2011 International Conference on Economics and Finance Research
IPEDR vol.4 (2011) © (2011) IACSIT Press, Singapore

Methodological and programming impairment solution of performing loans for banking companies

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Abstract - **As per International Financial Regulatory Standards, a banking company applies impairments to loans positions in order to emphasize fair value of its positions. IFRS recommends primordially using of present value of future cash-flows. Firstly, we ground a rational methodology for present value of future cash flows to be used for performing loans, and present value of guarantees for non-performing loans. Secondly, it will be presented a programming solution for having calculated present value of future cash-flows for all outstanding loans, process which is often invoked as difficult and time-consuming. The more numbers of positions are, the more performing is the programming solution, which replaces a basic script process of few days running to some minutes by using current script. Thirdly, we propose usage of modified duration methodology for setting up a risk-return profile. Programming solution is returning modified duration of loans, a term borrowed from fixed-income instruments, which reveals the banks' rigidity to change interest rate and spreads for outstanding loans. Research methods are deductive, logical and programming, as well. The result is a timely optimized impairment and related modified duration solution which encompasses the methodological proposal.**

Key words - Present value of future cash flows for loans, modified duration, risk-return profile, temporary data in Visual Basic, and impairment

I. INTRODUCTION

By this research paper, we shall present a methodology for impairment and a programming solution to overpass the impossibility to estimate the recoverable amount of the individual loan. This way a banking company should have a handy tool to determine the market value of the loans, which will be considered primordially in impairments calculations. The value of guarantees, as calculated by external appraisers, will be considered partially, for currently non-performing loans and part of current performing loans (by considering that from current performing loans some will be affected by non-performance).

II. METHODOLOGICAL AND PROGRAMMING IMPAIRMENT SOLUTION OF PERFORMING LOANS FOR BANKING COMPANIES

A. Research methodology and literature review about impairment methodology for loans

Methodology used in research is deductive and logical as well. Deductive process is used to consider in banking practice the using of present value of future cash flows in impairment process of loans. As well, it is proposed the borrowing of a sensitivity tool used for bonds to be used for loans as well.

Literature review is deriving from willing of authors to offer solutions for implementation of International Accounting Standards for banking companies.

International Accounting Standards no. 36 – Impairment of Assets, paragraph 39 (IASB, 2009)[1] states that estimates of future cash flows include:

a) Projections of cash flows from continuing use of the asset;

b) Projections of cash outflows that are necessarily incurred to generate the cash inflows from continuing use of the asset (including cash outflows to prepare the asset for use) and that which can be directly attributed, or allocated on a reasonable and consistent basis, to the asset; and

c) net cash flows, if any, to be received (or paid) for the disposal of the asset at the end of its useful life.

As well, International Accounting Standards no. 36 paragraph 66 (IASB, 2009)[2]states that if there is any indication that an asset may be impaired, recoverable amount is estimated for the individual asset. If it is not possible to estimate the recoverable amount of the individual asset, we should determine the recoverable amount of the cash-generating unit to which the asset belongs (the asset's cash-generating unit).

Provisions, according to International Accounting Standards no. 37 – Provisions, Contingent Liabilities and Contingent Assets, will be revised with the occasion of every balance-sheet and adjusted to reflect the best current estimation. If an outflow of resources is not probable anymore, the provision should be canceled. Provisions will not be recognized for future activities (IASB, 2009)[3]. Estimation of a future loss from exploitation reveals the fact that some assets could be impaired. The impairment is done according to IAS 36.

Banks' financial reports comprise recognized measures and additional disclosures of loan default. The recognized measures are the allowance for loan losses (a contra-asset to loans outstanding), the loan loss provision (expense which increases the allowance for loan losses), and loan write-offs (which reduce loans outstanding and the allowance for loan losses - accounting treatment to recognize reduced value of impaired asset). The main additional disclosure is for non-performing loans. As well, large size and the possibility of

renegotiation provide rationales for banks to provide for losses a loan-by-loan basis rather than by statistical analysis of historical data (Liu, 1995). [4]

Many of the reasons that loan loss provisions are good news stem from the fact that they are discretionary expenses. Loan write-offs are much less discretionary and are not expenses, though they do reduce. Write-off are not discretionary, even if reduce tax payments and capital (Wahlen, 1994).[5]

Loan loss provisions are good news only for "at risk" banks in the fourth quarter. Loan loss provisions for "not at risk" banks and in the first through third quarters are bad news. (Liu, 1997).[6]

