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REVIEW OF THE STATIC METHODS USED IN THE MEASUREMENT OF THE EXPOSURE TO THE INTEREST RATE RISK

Summary: Current financial regulation requires banks to have interest rate risk methods in place commensurate with the size and complexity of the bank. The more sophisticated model, the better the prediction of the future Net Interest Income and its sensitivity to the movement of the interest rate curve. The static methods of which an overview is presented in this article, struggle with limitations such as an unchanged interest rate curve, the non-inclusion of items with optionality and many others. The objective of this article is to show how static methods progressed with time, and how some of their limitations presented by a basic Maturity Gap analysis can be addressed in an interesting way. In addition, it also provides the reader with an interpretation of the results of the analysis performed through the aforementioned methods.

Keywords: re-pricing gap analysis, time bucket sensitivity, duration gap analysis.

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If you can't explain it simply,
you don't understand it well enough
Albert Einstein

1. Introduction

Interest rates are entities derived from the returns of financial assets, whose assumed sole purpose is to provide an investor with a return for the investment of his/her funds [Cernauskas, Demetriades 2004]. A fundamental concept in finance is that money has a time value that results from different investment opportunities. Thus a fixed income security bought today for a specified term will return the payoff or future value that is dependent on both the compounding method and interest rate employed. Interest rates paid or charged for money depend to a great extent on the length of the term of investments. Therefore, the interest rate represents the price paid to use money for a period of time and is commonly referred to as the time value of money.

This is an extremely important concept because changes in interest rates affect banks' earnings and its risk situation in different ways. For this reason it is necessary for the bank to put in place systems and the appropriate, most precise possible methods for the measurement of the interest rate risk which enable to reveal all its significant sources and to evaluate its impact on the operative profile of the bank.

In particular the measurement system has to:

- evaluate every significant type of interest rate risk in the Banking Book,
- utilize the generally accepted financial principles and measurement methods,
- base its analysis on assumptions and parameters which are well documented and described.

With regard to assessing interest rate exposure, the banks look at it from two different perspectives:

- The earnings perspective focuses on the impact interest rate changes have on a bank's near term earnings. After all, changes in the yield curve have a direct impact on a future net interest income. Hence, interest rate risk analysis from an earnings perspective will focus on assessing the earnings effects that may arise from changes in market interest rates.
- The economic value perspective focus on the impact interest rate changes may have on the economic value of the future cash flows and thus on the economic value of both interest rate book and capital. The present economic value is affected in two ways by changes in interest rates: by the change in future interest cash flows included in the calculation and by the change in the discount rates of all future cash flows used for this calculation [Basel Committee on Banking Supervision 2004].

2. Exposure to short-term interest rate risk

2.1. Maturity gap analysis according to basic approach

According to the Regulator, the Maturity Gap is the simplest technique for measuring a bank's interest rate risk exposure. It distributes interest-sensitive assets, liabilities and OBS positions into a certain number of predefined time bands according to their maturity (if fixed rate) or time remaining to their next re-pricing (if floating rate). Those assets and liabilities lacking definitive re-pricing intervals (e.g. sight deposits or savings accounts) or actual maturities that could vary from contractual maturities (a mortgage with an option for early repayment) are assigned to re-pricing time bands according to the judgment and past experience of the bank [Basel Committee on Banking Supervision 2004].

To evaluate earnings exposure, interest rate – sensitive liabilities in each time band are subtracted from the corresponding interest rate – sensitive assets to produce a re-pricing gap for that time band. This gap can be multiplied by an assumed change in interest rates to yield an approximation of the change in net interest income that would result from such an interest rates movement. The size of the interest rate movement used in the analysis can be based on a variety of factors, including the historical experience of the bank, a simulation of the potential future interest rate movements, and the judgment of the bank's management [Basel Committee on Banking Supervision 2004]. Usually, the banks apply +/− 200 bps parallel shock for this analysis. The application of this method is very simple and can be easily extendable to the measurement of the exchange risk [Basel Committee on Banking Supervision 2004]. For this reason, the Maturity Gap method presents significant limitations:

- it considers only the transactions existing in the Banking Book at the date of the analysis (no new business assumption),
- it disregards different maturities of the transaction within the same time buckets (all transactions falling into the same time bucket have the same risk profile),
- it allows to estimate only the uniform movements of the interest rates,
- it assumes that asset and liabilities in maturity will be reinvested/refinanced within the gapping period (without altering the Balance Sheet structure) – there is no new business strategy applied here.

The impact on the interest margin resulting from the movements of the interest rates (*NII* – Net Interest Income) is calculated as a product between the changes in the interest rates and the difference between an interest rate risk sensitive asset and liabilities:

$$\Delta NII = \Delta i \times GAP = \Delta i \times (\textit{sensitive asstets} - \textit{sensitive liabilities}).$$

Thus, the delta of interest margin is the function of two elements:

- interest rates movements Δi,
- the difference between assets and liabilities *GAP*.

