

MEASUREMENT OF BANK RISK AND INCOME AND OPTIMIZATION OF THEIR RELATIONSHIP

Seen through the prism of Serbian banking in the transition period
from the acceptance to the application of Basel II

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Abstract: *The risk is typical of any business, especially related to the activities carried out within the financial sector of an economy. In markets where participating banks are exposed to competition are forced to deal with different types of financial and non-financial risks. There are two major categories of risk in banks: credit risk and market risk. When it comes to risk-taking by banks, credit risk is especially pointed out, since this type of risk arises from the act of approving loans. Therefore, banks have an imperative to manage risks, to form an optimal portfolio for them at that moment, i.e. the appropriate relationship between risk and return. Greater risk is associated with higher profits, so the rational behavior of banks is aimed at establishing balance between risks and returns that are expected. The paper further discusses several analytical tools for risk measurement, which helps banks to measure their solvency, and evaluate their performance. In addition, the paper referred to the relevant points of Basel arrangements relating to capital standards for banks and the role of capital adequacy of risk management in banking sector.*

Keywords: *value at risk, credit risk, income, correlation, default probability of loan obligations*

1. INTRODUCTION

The participants in world financial markets, regardless of whether it is large or small corporations, banks, insurance companies or private investors, are under the influence of one important factor which is called risk. Risks are about the potential hazards and their impact on the status and position of a business entity or business organization. To make good financial decisions, which tend to have a sustainable effect, the law requires identification, analysis, measurement, and control and risk control. Focus on finance is a consequence of a consensus that the banking and financial systems as a whole should have a key, stabilization role in the future system.¹

¹ Djuric, D.: "From crisis to crisis?", International journal economics and law, Novi Sad, 2011.

General risk management objective is to optimize the risk-return relationship. The focus of the risk of bank risk is managing credit and market risks, of which critically depends the solvency risk of banks as a definite risk. Interest rate and currency risks as integral components fit into the market risk. Credit risk is the focus of bank management, because the risk is clearly associated not only with the bank's liquidity and with the adequacy of its capital, but also the profits of the bank. Loans are the source of earnings, and the lack of a collection of already approved loans the bank makes losses. In order to successfully manage risk, it is necessary to know (according to the size and type of the bank), the advantages of using certain methods and techniques that can be used to reduce the ability of the harmful side effects and implementation of credit risk or the effects of deterioration of the portfolio (which leads to an increase in risky assets) and to maximize the probability of achieving the intended results - primarily through the maintenance of the quality of the existing portfolio, and then by increasing the bank's results by improving the quality of loan portfolio.

The wave of financial modernization that swept the entire modern world is still not sufficiently spread to our country. The risks are mainly inadequately managed with insufficient quality. The basis of credit risk management still makes traditional credit analysis and usually only when approving loans. Portfolio approach is used to measure the extent prescribed by the National Bank of Serbia, according to the known requirements of limiting the exposure concentration and classification and presentation of claims reserves for potential losses.

The purpose of this paper is to answer the question about the goal of managing banking risks and why it is important to quantitatively measure risk and expected returns from banks. The first part explains the connection between capital and risk. Elementary functions of bank capital consist of absorption of potential losses that the bank has in its operations. To protect from the risk of insolvency, each bank must have an adequate level of capital. The second part is about the management of banking risks and the quantitative perception of bank risk. This section provides an overview of two analytical concepts in the modern methodology of risk management in banking: (a) VAR (Value at Risk) and CAR (capital at risk). The third part of the paper contains a review of methods of determining the profitability of banks as follows, the standard method of calculating the bank's expected return, bank's income adjusted for risk (RAROC parameter) and an ALL indicator (additional value of equity).

2. BANK CAPITAL AND RISK

Bank capital and risk are closely related. The bank's capital consists of funds that the owner has invested in the bank and which is placed on the owner's risk - whether the institution will earn less than the expected return on assets or property to remain even without part of its assets, or to completely lose the invested funds. There are numerous risks to which owners of the banks are exposed to: credit risk, liquidity risk, interest rate risk, operational risk, currency risk, and the risk of crime.