Currently, Internal Accounting Standard Board recognizes impairment of financial assets using an 'incurred loss' model (Sheridan, 2010)[7]. The model proposed by the IASB in its Exposure Draft (ED) issued in November 2009 is an "expected loss" model. Under this model expected losses are recognised through the life of a loan, not just after a loss event has been identified. (Sheridan, 2010). FASB has recently issued a proposed Accounting Standards Update (ASU) 'Accounting for Financial Instruments and Revisions to the Accounting for Derivative Instruments and Hedging Activities' in contrast to the phased approach being adopted by the IASB (Sheridan, 2010). This approach is closer to the IASB 'incurred loss' model currently being used rather than the 'expected loss' model being proposed, as the assessment of collectability of expected future cash flows is based on all available information relating to past events and existing conditions. The 'expected loss' model is based on forecasting expected losses at the inception of the loan taking into account projections of relevant economic factors. The 'expected loss' model may be more helpful to the prudential regulators who will be seeking to have additional amounts provided in excess of the accounting provisions being made under current standards.

IASB proposal to use an expected loss model is converging toward Basel Committee on Banking Supervision recommendations. Impairment should be identified and recognized when it is not probable or no reasonable assurance exists that the enterprise will be able to collect all amounts due according to the contractual terms. The instrument should be measured at its estimated realizable value. (BCBS, 2000 and Krueger, 2002)

Measurements of Probability of Default Based in credit risk models could be done on accounting data (scoring models, statistical models) and based on market data. The main advantage of market-price-based measures over accounting-data-based measures is that they pick up more subtle and fast-moving changes in borrower conditions, such as those that are reflected in capital market data and values. In addition, accounting-data-based measures are often only tenuously linked to an underlying theoretical model. (Estrella, 2000)

By this research paper we will replicate a rational methodology by building an "expected loss" model as long performing loans will continue to be paid in due time until maturity, and non-performing loans will be liquidated in 4 to 7 years (as currently considered as recovery time for guarantees).

The splitting of loans in performing and non-performing in different percentages in relation to impairment approach is a methodological process which each bank is following in a different way. The necessity to have a more common approach in impairments for those companies applying IFRS requirements, a set o common standards should be followed by banks. IFRS should recommend some approaches to cash-flows to be used in discounting, to recovery period, discount factor, inflation and allocation per guarantees.

B. Reasons for using modified duration methodology for loans

Strategic assets allocation process takes part from a larger selection process from great variety of banking products. This is closely related with assets quality approach included in CAMELS concept (Capital adequacy, Assets quality, Management, Earnings, Liquidity, and Sensitivity to market risk).

In current practice, there are specialized programs to allocate in a strategic manner the assets and liabilities of a banking company, by using return and risk and Markowitz efficient frontier as a method of selection.

One of most synthetic indicators for featuring risk profile of a banking company is the risk-return ratio. (Guill, 2008)[8]. For returns are considered potential returns for each on and off balance sheet item. For risk is considered average time to recover the invested amount. Sanford considered that corporate loans are similar to corporate bonds, and Borge decided to use the observable changes in corporate bond spreads to estimate the volatility in value of corporate loans with the same rating. (Guill, 2008) This way, average time to recover the money is an indicator similar to modified duration one, largely used in bonds sensitivity analysis. The third element for encompassing the risk risk-return profile is given by individual weights.

The modified duration indicator has a closely relationship during the strategic assets allocation, because the lately one could not become operational unless the on and off assets positions become highly liquid and are recovered being ultimately transformed into cash. This process is naturally happening when assets positions are matured. Average maturity for invested positions is emphasized by modified duration. For bonds, modified duration is returning firstly sensitivity information and, secondly, the time to recover the money. For loans, we are returning a value which is more valuable as time to recover the money compared to sensitivity information (Weil, 1973)[9].

The duration is an average of periods multiplied with discounted cash-flows over the price (the time necessary to recover the invested money). Multiplying the duration with a discount factor (1 / (1+ yield / number of payments per year)), we obtain an introduction of re-pricing influence in risk sensitivity, the so-called modified duration. It gives real information of price sensitivity to yields, assuming we don't reinvest in the same position the cash-flows.

Considering re-pricing period methodology (bucketing of loans depending on time scheduled to change the interest rate

and comparison of assets and liabilities on maturity buckets using this methodology), we would assume long-term reinvestment of cash-flows on the same position, with no information of the time to recover the money.

By using modified duration methodology, we introduce a multi-annual analysis of returns versus re-pricing gap methodology which is an immediate gap analysis.

