long term core	For deposit
Retail/transactional (current retail)	25,000	5	1,250	5	1,250	90	22,500	90	2,500	22,500	5	4.5
Retail/non-transactional (savings)	20,000	10	2,000	80	16,000	10	2,000	70	18,000	2,000	4.5	0.45
Wholesale (current)	5,000	10	500	10	500	80	4,000	50(reached)	2,500	2,500	4	2
Total current and savings	50,000	7.5	3,750	35.5	17,750	57.0	28,500		23,000	27,000	4.87	2.63

The regulation is restrictive with 46% of the current and savings accounts considered as Overnight from an IR point of view. That means that the maximum duration is 2.6 years for the sum of savings and currents accounts, this appears low.

However, we still have 54% of the NMD available for very long term funding since their maximum duration is 4.9 years. That means that the regulator allows us to use these 54% of NMD to refund our fixed rate portfolio. It means also that we have an IR indicator of our target long-term issuance: this shall be around the difference between our long-term loans portfolio and our core deposits. This is important since many banks have a tendency to refund themselves too short. Furthermore, this strategy minimizes the flattening risk between short-term and long-term interest rates.

The regulator provides some degrees of freedom for IR paying savings accounts. Indeed, many savings accounts do not have a direct sensitivity to IR. For example, some pay a formula equal to inflation plus a spread. Since inflation is not correlated at 100% with IR but rather between 50% and 70%, this is another grey area: the regulation qualifies as NMD any product which has no legal expiry date, whether it bears interest or not and whether this interest is correlated to the market or not. The criteria for considering an interest bearing stable deposit as core is that it is "unlikely to reprice" under the described scenarios. In the case of inflation paying savings, if the correlation is of 70%, it would be logical to consider 30% of these accounts as core.

In our example, we have a very interesting situation: savings account shall not reprice in the scenario where short term interest rates are going down and shall reprice in the opposite scenario where short term rates are going up. Indeed, the convention for amortization should depend on the scenario. This is not mentioned in the regulation nor is it mentioned that we cannot change the convention of amortization per scenario. We choose to take the less advantageous convention to the bank that is the shortest, which is the normal case. But by doing so, we massively underestimate our exposure to IR decrease in static gap, a very classical mistake.

Globally, from the point of view of static gap, the methodology of the regulator conducts to leads to the conclusion that the value of the stock of the bank will go down if IR are increasing: here, the implied duration of the capital would be of 10 years and a move of 200 bps would reduce its theoretical "IRRBB value" by around 20.6%, so out of the limits. This is counter-intuitive since the bank's NIM appears exposed to a decrease in IR.

	amount	duration		amount	duration
loan book	90,000	3.17	current and savings	50,000	2.63
treasury	8,000	0	short term deposit	20,000	0.25
Total assets	**98,000**	**2.91**	issuances	20,000	2.3
			total liabilities out of capital	**90,000**	**2.03**
			Fixed assets	-2,000	
			capital	***10,000***	***10.31***

If we assume that we can use the modified duration, things are slightly better but the antagonist conclusion does not change: the static gap still shows an exposure to the increase of the IR but this one remain inside the limits with the theoretical value of the "IRRBB capital" going down by only -11% when IR are up 2%.

	amount	duration		amount	duration
loan book	90,000	2.66	current and savings	50,000	2.63
treasury	8,000	0	short term deposit	20,000	0.25
Total assets	**98,000**	**2.44**	issuances	20,000	2.3
			total liabilities out of capital	**90,000**	**2.03**
			immo.	-2,000	
			capital	***10,000***	***5.65***

Using the convention required by the regulator leads to underestimating the exposure of the bank to a decrease in IR. It can even lead to the opposite conclusion that a decrease in IR should increase the value of the stock of the bank.

Actually, the difference in duration between the stock of assets and the liabilities using regulatory conventions for NMD gives rather an idea of the position of the bank versus its benchmark of reinvestment of its NMD, after taking into account all the other dated positions. It does not express the true exposure of the bank to IR.

However, we see that for our example using modified duration, the bank presents an acceptable exposure to IR and does not have to change its lending strategy. Is this conclusion an accurate translation of the reality? Why did the regulator choose such a position and how do we reconcile it with our first analysis? What is the optimum choice of duration for core NMD? To better understand this rules, we will first analyze the realty of the impact of an IR move on the income statement of the bank and subsequently on its market value.

NIM simulation and effect of IR on the value of the bank

We model the bank using ALM-Solutions® software, which allows exact replication of the income statement and balance sheet.

