The Internal Capital Adequacy Assessment Process ICAAP – a New Challenge for the Romanian Banking System

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Abstract. *In the near future, Romanian banks will have to implement the second pillar of the Basel II (ICAAP) Agreement. Given this new challenge (in addition to the ongoing economic and financial crisis), my article analyzes and presents both the main requirements of the process, in compliance with the NBR regulation draft, as well as some of the principles and methods used by advanced banks.*

Thus, I've analyzed some of the methods for the assessment of economic capital requirements for credit, market and operational risks (while also explaining the difference between economic capital and regulatory capital), based on the theory of unexpected losses, sustained by case studies.

Keywords: risks; economic capital; unexpected loss; default; Value-at-Risk.

JEL Codes: G21.
REL Codes: 11C, 11E.

Introduction

In order to sustain healthy and profitable banking activities, protect the interests of their shareholders and clients and avoid inducing negative effects upon the national or, in some cases, even the regional or global economy, banks must grant special importance to the identification, monitoring and limiting of risks.

The results of the assessment of a bank's exposure to the main risk categories (credit risk, liquidity risk, operational risk, market risk, reputation risk and other) leave the bank's management with two possibilities:

- to assume the exposure towards the respective risks, as the potential losses will be covered either from the net profit obtained during the course of the bank's activities, or from the bank's own funds/ capitals drawn up during its existence;
- to take the decision of transferring these risks (for example via an insurance), of eliminating the activities which led to the occurrence of the respective risks or of limiting the exposures to a controllable level.

In this respect, the banking current practice reflects the existence of two approaches on the determining of capital adequacy/own funds covering the risks undertaken:

- one in compliance with the regulations elaborated by the prudential supervision authorities which determine the risk assessment models and the methods for the computation of regulatory capital; the Basel I and Basel II Agreements are relevant in this respect;
- the other one in compliance with the bank's internal methods for the assessment of capital adequacy to risks (ICAAP- Internal Capital Adequacy Assessment Process), mainly based on the economic capital method.

Currently, the most important international standard in the domain of risk management is the Basel II Agreement on the International Convergence of Capital Measurement and Capital Standards for credit institutions and investment companies issued by the Basel Committee for Banking Supervision.

The Basel II Agreement is made up of three pillars (segments), namely the minimum capital requirements, the supervisory review process and market discipline, the purpose of which is to achieve higher levels of security and strength of the financial and banking system.

We mention that the implementation of the Basel II Agreement at the level of the Romanian banking system has begun in 2008, but out of the three pillars only the first one was fully implemented. This pillar is the one stipulating the necessity of computing the bank's solvency indicator (capital adequacy ratio):

$$\frac{\text{Total capital}}{\text{Credit Risk + Market Risk + Operational Risk}} = \text{Capital Adequacy Ratio (8\% minimum)}$$

The second pillar of the Basel II Agreement (ICAAP) stipulated requirements concerning both the monitoring authority and the banks monitored, demanding efficient internal processes, able to assess the own capital adequacy ratio based on a proper

assessment of portfolio risks (which, in general, entail different methods than the ones requested by prudential regulations).

1. The implementation of the 2nd pillar of the Basel II Agreement (ICAAP) – a new challenge for the Romanian banking system

The 2nd pillar of the Basel II Agreement will be implemented by the Romanian banking system sometime during 2009. Its specific regulations are currently at draft stages at NBR level.

Thus, banks will be required to elaborate own strategies and procedures on the internal assessment process of capital adequacy to risks, which must cover:

a) risks for which regulated capital requirements were elaborated, in compliance with NBR and CNVM Regulation no. 13/18/ 2006 on the determining of the minimum capital requirements for loan institutions and investment companies, including significant differences between the regulated treatment of risks for the computation of the minimum capital requirement and the treatment stipulated for the internal capital adequacy assessment process;

b) risks that have no capital requirements regulated, namely:

- risks derived from the utilization of less sophisticated approaches (the underestimating of credit risk in the context of the standard approach; the underestimating of operational risk in the context of or basic or the standard approaches);
- the underestimating of loss given default in crisis situations;
- the residual risk afferent to the techniques used for the mitigation of credit and securitization risk;

c) risks such as: the interest rate risk derived from activities outside the bank's trading book portfolio, concentration risk, liquidity risk, payment risk, reputation risk and strategic risk.

For the risks included in this category, banks may use qualitative assessments and risk diminishment methods (in other words, they must not have capital put aside).

d) risks outside the credit institution, namely the risks entailed by the regulatory environment, economic environment or the by the bank's unfolding of activities which cannot be classified in the situations listed under let. a-c.

Given this new challenge for the Romanian banking system, I would like to present one of the principles and methods used by advanced banks (from this point of view).

The internal capital adequacy assessment process (ICAAP) is used to assess the bank's possibilities to take on risks, reporting the result of the aggregation of all risk categories to its economic capital (thus determining its coverage potential). The bank uses its coverage potential to determine its risk appetite/limits, proactively administrating its risk portfolio.

The main objectives of the ICAAP system are the following:

- the analysis, monitoring and reporting of the bank's risk exposures, as well as its capital sources;
- the analysis, monitoring and reporting of the bank's capital adequacy/coverage potential with respect to its risk profile;

▪ forecasts on the evolution of risk exposures and the bank's capital/exposure coverage potential;

2. General principles on the assessment of economic capital requirements

The internal capital adequacy assessment process is based on the following principles:

a) the utilization of "economic capital", which differs from "regulatory capital", defined as each bank considers adequate, conditional upon its own risk profile and experience in risk management;

b) the capital necessary for each transaction is defined by the bank in compliance with its own risk exposure assessments associated to the respective transaction, considering credit risk, market risk or operational risk, as well as other risks (such as strategic or liquidity risk, etc.).

The *economic capital* is a bank's means of protecting itself against the various risks derived from banking activities, the objective of which is the covering of all potential unexpected losses.

The *expected loss* is the average estimated loss for a transaction/portfolio in a time interval.

Banks generally compute reserves or provisions for the expected losses, which are covered by the profit achieved during the respective financial exercise and included in the price of the transaction.