Present value of future cash flows determination is a kind of basic platform from which are deriving a lot of functionalities. Firstly, as presented above, present value of future cash-flows is the base for calculation of modified duration for all assets and liabilities, and not for bonds only. The main challenge is for loans due to thousands of positions involved.

Secondly, the loans market value is referential for impairment methodology. Usually, the banks are considering the present value of guarantees, totally ignoring the cash-flows derived from loans. This way, they suppose that all loans will default, and by consequence recovery is coming from guarantees only.

Thirdly, the implementation of risk-return methodology in current practice of Assets and Liabilities Committees would permit to banks to establish a strictly defined time interval, during which could be granted an increased interest to some liabilities positions, in the process of increasing liquidity and promotional funding. Even the risk-return ratio is temporarily deteriorated, the process is under control, by defining exact timing, in order to stop deteriorating this ratio. From increased liquidity, the future risk-return ratio will be improved.

The way by which present value of future cash flows and deriving modified durations for loans positions are calculated (most challenging balance sheet position due to long time recovery period – until 35 years, with monthly installments, and thousands of positions) is presented hereinafter by using a Visual Basic script. For very liquid positions, modified duration is zero, and for deposits not having intermediary cash-flows, modified duration is equal with residual maturity. For bonds, modified duration is as specified by specialty literature.

C. Programming solution using temporary data for speeding up processes in loans present value of future cash flows and modified duration calculations

The main peculiarity needed to be implemented after some optimization processes was to create temporary data (declared as Variant) where calculations to be performed as in memory, and not to be written in sheets, otherwise the process of calculation is very long. This way. the process of calculation was optimized from few seconds per loan to 2 minutes for 10000 loans.

Data set are hypothetical (in our simulation we have used (10.000 loans with variable maturities until 35 years, data is in equivalent EURO), being formed from 6 types of loans having the following descriptive stored beginning with a specified cell (colum 1, row 4) until column 9, row 4 (id, customer number, loan type <including currency>, customer name, current date, maturity date, number of monthly periods until maturity, nominal outstanding, and monthly interest rate %)

