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Hedge accounting within IAS39

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Abstract

This work proposes an accounting calculation scheme for hedging swaps based on the requirements listed under International Accounting Statement (IAS) 39. In particular we developed a procedure that assists risk managers in the identification of the hedging efficiency between a group of loans (or bonds) and swaps held in a bank portfolio qualifying for hedge accounting.

The proposed scheme aims at associating to any given swap of the bank portfolio, a certain collection of loans (or bonds) whose risk exposures offset each other. The final result is the construction of a number of hedges that are effective according to IAS 39.

Hedge accounting within IAS39

1. Why IAS 39

In past years additional attention was devoted to the accounting standards related to financial instruments. With the increased sophistication of capital markets and the use of derivatives, the need for accounting rules to ensure transparency in financial statements through adequate disclosure of positions and exposures becomes crucial. Accounting rules need to be standardised, so that the performance and solidity of financial institutions can be assessed and compared in a coherent way through the financial statements. In this vein, regulatory bodies in different countries have been working to establish standards for financial accounting and disclosure.

The need of proper accounting standards was felt even more intensively in February 1995, when the banking world was shaken by large-scale failures such as the Barings Bank collapse. Accounting standard organisations realised that the existing historical cost convention was unsatisfactory for financial instruments giving no indication of the inherent risks.

The most important actors in the development of accounting standards have been the International Accounting Standard Committee (IASC) with its IAS39 standard and the US Financial Accounting Standards Board (FASB) with the FAS133 standard. The two standards have substantial overlap; the most significant difference is that the FAS133 standard is limited to hedge accounting whereas IAS39 also covers other accounting areas.

IAS39 was issued in March 1999 and is effective since January 2001 in those countries the Parliaments of which have integrated the standard in the related national laws. The standard sets requirements for a wide range of instruments and, for the first time, disciplines the recognition, de-recognition and measurement of derivatives.

In general, IAS39 requires all derivatives to be recognised on the balance sheet and measured at fair value. This is a main change with respect to previous practices where derivatives used for hedging purposes were often off balance sheet. The requirement that all derivatives are visible on the balance sheet aims to give transparency and insight into the true exposure of a financial institution or company. Profits and losses arising from changes in fair values of derivatives are recorded in the income statement.

Additionally, derivatives used to hedge a group of assets or liabilities could qualify for hedge accounting. Hedge accounting applies, however, only when strict hedge effectiveness criteria are satisfied. By effectiveness it is meant the degree of correlation between changes in fair value of the exposure and changes in fair value of the designated hedge. If hedge effectiveness criteria are fulfilled then hedge accounting can be applied with the consequence that both the hedging derivatives and the hedged group of assets or liabilities are recorded at fair value but with opposite sign. Measuring the hedge effectiveness is therefore a crucial part of the IAS39 standard. One of the most important requirements for good management is to be able to identify which hedging strategies qualify for hedge accounting under IAS39 and which not. Accomplishment of this task is not trivial and requires the assistance of appropriate procedures, especially because the limits imposed by IAS39 on the use of hedge accounting are strict even for hedges that are economically effective.

This work focuses on the conception of a methodology that is efficient in selecting portfolios of loans (or bonds) and interest rate swaps that fulfil hedge effectiveness criteria and therefore qualify for hedge accounting.

The paper is structured as follows. Section 2 sets the problem. Section 3 states the objective and explains the leading features of the procedure, whereas Section 4 describes its functioning by means of an example. Section 5 concludes.

2. IAS39 requirements

As the use of derivatives has become more and more intensive, concern about their accounting has increased. The main concern is that derivatives are traditionally off balance sheet items and there is little disclosure about the risks implied by their use. IAS39 is an effort along the direction of an improved transparency by means of strict rules for the accounting of derivatives.

The problem can be illustrated by the following example. A fixed rate debt is converted into a variable interest rate via an interest rate swap. The debt and the swap are considered together as a synthetic variable rate borrowing, and the amount receivable or payable under the swap is used to adjust the interest rate payable on the debt.