An *unexpected loss* represents the possibility that the actual loss might exceed the expected loss, and bank must have sufficient capital to cover this loss as well.

Furthermore, the economic capital is the capital necessary for a bank to remain solvent in case of extreme loss (unexpected losses computed at a specific confidence level and a specific time span) occurrences due to the improper evolution of the macroeconomic environment, market conditions, the economic and financial performances of clients towards whom the bank registers exposures, as well as the manifestation of other banking risks.

The level of a bank's economic capital is determined based on the strategy used to determine the coverage degree of extreme potential losses (worst case losses –WCL) conditional upon a specific confidence level, usually below 100%.

The main reason is that the 100% percentage corresponds to the hypothesis that the bank will never undergo bankruptcy, but because the level of economic capital required in this case is very high, banks prefer using lower percentages.

In such cases, if a bank's management determines a confidence level of say 99.97%, this means there is still a possibility of 3 to 10,000 (or that the respective bank might undergo bankruptcy 3 times in 10,000 years) that the potential losses exceed the value of the estimated economic capital necessary for the covering of unexpected losses, which makes the bank insolvent.

For instance, conditional upon the methodology of Standard & Poor's, one can determine the following relation between the bank's rating and the confidence level which must be used to compute its economic capital (Ong, 2003):

The correspondence between the rating and the confidence level for the economic capital

Table 1

Loan rating put forth by the bank	Confidence level (%)
AAA	99.99
AA	99.97
A	99.90
BBB	99.70
.....	

3. The analysis of the differences between economic capital and regulatory capital

In this context, we feel an analysis of the differences between economic capital and regulatory capital in compliance with the Basel II Agreement is necessary, given that some analyses/studies present the two terms as comparable in the perspective of the implementation of the new capital agreement (Burns, 2004).

For instance, the computation of the minimum capital requirements for credit risk in compliance with the Basel II Agreement (Pillar I) is based on the risk profile of the respective bank, the internal indicators for the probability of default and loss given default being used in this respect. However, when turned into a capital requirement, the same approach is used by all banks, meaning that the curves afferent to the regulated risks weights are the same (used as reference elements – proxies – for the correlation of default cases). At the same time, each bank has its own model turning risk indicators into economic capital requirements.

Furthermore, several differences may occur in terms of the risks parameters used. Thus, a bank may use in its internal economic capital assessment model an estimation of the loss given default (LGD) for the long-term which covers the entire economic cycle; at the same time, the LGD estimation used for the determining of the regulated capital reflects negative macroeconomic conditions.

Another fundamental difference between economic capital and regulated capital, computed in compliance with the stipulations of the Basel II Agreement, derives from the scope of the two types of capital. Thus, while the regulated capital requirements cover only credit, market and operational risks, economic capital requirements cover all the risks afferent to banking activities (including liquidity risk, interest rate risks afferent to the banking book, as well as concentration risk, partially explained by the Basel II Agreement, etc.).

Another essential difference is the fact that the measurement of the economic capital requirements also includes a diversification benefit which is not considered in the computation of regulated capital. The diversification benefit is represented by the assessment of the changes in the risk exposures afferent to each business line in relation with the changes in the risk exposures towards all businesses unfolded by the respective bank.

As a rule, the economic capital requirement is superior to the regulated capital requirement; more seldom, the situation can be the other way around, conditional upon the risk profile specific to the respective bank (prudent) and upon the diversification benefit.

We mention the fact that the internal capital (economic capital) assessment process relies on sophisticated models/IT

applications for the determining of the bank's exposure to risks.

Advanced banks supplement this information with information on their profitability, using a model called RAROC (risk adjusted return on capital) to fundament their business decisions.

4. Methods used for the determining of the economic capital of the bank

At least three risk categories are considered in the determining of the bank's economic capital: credit risk, market risk and operational risk (additionally, could be considered liquidity risk, interest rate risk for the banking book, etc.).

Credit risk is the main risk afferent to banking activities. It represents the possibility of registering losses or of failing to achieve the estimated profit due to counterparty's infringement of its contractual obligations, expressed in credit reimbursement failures derived from loans granted to retail and corporate clients, investments at other banks, obligations purchased, etc. (NBR Norm 17/2003). The general definition of market risk is the risk of registering losses or of failing to achieve the estimated profit due to fluctuations in the value of market prices, interest rates and exchange rates afferent to the bank's assets and liabilities.

The assessment of market risk and the determining of regulatory capital require the assessment of the following items only, not of the entire assets and liabilities portfolio:

- the bank's trading book, which requires the assessment of the risks afferent to interest –bearing instruments and shares – namely of interest rate risk and price risk;
- currency risk and the risk associated to merchandise (trading book plus banking book).

The bank's trading book includes its positions on financial instruments or on the merchandise held either to be traded or for the hedging of other trading book items (outside the banking book), namely the portfolio of shares, bonds, other similar items, merchandise and financial derivatives.

The *interest rate risk of the banking book* – occurs due to market fluctuations of the interest rate and may unfavorably affect the bank's financial results conditional upon the structure of its banking book assets and liabilities on fixed and variable interests (the bank's balance sheet minus the trading book).We mention the fact that the assessment of the capital requirement for this risk supplements the assessment of the market risk capital requirement mentioned above.

Operational risk represents the risk of registering losses or of failing to achieve the estimated profit due to internal factors (the improper unfolding of internal activities, improper personnel or improper systems, etc.) or external factors (economic environment, changes in the banking environment, technological progress, etc.).

Liquidity risk is the risk of registering losses or of failing to achieve the estimated profit due to the bank's impossibility of repaying its short-term payment obligations at all times without additional costs or losses which cannot be covered by the bank.

5. Economic capital for credit risk

In order to determine the economic capital necessary to protect a bank against insolvency, banks use internal credit risk models.

The implementation of an internal credit risk model first of all requires systems, IT applications and complex databases (such as warehouses), of which one can extract/in which one can collect information on exposures, default probabilities, recovery rates, etc.