Results	Opening Bala...	01/2016 - 12/...	01/2017 - 12/...	01/2018 - 12/...	01/2019 - 12/...	01/2020 - 12/...	01/2021 - 12/...	01/2022 - 12/...
Book Values - Assets	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,001**
investment & cash	8,000							
loans	90,000	61,556	37,283	29,476	23,427	18,658	14,825	11,601
immobilization	2,000	1,900	1,800	1,700	1,600	1,500	1,400	1,300
Roll Accounts		28,175	52,178	59,719	65,501	70,004	73,573	76,533
Treasury		8,370	8,738	9,106	9,473	9,838	10,203	10,567
Book Values - Liabilities & Equities	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,001**
Book Values - Liabilities	**90,000**	**90,000**	**90,000**	**90,000**	**90,000**	**90,000**	**90,000**	**90,001**
customers liabilities	70,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
issuances	20,000	16,000	12,000	8,000	4,000			
Roll Accounts		24,000	28,000	32,000	36,000	40,000	40,000	40,000
Book Values - Equity	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**
INCOME STATEMENT								
Interest Income - Assets		**1,448**	**1,347**	**1,295**	**1,326**	**1,415**	**1,518**	**1,636**
Interest Expenses - Liabilities & Equities		**125**	**82**	**51**	**48**	**74**	**126**	**232**
Net Interest Income		**1,323**	**1,264**	**1,243**	**1,277**	**1,341**	**1,392**	**1,404**
Gain/Losses on Financial Instrument								
Commissions & Others		**714**	**740**	**766**	**792**	**818**	**844**	**870**
Net Banking Income		**2,037**	**2,004**	**2,009**	**2,069**	**2,159**	**2,235**	**2,274**
Cost		**-834**	**-860**	**-886**	**-912**	**-938**	**-964**	**-990**
Income before impairment charge		**1,203**	**1,144**	**1,123**	**1,157**	**1,221**	**1,272**	**1,284**
Impairment Charge		**-69**	**-69**	**-68**	**-68**	**-68**	**-68**	**-67**
Income Pre Tax		**1,134**	**1,076**	**1,055**	**1,089**	**1,153**	**1,204**	**1,217**
Income tax benefit / (expense)		-227	-215	-211	-218	-231	-241	-243
Net Income		**907**	**861**	**844**	**871**	**923**	**963**	**974**
Dividends		**907**	**861**	**844**	**871**	**923**	**963**	**974**
ROE	**0.00 %**	**9.07 %**	**8.61 %**	**8.44 %**	**8.71 %**	**9.23 %**	**9.63 %**	**9.74 %**

The ALM-Solutions® software replicates both the income statement and the balance sheet applying each accounting rule and adjusting the treasury accordingly. We do the calculation on 10 scenarios:

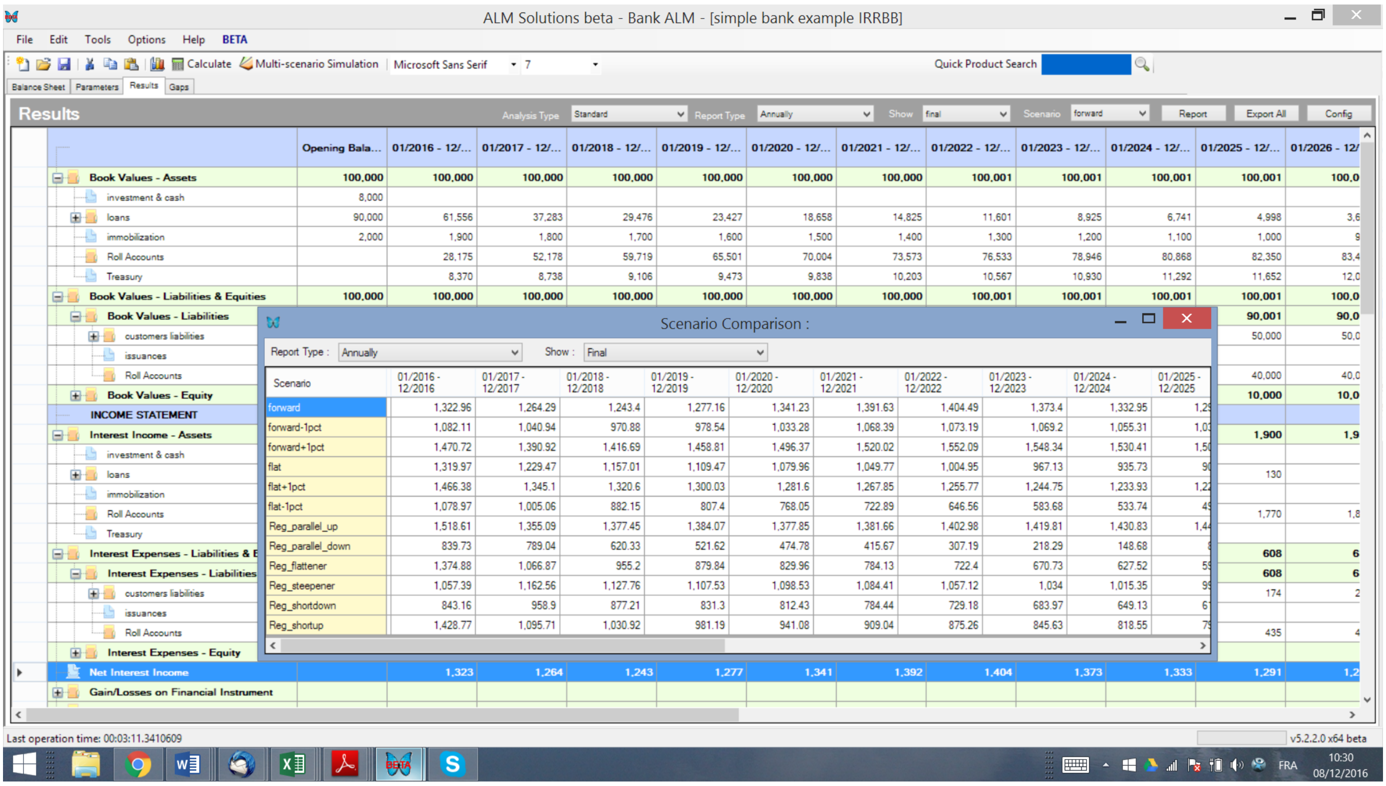
- Realization of the forward rates and translation of this realization by +1% and -1%
- We keep the curve flat and then translate it by +/- 1%
- We run the 6 regulatory stress test scenarios defined by IRRBB368

Prepayments are modified in translation scenarios: if IR are up by 1%, they go down 20% being 80% of the initial 5%. Inversely, if IR are down by 1%, they go up by 20% being 120% of the initial 5%.