Using the Maturity Gap method, the bank can manage its position to the interest rate risk through:

- the immunization of interest rate risk keeping the *GAP* close to zero[1],
- directional *GAP* keeping the voluntary mismatching according to the expectation of the future movements of the interest rate curve and an analytical understanding of the maturity profile of the balance sheet.

GAP > 0 the bank is exposed to the reinvestment risk, meaning that in cases of interest rates' increase it is going to show a profit. To the contrary, in cases of interest rates' decrease it is going to show a loss.

GAP < 0 the bank is exposed to the refinancing risk meaning that in cases of interest rates' increase it is going to show a loss. To the contrary, it realizes profits if the interest rates decrease.

In consequence, if *GAP* = 0, the bank is immune to the interest rate risk and movements of the curve. Of course, in this sense the directional *GAP* strategy consists in the adjustment of the sign of the *GAP* (increasing it when there are upward expectations for the interest rates and reducing it when there are downward pressures from the market).

A simple Maturity Gap analysis, as described by the Regulator, can be easily performed in the Excel spreadsheet, however the significant limitations deriving from this approach cannot be underestimated. This basic method has been enriched through the introduction of the incremental gap method [Lusignani 1996], where the incremental gap is obtained by the summation of the subsequent gaps weighted for the time factor. This time factor represents the time between the central value of the bucket and the end of the gapping period:

$$\Delta IM = \sum GAP \times (T-t) \times \Delta j,$$

where: T – represents the length of the gapping period, t – maturity related to the i-th time bucket, Δj – shock in the interest rates curve.

2.2. Maturity gap analysis according to the advanced approach

The advanced derivation of the Maturity Gap needs the support of the system. The system positions the transaction principal exactly at the date when the transaction begins to become sensitive to the rate changes. In this method the transaction principal is split into: maturity flow and re-fixing flow. Maturity flow refers to the fixed rate or floating rate transactions which amortize or mature and needs to be reinvested or refinanced. Here it is assumed that every flow in maturity under the horizon of the gapping period (usually one year) is reinvested (refinanced) until the end of the gapping period at the market forward rate in the reference currency. Instead, the re-fixing flows refer only to transactions at the floating rate which need to reset their rate at the re-fixing date. These flows are used to determine the expected change in the interest margin for a predetermined gapping period given a parametric shock (parallel or non-parallel shifts) to the rate curve associated with the transaction. Analysis using this approach is usually supplemented by the fixing analysis (described later) of the parameters for floating rate transactions. For transactions of this type it is possible to estimate the impact of each parameter in terms of the contribution to the interest margin for each time bucket. For the flows in maturity the measurement of the impact on the interest income in front of the shock of the interest rate curve is realized through the calculation of the difference between the interest from the reinvestment of assets or the refinancing of liabilities at the forward rate calculated from the shocked and non-shocked curve. In particular, this is done through the positioning of the underlying each interest maturity date giving rise to two opposite flows (maturity and the issuance of a zero coupon bond). The sum of these amounts at each date indicates the change in the underlying date between one period and another (see Figure 1). This can be seen as an amortisation schedule for the principal and is determined both for items at fixed rate and for those at floating rate.

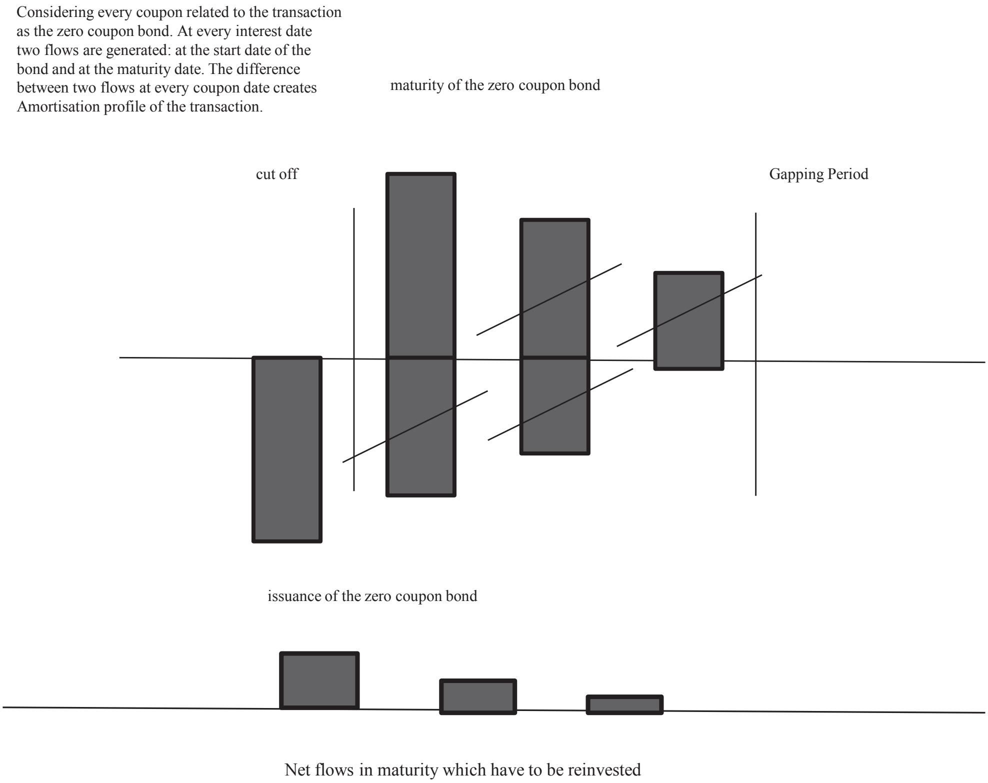

Fig. 1. The maturity flows related to the transaction at fixed or floating rate

Source: own elaboration.