Another important characteristic of the internal credit risk model is linked to the fact that it ensures the computation of risk indicators differentiated on client categories and credit quality levels (rating categories), such as the unexpected and the expected loss indicators.

At the same time, the model must ensure the aggregation of individual risk exposures at the level of the bank's total portfolio by considering other elements in the computation as well, such as the default correlation indicators (based on the premise that not all clients from all activity sectors undergo insolvency/default at the same time), macroeconomic indicators, etc.; in these terms, the expected/ unexpected loss indicators may differ from the value of individual losses.

5.1. The expected loss afferent to the bank's credit-type product portfolio

Basically, the expected loss indicator is a sum which the bank expects to lose in a specific time horizon (usually one year), due to the impossibility of recovering exposures derived from credit-type products granted to the individual and corporate clients of the bank. Thus, the expected loss per client/ a category of clients represents the difference between the value of the exposure at a certain moment and the sum which can be recovered by the bank if the clients enter default; it depends on three variables:

- The sum exposed to default risk, namely the exposure at default-EAD ;
- The probability of default-PD;
- The loss given default – LGD, defined as the loss registered by a bank due to the occurrence of a credit default event.

Default risk refers to the occurrence of at least one of the following events:

- the analysis reveals the fact that if the debtor might not be able to fully pay its debts (principal, interest, commissions), the bank may undertake measures such as the selling of collaterals;
- the debtor has overdue debts exceeding 90 days.

The estimation of the probability of default may be based on one of the following three techniques: using internal data, using external data or using statistic default models. Furthermore, a bank may also use one main information source and several secondary ones in order to compare the afferent results and to adjust the estimations derived from the utilization of the initial source.

Banks may also use an average determined based on the information collected from several different banks, in order to increase the relevancy of the respective analyses.

In this respect, we believe it is imperative that banks collect and keep

substantial historic data on overdue debts, the ratings granted, the elements which led to the undertaking of crediting decisions, the rating history/changes, a history of PD estimations, the debtors' basic data and information on the facilities granted.

The probability of default is generally determined conditional upon the client's credit rating; at the same time, the weaker its quality, the bigger the expected loss derived from the exposure undertaken towards the respective client, as attested by the example in figure 1:

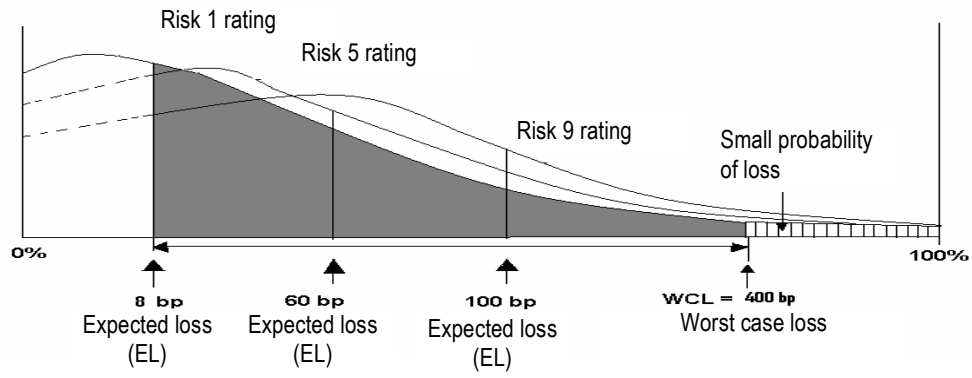

Figure 1. *The correspondence between the expected loss and the client's loan rating*
Note: the example is based on a work scenario.

The above-mentioned data reveals the fact that for a client whose credit rating is 9, the expected loss estimated for a specific time horizon (for instance one year) is close to the expected loss in extreme cases (worst case loss), which in our opinion restricts the access of the respective client to loans.

The probability of default is not the only component of credit risk, and banks measure not only the probability that a debtor registers default, but also how much that debtor would lose if such an event occurred. The actual loss will depend first of all on how much of the respective exposure the bank expects to recover from the debtor. If the sums recovered are insufficient to cover the exposure, this generates a Loss given default-LGD of the debtor (expressed as a percentage of the exposure).

At the same time, the loss depends on the bank's exposure towards the debtor when the latter enters default, expressed as Exposure at default-EAD. Loss given default-LGD and Exposure at default-EAD are determined for each facility/loan-product type.

Furthermore, expected loss is computed with the following formula (International Convergence of Capital Measurement and Capital Standards, 2006):

Expected loss = Exposure at default (EAD) × Probability default (PD%) × Loss given default (LGD%)

The probability of default (PD) and the loss given default (LGD) indicators are computed by the respective bank based on the historic data obtained or by drawing a

correspondence between the bank's internal credit ratings and the PD and LGD indicators determined by external entities (such as international rating agencies).

For instance, by drawing up a correspondence between a bank's internal rating system with 10 rating categories and associated default probabilities for a time span of one year with the external ratings granted by Standard & Poor's, the result is as follows (Burns, 2004):

The correspondence between the rating system of a bank and Standard & Poor's ratings

Table 2

Internal credit rating	1	2	3	4	5	6	7	8	9	10
Probability of default (PD) (%)	0.03	0.06	0.10	0.25	0.50	1	2.50	8	22	100
Correspondence with the external rating	AA	A	BBB+	BBB	BB+	BB	B+	B	CCC	D

The estimation of the actual loss in case of a default situation can similarly be achieved; thus, LGD percentages for loans are usually determined conditional upon the loan-type product/category, the value and the type of the afferent collateral, the existence of a credit hedging instrument such as a credit default swap etc.

At the same time, we believe that, in order to avoid insolvency, banks must register credit risk provisions from the profit achieved based on the value of the expected loss indicators computed. These provisions will be used to cover the respective losses whenever they might occur.

5.2. Unexpected loss and the economic capital for the loan-type products portfolio

Within the time horizon for which expected losses towards a client/client category/portfolio were computed, the bank may not register actual losses at the estimated levels. In these terms, the investments made in the respective loan-type products contribute to the increase in the bank's profit, as the specific credit risk provisions are annulled and registered as incomes or used for the covering of the expected losses computed for the next year.