There are several levels of defense that the bank owners can rely on to protect their financial situation of the institution:

- Quality Management - the ability of first-class managers to react quickly and solve problems before they disable the defense of the bank;

- Diversification - variety of financial sources of the institutions and diversity in the use of funds has the effect of reducing risk. Banks generally seek to achieve two kinds of diversification to reduce risk - portfolio diversification and geographic diversification;
- Deposit insurance - is one of the defense line against risk in the banking industry;
- Equity - becomes the ultimate line of defense against risk in circumstances where all other forms of protection have denounced it. Equity absorb losses arising from unpaid loans, weak investment in securities, crime and poor assessment of management, so the bank can continue its operations until the problems are not corrected, repaired and losses. When the risk of failure is high (for whatever reason), it is essential that financial institutions hold more capital.

The financial sector in many countries in the world has changed radically over the last two decades. Advances in information and communication technology, deregulation and globalization, particularly the strengthening of cross-border operations of large banks are the main causes of these changes. When banks operate in the conditions of a dynamic environment, the question of increased business risk is justified. In such circumstances, it is important to determine the minimum amount of equity required for a bank to prevent the possibility of entering into the insolvency problem.

The Basel Committee on Banking Supervision conducted international harmonization of rules in banks and other financial institutions. The Basel framework provides covering risks to which financial institutions are faced by capital. The first key document of the Basel Committee on mandatory minimum capital of banks was passed in July 1988, and was related to the regulation and supervision of credit risk (Basel I). This document established the basic standard for the calculation of capital adequacy. Countries that have signed the document pledged to build a proposed standard in their national laws up to December 1992. The Basel Committee's in January 1996, adopted an amendment (along with the first document) relating to the regulation of market risks of banks. This amendment is another key document of the Committee. The Basel Committee has adopted the third key document in June 2004, and its content is mainly related to the regulation of credit risk. This is a document known as Basel II.²

According to Basel I, banks have primary and secondary capital. Primary capital of the bank consists of ordinary shares and published reserves. In addition, long-term non-cumulative preference shares have the same treatment as ordinary shares. Secondary capital consists of undisclosed bank reserves, revaluation reserves, general reserves, hybrid capital instruments and subordinated instruments debit. Undisclosed reserves are reserves have passed through the bank's income statement, respectively, which are accepted by the supervisory authorities. Their lack of transparency puts them in a secondary capital. General reserves are established in relation to the losses of the bank.

Hybrid capital instruments include debit and instruments that have certain properties of both equity and debt. Each of them has properties that adversely affect the quality of these instruments as an integral part of the capital. Bearing in mind that long term work of the subsidiary instruments have significant drawbacks in terms of its fixed maturity (and the inability to absorb losses except in case of liquidation), they are with 50% in relation to

² In Serbia, the regulation concerning the banking sector is still coordinated with the Basel I standards. It is uncertain when the legislation in the banking system will be implementing Basel II, because of the fact that is necessary to fill a number of preconditions. The standardized approach of Basel II does not differ significantly from the Basel I, in addition to being more sensitive to risk individual groups of assets.

primary involved in the bank's secondary equity capital. Height of secondary capital is limited to a maximum of 100% of primary capital.

In determining the credit risk, all banks balance sheet items are weighted with weights in the amount of 0%, 20%, 50%, or 100%, depending on the risk. Off-balance sheet positions are first expressed in their equivalent credit, and then weighted with the appropriate risk weights. Total risk weighted equal to the sum of two components: risk-weighted assets and risk weighted off-balance sheet equivalent positions. Once the conversion of off-balance sheet positions (or more accurately conversion of the credit risk present for instruments that cannot be divided into products), these instruments do not always show the actual size of credit risk.

Basel I express capital adequacy ratio as the ratio (or rate):

$$\text{The capital adequacy ratio} = \frac{\text{Available capital}}{\text{Risk assets}} \times 100$$

For example, the coefficient of the total capital of 10% means that the sum of level one and level two of capital is equal to 10% of total risk assets. The coefficient of the level one of a capital of 5% means that the level of a capital is equal to 5% of total risk assets. The Basel agreement stipulates that the available bank capital (level one capital plus level two capital) must be equal to at least 8% of risk assets of the bank. Therefore, it is a minimum, and national regulatory bodies have the right to establish higher levels of capital adequacy³.