Before the introduction of IAS39 the accounting of these instruments was straightforward: the swap, provided it was perfectly matching the debt obligation, was disclosed as part of the terms of the debt and was recorded at its nominal cost together with the debt. However, this way of accounting makes it difficult to determine the underlying economics and to assess and manage the risk incurred through derivatives. Hence the need for disclosure and the logical choice to separate derivatives from the underlying host contract recording each item at its fair value to make the risk more visible.

An exception to the general rule can be made when hedge accounting is applicable but only in a special case. In fact, hedge accounting is applicable in two cases:

1. the derivative is mirroring the cash flows inherent to the asset or liability it is hedging

2. the derivative is closely mirroring the exposure profile of a group of assets or liabilities

In the first case, the so-called short cut method is used; i.e. the hedged item fair value is considered to be equal to the fair value of the hedging derivative and no effect is generated in the P&L by the movement in the market conditions. In the second case, the effectiveness of the hedge is evaluated and whenever it is not perfect, the portion of ineffectiveness (which is limited by strict rules) is recorded in the P&L.

When hedge accounting does not apply, the derivative is recorded at its fair value, whereas assets (typically loans) and liabilities (typically bonds) are recorded at their historical cost leading to a clear assessment of the derivative exposure.

In summary, the general principle set by IAS 39, regardless the applicability of hedge accounting or not, is to ensure disclosure of all type of risks associated with a derivative, either they be related to the derivative itself or to the ineffectiveness of a hedge. This can be avoided only when the hedge can be regarded as 'perfect' and the short cut method is applicable.

IAS39 establishes requirements governing whenever transactions entered into for hedging purposes qualify for hedge accounting. The new requirements are restrictive reducing the transactions for which hedge accounting is applied. Hedge criteria include:

(1) Both the hedged item and the hedging instrument should be clearly identified and documented. Management must document exactly what is the hedged risk and how it will assess the effectiveness of the hedge.

(2) The hedge must be effective: at the inception of the hedge, the impact of the hedged risk on the hedged and on the hedging item must "almost fully" offset; subsequently, effectiveness must be tested regularly throughout its life.

Requirement (2) claims that, to be classified as effective, the hedge does not have to be perfect. The constraint is rather that the hedge is expected to be:

(i) Highly effective at inception, i.e. changes in fair values should ‘almost fully’ offset, and

(ii) Effective in practice throughout the life of the hedging relationship i.e. the ratio of the change in fair value of the hedged item and the hedging item must remain within a range of 80% to 125%. If during its life the hedging relationship fails to remain within the pre-set range, the derivative will be accounted for at its mark-to-market whereas the assets or liabilities at historical cost.

A third hedge accounting constraint applies to the hedge of an expected future transaction. In this case the transaction being hedged must be 'highly probable', which means its timing can be forecast reliably within three months period (see [1]). However, as in this work we have not considered the problem of hedging expected future transactions, in the rest of this document we will focus only on the first two requirements.

This work is based on a common example: interest rate swaps hedging a group of loans. In particular, we developed and implemented a procedure that assists practitioners in the monitoring of the hedging relationships between swaps and loans qualifying for hedge accounting.

IAS39 recognises three kind of hedging relationships, according to the type of risk being hedged and to the source of the exposure: fair value hedge, cash flow hedge, and hedges of a net investment in a foreign entity. A detailed description of these hedging relationships is not in the scope of this analysis (which is restricted to the fair value hedge) and can be found in [2] (page 43). In the fair value hedge the risk being hedged is a change in the fair value of a recognised asset or liability (due in our case to a movement in interest rates) that will affect the income statement. The following section illustrates a procedure whose goal is to identify as many as possible hedging relationships meeting the above mentioned accounting constraints necessary to qualify for hedge accounting and to maximise the effectiveness of the hedge. According to the requirement of IAS39, a hedging relationship is defined for the entire life of the hedging instruments. The procedure associates to any given swap a combination of loans (or bonds) so that the resulting hedged portfolio is effective (point (2) above). In practice, the procedure aims at fulfilling the effectiveness criteria at inception (first constraint) leaving the monitoring of the effectiveness of the hedge during its life to an ex-post calculation time.