At the same time, regardless how prudent the standards/risk management methods used by a bank are, the expected loss estimations can be exceeded if unforeseen macroeconomic events or market changes occur, etc.

Chart 2 displays the evolution of the actual losses as compared to the expected (displayed horizontally) and the unexpected losses (Ong, 2003):

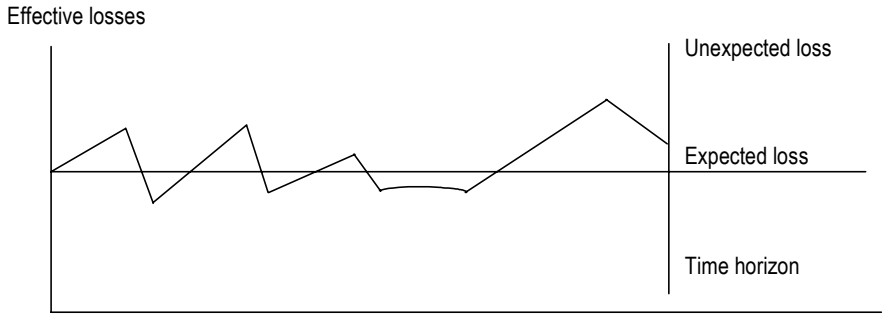

Figure 2. *The evolution of the actual losses as compared to the expected and the unexpected losses*

The unexpected loss is represented by the estimated volatility, namely the standard deviation of the potential (actual) loss as compared to the expected loss and is computed with the following formula (Ong, 2003):

Unexpected Loss – UL =

$$= EAD \times \sqrt{PD \times \sigma^2 LGD + LGD^2 \times \sigma^2 PD}$$

where:

EAD = Exposure at default

PD = Probability of default

σPD = The standard deviation of the PD

σLGD = The standard deviation of the LGD

Here's an example of computation of the unexpected loss afferent to a loan granted for one year to a client with a credit rating of 3 (the equivalent of a BBB rating granted by Standard & Poor 's) (Ong, 2003):

The computation of an unexpected loss for a loan granted for one year, with a loan rating of 3

Table 3

Loan granted (COM) *-EUR-*		10,000,000	
Loan used (OS) *-EUR-*		5,000,000	
Unused part given default (UGD)			65%
Exposure to default (EAD)	EAD = OS + (COM – OS) × UGD	8,250,000	
Probability of default (PD for 1 year, with a rating of 3)			0.15%
Standard deviation of PD (σ PD)			3.87%
Loss given default (LGD)			50%
Standard deviation of LGD (σLGD)			25%
Unexpected loss (UL) *-EUR-*	$UL = EAD \times \sqrt{PD \times \sigma^2 LGD + LGD^2 \times \sigma^2 PD}$		**178,508**

In this context, given the fact that banks must compute the expected and unexpected loss at the level of the entire portfolio, we believe it is necessary that a comparison is made between the result of the aggregated expected and unexpected individual losses at the level of the portfolios they are included in. Thus, the expected loss at portfolio level is equal to the sum of individual asset (credit) losses from the respective portfolio and is computed as follows (Ong, 2003):

$$ELP = \sum_i EL_i = \sum_i EAD_i \times PD_i \times LGD_i$$

where:

ELP = expected loss at portfolio level and Eli = Expected individual loss.

At the same time, the unexpected loss at portfolio level is computed as follows: (Ong, 2003):

$$ULP = \left[\sum_i \sum_j \rho_{ij} \times UL_i \times UL_j \right]^{1/2}$$

where:

ρij is the correlation of defaults between asset (loan) i and asset (loan) j.

The above-mentioned formula makes it obvious that the unexpected loss at portfolio level is not equal to the sum of individual unexpected losses.

Thus, due to the diversification effect, the unexpected loss at portfolio level is much smaller than the sum of individual losses $\left(ULP < \sum_i UL_i \right)$.

We believe this conclusion reflects the fact that only a part of the unexpected loss for each asset contributes to the total sum of unexpected losses afferent to a portfolio. This sum is called risk contribution- RC and is computed in compliance with the following formula (Ong, 2003):

$$RC_i = \frac{UL_i \times \sum_j \rho_{ij} \times UL_j}{ULP}$$

One can determine the unexpected loss afferent to a portfolio as the sum of individual risk contributions, based on the formula:

$$ULP = \sum_i RC_i$$

Here's an example of a computation of the unexpected loss afferent to a portfolio made up of two assets/loans (Ong, 2003):

The computation of the unexpected loss afferent to a portfolio made up of two assets (loans)

Table 4

Loan 1 (example from table 3)	
Unexpected loss (UL) *-EUR-*	**178,508**
Loan 2	
Loan granted (COM) *-EUR-*	2,000,000
Loan used (OS) *-EUR-*	1,500,000
Loan rating	5
Maturity - *years*	3
Unused part given default (UGD)	48%
Exposure to default (EAD) *–EUR -* $EAD = OS + (COM - OS) \times UGD$	1,740,000
Probability of default (PD for 1 year, with a rating of 3)	4.85%
Standard deviation of PD (σ PD)	21.48%
Loss given default (LGD)	35%
Standard deviation of LGD (σLGD)	24%
Expected loss (EL)-*EUR-* $UL = EAD \times \sqrt{PD \times \sigma^2 LGD + LGD^2 \times \sigma^2 PD}$	29,537
Unexpected loss (UL) *-EUR-*	**159,906**
Computation of the risk indicators per portfolio	
The correlation indicator of the defaults of the two loans (ρ)	3%
Expected loss of the portfolio *–EUR -* $EL = EL_1 + EL_2$	35,724
Unexpected loss of the portfolio (ULP) - *EUR-* $ULP = \left[\sum_i \sum_j \rho_{ij} \times UL_i \times UL_j \right]^{1/2}$	243,212
Risk contribution of loan 1 $RC_1 = UL_1 \times (UL_1 + UL_2 \times \rho)/ULP$	134,538
Risk contribution of loan 2 $RC_2 = UL_2 \times (UL_2 + UL_1 \times \rho)/ULP$	108,656
$RC_1 + RC_2 = ULP$	243,212
$UL_1 + UL_2 > ULP$	338,414

The determining of the volume of economic capital is based on the necessity of covering the volume of unexpected losses, so that the respective bank is solvent and able to continue its activities.