The stock is "rolled" into a new production with identical characteristics.

Obviously, simulations confirm our first qualitative analysis: the bank is significantly exposed to a decrease in IR. Inversely, an increase in IR is favorable to the NIM even the first year. This is a very classical result and most retail banks have the same exposure even though our example shows a high sensitivity to IR.

Net Interest Income (NII) per scenario in dynamic gap



A CFO concerned with the volatility of his result would be eager to lend longer or to hedge, if swaps are available, by entering receiving swaps. By doing so, the CFO would be limited by the result of the static analysis we made, using regulatory conventions.

Obviously, if interest rates are going up, not only will the NIM of the bank increase but also subsequently its market value. Indeed, banks structurally are highly leveraged entities (requiring only about 10 to 15 of capital to manage a balance sheet of 100 or more) and their PER does not move that much with IR. Subsequently, every increase of the NIM directly affects their market value in proportion to their PER x (1-tax rate).

Our example is modeled as a complete bank, generating commissions, paying charges and cost of risk, plus taxes. The net income is supposed to be fully distributed. The bank appears in good standing except for its exposure to IR:

- Income around 1,000 that is almost 10% of ROE (Return on Equity) in the current context of extremely low IR,
- Cost/income ratio around 40%,
- Cost of risk pretty low at -69,
- Good balance between NIM and commissions.

Balance sheet and Income statement, « forward » scenario of realization of the forward

ALM Solutions beta - Bank ALM - [simple bank example IRRBB]

File Edit Tools Options Help BETA

Calculate Multi-scenario Simulation Microsoft Sans Serif 7 Quick Product Sea

Balance Sheet | Parameters | Results | Gaps

Results — Analysis Type: Standard — Report Type: Annually — Show: final

	Opening Bala...	01/2016 - 12/...	01/2017 - 12/...	01/2018 - 12/...	01/2019 - 12/...	01/2020 - 12/...	01/2021 - 12/...	01/2022 - 12/...
Book Values - Assets	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,001
Book Values - Liabilities & Equities	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,001
INCOME STATEMENT								
Interest Income - Assets		1,448	1,347	1,295	1,326	1,415	1,518	1,636
investment & cash		-11						
loans		1,343	983	738	585	465	371	293
immobilization								
Roll Accounts		116	364	557	741	950	1,147	1,344
Treasury								
Interest Expenses - Liabilities & Equities		125	82	51	48	74	126	232
Interest Expenses - Liabilities		125	82	51	48	74	126	232
customers liabilities		-10	10	10	10	10	10	35
issuances		185	145	105	65	25		
Roll Accounts		-50	-73	-64	-27	39	116	197
Interest Expenses - Equity								
Net Interest Income		1,323	1,264	1,243	1,277	1,341	1,392	1,404
Gain/Losses on Financial Instrument								
Commissions & Others		714	740	766	792	818	844	870
Net Banking Income		2,037	2,004	2,009	2,069	2,159	2,235	2,274
Cost		-834	-860	-886	-912	-938	-964	-990
Income before impairment charge		1,203	1,144	1,123	1,157	1,221	1,272	1,284
Impairment Charge		-69	-69	-68	-68	-68	-68	-67
Income Pre Tax		1,134	1,076	1,055	1,089	1,153	1,204	1,217
Income tax benefit / (expense)		-227	-215	-211	-218	-231	-241	-243
Net Income		907	861	844	871	923	963	974
Dividends		907	861	844	871	923	963	974
ROE	0.00 %	9.07 %	8.61 %	8.44 %	8.71 %	9.23 %	9.63 %	9.74 %

The valuation of the bank is done using two methodologies:

- PER: 10 times the income in year 1
- Dividend Discount Model (DDM): actualized value of the income over 10 years at 10% plus final value of capital at 10%

Each methodology shows that the value of the bank decrease when interest rates decrease. It is interesting to notice that the PER even provides a sensitivity of the value of a bank to IR which is logically long term.

Note also that a decrease in interest rates effectively reduces the ROE of banks as it does for the rest of the economy: indeed, ROE are usually measured using a risk premium above the long term IR. Therefore, a decrease in this ROE when IR are decreasing is a normal phenomenon in the economic cycle. What matters is to keep it under control and to makes sure that the exposure is not excessive, since most of the banking costs are fixed: branches, employees, systems…