3. The procedure

In the following section, we will use the IAS39 terminology, and we will refer to a portfolio of a hedged and a hedging item as to a "hedge". As outlined above, the goal of this work is to build hedges that qualify for hedge accounting.

The idea is to search, for any given swap, the combination of loans (bonds) whose sensitivity to changes in the yield curve is of the "same type", but opposite in sign. By the "same type" we mean that in any given point of the yield curve the sensitivities of the two instruments are of the same magnitude. If this were the case the hedge would be insensitive to changes in the yield curve. Therefore, we would expect its net present value to be almost unaffected by these changes.

The selection of the best combination of existing loans (bonds) given a swap is based on the principle that at the time IAS39 is applied to a balance sheet, a bank should identify in its existing balance sheet, the existing transactions (and related derivatives) for which hedge accounting is sought. Typically, banks were extensively using so-called ALM swaps to hedge the entire balance sheet exposure, i.e. plain vanilla swaps which were reducing the total sensitivity of the balance sheet to interest rate movements. In this instance, the bank is confronted with the problem that a unique relationship between hedging derivatives and hedged assets or liabilities is not available.
Therefore, the bank should extract from its pool of loans or bonds the combination which is best hedged from the plain vanilla swaps entered into for ALM reasons.

Let S denote the swap and $L_1, L_2, \ldots, L_k$, a set of loans[1]. The hedged item can be written as $\sum_j x_j L_j$ where x_j indicates the portion of loan L_j used. Denote by $MMkt(S)$ and $MMkt(\sum_j x_j L_j)$ the actual swap and hedged item mark to market, and by $MMkt^i(S)$ and $MMkt^i(\sum_j x_j L_j)$ the mark to market values as computed in the ith scenario (i=1,2,3) where i=1 corresponds to a hypothetical shift of the yield curve of 100 bps up, i=2 to an hypothetical shift of 100 bps down, and the i=3 to an inversion of the yield curve.

Under IAS 39, the hedge will qualify for hedge accounting if conditions (i) and (ii) stated in the previous section are fulfilled. Condition (i) (i.e. the risks of the hedged and hedging items at inception almost fully offset), requires that the variation of the mark to market of the swap and of the hedging item, as a consequence of changes in the yield curve, are roughly of the same magnitude. This translates into the following relationship holding at initial time t_0, and for each hypothetical scenario i=1,2,3.

$$lb^i < \left| \frac{MMkt^i(S) - MMkt(S)}{MMkt^i(\sum_{j=1}^{k} x_j L_j) - MMkt(\sum_{j=1}^{k} x_j L_j)} \right| < ub^i \qquad i = 1,2,3, \qquad (1)$$

where lb^i and ub^i are pre-established lower and upper bounds. A hedge fulfilling relationship (1) is said to be effective at inception.

As time passes, the mark to market values of the considered items change and the above relationship can be affected by:

- changes in the yield curve;
- occurrence of maturing cash flows either in the swap or in the group of loans (bonds).

A change in the relationship is accepted by IAS39 which requires that the hedge must remain "effective in practice" during all its life. The meaning of "effective in practice" translates into the following relationship holding at any time $t > t_0$:

[1] The same methodology can be applied to bonds.

$$lb^i < \left| \frac{MMkt^i(S) - MMkt(S) + C^S}{MMkt^i(\sum_{j=1}^{k} x_j L_j) - MMkt(\sum_{j=1}^{k} x_j L_j) + C^H} \right| < ub^i \qquad (2)$$

where cashflows are taken into account by adding the quantities C^S and C^H that represent the total amount of cash flows matured between t_0 and t both on the swap and the hedged item side.

lb^i and ub^i are set respectively to 80% and 125%. When relationship (2) ceases to hold, the hedge becomes ineffective and it has to be discontinued.