In addition to the above-mentioned information, the necessary volume of economic capital is determined as a capital multiplier of the unexpected loss afferent to the portfolio and is based on the statistic confidence level required for the assessment of the volatility of loss, as well as on the necessity of computing "Worst case losses" WCL and the loss distribution "tail".

The capital multiplier represents in this case the number of standard deviations of an unexpected loss and is computed in compliance with the formula (Ong, 2003):

Economic Capital (EC) = Unexpected loss (ULP) × Capital multiplier (CM)

The capital multiplier is determined conditional upon the relation between the bank's rating (according to the Standard & Poor's methodology, for instance) and the afferent statistic confidence level.

Various methods are used for the determining of the capital multiplier, the most popular being the Extreme value theory – EVT, which considers the losses which may occur in extreme cases and the estimation of the loss distribution "tail".

Here are the capital multipliers drawn up in compliance with the Pareto method for loss distribution, which comes across as follows in relation to the Standard & Poor's ratings (Ong, 2003):

Capital multipliers determined in compliance with the Pareto method

Table 5

Credit rating of the Bank	Confidence level (%)	Capital multiplier (tail fit) = 99.95%-99.92%
AAA	99.99	19.64
AA	99.97	14.77
A	99.90	10.32
BBB	99.70	6.95

The complex models used for the determining of the economic capital turn the loss volatility afferent to the portfolio into an economic capital margin. Below is an example of an economic capital computation based on the de probability of default (PD) and loss given default (LGD) indicators, turning/translating them into an economic capital margin via an internal model, also considering the own parameters of the model, such as the default correlation parameter. The capital margin is expressed as the economic capital sum necessary to cover a 100 EUR exposure with a 1 year time horizon:

The determining of the economic capital margin, conditional upon a bank's risk parameters

Table 6

Loan-type facility categories	LGD (%)	Credit rating categories/ PD						
		1	2	3	4	5	6	7
		0.03%	0.06%	0.1%	0.25%	0.5%	1%	2.5%
A	10	0.18 EUR	0.25 EUR	0.37 EUR	0.63 EUR	0.98 EUR	1.45 EUR	1.94 EUR
B	20	0.29 EUR	0.49 EUR	0.73 EUR	1.44 EUR	1.99 EUR	2.75 EUR	4.01 EUR
C	30	0.45 EUR	0.75 EUR	1.08 EUR	1.85 EUR	2.87 EUR	3.91 EUR	5.62 EUR
D	40	0.58 EUR	0.91 EUR	1.33 EUR	2.55 EUR	3.88 EUR	5.33 EUR	7.54 EUR
E	50	0.77 EUR	1.14 EUR	1.88 EUR	3.81 EUR	4.64 EUR	6.55 EUR	10.11 EUR
F	60	0.99 EUR	1.77 EUR	2.18 EUR	3.48 EUR	5.76 EUR	7.98 EUR	12.03 EUR

Note: The data above is based on a work scenario.

Similarly, the results of the assessment of economic capital for each business line category may be centralized in a centralized panel of capital factors expressed in percentages, whereas the determining of the economic capital margin necessary for the covering of credit risk is the result of the weighting of the bank's exposure with the capital factor.

The main difference between this example and the example above is the fact that each capital factor expresses the credit risk of the respective client in percentages, conditional upon the credit rating and the maturity of the respective asset, and the computation considers the credit maturity as follows:

The determining of the economic capital factor (%) conditional upon the maturity of the exposure

Table 7

The confidence level of the capital factors is 99.70%, at a recovery rate of 70% (or LGD of 30%)										
Credit rating (RR)	Maturity (years)									
	1	2	3	4	5	6	7	8	9	10
1	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
2	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
3	-------	-------	-------	1,63%	2,09%	2,61%	2,86%	-------	-------	-------
4	-------	-------	-------	2,42%	2,82%	3,30%	3,63%	-------	-------	-------
5	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
6	-------	-------	-------	7,23%	9,11%	9,70%	10,50 %	-------	-------	-------
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Note: The table is based on a work scenario.

As one can see, the capital factor increases conditional upon the maturity of the rating and the deterioration in the quality of the respective loan, given the same maturity.

6. Economic capital for market risk

The determining of the economic capital necessary for the covering of market risk exposure is based on the bank's exposure to

this risk, computed with the Value at Risk method.

Value at Risk is a method for the assessment of market risk which measures the greatest loss that may be registered by an instrument/portfolio of financial instruments in a specific time horizon, given normal market conditions and a preset confidence level. For example, 10-days, 99%, RON, VaR=1,000,000 for portfolio P means that in a time horizon of 10 days, the respective portfolio has a 99% probability of losing a maximum of one million lei.

The fundamental hypothesis of any VaR model is the fact that all changes in the value of a portfolio may be explained by the variation of a limited number of factors, namely the market risk factors. In compliance with international practices, one of the following methods is generally used for the assessment of the capital necessary to cover market risk exposure using the VaR method: delta-normal (variant - covariant), the historic simulation and the Monte Carlo simulation.

- The Delta Normal method (or the variant – covariant method) is based on the idea that risk is measured by the assessment of a portfolio in its initial status and the results are subsequently extrapolated (deducting the potential variations in the value of the portfolio using partial derivatives at local level).
- The historic simulation method – is a method based on the idea that risk exposure can be measured by fully reassessing the portfolio in compliance with scenarios based on historic data.
- The Monte-Carlo simulation method – is, like the historic simulation method, a global method based on the fact that risk exposure can be measured by fully reassessing the portfolio in compliance with randomly generated scenarios based on the estimated distribution of risk factors.