The exposure to the interest rate risk also derives from the variation of the interest rate to which the transaction is linked at the fixing date and consequently having an impact on the interest flow and the interest margin. This kind of risk exists only in the case of floating rate transactions and only for the component in re-fixing (as opposed to the component in maturity). The delta interest is calculated as the difference between the interest under the shocked benchmark rate scenario and the non-shocked scenario. Also in this case two flows of an opposite sign are calculated for the component in re-fixing: one at the start date and one at the maturity date of the zero coupon bond (see Figure 2). The sum of the flows in maturity and re-fixing gives the correct amount in re-pricing.

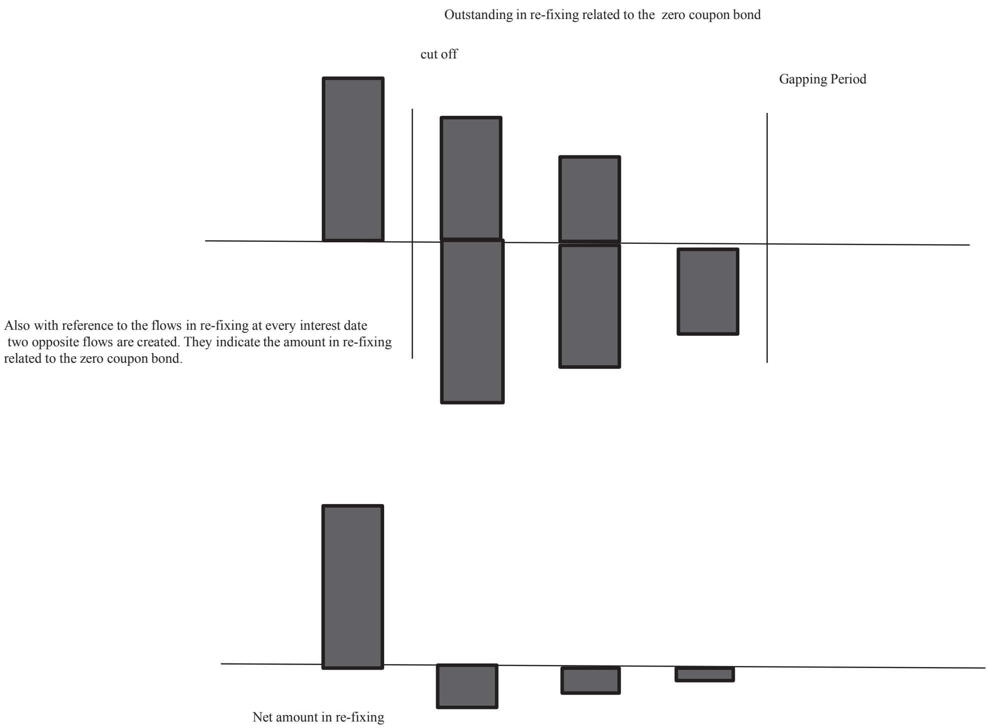

Fig. 2. The re-fixing flows related to the transaction at fixed or floating rate

Source: own study.

2.3. Comparison of two approaches (basic Maturity Gap and Re-pricing Gap)

Both methods take into consideration the flows related to the underlying transactions and position them at the date at which they become sensitive to the interest rates. Meanwhile the maturity gap classifies them in the function of the time bucket into which they are expected to fall, the re-pricing gap positions them at the exact date of risk. This is possible because of the use of the advanced ALM system. In both cases these flows are used to determine the expected change in the interest margin for a predetermined gapping period given a parallel shock of 200 bps (obviously it is possible to assign whatever magnitude of the shock) to the rate curve associated with the transaction. One of the most important limits of the maturity gap analysis consists in the impossibility of the identification of the parameters (risk factors) to which the transaction is linked. This means that the transaction at floating rate is distributed to the appropriate time bucket according to the time left to its re-pricing. Therefore, if the transaction falls into the time bucket of 3-6 months it is not clear to which market parameter it is linked. Instead, the re-pricing gap approach allows estimating the impact of each parameter in terms of its contribution to the interest margin for each time bucket. Using the maturity gap approach it is not possible to know if the estimated sensitivity of the expected margin derives from maturity flows (the transactions which amortize or mature and have to be reinvested or refinanced at the "new" interest rate) or from the flows in re-fixing. This is the important disadvantage with respect to the re-pricing gap which calculates the NII (Net Interest Income) sensitivity caused by the component in maturity reinvesting (refinancing) it at the forward rate until the end of the gapping period. Finally, the most important thing which gives such a big advantage to the re-pricing gap locating it at the top of the static methods family is that it captures the sensitivity deriving from the non-perfect indexation of the transaction. In particular, if the transaction is the floating rate perfectly indexed, the re-pricing flow is positioned at the first rate reset date for the transaction as a whole. If not, the sensitivity captured from the non-perfect indexation is calculated and shown also for the subsequent re-fixing dates. Imperfect indexation arises in the following situation:

- rate fixing period different to the interest payment period,
- the presence of financial spreads,
- weight of indexation parameter not equal to 1,
- average indexation.