Income after taxes

	1	2	3	4	5	6	7	8	9	10	**Market capitalisation**	
Scenario	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	**PER**	**DDM**
forward	907.3	860.6	844.1	871.3	922.8	963.3	973.8	949.1	917.0	883.8	**9,073**	**9,409**
forward-1pct	714.6	681.9	626.0	632.4	676.4	704.7	708.8	705.8	694.9	677.7	**7,146**	**8,038**
forward+1pct	1,025.5	961.9	982.7	1,016.6	1,046.9	1,066.0	1,091.9	1,089.1	1,074.9	1,057.8	**10,255**	**10,199**
flat	904.9	832.7	774.9	737.1	713.7	689.8	654.2	624.1	599.2	578.5	**9,049**	**8,388**
flat+1pct	1,022.0	925.2	905.8	889.6	875.0	864.3	854.8	846.2	837.8	831.5	**10,220**	**9,378**
flat-1pct	712.1	653.2	555.1	495.5	464.2	428.3	367.4	317.4	277.6	244.1	**7,121**	**6,876**
Reg_parallel_up	1,063.79	933.19	951.3	956.81	952.04	955.3	972.58	986.25	995.28	1004.54	**10,638**	**9,861**
Reg_parallel_down	520.68	480.35	345.6	266.85	229.59	182.51	95.94	25.03	-30.44	-77.69	**5,207**	**5,431**
Reg_flattener	948.8	702.62	613.49	553.42	513.73	477.28	428.11	386.99	352.63	325.41	**9,488**	**7,401**
Reg_steepener	694.82	779.17	751.55	735.58	728.59	717.5	695.89	677.6	662.89	649.54	**6,948**	**8,260**
Reg_shortdown	523.42	616.24	551.1	514.59	499.71	477.53	433.53	397.58	369.92	345.49	**5,234**	**6,884**
Reg_shortup	991.92	725.68	674.07	634.5	602.62	577.21	550.4	526.91	505.46	489.26	**9,919**	**7,928**

Each scenario would deserve a comment. Globally, we see that:

- The bank is exposed to a decrease in interest rates
- In the forward scenario, the IR increases gradually allowing the income to improve after a difficult period. In the flat scenario, the old loan portfolio made with higher IR is progressively amortizing and the loans are replaced with new loans at the current low market conditions. Subsequently, the income decrease progressively.
- The regulatory scenario of a decrease in interest rates (parallel shift down) assumes that IR is down by 2%: of course, with a 7 years swap at zero currently, it means loans at negative rate. This is absurd and actually regulators are allowed to keep IR positive or above a certain threshold. We have decided to keep the scenario as it is because (1) we have seen that it is not the scenario generating an issue in static gap and (2) in the current environment we still do not know which regulatory down scenario the regulator will recommend (having 10 years rate at -1.8% with commercial margin below 1% is generating a loss for each new loan!)

<u>Subsequently, there is an antagonism between the requirement of the regulator expressed by the limits given in term of variation of value of the stock using its convention for valuing the NMD and the natural exposure of banks to a decrease in interest rates. This is a fundamental result of ALM and one of the danger of the application of the static gap analysis as a standalone methodology</u>.

This different and even sometimes opposite view of risk is structural in nature. For most institutions, simulations show clear and significant exposure to IR decrease, as our qualitative analysis previously showed. These institutions are not obvious risk-takers: they simply serve their customers as they have done for years without any issue and for many they never faced any major issue, even during the 2008 crisis.

Still the regulator is eager to limit the transformation of NMD into long-term investment.

The reason of the structural difference between the two approaches is actually very logical and fully justified.

The static gap methodology is translating the concern of the regulator in case of liquidation.

The regulator is well aware of the dangers of the static gap methodology: it is clearly mentioned in the regulation:

§11 page 3 " If a bank solely minimizes its economic value risk by matching the repricing of its assets with liabilities beyond the short term, it could run the risk of earnings volatility".

It is a soft way of saying that the bank may take the wrong hedging position or move its business toward too much variable rates loans in front of much less sensitive liabilities.

This approach is by the way in the continuity of the regulation of July 2004, BCBS108, which already mentioned page 28 annex 1 point 7:

7. "*Although gap analysis is a very commonly used approach to assessing interest rate risk exposure, it has a number of shortcomings…*"

It also already emphasized the importance of a dual approach: "*simple maturity/repricing schedules can be used to generate simple indicators of the interest rate risk sensitivity of both earnings and economic value to changing interest rates"* (page 27. §4).

However, the regulator acknowledges that it is still favoring the static gap methodology:

11. "*While the economic value and earnings-based measures share certain commonalities, the Committee observes that most commercial banks primarily utilize the latter for IRRBB management, whereas regulators tend to endorse the former as a benchmark for comparability and capital adequacy.*" (page 3. D368)

The reason is very simple and actually is more related to capital adequacy than benchmarking (which can be done using the d368 conventions on NIM calculations): The concern of the regulator is different. It is more focused on its own risk in case it has to liquidate the bank. This approach justifies looking only at the stock and not to consider any new business since for the intervening regulator, there will be none. Obviously, if all lines were at variable rate, the liquidation would not face the risk of a variation of the Marked to Market (MTM) of the positions if IR were moving.

In this view, the regulator's main concern is the "No Maturity Deposits" (NMD) because in case of liquidation, it may have to give them back at par. Therefore, it would bear no risk if they were considered as overnight deposit[9]. Obviously banks strongly disagree with this view on their most valuable asset in most cases and de facto a very long-term and stable resource.

Indeed, the actual rule is simply a compromise between:

- The regulator who considers that NMD are a risk for the bank in case of liquidation and should not be used to refund excessively long-term IR exposure[10].
- The banks who consider that NMD have a MtM price which is highly sensitive to IR since it is a perpetual resource at 0 for most of the current accounts (or inversely with no sensitivity for savings account paying an IR highly correlated to the market short-term rate).

[9] We do not take into account the fact some countries as in Europe have guarantee funds for deposits up to a certain amount.
[10] We are not speaking about liquidity which is handled separately but about IR exposure only.

As we have seen, the compromise appeared as reasonable, since the duration of a loan book of a standard retail bank is below 5 years. However, as always, "the devil is in the details" and the margin of safety included in the regulation considering what is "core" and not "core" makes the constraints much more significant.