The procedure is successful in building hedges that are initially effective. However, the monitoring of the effectiveness of the relationship (2) during the life of the hedge is left to the risk manager and is not handled by the procedure.

For each loan and swap the vector of sensitivities η of dimension m+1 (where m is the number of points in time for which observations on the yield curve are available) is calculated. For i=1,2,...,m, the ith component of η, say η_i, represents the sensitivity of the mark to market value to changes in the ith point of the yield curve. The m components are known as key rate durations (see [3]). The (m+1)th component represents the total sensitivity, i.e. the sum of the first m components, multiplied by a factor P:

$$\eta = \left(\eta_1, \eta_2, \ldots, \eta_m, P\sum_{j=1}^{m} \eta_j, \right),$$

where P is chosen by the user. The role of P will be clarified later.

In order to reduce the computational burden, for any swap S, a restricted number of K loans that may be "more suitable" as hedged items are selected. The "more suitable" loans are those whose vector of sensitivities η is similar (i.e. exhibiting sensitivity in the same points of the yield curve) and of opposite sign compared to the swap. K is chosen by the user. Within the K-subset, the "best " combination of k loans will then be chosen.

The procedure begins by identifying the K-subset. For this we define the Time Average Sensitivity (TAS) index, which is given by

$$TAS(Y) = \frac{\sum_{i=1}^{m} t_i |\eta_i(Y)|}{\sum_{i=1}^{m} |\eta_i(Y)|}$$

where Y={S,L}, and $\eta_i(Y)$ is the sensitivity of Y to the ith point t_i of the yield curve.

The K loans chosen are those exhibiting the "closest " distance from the swap in terms of TAS where the distance is defined as $|TAS(S) - TAS(L)|$.

The second step aims at finding the k-combination of loans, within the K-subset, that "best" hedge the swap S. In other words, the goal is to find the hedge whose loans are within the K-subset and whose effectiveness at inception is maximised. In our framework this corresponds to minimise the distance between the two vectors of sensitivities. This is achieved by two subsequent steps. First, given k loans, the procedure searches for the sequence $x_1, x_2, ..., x_k$ that minimises the objective function

$$\left\| \eta(S) - \sum_{j=1}^{k} x_j \eta(Lj) \right\|^2 \qquad (3)$$

under the constrains

(i) $0 \leq x_j \leq d_j$,

(ii) $\frac{a}{ub_3} \leq \sum_{j=1}^{k} C_j x_j \leq \frac{a}{lb_3}$

where d_j is the proportion of the jth loan still available (not previously used for hedging purposes), $a = \left| MMkt_3(S) - MMkt(s) \right|$ and $C_j = \left| MMkt_3(L_j) - MMkt(L_j) \right|$. The subscript 3 denotes the curve inversion scenario.[2]

The minimisation of the target function is applied to all the k over K combinations of loans and the minima are stored together with the corresponding coefficients.
Then, as a second step, the linear combination of loans for which the objective function shows a global minimum is selected. Loans and swap form the hedge that is a candidate for hedge accounting.

A discussion about the choice of the target function (3) and of the constrains is now required. While the choice of the metric and that of the first m entries of the vector of sensitivities is quite intuitive, the last entry, the total sensitivity times the parameter P deserves some comments. In general there is a trade off between hedging the swap against parallel shifts and curve inversion. Hedges, which are robust to parallel shifts of the yield curve, are sensitive to curve inversion and vice-versa. Since the minimisation of total sensitivity amounts to immunise the hedge against parallel shifts, higher values of P entail a better hedge against that scenario, but likely worst results in terms of curve inversion. The opposite holds for lower values of P. Then the user may act on P to establish the desired portfolio robustness in the first two or in the third scenario. Constrain (i) is a natural requirement, whereas constrain (ii) has been introduced to force (1) to be fulfilled in the curve inversion scenario. Furthermore it speeds up the procedure.