Hereinafter is presented the Visual Basic script within a spreadsheet file with specific explanation of performed sub-operations.

```
' Name of the program
        Sub loans_present_value()
' Marks beginning time of calculus process
        timp0 = Time
' Dezactivates the automatic calculation
        Application.Calculation = xlCalculationManual
' Hides screen visualizations
        Application.ScreenUpdating = False
' Calculate
        Calculate
' Determines number of positions
        n = Sheets("md").Cells(2, 2).Value
' Defines temporary files with 423 rows and 17 columns
        Dim tmp(423, 17) As Variant
        Dim tmp2(423, 17) As Variant
' Displays status bas in the bottom part of the sheet
        Application.DisplayStatusBar = True
' Defines calculation line and destination  cell
                        LastRow_md =
  Worksheets("md").Cells(Rows.Count, 2).End(xlUp).Row
            md = Range(Worksheets("md").Cells(1, 1),
          Worksheets("md").Cells(LastRow_md, 9)).Value
' Defines maturities
        maturitati = Array(0, 1, 3, 6, 9, 12, 18, 24, 30, 36,
        48, 60, 84, 120, 180, 240, 360, 420)
' Prepares sheet by deleting previous recordings
        Sheets("md").Range("J4:BQ50000").ClearContents

' Perfoms iterations
        For i = 4 To LastRow_md
' Displays the calculated position and time from inception
in the bottom side of sheet
         Application.StatusBar = "linia " & i & " / " & n &
        "; " & Format(Time - timp0, "hh:mm:ss") & "s"
' Cleans temporary sheets
        Erase tmp
        Erase tmp2
' Calculus for first loan; takes data from sheet “md”
' id
        tmp(4, 1) = 1
' customer number
        tmp(4, 2) = md(i, 2)
' loan type
        tmp(4, 3) = md(i, 3)
' customer name
        tmp(4, 4) = md(i, 4)
' current date
        tmp(4, 5) = md(i, 5)
' maturity date
        tmp(4, 6) = md(i, 6)
' number of monthly periods until maturity
```

```
            tmp(4, 7) = md(i, 7)
' nominal outstanding
            tmp(4, 8) = md(i, 8)
' monthly interest rate (%)
            tmp(4, 9) = md(i, 9)
            k = 4
            present_value = 0
            tcd = 0
          tmp(k, 11) = PPmt(tmp(k, 9), k - 3, tmp(4, 7), -tmp(4,
8), 0, 0)
          'tmp(k, 8) = tmp(k - 1, 8) - tmp(k, 11)
          tmp(k, 10) = IPmt(tmp(k, 9), k - 3, tmp(4, 7), -tmp(4,
8), 0, 0)
          tmp(k, 12) = Pmt(tmp(k, 9), tmp(4, 7), -tmp(4, 8), 0,
0)
          'Yield to maturity
          ww = 0.0625 / 12
          tmp(k, 17) = 0.0625 / 12
' Calculation for discount factors (d)
          tmp(k, 14) = 1 / (1 + tmp(k, 17)) ^ (k - 3)
          tmp(k, 15) = (k - 3) / 12
' Calculation of the product between time (t) si cash-flows (c)
          tmp(k, 16) = tmp(k, 15) * tmp(k, 12)
          tmp(k, 13) = Abs(PV(tmp(k, 17), tmp(k, 7), tmp(k,
12), 0, 0))
' Calculation of market value for first loan
          present_value = present_value + tmp(k, 12) * tmp(k,
14)
' Calculation of duration for first loan
          tcd = tcd + tmp(k, 14) * tmp(k, 16)
' Calculation for next loans; takes data from temporary sheet
  “tmp”, in order to increase speed
            'Dim m As Integer
            m = md(i, 7) + 3 'number of row from temporary
            file
            For k = 5 To m

            tmp(k, 1) = k - 3
' id
          tmp(k, 2) = tmp(4, 2)
' customer number
          tmp(k, 3) = tmp(4, 3)
' loan type
          tmp(k, 4) = tmp(4, 4)
' customer name
          tmp(k, 5) = tmp(4, 5)
' current date
          tmp(k, 6) = tmp(4, 6)
' number of monthly periods until maturity
          tmp(k, 7) = tmp(k - 1, 7) – 1
          'Calculate
' monthly interest rate (%)
          tmp(k, 9) = tmp(4, 9)
          tmp(k, 11) = PPmt(tmp(k, 9), k - 3, tmp(4, 7), -
tmp(4, 8), 0, 0)
          tmp(k, 8) = tmp(k - 1, 8) - tmp(k, 11)
          tmp(k, 10) = IPmt(tmp(k, 9), k - 3, tmp(4, 7), -tmp(4,
8), 0, 0)
          tmp(k, 12) = Pmt(tmp(k, 9), tmp(4, 7), -tmp(4, 8), 0,
0)
          tmp(k, 17) = 0.0625 / 12
' Calculation of discount factor (d)
          tmp(k, 14) = 1 / (1 + tmp(k, 17)) ^ (k - 3)
          tmp(k, 15) = (k - 3) / 12
' Calculation of the product between time (t) and cash-flows
(c)
          tmp(k, 16) = tmp(k, 15) * tmp(k, 12)
          tmp(k, 13) = Abs(PV(tmp(k, 17), tmp(k, 7), tmp(k,
12), 0, 0))
' Calculation of market values for next loans
          present_value = present_value + tmp(k, 12) * tmp(k,
14)
' Calculation of duration for next credits
          tcd = tcd + tmp(k, 14) * tmp(k, 16)
            Next k
' Storage in temporary file „tmp” of six final data for each
loan
                    ' Monthly payment
                      tmp(2, 12) = tmp(4, 12)
                    ' Present value
                      tmp(2, 13) = present_value
                    ' Product between time, cash, and
discount factor
                       tmp(2, 14) = tcd
                    ' Duration
                       tmp(2, 15) = tcd / present_value
                     ' Calculation of modified duration
                         tmp(2, 16) = tmp(2, 15) / (1 + 0.0625
                         / 12) ’ 0.0625 is yield to maturity
                     ' Calculation of „dollar value of one basis
point”
                         tmp(2, 17) = tmp(2, 13) * tmp(2, 16) *
0.0001
' Storage of 17 final results from temporary field „tmp”
featuring each loan
            For col = 10 To 15
                Sheets("md").Cells(i, col) = tmp(2, col + 2)
            Next col
            For linie2 = 4 To m
                For col = 1 To 17
                        tmp2(linie2 - 3, col) = tmp(linie2, col)
                Next col
            Next linie2
        'Centralisation of data
        total_princ = 0
        total_int = 0

        For mat = 1 To 17
          a = 2 + Null
          temp_princ = 0
          temp_int = 0
```

```
        For linie3 = maturitati(mat) + 1 To maturitati(mat + 1)
            ‘ Calculation of Total Principal
                If IsNull(tmp2(linie3, 11)) = False Then total_princ = total_princ + tmp2(linie3, 11)
            ‘ Calculation of Principal on maturities
                If IsNull(tmp2(linie3, 11)) = False Then temp_princ = temp_princ + tmp2(linie3, 11)
            ‘ Calculation of Total Interest
                If IsNull(tmp2(linie3, 10)) = False Then total_int = total_int + tmp2(linie3, 10)
            ‘ Calculation of Interest on maturities
                If IsNull(tmp2(linie3, 10)) = False Then temp_int = temp_int + tmp2(linie3, 10)
        Next linie3
            ‘ Storage in sheet “md” of principal and interest for each standard maturity bucket and for each loan
            Worksheets("md").Cells(i, mat + 16).Value = temp_princ
            Worksheets("md").Cells(i, mat + 34).Value = temp_int
            Worksheets("md").Cells(i, mat + 52).Value = temp_princ + temp_int
      Next mat
‘ Storage in sheet “md” of principal and interest per total for each loan
        Worksheets("md").Cells(i, 16).Value = total_princ
        Worksheets("md").Cells(i, 34).Value = total_int
        Worksheets("md").Cells(i, 52).Value = total_princ + total_int
   Next i


        Sheets("main").Activate
        ActiveSheet.Range("c23").Select
 ‘ Displays a message that calculation has been finished in “x” time period
        MsgBox "Calcul finisehd in " & Format(Time - timp0, "hh:mm:ss") & "s"
        Calculate
        Application.DisplayStatusBar = False
        Application.ScreenUpdating = True
End Sub
```