Seen from a dynamic gap point of view, a bank benefits from reinvesting its non interest-bearing NMD in long-term IR instruments in order to stabilize its NIM, whereas the regulator wants to limit this transformation and have the banks invest them shorter term in order to avoid any excessive risk of MtM variation, even though it may result in a more volatile NIM.

So the truce remains in a reasonable balance between excessive long-term transformation (nobody would agree to reinvest current accounts at 30Y rates and face the risk of seeing a major change during this period to the activity of the bank or the economy) and excessive short-term position (symmetrically, investing its current accounts at overnight rate would not only be counterproductive but extremely risky for the bank).

Actually, both visions are not truly antagonist since, as in our example, it is not in the interest of the regulator to force the bank to increase its exposure to a decrease in IR because this would result in a higher probability of default.

Banks' ALM objective is to stabilize the NIM under the constraint of respecting the limits on variation in EVE.

From our previous discussion, it is clear that ALM managers will have to integrate this new requirement to their approach.

In the current regulation, banks can choose their parameters in term of duration of NMD and more importantly in term of percentage considered as core. In addition, they apply the same methodology to their capital which is not considered as a short-term resource either. Subsequently, the normal structure allows for the alignment of both risks – static and dynamic - showing a duration of liabilities above the duration of the assets.

It may no longer be the case in the new regulation after January 2018 and the objective of an ALM manager differs:

The mathematical expression of the objective of ALM under IRRBB d368 will be to minimize the volatility of the NIM under the constraint of respecting regulatory limits in terms of variation of EVE.

This raises the issue of knowing what to do if, as in our example, the application of d368 results in greater bank exposure to a decrease in interest rates.

Obviously, there are many cases where this would be fully justified and one understands perfectly that the benchmark of reinvestment of the NMD should remain reasonable. However, the new rule may have more impact. Indeed, imagine a book having mostly long-term mortgages, it is difficult to admit that this retail bank simply serving its retail and SME customers may have to face the paradoxical constraint of having to reduce its mortgage lending or enter into paying swaps in order to comply with IRRBB d368 (and pay the spread if the curve is "in contengo" that is IR increasing with duration). Obviously, nobody would do so. The most likely situation will be for the bank to issue longer-term covered bonds in order to adjust its liabilities.

IRRBB d368 will push banks to improve their balance sheet management approach by having a more global view on their strategy of refunding. This is a massive change with the previous clearly segregated approaches between liquidity and IR risks.

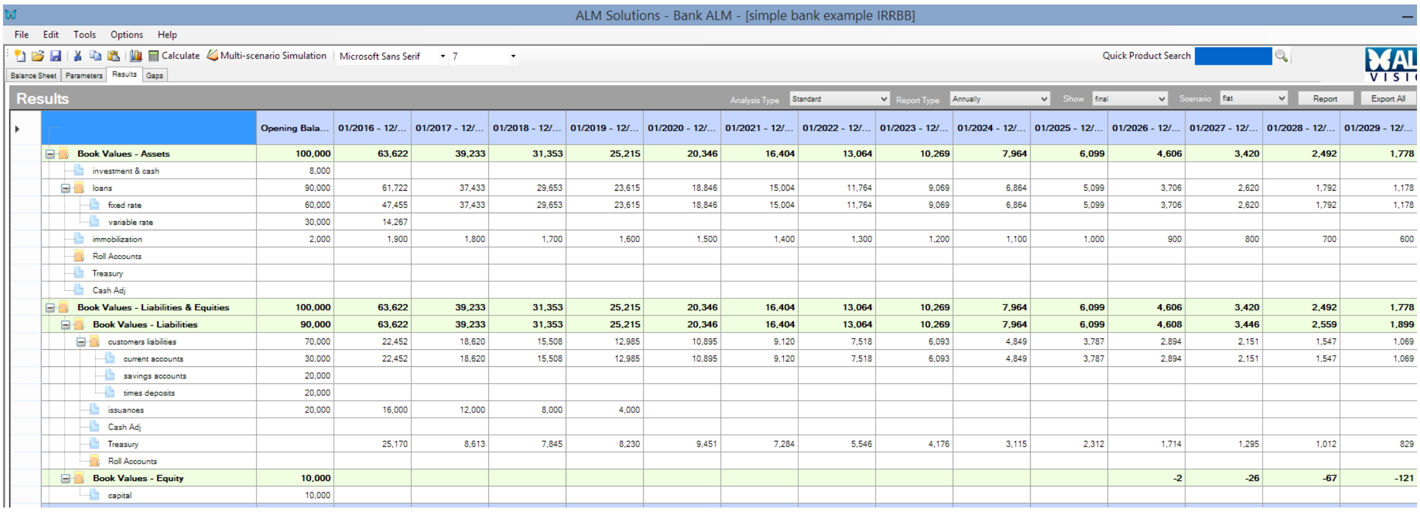
In our example, you may have noticed that the bank chose to refund itself with fixed rates issuances and not variable rates. There is a reason: by doing so, even though the bank increases its exposure to a downward translation of the IR curve, it reduces its risk of flattening or worse, of crisis on the short-term IR. This is where the new regulation may result in a much more sophisticated approach.

Calculating the EVE

For calculating the Economic Value of Equity, we shall use the methodology recommended in our previous memorandum on IRRBB368[11]: we simply price MtM each lines of the balance sheet using the amortizing rules resulting from the application of the conventions for NMD (note that the shift of the curve needs in this case to be taken initially and not the day after).