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[2] The minimisation problem defined here is equivalent to the Kuhn-Tucker problem that searches for a minimum of a quadratic function $f(\mathbf{x}) = \left\| A\mathbf{x} - b \right\|^2$ under certain constrains for **x**. The solution is found by using the Fortran routine E04NCF provided within the Nag Library (mark 19).

It is worth noting that the objective function has been defined independently from the scenarios used to measure hedge effectiveness. Hence we may expect the procedure to perform well even under different scenarios.

The algorithm is iterated for all the available swaps. Swaps are processed going from the highest to the lowest mark to market value. A different ordering may be likely to produce different results.

It is important to stress that a hedge selected by the procedure is a candidate for hedge accounting but not necessarily eligible. In principle the best hedge available may still be ineffective in one or more scenarios and therefore unsuitable for hedge accounting.

The following section shows an example of a hedge that is initially effective and stays "effective in practice" throughout its life.

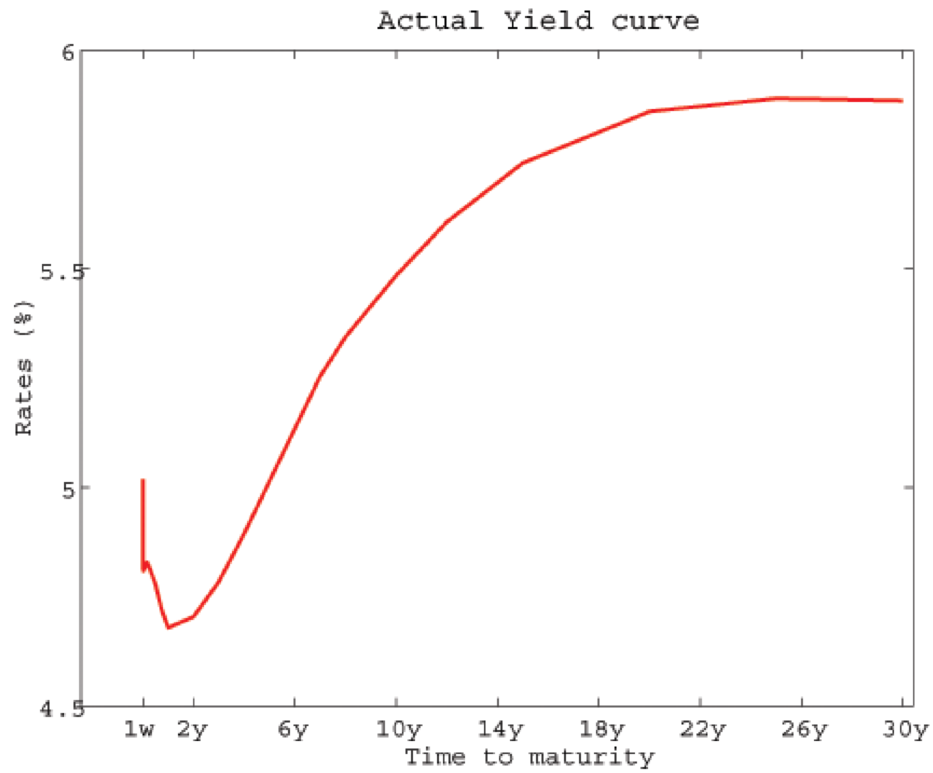
4. Example

Here we consider a bullet payer swap, whose main features are reported in the table below.[3]