The constitution of quality bank assets is the way for bank to achieve a good adequacy of its capital. Assets of the bank of course depend on the quality of bank placements, and the credit worthiness of its customers. As each portfolio depends on the quality of individual instruments, and credit portfolio, which makes most of the assets of commercial banks, depending on the credit quality of each individual and their correlation within the portfolio. Accordingly, the bank has an imperative to manage credit risk, first, at the level of the portfolio, then, at the level of individual clients and individual placement and finally, at the level of each transaction. The effects achieved in each of these "steps" will determine the level of quality risk assets, which compared to the capital, provides an adequacy ratio.

3. QUANTITATIVE MEASUREMENT OF BANK RISKS

Risk management by banks means optimizing risk/return ratio. Banks make money by taking risks. However, it is important to know how bank management professionally manages the bank's risk, as excessive and uncovered risks would lead to insolvency of the bank. Professional risk management means that bank achieves a sufficient rate of return on equity at the accepted level of risk⁴.

Starting from the fact that the general objective of banking risk management is optimization of trade-off between risk and return, the focus of bank management is to manage credit and market risks, of which critically depends the risk of solvency as a definite risk of the bank.

³ Regulators in many countries not consider appropriate the coefficient related to the level of a banking capital, if this ratio is below 6%. Also, in some countries, regulators stipulate different ratios of capital adequacy of some banks - such as the United Kingdom.

⁴ Bessis, J. „Risk Management in Banking“, 2nd Edition, John Wiley & Sons, Ltd., Chichester, England, 2002

The modern concept of risk management of this bank has the following components:

- Adequate evaluation of credit and market risks;
- Collection of risk price by the appropriate banking services;
- Allocation of risk prices charged to reserves and capital of the bank;
- Coverage of the expected risk from established reserves of the bank;
- Covering the unexpected risks of share capital;
- Establishment of economic capital adjusted for risk;
- Managing risk portfolio;
- Monitoring of risk by the special department of the bank

The causality of risk and return in the investment process is expressed as the ability of investors to appreciate the scope of acceptable risk that accompanies the expected return. Of course, the investor might be inclined to take risks at the cost of loss that is certain, as it can be oriented to investments that will not involve any risk. However, standard behavior of its expectation assumes investors will realize the maximum return at the accepted level of risk, and achieve the lowest risk with a given level of return. The results show the investment in the future period. Future return may be the basis for making decisions about placement or investment.

Managing banking risk is qualitatively and quantitatively. Qualitative risk management is based on empirical estimates of banking experts and it is especially important for those risk factors that cannot be quantified. For risk factors that can be quantified, the general trend in banking is the increasing use of quantitative methods of risk management. Contemporary methodology of risk management in banking emphasizes two analytical concepts: (a) VAR (value at risk) and (b) CAR (capital at risk). VAR (value at risk) is an indicator that measures the maximum potential loss of the bank's portfolio in a given period due to changes in prices of its parts, based on data from the past. This indicator is used for measuring and managing credit and market risks in the business of financial institutions. CAR (capital at risk) is the amount of capital (financial institution) required to cover the size of the bank in advance of their potential losses in the future.

VAR is the maximum loss that can occur at a given level of tolerance. The level of tolerance is likely to involve losses projected break the mathematical limit. If, for example, the tolerance level is 5%, this means that the calculated value of at-risk (VAR) is valid in 95% of cases, respectively, on account of probability in 5% of cases will be surpassed. The purpose of quantitative determination of VAR is to provide an adequate level of capital and economic capital at risk (CAR). Therefore, banking risks managing is reduced to the calculation of VAR in order to determine the basis of CAR height. In doing so, the CAR is treated as the ultimate protection of bank insolvency. Bank insolvency may still occur in very exceptional cases, if a disaster loss occurs (stress) that CAR cannot endure, because in this case the tolerance level is breached.

The role of VAR and CAR concepts is as follows:

- VAR is an analytical basis for measuring the level of risk throughout the bank, business units, groups of various banking products and customer groups;
- VAR can be combined with the amount of return on various sectors of banking activities and the business units in order to realize the profitability of risk-adjusted for height;
- CAR aggregates all types of risk and therefore should be quantified and operationalized at the bank (at portfolio level).