The calculations of centralized dollar value of one basis points (present value of one basis point), present value and average modified duration should be done one each portfolio (EURO, USD, RON) and currency (corporate / retail) by using simple spreadsheets solutions. The storage sheet (called “md”) are introduced by the command line, as presented above:

```
' Storage of 17 final results from temporary fields „tmp” featuring each loan
        For col = 10 To 15
            Sheets("md").Cells(i, col) = tmp(2, col + 2)
```

Final synthetic data should look as presented in Table 1- Selection of final synthetic figures.

Any decreased present value against book value (nominal) should determine the value of impairments. This case (as presented in Table 1) performing loans should be impaired for corporate loans denominated in USD currency. This operation of impairment should be easily identified by comparing the average yield to maturity used for discounting (6.25%) with the average interest rate of specific portfolio.

III. CONCLUSIONS

By accepting this methodology of specific impairment of loans and using of modified durations in risk-return analysis, and applying current programming solution, the banking profitability is optimized, by choosing an impairment solution based primordially on present value of future cash-flows and secondly on the value of guarantees.

Modified duration is given a tool in Assets and Liabilities Committees (ALCO) meetings to find fine tuning solutions based on three elements (weights, modified duration, and potential returns). There is obtained a time to recover the money information needed in risk-return analysis. As well, could be derived the following tactical measures for ALCO members:

a) If market value is too high, it means that market yields used for discounting are too low; therefore there is a high probability to face refinancing (customers running away to other banks); measures to be taken: decrease interest rates through spreads;
b) If the market value is too low, it means the market yields are too high, firstly, there is needed an impairment; secondly, Bank’s loans are competitive versus competition; measures to be taken: there is room for potential increase of spreads for new loans.

The actual methodology could be improved by using different yields for discounting the future cash-flows for loans, by adding adequate spreads for each specific loans, inflation and foreign exchange influence.

The main benefit is far away from processing a high number of loans in a timely manner, whose market values are calculated and from whose comparison with book value is deriving the level of write-off to be applied to each loan due to impairment. Nowadays, impairment methodology being crucial in banking profitability, the inputs in impairment solutions, in the form of variables or methodology, should acquire special attention.

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TABLE I. SELECTION OF FINAL SYNTHETIC FIGURES

thousands EURO

description	Total	Corporate loans in RON	Corporate loans in EUR	Corporate loans in USD	Retail loans in RON	Retail loans in EUR	Retail loans in USD
Nominal	280,758	49,057	174,106	1,622	767	55,159	46
Nominal weight	100%	17.47%	62.01%	0.58%	0.27%	19.65%	0.02%
Presebnt value	287,339	49,599	174,793	1,620	1,181	60,100	47
Average interest rate	7.12%	10.19%	6.54%	5.69%	13.71%	7.21%	8.37%
Average modified duration (years)	2.785	0.299	1.337	0.287	6.828	9.037	1.267
Present value of one basis point	80	1	23	0	1	54	0
Total cash-flows (future value)	364,681	50,624	191,972	1,649	1,943	118,441	51