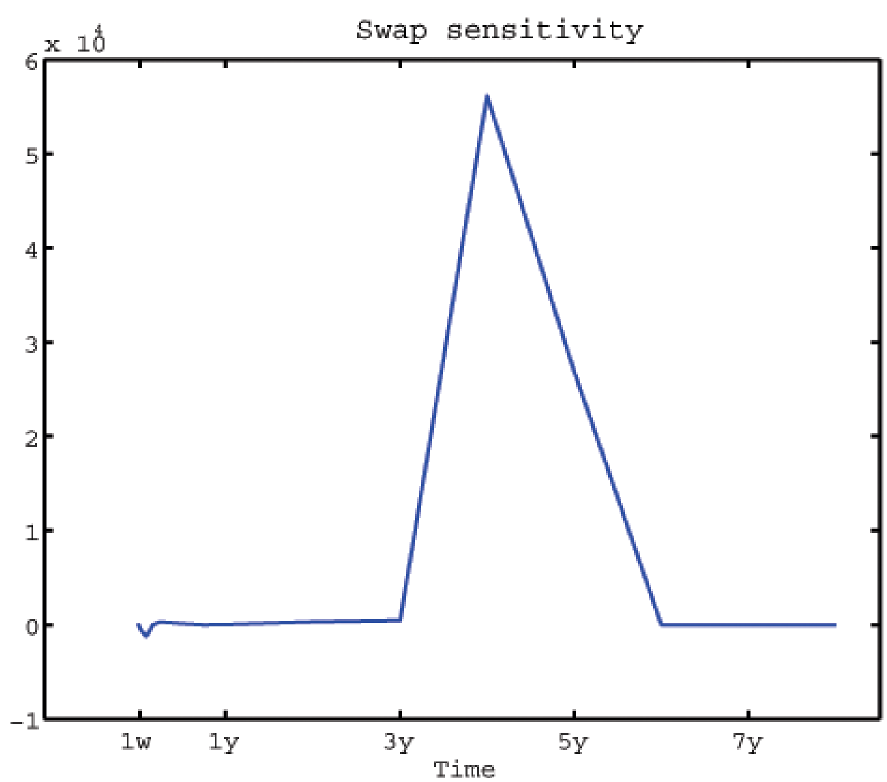
Pr	Rate	TTM	TAS	Tot. Sens.	MMkk
218	5.82	4.33	4.31	82,593	-14.17

Time to maturity (TTM) and TAS are expressed in years, the principal (Pr) and the mark to market (MMkt) in million Euros. The swap is hedged by using at most k=7 loans. The number of loans available is 428 (amortizing and bullet). The actual yield curve is shown in Figure 1.

[3] The data used in the example were provided by the European Investment Bank.



The sensitivities of the swap in each point of the yield curve are plotted in Figure 2.



As evident from the picture the swap exhibits greater sensitivity just before its expiry date. The parameters of the routine are set to K=20 and P=10. Portfolio total sensitivity and hedge effectiveness at inception for each of the three scenarios (in percentage points) are reported below:

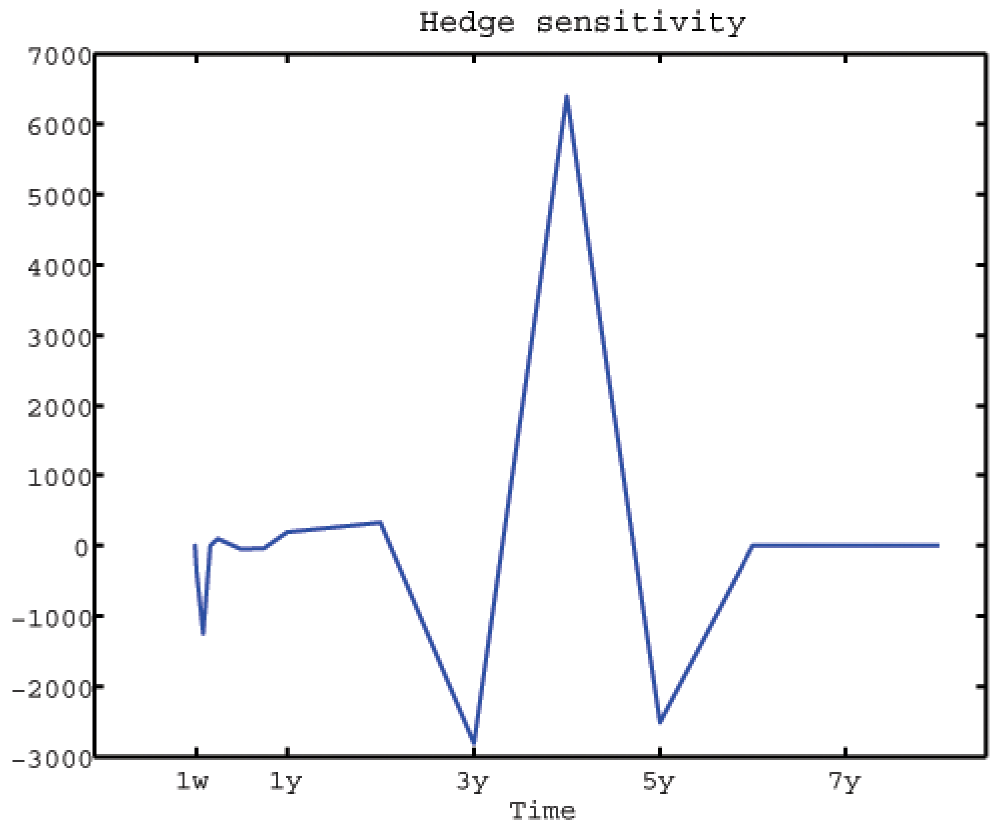
Tot. Sens.	+100bps	-100bps	Curve Inv.
-28.37	99.93	100.00	101.93