2.4. Re-pricing gap analysis and re-fixing gap analysis

The re-pricing gap here refers to the advanced derivation of the maturity gap which was described above. In this stage the purpose is to focus on its application and the difference with respect to the re-fixing gap which shows all flows in re-fixing (not only the first re-fixing date but also the subsequent dates). The re-pricing gap usually shows the picture of the exposure to the interest rate risk within a short time period (12 months). It captures the positions both at the fixed rate which mature and need to be reinvested (if assets) or refinanced (if liabilities) and the floating rate which will reset its rate, generating in this way the interest rate risk exposure. The gapping period (usually 12 months) is split into monthly time buckets giving in this way more precise information about the time when the risk is present. The more precise the information about the timing related to the presence of risk, the more accurate the measure of the exposure to the interest rate risk. It is worth highlighting at this point that even if it delivers the fast overview from the interest rate risk perspective, it does not consider the structure and the positions of the subsequent re-pricing gaps related to the given position. Instead, it "sees" only the first risk date of the position in the fixation. For example, imagine that the bank has an amount of liabilities which re-price in January 2013, April 2013, July 2013 and October 2013 (it is indexed to Euribor3m). Under the re-pricing gap approach we will see only the re-pricing in January 2013 if analyzed in December 2012 (the cut-off date). Under this approach, the positions in maturity and in re-fixing are separated which facilitates greatly the interpretation of the results. The bank is aware when the risk derives from the expiration of the position and when it is caused by re-fixing. In order to calculate the sensitivity of the interest income, flows in re-fixing and in maturity are summed up. Again, the sensitivity of the interest income driven by the amount in re-fixing is separated from the sensitivity caused by the flows in maturity. This helps a lot in the analysis of the results. Let us analyze the re-pricing gap of the bank as shown in the graph below.

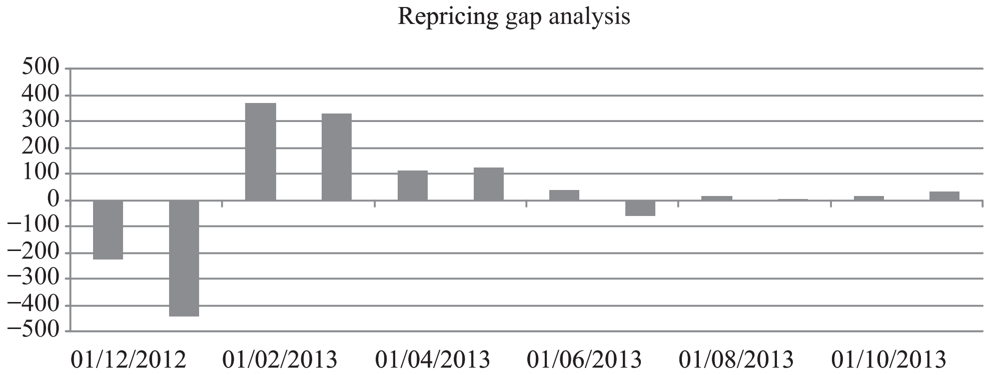

Fig. 3. Re-pricing gap analysis (numbers are in millions of Euro)

Source: own elaboration.

The graph shows a significant negative gap in January which refers to the liabilities in re-fixing. From the IRR perspective, this net amount of liabilities will reset its rate and consequently expose the bank to the upward movement of the curve. Furthermore, positive gaps in re-fixing can be noticed in the successive months. On the contrary they expose the bank to the downward movement of the curve. The subsequent presence of both negative and positive gaps in re-fixing partially offset the exposure to the fluctuations of the interest rates. The re-fixing gap analysis enriches the details provided by the re-pricing gap. It gives the information about the existing mismatching between assets and liabilities at the floating rate indexed to the different risk factors (Euribor3m, Libor1m, etc.) grouped in monthly or bi-weekly time buckets (or even daily) within the predetermined time horizon (for example 12 months). The simplest form of the re-fixing gap approach does not incorporate the projection of the new volumes which the bank is going to disburse under the examination period. Instead, the positions are inertial (in a run-off). Unlike the re-pricing gap, the re-fixing analysis takes into consideration all the re-fixing dates of accounts related to the assets and liabilities under the gapping period. This is important information for the bank in order to contain the risk of mismatching and the high sensitivity driven by the interest rates' fluctuations. It is a fundamental tool for setting the hedging strategy and to contain the negative impact on the interest income of the bank. Let us consider the following graph representing the re-fixing gap of a bank:

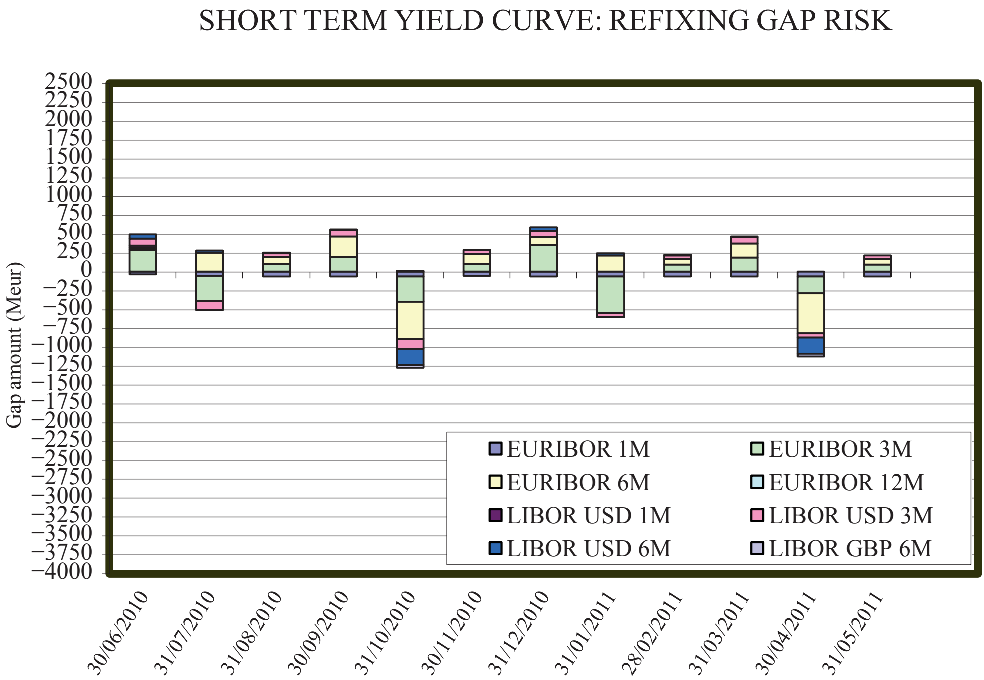

Fig. 4. Re-fixing gap analysis

Source: own elaboration.

The graph shows negative mismatching in October 2010 and April 2011 caused by the Euro1bln net position in liabilities. This position is linked to Euribor6m.

Instead, from the asset side the numerous net positions in assets are distributed steadily over time (in this case 12 months) linked mainly to Euribor6m and 3m. The bank is significantly exposed to the upward movements in the level of the Euribor6m while approaching the re-fixing date in October. Furthermore, this risk is concentrated in a one month time period. Suppose that in October 2010 following some important sudden event, the market responds through a hike in interest rates level. The bank incurs losses due to the negative gap in re-fixing. Subsequently, the market adjusts interest rates to the pre-October levels. The bank has positive mismatching in November and again incurs losses. As can be seen, not only the magnitude of the single gap is important but also their distribution over time. The hedging strategy consists in entering into the Forward Rate Agreement (FRA). The bank, in this case, buys a FRA, locking the rate on the negative mismatched position in October.

The method presented above is static. That is, the evolution of the balance sheet from the perspective of new business production, customers' behavior with reference to the items with embedded options and the future evolution of the interest rates are not taken into consideration. Instead, the positions of the balance sheet are in a run-off, and the impact on Net Interest Income is calculated under a forward curve scenario. These days, following the recent turbulences in the financial market, banks try to switch to the dynamic approaches in order to deliver to senior management the most accurate view of the possible risks and returns deriving from the composition of the bank's balance sheet.

3. Maturity gap analysis from the economic value perspective

Maturity gap analysis also facilitates the analysis of the effects of the interest rate changes on the economic value of capital. In principal this analysis is based on, firstly, the determination of the cash flows of the transactions and the subsequent mapping of them on the corresponding time bands. In order to establish the economic value effects, the sensitivity factors are assigned to each time band (modified duration, basis point value) indicating in this way their time bucket sensitivity. In order to obtain the overall measure of the structural risk exposure, the change in the present value of gaps is related to the own funds of the bank indicating in this way the percentage of its own funds to be effected in cases of interest rates movement.

The regulator defines the duration-based weights which can be used in combination with a maturity/re-pricing schedule to provide a rough approximation of the change in a bank's economic value that will occur given a particular change in the level of market interest rates. Moreover, an average duration is assumed for the positions that fall into each time band. The average durations are then multiplied by an assumed change in interest rates to construct a weight for each time band, reflecting the broad differences in the coupon rates and maturities (for instance, one weight for assets and another for liabilities). The weighted gaps are aggregated across time bands to produce an estimate of the change in the economic value of the bank that would result from the assumed changes in interest rates. According to the Regulator, estimates derived from a standard duration approach may provide an acceptable approximation of the bank's exposure to changes in economic value for less complex banks. However it admits that such estimates may not reflect interest rates arising from changes in the relationship among interest rates within a time band (basis risk). In addition, it does not reflect the differences in the actual sensitivity of positions because of the average duration applied to every time band. Finally, the risk of options can be not adequately captured given the simplifying assumptions which lie under the calculation of standard duration [Basel Committee on Banking Supervision 2004].