Next, we will display the main quantitative standards which must be observed by the bank for the assessment of market risk using the VaR method in compliance with the stipulations of the Basel II Agreement (Bank of International Settlements, 2006):

- Value-at-Risk must be computed on a daily basis; the Value-at-Risk computation must use a confidence level of 99% and an instant shock price equivalent to a 10 days-change in prices; in other words, the minimum holding period will be of at least 10 trading days; the data history for the computation of VaR will be of one year minimum;
- The updating of information sets at least once every three months and their reassessment whenever market prices change; the acknowledgement of empirical correlations between large risk categories (such as interest rates, exchange rates, merchandise and capital instrument prices, including option-related volatilities from each risk category); the possibility of performing back-testing and stress-testing operations;
- The determining of a separate capital margin covering the specific interest rate risk and capital instruments risk; the utilization of a proper set of market risk factors, namely installments and market prices which affect the value of the positions in the bank's trading book, which must be sufficient so as to stress the risks afferent to the respective positions.

The computation of the capital requirement covering the bank's market risk exposure is achieved in two stages, the first stage being the determining of an initial capital requirement (MRPt), in compliance

with the formula (Bank of International Settlements, 2006):

$$MRP_t = \max(VaR_t, k \times \frac{1}{60} \times \sum_{i=1}^{60} VaR_{t-i}) + MRS$$

where:

k is the multiplication factor and MRS is the risk margin specific to each type of asset in the trading book.

In other words, the capital requirement is expressed as the largest value between the VaR assessment for the previous day and the average of the daily VaR assessments for each of the 60 previous work days (trading days), multiplied with a k factor = 3 or 4.

The results of the assessment of the market risk exposure obtained by estimating the Value at Risk are checked and historically validated via "Back Testing" and "Stress Testing" techniques.

Thus, in the second stage, in order to obtain a precise measure of the risk exposure, VaR measures require adjustments, based on the accuracy of the model determined during the backtesting operations performed, using a correction coefficient (Bank of International Settlements, 2006):

Adjusted Capital Requirement = Correction Coefficient × Initial Capital Requirement

In addition to the above-mentioned requirements, determined in compliance with the stipulations of the Basel II Agreement, banks may use other quantitative standards for the determining of their economic capital, drawn up by the bank's managements in compliance with their risk profiles (for inst., they may draw up another confidence level than the 99% standard Basel II requirement, a level which corresponds to the loan rating target).

Furthermore, aside from the capital requirement derived in compliance with the VaR method, banks may also consider unused market risk limits (as the respective part is not included in the economic capital estimation in compliance with the VaR method and if used, it may lead to additional capital requirements), as well as some penalties if these limits are accidentally exceeded.

Next, we will perform a Value-at-Risk (VaR) analysis of a bank's trading book, where we used the historic simulation method and the Monte Carlo simulation method.

The computation of potential loss from market risk exposure, according to the Value at Risk method

Table 8
-RON-

			April – June 2006	April – June 2005
		maximum	201,781,167	300,140,661
The Present Value of trading book positions		medium	48,968,945	60,890,063
Historic simulation	average VaR		3,675,685	9,372,788
	% in own funds		0.11%	0.31%
	% in medium PV		7.51%	15.39%
	maximum VaR		13,638,258	26,034,709
	% in own funds		0.41%	0.87%
	% in PV maxim		6.76%	8.67%
Monte-Carlo	average VaR		2,927,426	10,010,748
	% in own funds		0.09%	0.33%
	% in medium PV		5.98%	16.44%
	maximum VaR		10,414,765	26,009,936
	% in own funds		0.32%	0.87%
	% in maximum PV		5.16%	8.67%

Note: The table is based on a work scenario.

As follows, we will determine the initial capital requirement according to the following formula:

Initial Capital Requirement = Max (VaR of the last day of the previous month) 3 × average VaR for the past 60 day

The VaR value was determined via the historic simulation method using a confidence level of 99% and a holding period of 10 days (in compliance with Basel II). The following results were obtained: average VaR for the 2nd quarter of 2006: 3.675 thousand RON, VaR on 30.06.2006: 4.853 thousand RON. Consequently, the initial capital requirement is:

Initial Capital Requirement = Max (4,853; 3 × 3,675) = 11,025 thousand RON.

In order to obtain a proper means for the measurement of risk exposures, the bank adjusts the initial capital requirement in compliance with the results of the backtesting operations using a correction coefficient:

Adjusted Capital Requirement = Correction Coefficient × Initial Capital Requirement.

Considering a correction coefficient of 1.35, the adjusted capital requirement is:

Adjusted Capital Requirement = 1.35 × 11.025 = 14.883 thousand RON.

The internal model for the determining of the economic capital for market risk can also consider the VaR drawn up by the management. Thus, if in the following example:

- The initial capital requirement derived based on the VaR method using a confidence level of 99.99% is of 4,000,000 EUR; the correction coefficient is 2,
- The VaR limit is 6,000,000 EUR; the margin afferent to the unused part of the limit is 15%,

Then the economic capital for market risk is:

2 × 4,000,000 EUR + 0.15 × (6,000,000 EUR – 4,000,000 EUR) = 8,300,000 EUR

Note: The table is based on a work scenario.

Because the exceeding of the VaR limit is considered an infringement of the bank's risk policy and may lead to losses not assumed/expected by the bank's management to the infringement of prudential indicators (for instance the minimum solvency indicator), it will be adequately penalized.

Thus, if the penalization margin of the bank for the exceeding of the VaR limit is 3, and the exceeding sum is 2,000,000 EUR (for an exposure of over 8,000,000 EUR), the new capital requirement will be:

2 × 4,000,000 EUR + 0.15 × 0 + 0.15 × (8,000,000 EUR – 6,000,000 EUR) = 14,000,000 EUR

Note: The table is based on a work scenario.

In these terms, the economic capital requirement is much higher, and in order to determine its risk adjusted profitability, the treasury department of the bank will obtain much lower results, which will diminish the financial results of this business line, as well as the financial remuneration of the respective employees.

7. Economic capital for operational risk

If renowned banks have been using economic capital assessment methods and systems for the determining of credit risk and market risk for a long time now, when it comes to operational risk most banks consider it a "work in progress" activity.