There are several advantages in this methodology: results are exact and we do not have to distinguish variable rates, spread, fixed rates… Indeed, we have a better estimate with a more flexible methodology. Notice that this methodology allows us to automatically get the value of the caps and floors and other derivatives as soon as these are properly input into to system.

Amortizing on the balance sheet in "static regulatory gaps" – "flat" scenario



	Opening Bala...	01/2016 - 12/...	01/2017 - 12/...	01/2018 - 12/...	01/2019 - 12/...	01/2020 - 12/...	01/2021 - 12/...	01/2022 - 12/...	01/2023 - 12/...	01/2024 - 12/...	01/2025 - 12/...	01/2026 - 12/...	01/2027 - 12/...	01/2028 - 12/...	01/2029 - 12/...
Book Values - Assets	**100,000**	**63,622**	**39,233**	**31,353**	**25,215**	**20,346**	**16,404**	**13,064**	**10,269**	**7,964**	**6,099**	**4,606**	**3,420**	**2,492**	**1,778**
investment & cash	8,000														
loans	90,000	61,722	37,433	29,653	23,615	18,846	15,004	11,764	9,069	6,864	5,099	3,706	2,620	1,792	1,178
fixed rate	60,000	47,455	37,433	29,653	23,615	18,846	15,004	11,764	9,069	6,864	5,099	3,706	2,620	1,792	1,178
variable rate	30,000	14,267													
immobilization	2,000	1,900	1,800	1,700	1,600	1,500	1,400	1,300	1,200	1,100	1,000	900	800	700	600
Roll Accounts															
Treasury															
Cash Adj															
Book Values - Liabilities & Equities	**100,000**	**63,622**	**39,233**	**31,353**	**25,215**	**20,346**	**16,404**	**13,064**	**10,269**	**7,964**	**6,099**	**4,606**	**3,420**	**2,492**	**1,778**
Book Values - Liabilities	**90,000**	**63,622**	**39,233**	**31,353**	**25,215**	**20,346**	**16,404**	**13,064**	**10,269**	**7,964**	**6,099**	**4,608**	**3,446**	**2,559**	**1,899**
customers liabilities	70,000	22,452	18,620	15,508	12,985	10,895	9,120	7,518	6,093	4,849	3,787	2,894	2,151	1,547	1,069
current accounts	30,000	22,452	18,620	15,508	12,985	10,895	9,120	7,518	6,093	4,849	3,787	2,894	2,151	1,547	1,069
savings accounts	20,000														
times deposits	20,000														
issuances	20,000	16,000	12,000	8,000	4,000										
Cash Adj															
Treasury		25,170	8,613	7,845	8,230	9,451	7,284	5,546	4,176	3,115	2,312	1,714	1,295	1,012	829
Roll Accounts															
Book Values - Equity	**10,000**											**-2**	**-26**	**-67**	**-121**
capital	10,000														

The equity appears as an overnight liability in order to keep its MTM equal to the nominal, whatever the scenario. In order to neutralize the creation of income, we assume a full distribution.

Obviously, the amortizing of the balance sheet will depend on the scenarios due to the different prepayment speed (the treasury effect is annulated since all income are paid as dividend).

[11] « The new standard for IRRBB defined by the Basel Committee on Banking Supervision: finally, ALM makes its revolution », July 2016. *Serge Moulin*. ALM-Vision research.

Scenario Comparison : Balance Sheet.Book Values - Assets

Report Type : Annually   Show : Final

Scenario	Opening Balance	01/2016 - 12/2016	01/2017 - 12/2017	01/2018 - 12/2018	01/2019 - 12/2019	01/2020 - 12/2020	01/2021 - 12/2021	01/2022 - 12/2022	01/2023 - 12/2023	01/2024 - 12/2024
flat	100,000	63,621.68	53,672.72	47,789.69	42,405.5	37,391.11	35,615.59	34,013.95	32,589.16	31,344.73
Reg_parallel_up	100,000	64,244.34	54,081.66	48,213.33	42,845.69	37,848.41	36,072.89	34,471.25	33,046.46	31,802.03
Reg_parallel_down	100,000	63,004.73	53,199.38	47,302	41,901.81	36,871.05	35,095.53	33,493.89	32,069.1	30,824.67
Reg_flattener	100,000	63,004.73	53,945.7	48,048.32	42,648.13	37,617.37	35,841.85	34,240.21	32,815.42	31,570.99
Reg_steepener	100,000	64,244.34	53,342.52	47,474.19	42,106.55	37,109.27	35,333.75	33,732.11	32,307.32	31,062.89
Reg_shortdown	100,000	63,004.73	53,114.43	47,217.05	41,816.85	36,786.09	35,010.57	33,408.93	31,984.14	30,739.71
Reg_shortup	100,000	64,244.34	54,144.16	48,275.83	42,908.2	37,910.92	36,135.4	34,533.76	33,108.97	31,864.54

The IRRBB368 calculation simply require to value MTM all balance sheet and compare the results between stressed scenarios and the reference one. Notice that the valuation of the reference scenario does not need to use the correct market spread for valuating loans since we just focus on the variation (the effect is negligible compared to the IR effect). Notice also that our methodology has the advantage of using natively the proper IR curve to actualize each line and is an enhanced methodology compared to the one accepted by the regulator with wider time bucket and approximations in term of spread.