3.1. Time bucket sensitivity analysis

Sensitivity analysis is a method for calculating the change in the present values of items due to a shift in the interest rates curve. The sensitivity (ΔPV) of the transaction is calculated as the difference between its Present Value (PV) determined with the current market rates and its Present Value under the shocked interest rates scenario (PV^*):

$$\Delta PV = PV^* - PV.$$

The traditional approach consists in positioning cash flows, fair value and sensitivity at the date at which the flow is expected to occur (according to its contractual or modelled maturity). Such a representation, in cases of transactions at fixed rate, reflects the correct riskiness of the transaction over time but this is not the case for the transactions at floating rate. This is caused by the fact that the sensitivity of the transactions at floating rate is also linked to the change in the forward rate. Consequently, even if the overall sensitivity of the transaction at floating rate corresponds to the sum of the sensitivities for a single time bucket, their distribution over time cannot be measured correctly through this approach. In order to improve the accuracy of the interest rate risk measurement, the traditional approach has been enriched through the method which positions the sensitivity of the transaction at the floating rate at the actual risk dates. Here the underlying assumption related to the perfectly indexed floating rate transaction consists in its representation, in terms of fair value and sensitivity, by positioning the notional and the coupon interest known at the analysis date at the coupon payment date. The zero coupon bonds forward are generated for every coupon of the floating rate instrument which is unknown. The notional of the zero coupon bond is equal to the notional of the coupon to which this bond is referring to. The interest flows are calculated with the forward rate implicit in the discount curve with the tenor equal to the tenor of coupon. Summing the flows related to the sensitivity and fair value generated in the tradition approach (by payment dates) and the zero coupon forward approach, it is possible to obtain the correct picture of the riskiness of the floating rate instrument in terms of its distribution over time buckets. Moreover, in this way the transactions at floating rate are equivalent to the transactions at fixed rate with maturity equal to the tenor of the coupon. Summarizing, under the payment approach it is possible to obtain the sensitivity distribution over time buckets according to the actual representation of the riskiness only in cases of the transactions at fixed rate. However, for the transaction at floating rate the second approach (zero coupon forward) needs to be applied in order to capture the true risk date. In cases of the floating rate in perfectly indexed transactions, the actual risk date occurs exactly at the first re-pricing (see the figure below). In cases where the floating rate transaction is not perfectly indexed, the interest flows and related replicating flows do not eliminate each other (in terms of cash flow, fair value and sensitivity). The difference is due to the non-equivalence of the floating rate in terms of risk with a zero coupon maturing at the coupon's maturity date. The figure 5 presents the crucial points underlying both approaches.

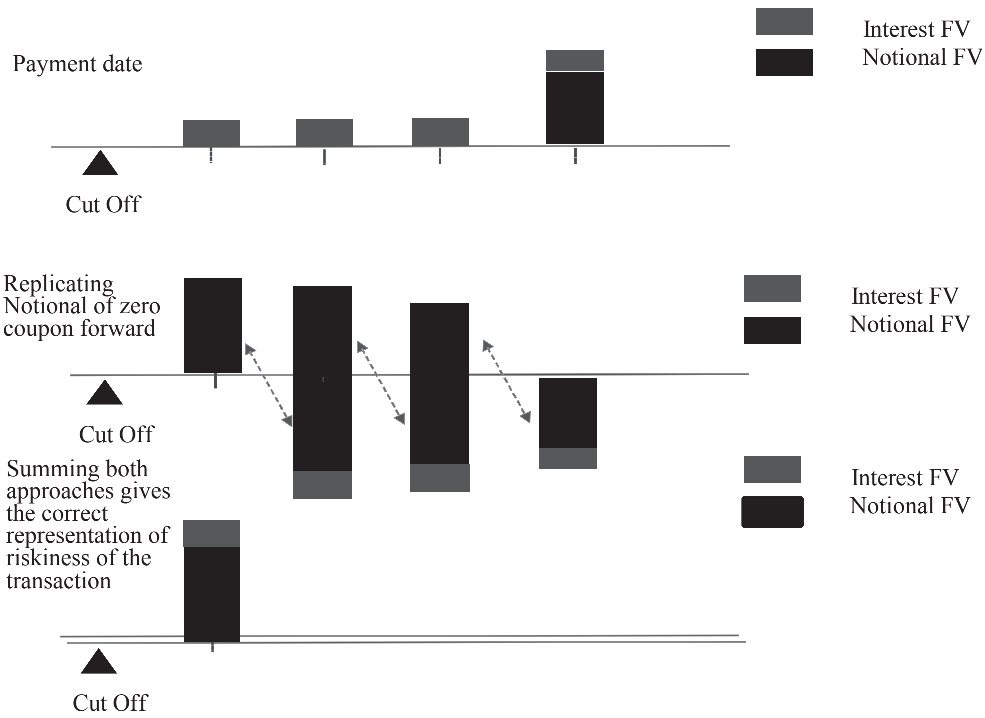

Fig. 5. Time bucket sensitivity analysis according to payment and zero coupon forward approach

Source: own study.