A simple approach for the assignment of economic capital to operational risk is to attribute a risk rating to each transaction/ business line (one a scale of 1 to 5, for example) based on operational risk factors/ operational risk types. This rating should reflect the probability of risk and of operational loss occurrences, based on which the economic capital requirement is determined.

Another approach is the utilization of the AMA – Advanced Measurement Approach, regulated via the Basel II Agreement; for the determining of the economic capital, risk parameters are adjusted conditional upon each bank's own policies (similarly to the computation of the economic capital for market risk). This method is more sensitive to a bank's actual exposure to operational risk, as compared to the other approach, because, in compliance with the latter, the capital requirement for operational risk is computed by the internal system measuring the bank's operational risk.

Based on this internal system (which includes assessment methods, specialized IT applications, etc.) the bank assesses the losses afferent to operational risks by using a set of information (both internal and external) on the historic data registered due to these risks (the elaboration of this database is another difficult task for the bank). In order to use the AMA, a bank must meet the following requirements (Bank of International Settlements, 2006):

- the internal system must reasonably assess the bank's unexpected losses based on the following elements:
- a relevant combination of internal and external data on the losses registered due to the occurrence of operational risk events;
- an analysis of operational risk scenarios and their financial effects;
- an analysis of the business environment in which the bank unfolds its activity;
- the complexity degree of the bank's internal control system;
- the bank's internal system must be able to assign economic capital for operational risk on business lines, so as to stimulate the improvement of the operational risk management system;
- the bank must have a detailed historic database with all the operational risk events registered (covering at least the past five years).

In order to use this method, banks must collect three types of information for each business line: the exposure to the operational risk indicator (EI), information on loss occurrence probabilities (PE), as well as the loss generated by this event (LGE). Next, the expected loss is computed in compliance with the following formula (Basel Committee, 2001):

Expected Loss (EL) = Exposure Indicator to Operational Risk (EI) × Loss occurrence probability (PE) × Loss generated by the respective event (LGE)

In order to compute the economic capital requirement, the bank applies a fixed percentage (the gamma factor) to the thus-computed indicators and the necessary capital will be the sum of these weights for all operational risk categories assessed by the bank.

The computation of the economic capital requirements for operational risk for a trade bank

Table 9

-thousand RON-

Business lines	Business units	Exposure to operational risk	Gamma factor (%)	Capital requirement
Retail	Front-office activities	205,347.00	18	36,962.00
	Personal loans	65183.00	12	7,822.00
	Mortgage loans	33,532.00	12	4,024.00
	Cards	28,255.00	15	4,238.00
	Consumer loans	20,599.00	12	2,472.00
	Private Banking	1,710.00	12	205.00
Corporate	Local public administrations	8,598.00	18	1,548.00
	SME clients	317,206.00	15	47,581.00
	Large clients	120,232.00	15	18,035.00
	Strategic clients	66,812.00	15	10,022.00
Treasury	Title operations	85,360.00	18	15,365.00
	Money market operations	163,531.00	18	29,436.00
	(FX market operations)	4,049.00	18	729.00
Capital Markets	Syndicated loans	11,659.00	18	2,099.00
	Financial investments	4,075.00	18	734.00
	External participations	198.00	18	36.00
	Internal participations	11,000.00	18	1,980.00
Total economic capital				183,288.00

Note: The table is based on a work scenario.

We mention the fact that similar methods to the ones presented above are used for the other types of risk categories considered in the internal economic capital models of banks (liquidity risk, the interest rate risk afferent to the banking book, etc.) so as to ensure the stability of the economic capital necessary for their coverage.

8. Own capital which may be used by banks to cover their risk exposures

After the assessment of the capital requirements necessary for the covering of the various risk categories mentioned above, the next step undertaken by banks will be to compare the aggregated sums with their own capitals.

As a rule, in the context of losses generated by banking activities, the primary source used to cover these losses represents the profit achieved during the respective year and the risk provisions drawn up. If these are insufficient, the bank will resort to its other funds drawn up during the years (starting from the general risk reserves).

In phase three, a bank resorts to the utilization of its free capital (the one up to the minimum limit of the solvency indicator regulated by the monitoring authorities); if these funds prove insufficient as well and the bank cannot increase its own capital (with the help of its shareholders), then it may undergo insolvency.

Here's an example of an assessment of the economic capital requirement for credit risk, market risk and operational risk, as compared to the bank's own capital:

Distribution of the bank's capital on risk categories

Table 10

31-Dec-07

	Sum (thousand RON)	(%)
Total capital (own funds)	**3,112,055**	**100.00**
Credit risk capital	2,490,791	80.04
Operational risk capital	353,915	11.37
Market risk capital	37,960	1.22
Free capital	229,389	7.37

The data displayed above reveals the following aspects:

- based on the assessment of its exposure to credit risk, market risk and operational risk, on December 31st 2007, the bank required a minimum capital level of 2,882.67 million RON.

The bank's own funds level of 3,112.06 million RON was enough to cover the minimum level mentioned and has a reserve of approximative 7,4% for the sustained development of the bank's businesses (including the covering of the other risk categories which were not computed).

- The main risk for which the bank assigns own capital is credit risk, which requires approximative 80% from the total capital of a bank, followed by operational risk (approximative 11% from total); market risk has a lower weight (approximative 1%).