The hedge has proved to be almost perfectly effective in scenario 1 and 2 and very good in scenario 3 and therefore qualifies for hedge accounting. The hedging item is composed by loans with the following features:

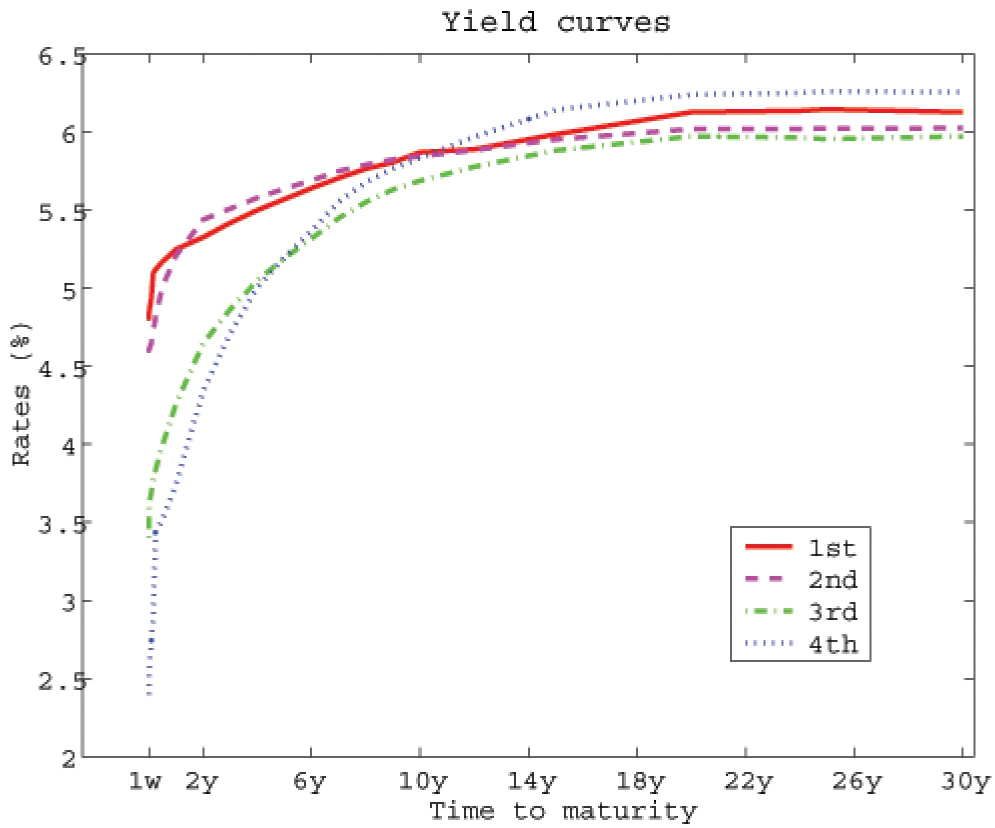
Id	**%**	**Type***	**Pr**	**TTM**	**TAS**	**Rate**	**Fr**
1	100	B	60.1	4.42	4.33	5.1	1y
2	100	B	21.5	4.41	4.26	4.33	1 y
3	74.2	A	76.2	4.75	4.27	-	-
4	100	B	15.5	4.42	4.32	5.42	1 y
5	100	B	18.76	4.42	4.34	4.31	1 y
6	100	B	11.24	4.42	4.34	4.31	1 y
7	100	B	33.9	4.42	4.34	4.33	1 y