4. Duration gap analysis

In the last few years the application of duration indicators has been extended to the measurement of the exposure to the interest rate risk of assets and liabilities being part of the Banking Book. Using the tool of duration, the second approach of interest rate risk management develops duration gap models whose objective variable is the economic value of equity [Bierg, Kaufman1985; Drago 1998; 2001; Fabrizi 1995; Lusignani 1996].

Duration is a measure of the average life of the security. It represents the speed of payment of a security, and consequently the price risk relative to other securities with the same maturity. Duration is calculated as the weighted average time until the receipt of all cash flows from the security, where the weights are the present values of the cash flows to the total present value of the security:

$$D = \sum_{t=1}^{n} (t \times PVCF_t) / \sum_{t=1}^{n} PVCF_t,$$

where: D is the duration of the security, t is the length (number of months, years, etc.) to the date of payment, and $PVCF_t$ is the present value of the payment (CF) made at t, calculated as $CF_t /(1+r)^t$, where the summation $\sum$ is taken from the first to the last payment n and r is yield to maturity.

The measure of duration, which is measured in units of time, e.g. months or years is referred to as Macaulay's duration. However, as observed by Burghardt [1994], duration measured in years is of no particular use. Its primary application as a measure of the interest rate risk in the markets can be obtained after transformation into modified duration. This interpretation of duration represents the price volatility of the security and its interest rate risk. Mathematically, duration is an approximation acceptable only for very small interest rate movements and it becomes imprecise in cases of significant shift in the term structure. In fact, it is the linear approximation of the relation price-return, which, as is well known, is not linear. The degree of approximation can be improved by the introduction of convexity which takes account of the curvature of the non-linear relationship between the price of the security and its return [Hull 2012].

As mention earlier, duration relates changes in interest rates and percentage changes in security prices linearly as follows [Kaufman 1984]:

$$\frac{\Delta S}{S} = -D \times \frac{\Delta i}{1+i} \approx -D \times \Delta i,$$

where: S is price of the security, i is the yield to maturity, and Δ is the change from the previous value.

Duration is very often used to monitor the value of capital of the financial institution in cases of fluctuations of the curve. The assumption of a particular degree of risk exposure is the function of the bank's senior management risk appetite ("risk appetite" of the institution is usually formalized in the ALCO policy). The choice of selecting the capital value as a target position is dictated by the fact that this is a primary concern to the shareholders of the bank. While the interest rate sensitivity or risk of individual position is related to its modified duration, the interest rate risk of the target position is related to the difference, or gap, between the average duration of the assets of the institution and the average duration of the liabilities. The duration gap (*DGAP*) is

$$DGAP = DA - w \times D_L,$$

where: D_A and D_L are the average duration of assets and liabilities, respectively, and w is the weight defined as L/A (market value of liabilities to the market value of assets).

Let us imagine that the *DGAP* of the Banking Book items of the financial institution is > 0. In this case the bank behaves as a net asset position. Consequently, when the interest rates increase the value of capital will diminish accordingly. On the contrary, in the case of interest rates' decrease the capital value will increase as a function of the magnitude of the *DGAP*, the shock in the interest rates movement and the dimension of the assets of the financial institution. Exactly the opposite will happen in the case of the *DGAP* < 0. The institution can change its degree of interest rate exposure to any extent it wishes by changing the composition of the balance sheet in such a way as to obtain the desired duration gap for its target position. The greater the duration gap, the greater is the institution's risk exposure for a particular target position and conversely the smaller the gap, the smaller its exposure. The elimination of this risk consists in putting into place the immunization strategy and setting the Duration Gap to zero. The financial institution, however, attempts to maximize its profits but profit maximization presumes a desired level of risk exposure. The desired risk-return trade-off for a financial institution is determined by its ALCO policy and may be different from bank to bank. Managing the interest rate risk consists in determination of both the direction and size of its gap on the basis of its predicted interest rates. A bank may pursue two interest rate risk strategies: a passive (immunization) strategy or an active strategy. The example below shows the immunization strategy of a bank. It should be underlined that through the immunization strategy a bank may reduce or even lose the income gained if it had managed the interest rate risk correctly. On the other hand, by immunizing the bank also decreases its chances of suffering losses if the risk is mismanaged. Let us consider that the initial value of capital is equal to 100 Euro. The average duration of assets is equal to 4.17 years, meanwhile the average duration of liabilities (deposits *P* for example) is equal to 1 year and $P/A = 0.9$. This yields a duration gap: $4.17 - 0.9 \times 1 = 3.27$ years. The immunization condition is not maintained. The bank can reduce the gap to zero through:

- shortening the duration of its assets by 3.27 years to 0.9 years,
- lengthening the duration of its deposits to 4.63 years so that $0.9 \times 4.63 = 4.17$.