The values of VAR and CAR must be constantly adjusted during the business activities of the bank. If it is assumed that the level of risk is given size, it would have to reach an appropriate adaptation to the value of CAR. For example, if the level of risk in general increase (VAR increasing), then CAR must be increased. Conversely, if it finds that the level of capital given size, then the imbalance between VAR and CAR should be corrected on the side of risk (for example, through changes in the structure of investments in order to reduce the share of loans with higher rates of risk).

VAR has advantages over traditional risk measures. Traditional measures of risk are unable to perform the quantification of risk at the level of the entire bank. VAR can be quantified at all levels including the level of the bank's portfolio. Furthermore, the VAR is quantitatively expressed in one figure and compared to the traditional measure of risk is much better connected with the amount of CAR. However, traditional measures of risk should continue to apply as a supplement to modern quantitative VAR measure.

VAR concept will be considered in the context of three types of potential losses of the bank:

- **Expected loss (EL)** is a statistical estimate of average annual losses;
- **Unexpected loss (UL)** is the maximum loss that can exceed only in limited cases. VAR just showing the unexpected loss and the level of tolerance shows the percentage of possibility of loss that is not covered by the VAR;
- **Outstanding** (catastrophic) losses are not covered by the VAR qualifications, but the probability of their occurrence is very low.

The distinction between expected and unexpected losses is the basis for the formation of appropriate sources for their financing, as follows:

- **Operating reserves** - only cover expected losses on the average number of annual losses, calculated on the basis of long-term statistical series;
- **Capital bank** - is a source to cover only unexpected losses if they occur in the monitored period. Unexpected losses are becoming value at risk when the level of tolerance is determined.

Exceptional (catastrophic) losses of the bank may be avoided. Although catastrophic losses in the analytical sense should not be covered by bank capital, though healthy and strong banks are trying to form a part of capital given the extremely stressful situation. Using the strategy for determining the level of tolerance, the bank indirectly determines whether the risk of unexpected losses punching designs with a probability of 5% or only 1%. If the bank tried to determine the level of tolerance so that risks are covered 100%, this would drastically increase the value of VAR and CAR to the extent that banks would be unable to operate as profitable business institutions. In addition, it is necessary to bear in mind two completely different situations occurrence of catastrophic losses. If such losses occur due to very large errors in the bank, then according to the logic of market economy such a bank should fail. However, if catastrophic losses incurred due to very strong economic and political turmoil, such losses should be addressed at the macro level.

While determining economic capital of the Bank, it must be taken into account that in reality the distribution of unexpected risks (in particular, credit risk) may deviate from the so-called normal distribution. In theory, this is a departure from the normal distribution of risk known as "inclination" of credit risk. To determine the economic capital, the management of banks applies a correction multiplier, a factor that increases the economic capital of the bank in relation to the amount that would be received only based on exposure and standard deviation. The amount of this correction factor is determined, in principle, by the bank management, given its empirical evaluation in terms of risk distribution form with your bank. This corrective multiplier has value of 1.65 or 2.33, which is multiplied by the

standard deviation (σ). Multiplier of 1.65 corresponds to the level of tolerance of 5%, while the multiplier of 2.33 is associated with the level of tolerance of 1%. Thus, the obtained product, or 1.65σ 2.33σ is a measure of the amount of economic capital to cover unexpected losses in the future.

4. METHODS FOR DETERMINING THE PROFITABILITY OF BANKS

4.1. Calculation of the expected return

Future return can be measured in different ways. The standard way is to calculate the so-called expected return. The expected return as a parameter express future return in the form of uniform size, but also show the distribution of all possible returns of the bank in time. This parameter is equivalent to the average of all returns that can be realized, weighted by the probability of realization:

$$E(R) = p_1R_1 + p_2R_2 + p_3R_3 + \dots + p_nR_n,$$

i.e.

$$E(R) = \sum_{i=1}^n p_i R_i$$

where $E(R)$ = expected return, R_i ($i = 1, \dots, n$) = potential return, and p_i = probability that the return will be realized.