One may observe that bullet loans are entirely taken. This is because all these loans have time to maturity almost equal to that of the swap but smaller principal. Therefore, their sensitivities are almost coincident in time, opposite in sign and smaller in magnitude. The amortizing loan, whose sensitivity is spread over time, is finally selected since the amount of bullet loans was not sufficient to offset the swap sensitivity.
The sensitivity of the resulting hedge is shown in Figure 3.

* A = ammortising, B = bullet



Note that the hedged item has considerably reduced (by a factor of ten!) the high sensitivity peak displayed by the swap.
As time passes by the hedge tends to lose its effectiveness. IAS 39 takes this into account, but it requires the hedge to remain "effective in practice" through time. In this example we have chosen four dates to verify hedge effectiveness in practice by computing the ratios given in (2). In each date we arbitrarily impose a yield curve evolution. The yield curves are shown in Figure 4.



The effectiveness ratios are shown below

Time	+100bps	-100bps	Curve inv
12 m	99.35	99.49	99.38
16 m	93.49	93.93	93.60
28 m	96.02	96.25	95.86
40 m	92.7	92.94	93.18

Although lower than at inception, the ratios fall within the pre-established bounds and the hedge remains effective.

The choice of the points in time at which ratios are computed is arbitrary. However our choice focussed on those date that are expected to be critical, such as those immediately after a cash flow payment from the swap side. In these circumstances there is a lack of balance between the cash flows stream of the swap and that of the hedging item that are likely to produce a bad performance of the hedge. The fact that in these dates the ratios are within the pre-established bounds strengths our confidence in the quality of the hedging performance.

5. Concluding remarks

In this work we have proposed an algorithm identifying hedges involving swaps and loans (or bonds), that qualify for hedge accounting under IAS 39. The effectiveness of the hedges is then monitored through time although the choice of the points in time when the hedge is to be monitored is left to the user. The core of the procedure is the target function (3), which seems to be properly designed as confirmed by the example and several other trials. Nevertheless other forms of this function maybe thought of. For instance one may also take into account the degree of correlation among yield rates as in [4]. A final remark regards the choice of the scenarios. In our view parallel shifts and curve inversion scenarios are probably very simple cases. More realistic scenarios could be considered, for instance by making use of principal components analysis. Identifying two or three main factors (or components) which drive the yield curve evolution one could then compute the ratios with respect to movements of those factors.
Finally, it must be noted that hedge effectiveness is influenced also by the variable leg of the hedging swap. In fact even in case of a fixed leg of a swap mirroring the cash flows of a set of loans, the mark to market of the hedging item and the hedged item will not behave at the same way. This effect becomes unmanageable if the second leg of the swap is not a variable rate but a fixed rate.

6. References

[1] Price Water House and Coopers, Financial Instruments. IAS39: The Essential Guide to the Q&As.
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[3] Ho T.S.Y., (1992): "Key Rates Durations: Measures of Interest Rate Risks ", The Journal of Fixed Income, pp 29-44.
[4] Falkenstein E. and Hanweck J. (1996): "Minimizing Basis Risk from Nonparallel Shifts in the Yield Curve ", The Journal of Fixed Income, Vol 6 No1.