Let us suppose that the bank prefers to go through with the second possibility (lengthening the duration of deposits). It can do so by reducing the volume of the liabilities with shorter duration and increase the volumes of the liabilities with a longer duration. Consequently, the immunization condition is satisfied. An interest rates increase, by say 200 bps, will decrease the value of assets exactly in the same way as before changing the composition of the balance sheet (the assets side has been not changed). Instead, the composition of liabilities has been changed by reducing the proportion of the shorter term deposits. Through the immunization strategy, the bank protects its capital level as the change in the asset market value is offset by the change in the market value of deposits [Kaufman 1984].

4.1. Managing the interest rate risk through the Duration gap approach

Let us suppose that the bank predicts a decline in the level of interest rates in the next period and, in accordance with its ALCO policy, accepts the risk in terms of duration gap of one year so that:

$$DA - w \times D_L = 1.$$

Imagine also that the average duration of assets is equal to 4.17 years meanwhile the average duration of liabilities (deposits *P* for example) is equal to one year and *P/A* = 0.9. The market value of total assets is equal to 1000 Euro. Again, as in the previous example the bank can go through the strategy of shortening the duration of assets from 4.17 to 0.9 years or lengthening the duration of liabilities from 1 to 4.63 years. The bank will gain an increase in the value of capital if the interest rates decrease as predicted by the Treasurer of the Bank. Now, contrary to the bank's expectations, let interest rates increase by 200 bps rather than decrease. The bank is worse off. The market value of capital has declined by 20 Euro (1000 × 2%). The bank has deteriorated the market value of capital. However it is worth to remember that in order to undertake the active strategy for the interest rate risk management, the bank has to be able to predict the interest rate movements and to be right [Kaufman 1984].

4.2. Limits of Duration gap analysis

This is theoretically appealing but requires the complete information of data set related to items of the balance sheet (such as the maturity and the re-pricing frequency of every single position). Moreover the early redemption of loans or other options included in the transactions are not taken into account. From the a mathematical standpoint, a duration gap analysis works well only for small interest rate changes and it assumes that when the level of interest rates changes, interest rates on all maturities change by exactly the same amount (parallel shift). However, despite all above mentioned limits it is still commonly used in banking practice.

5. Conclusion

The aftermath of the recent financial crisis and its inevitable consequences, such as the historically lowest level of interest rates, has significantly increased the importance of the awareness of exposure to the financial risks. It is no longer possible not to take into account the contributions given by the risk management function and the ALM Treasury unit. While the risk management monitors and calculates the risk metrics, the ALM Treasury unit has the responsibility for the elaboration and proposal of the most appropriate risk strategies. This is exactly where the risk-return profile with reference to these financial risks should be produced and maintained over time. The Treasury should elaborate the analysis driving versus optimal position in terms of interest rate risk, liquidity and foreign exchange risks. It should be the engine for obtaining the appropriate balance sheet composition, permitting to take advantage of whatever situation in the financial markets.

The methodologies presented above for calculating the interest rate risk are static because they are not taking into account the evolution of the interest rate curve and the composition of the balance sheet. However, being enriched through the introduction of the advanced derivations of the basic methodologies proposed by the Regulator, provides the bank with the wide picture of the underlying risks. In particular, they play a positive role in cases of banks which are not going to put in place active strategies for maximizing earnings, but instead are trying to minimize the risks and their main objective is to drive the bank's position versus immunization. Furthermore, the more complex the bank and its product, the more sophisticated methods of measurement of financial risks should be incorporated within the Risk and Treasury tools. ALM methodologies should be seen as an asset which the bank owns and the willingness to progress and to evolve these methods has to be seen as of a high importance for the senior management. Certainly this forward looking approach will be of benefit in the future and the bank will capitalize on this investment.

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PRZEGLĄD STATYCZNYCH METOD POMIARU RYZYKA STOPY PROCENTOWEJ

Streszczenie: Obecnie obowiązujące rozporządzenia finansowe wymagają, by banki dysponowały metodą obliczenia ryzyka stopy procentowej, która jest proporcjonalna do wielkości i złożoności banku. Im bardziej zaawansowane modele, tym lepsze jest przewidywanie przyszłych odsetek netto i ich wrażliwości na ruch krzywej oprocentowania. Metody statyczne, których przegląd przedstawiono w artykule, wciąż napotykają na ograniczenia, takie jak niezmienność w czasie krzywej stopy procentowej, brak uwzględnienia ryzyka opcji klienta i wiele innych. Celem tego artykułu jest pokazanie, w jaki sposób metody statyczne ewoluowały w czasie i w jaki sposób niektóre, przedstawione ograniczenia mogą być rozwiązane. Artykuł zapoznaje również czytelnika z interpretacja wyników analizy ryzyka stopy procentowej przeprowadzonej przy użyciu wymienionych metod.

Słowa kluczowe: metoda luki niedopasowania aktywów i pasywów, analiza wrażliwości okresowej, analiza okresowa.