If, for example, calculates the probability of falling heads over tails in the coin-flip then will in the series of throwing will be obvious equal distribution. For an investor who has an amount of 100 coins and by flipping coins attempt to assess the distribution of return - while respecting the rule that for every head gets initial amount sum plus 20%, and for each tails of the initial amount minus 10% - equally likely outcomes are as follows:

Heads + Heads = return of 40%;
 Heads + tails = return of 10%;
 Tails + heads = return of 10%;
 Tails + tails = loss of 20%

The probability to realize return of 40% is 1 in 4 or 0.25. For a return of 10% probability is 2 to 4 and 0.5, and the loss of 20% probability is 1 in 4 that. 0.25. The expected return, according to the formula given above in this "game" is:

$$\text{Expected return} = (0.25 \times 40) + (0.5 \times 10) + (0.25 \times -20) = 10\%$$

Given the potential return and the likelihood of its implementation, investment alternatives of 100 currency units invested in the two financial instruments can be compared to.

Return of financial instruments A and B

Instrument	Expected value at the end of the year	Expected return	Probability
A	110	+10	0.3
	120	+20	0.4
	130	+30	0.3
			1.0
Expected return = $0.3 \times 10 + 0.4 \times 20 + 0.3 \times 30 = 20\%$			
B	60	-40	0.3
	120	+20	0.4
	180	+80	0.3
			1.0
Expected return = $0.3 \times -10 + 0.4 \times 20 + 0.3 \times 80 = 20\%$			

As both financial instruments (A and B) have the same expected return, the bank (i.e. the investor) could not decide on which one to invest on the basis of return comparison. However, these instruments carry various risks, uncertainties and achieve the expected return, which will affect the investor to make a decision until after the analysis of investment risk.

The risk of future bank returns is measured by dispersion of the probability of achieving returns in relation to the expected return of the bank, i.e., the probability distribution that the returns will be higher or lower than expected. The size of the dispersion of the probability is determining over the standard deviation. Accordingly, the investment risk is measured by the standard deviation of future returns relative to expected return on investment. If the standard deviation is zero, then it is a risk-free investment. Investment of banks that are more risky, have a higher standard deviation.

Standard deviation (s or σ) is calculated by calculating the variance, which is also an expression of the statistics term for dispersion. Variance (V or σ^2) is the sum of squares of dispersion around the expected return, weighted by the probability of occurrence. That is, the variance is the standard deviation squared.

Variance is calculated as:

$$V = \sum_{i=1}^{i=n} (E(R) - R_i)^2 \cdot p_i(R_i)$$

and standard deviation as:

$$S = \sqrt{V}$$

Knowing the standard deviation of return and expected return enable construction of probability distribution curve. So, instead of watching all the possible outcomes of investments, only likely deviations from the expected return are seen. Nevertheless, not negative deviations, which are manifestations of risk by definition. Only positive deviations (deviations above the expected return) are taken into account. Normal distribution curve shows return equal return deviations from the expected size. Comparison of different return curves of the normal distribution allows the investor to choose the appropriate investment alternatives: if the spread is higher of possible return, the curve will have a flatter shape, and such investment will be riskier than investments whose outcome spread is smaller.

Calculating variance and standard deviation of return

	Expected return at the end of the year	Dispersion E(R)-Ri	The square of dispersion [E(R)-Ri] ²	Probability	Variance [E(R)-Ri] ² x pi
A	+10	- 10	100	0.3	30
	+20	0	0	0.4	0
	+30	+10	100	0.3	30
		0	200	1.0	60
B	-40	-60	3.600	0.3	1.080
	+20	0	0	0.4	0
	+80	+60	3.600	0.3	1.080
		60	7.200	1.0	2.160

Expected return (A): E(R) = 20% standard deviation S = $\sqrt{60} = 7.74\%$

Expected return (B): E(R) = 20% standard deviation S = $\sqrt{2160} = 46.50\%$

Although both investments have the same expected return of 20%, the average investor will choose the investment in a financial instrument A, because it is less risky investments - the standard deviation of return is 7.7%, in relation to standard deviation of return on investment in B, which is 46.5%. If investments have different return and different risk, then the investor chooses the investment alternatives according to its own preferences according to the indifference curve. This curve shows to which alternative is indifferent, i.e. which alternative investments are equally desirable for him.