The structure of the bank's capital/own funds can be displayed as follows:

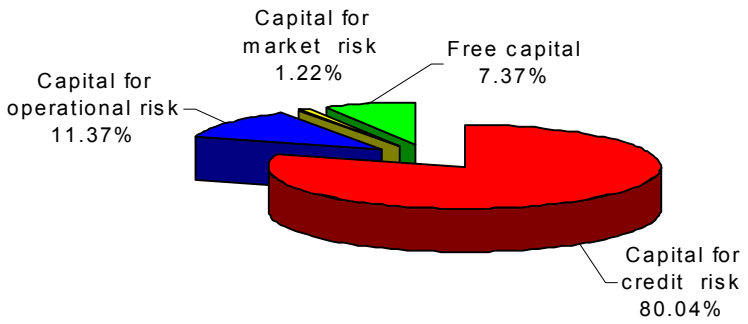

Figure 3. *The structure of the bank's capital/own funds on risk categories*

Considering the fact that it is very important that the bank's management knows the value of the capital assigned for each line of activity, below is a distribution example/structure of the bank's capital assigned on lines and business units:

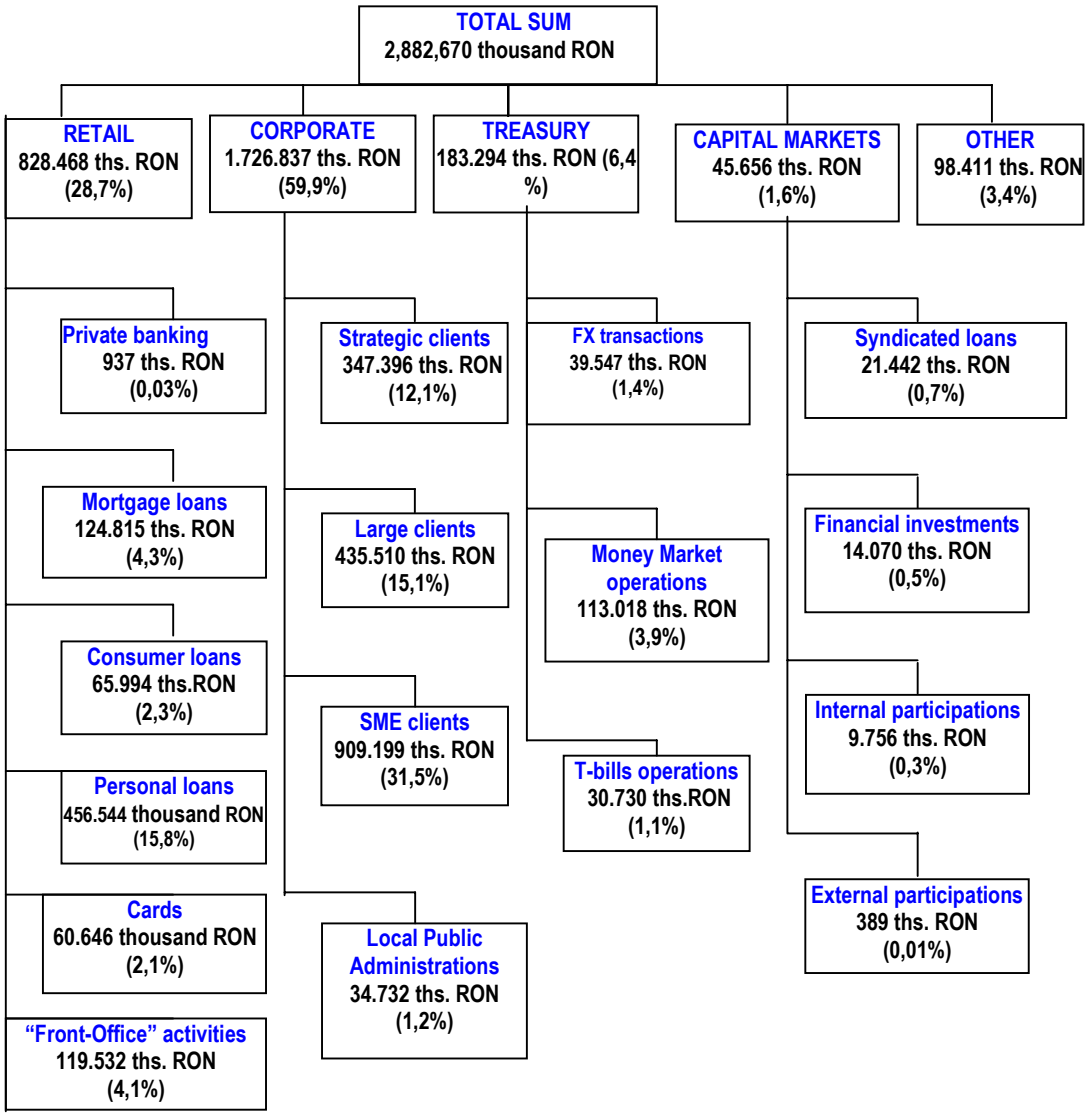

Figure 4. *The structure of the bank's capital assigned on lines and business units*

Conclusions and recommendations

The implementation of the second pillar of the Basel II Agreement (ICAAP) in the subsequent interval (most likely up to the end of 2009) represents a new challenge for the Romanian banking system (in addition to the ongoing economic and financial crisis), as banks will have to elaborate and implement strategies, procedures and systems on the internal capital adequacy assessment process.

This process must consider both the risks for which capital requirements were expressly stipulated in the Basel Agreement (pillar 1), and the remaining risks (liquidity risk, interest rate risk derived from activities outside the trading book, reputation risk, strategic risk, etc.).

In the context of the ongoing crisis, we believe these new requirements will support

banks (mainly those which do not have such processes), as they will lead to the improving of the risk exposure assessment process and the capital management process. Let's not forget the diminishment of the solvency indicator at banking system level either, which dropped from 13.77% on December 31st 2007 to 12.34% la 31 on December 31st 2008.

Furthermore, this descendent trend must be combined with the fact that in 2009 banks will no longer register such good financial results as those registered in 2008. Because of this, the own funs/capitals which have to support the banks' risk exposures in 2010 may not be substantially increased with the profits realized in 2009.

The analysis of the main economic capital assessment methods and the presentation of study cases on the computation of economic capital and on the covering of risk exposures from own capitals reveals that they are increasingly based on assessment methods and instruments which rely heavily on the theory of probabilities/ statistics, the existence of complex statistic databases, IT applications and specialized personnel.

In this context, we feel that the implementation of a risk exposure assessment process and of capital management is an important step in the maintenance of the stability of the Romanian banking system. We also believe that Romanian banks should accelerate this process with the help of their mother-banks (over 90% of the Romanian banking system is controlled by foreign capital), most of which have the necessary logistics and the know-how to do so.

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