Scenario	Assets	customer deposits	issuances	total liabilities	EVE	**Var. EVE**
flat	105,741	69,932	20,643	90,576	15,166	**0**
Reg_parallel_up	101,035	67,546	19,616	87,161	13,874	**-1,292**
Reg_parallel_down	111,549	73,248	21,825	95,073	16,476	**1,310**
Reg_flattener	106,053	70,347	20,470	90,817	15,236	**71**
Reg_steepener	105,411	69,635	20,823	90,458	14,953	**-213**
Reg_shortdown	107,503	70,865	21,327	92,192	15,311	**145**
Reg_shortup	104,072	69,112	19,999	89,111	14,962	**-204**

The worst scenario is parallel up with a variation in EVE of 13% of the capital.

Without surprise, results confirm our qualitative analysis and duration analysis: the static gap methodology generates a constraint for banks, expressing the risk faced by a central bank on the stock in case of run-off if IR are going up. This depends obviously of the conventions on what is a core deposit. As we have seen, results are extremely sensitive to these conventions as well as the prepayment assumptions. Banks will have to be extremely cautious when defining both.

Notice that our example stays, as anticipated, inside its 15% limit of capital. However, this appears to be a pretty unstable result even though our example was made to show the danger of the static gap methodology since we chose a very disadvantageous modeling of the savings accounts as well as relatively low prepayment curve.

This modeling has a heavy consequence: we cannot hedge sufficiently against the main risk of the bank, that is a decrease of the IR whether by entering receiving swaps or by expanding our portfolio of fixed rates long-term loans. In this situation, the bank should naturally reconsider its assumptions in term of stability of deposits in order to gain some flexibility. But this will necessarily imply a negotiation with the regulator.

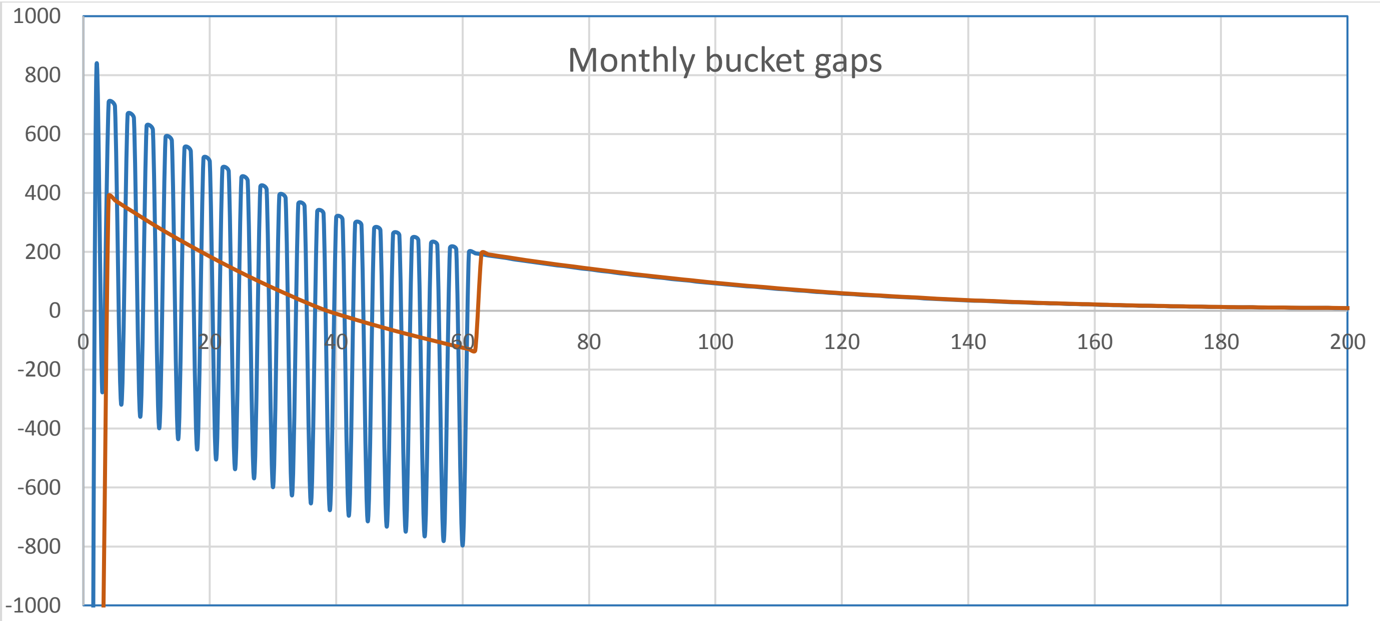
The gap buckets analysis

The bucket analysis is a useful complementary element of information on the IR position but cannot be used as the main element of decision, even though it is still the case in some banks.

The ALM-Solutions® software automatically computes the analysis allowing us to complete our case study. The curve shows a regular decrease of the exposure of a cyclical nature due to the fact that issuances are done quarterly. Only the first point appears as significantly unbalanced at 4.5 billion (bn.). This is the simple application of our conventions:

- In the assets: 8 bn. treasury plus 30 bn. variable rates loans and 0.8 bn. fixed rates loan amortization
- For liabilities: 3.5 bn. of conventional amortization of current accounts and 40 b. of savings and times deposits at variable rates.

After this "excess" of liabilities at very short-term, we see logically an excess of assets with a slight distortion coming from the issuances.