From the relationship of risk and return, we can make following conclusion: the value (price) of a financial instrument (i.e. some form of financial active) is determined by:

- The expected return of the instruments;
- Risk of instruments expressed through the variance or standard deviation of expected return;
- Premium, required to take the risk of investment

However, the losses of banks vary from year to year. It is necessary to know how much the bank is statistically projected amount of losses in relation to long-term average. This annual deviations from long-term average can be calculated by variance and standard deviation of losses.⁵

The maximum amount of loss for the bank is determined based on three factors:

- The amount of exposure to loss;
- The value of standard deviation;
- selected tolerance level

⁵ Variance $V = \sum \frac{\{X_i - E(x)\}^2}{n}$;

Standard deviation (S) is following:

$$S = \sqrt{\sum \frac{\{X_i - E(x)\}^2}{n}}$$

4.2. Return adjusted for risk

In the modern banking, traditional methods of determining bank profitability (ROA and ROE), are supplemented by new methods. Starting from the basic principles, which examines the risk-return ratio, banks, looked for new parameters that could express the return corrected for bank risk. In this context, two new parameters appeared as follows:

- **RAROC** (Risk-Adjusted Return on Capital), return of capital adjusted for risk;
- **SVA** (Value Added Shareholders), the additional value of equity.

Both parameters are based on the use of **CAR** as a measure of economic capital level. These methods still apply all the major banks in the U.S. and Europe.

RAROC is a means for determining the capital requirements of banks. There are two main reasons for measuring risk and determining the amount of risk capital required to support each transaction of the bank:

1. For the purposes of risk management in order to determine the contribution of the overall risk of bank transactions;
2. For estimation purposes, in order to determine the economic profitability of various transactions on a comparable basis, adjusted to the level of risk.

In assessing of RAROC, the return and bank capital are taken into account, where both sizes are previously adjusted for risk. One of the basic assumptions of RAROC methodology is that reserves finance expected loss. RAROC can be counted at the level of the bank, and at the level of specific transactions. RAROC is calculated for a selected period of time, so that the economic capital of the bank (and adjusted net income) is also bound for that period. RAROC is presented as a rate of return of the loan, which is adjusted by the amount of risk as follows:

$$\text{RAROC} = \frac{\text{interest margin} - \text{expected loss (EL)}}{\text{CAR} \geq 25\%}$$

The return of the loan is the expected interest margin, from which the expected losses of the bank are deducted. This is obtained by the net interest margin, which is put in relation with the economic capital of the bank (CAR). The rate RAROC for specific loans compared with the marginal rate of return (hurdle rate). The latter rate is the lowest rate of return on equity that the bank shareholders are consistent with. The marginal rate of return is established in the capital market. The meaning of the concept of RAROC is that the bank has an analytical basis to decide whether to approve a loan or not. The bank will approve the loan only if the loan makes its return on capital that is at least equal to the marginal rate of return on capital (i.e. the rate expected by bank shareholders). If the loan offers a lower rate of return of RAROC, the bank does not approve such a loan. In the area of proposed borrowings that provide a higher return rate of RAROC, the bank gives priority to those projects that offer higher rates of return, with the risk of the loan already taken into account.

One of the most obvious advantages of RAROC is that this parameter is the only measure of success and a means of capital budgeting that reflects concern for the bank's total risk, using a measure of risk. Advantages of a RAROC are economic profit transaction accounts including opportunity cost of capital; to estimate the economic return per unit of economic capital commitment, and allow comparison of various risk activities or products on a consistent basis. As the RAROC is the result of the relationship of realized returns with VAR, RAROC is growing when the risk decreases and decreases when the risk is growing.

Case study: 1. Simulation model for the classification of balance sheet assets and off-balance in the bank - with one of the applications of RAROC (suited for small and mid-sized banks and business conditions in Serbia).

The input parameters for this analysis are:

1. The annual level of total assets (in this case the loan) is 500,000,000
2. According to the classification into categories, interests are defined:

- i. A category of interest 14%
- ii. B category of interest 15%
- iii. V category of interest 18%
- iv. G category of interest 18%
- v. D category of interest 18%

3. Criteria for classification of balance sheet assets and off-balance items by the level of collectability of the amount of bank's reserves (and other financial institutions):

- | | |
|------------|---------------|
| A category | Reserves 2% |
| B category | Reserves 5% |
| V category | Reserves 25% |
| G category | Reserves 50% |
| D category | Reserves 100% |

4. The mortgage is included as a deduction, which carries a reduction in reserve on placing by 50%

The purpose of the analysis is to recognize the interdependence of interest (as income) and the amount of calculated reserves (as expenditure) on the result, and depending on the classification of placements and deductibles.