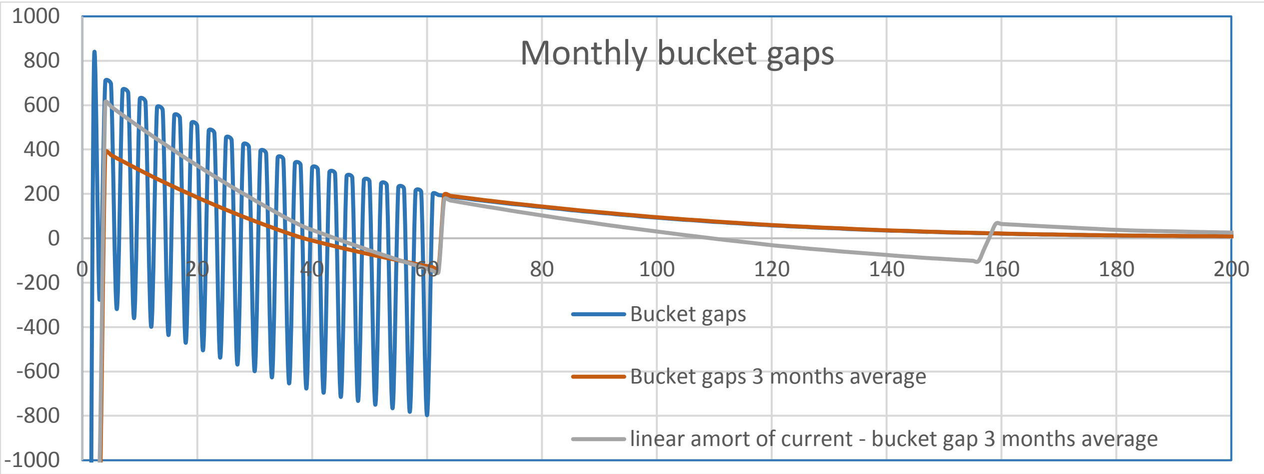


<u>The "excess" of very short-term liabilities is an intrinsic characteristic of the banking industry which is based on the transformation of short-term deposits into longer term loans</u>. This is perfectly normal and does not necessary express an excess in risk. A banking proverb says that "loans make deposits" to express the fundamental mechanism of monetary creation. Notice that the first bucket could show significantly different results, should the convention on savings or currents accounts be differed.

Optimizing the amortization profile of NMD

We choose a logical profile for amortizing our NMD that is to replicate the amortizing of our stock of fixed rates loan. Other shapes are possible, for example:

- Linear amortization: this simple shape is used by many banks
- Replicating the amortization of the portfolio for durations above 5 years and then adjusting before in order to respect the limit of 5 years duration. This shape was chosen without the 5 years duration constraint which is making it more complex and less attractive.



The graph shows that the linear convention generates a less regular profile especially in the long term. This may be a trap. Indeed, we have seen banks which decided to hedge the long term flattener the convention created by entering forward swaps. That is why it is recommended:

- to limit its hedging strategy to the first years: 3 to 5 years and then open its exposure
- to be reasonable and consistent, hedging for example every quarter up to 7 years swaps
- to always implement a multiple approach in analyzing its IR exposure.

Conclusion

IRRBB368 is a revolution in ALM. It requires a much more rigorous and technical approach than previously: modeling of dynamic gaps, definition of scenarios with variation of CPR, MtM valuation of the banking book… However, the limits imposed by the regulator to hedge the natural exposure to a decrease in interest rates of most banks may become an issue if regulators are not reasonable in their interpretation of the text. They should be reasonable since the first guarantee of a safe banking system is to have properly hedged banks, that generate regular income and are well prepared for difficult times when risk increases and, due to the subsequent recession, interest rates decrease.

From an operational point of view, too many banks are late in their preparation for implementing the new regulation both in terms of systems and more importantly and of concern, in terms of expertise in ALM.

About ALM-VISION

ALM-Vision is a quantitative modeling company founded in 2011. Its mission is to provide quantitative analysis and scientific support to financial institutions.

The core of our business activity is Asset Liability Management (ALM) modeling. Our modeling tool ALM-Solutions® is proprietary software developed internally by our team for highly precise state of the art modeling of banking assets and liabilities to monitor the financial institutions' interest rate, credit and liquidity risk and to understand the impact of a variety of economic scenarios on the balance sheet and income statements, including stress testing. We have also high quality pricing capacities for complex structured financial products.

In addition to ALM modeling, ALM-Vision provides advisory services to financial institutions and is called in to intervene on technical matters that require high pricing capacity and substantial and extensive experience in the financial markets (CVA, FVA, deal structuring, ABS, NBT, inflation-linked products, commodity derivatives and modeling, credit restructuring…).

Most bank ALM and/or risk teams are left alone to handle the new regulatory environment. With the current difficult environment for the financial industry, both human and technological resources are scarce and the teams have neither the time nor the capacity to develop the scientific part of their job. We provide our customers with this technical support and act as a bridge for best practices between our customers. Indeed, each customer brings us new needs, new issues, new requirements which reinforce our expertise. Our rule is to systematically share new non-client specific developments as a way to diffuse best practices around the industry. We strongly believe that our success is based on the fact that we more than an IT provider: we are a scientific support team, with strong financial expertise assisting our clients in the whole modeling and analysis of their balance sheet.

In ALM, software is just the tool. The core of the added value is the modeling and the analysis. Leveraging on our strong financial and market experience, we help our customers to focus on this core in the most efficient way.

Disclaimer