The aim of the analysis is to come up to model, through several portfolio combination, that is in real terms

optimal for the bank, as well as to identify the combination of portfolios that carry the highest profit or the greatest loss.

Figure 1: Scenario of equal investments in each category

	A	B	C	D	E	F	G	H	I
1	SIMULATION MODEL FOR CLASSIFICATION OF BANKING ASSETS IN BANKS								
2									
3									
4	CATEGORIES OF COMPANIES	BALANCE SHEET ASSETS (INVESTMENT PERCENTAGE)		INTEREST RATES		YEARLY VALUE	PERCENTAGE OF RES RESERVATION		
5									
6	CATEGORY A	100000000.00	20.00	1.20%	14400000.00	2.0%	1.00%		
7	CATEGORY B	100000000.00	20.00	1.30%	15600000.00	5.0%	2.50%		
8	CATEGORY V	100000000.00	20.00	1.50%	18000000.00	25.00%	12.50%		
9	CATEGORY G	100000000.00	20.00	1.50%	18000000.00	50.00%	25.00%		
10	CATEGORY D	100000000.00	20.00	1.50%	18000000.00	100.00%	50.00%		
11	SUM	500000000.00			84000000.00				
12				% of placed	16.80%				
13									
14		AMOUNT OF RESERVES FOR MORTG INTEREST MINUS RESER AMOUNT OF RESERVATION WIT INTEREST MINUS RESERVE							
15									
16		20000000.00		12400000	1000000	13400000			
17		50000000.00		10600000	2500000	13100000			
18		25000000.00		-70000000	12500000	5500000			
19		50000000.00		-320000000	25000000	-7000000			
20		10000000.00		-820000000	50000000	-32000000			
21	SUM	182000000.00		-980000000	91000000	-7000000			
22									
23		36.40		-19.6	18.2	-1.4			
24									
25									
26									

According to the above mentioned table, if on the day of the balance (calculation of results) the structure placement the same in all categories, the result is a negative RAROC rate. Therefore, finer simulation shows that if investments are evenly distributed across categories, then we have the following situation:

- A positive result can be achieved only if V, G and D categories of investments are within the quarter by the maturity
- If the maturity of placements in V, G and D categories exceeds the quarter end dates, the result is negative, with or without a mortgage, except that loss without the security investments by mortgage higher more than 14 times (leverage factor);
- If it is necessary to approve the placement of clients from V, G and D categories (for a period that disrupt maturity in terms of quarterly reporting and determination of profit), that placement should not be approved without a mortgage.

The purpose of the simulation model shown above is analytic. In reality, this model is unsustainable because with such proportion of loans (and their classification), the banks as institutions would be unable to work.

If according to the National Bank of Serbia (NBS) on average bad assets of banks in a particular year amounted to 22% where the bad assets is consists of V, G (and D as extremely bad) category, and the good assets form A and B, and if the placement of 500,000,000 are distributed according to the criteria set by the NBS, we will obtain the following picture:

Figure 2.

	A	B	C	D	E	F	G	H	I			
1	SIMULATION MODEL FOR CLASSIFICATION OF BANKING ASSETS IN BANKS											
2												
3												
4	CATEGORIES OF COMPANIES		BALANCE SHEET ASSETS (INVESTME	PERCENTAGE	INTEREST RATES	YEARLY VALUE	PERCENTAGE OF RES	RESERVATION				
5												
6	CATEGORY A		195000000.00	39.00	1.20%	28080000.00	2.0%	1.00%				
7	CATEGORY B		195000000.00	39.00	1.30%	30420000.00	5.0%	2.50%				
8	CATEGORY V		55000000.00	11.00	1.50%	9900000.00	25.00%	12.50%				
9	CATEGORY G		55000000.00	11.00	1.50%	9900000.00	50.00%	25.00%				
10	CATEGORY D		0.00	0.00	1.50%	0.00	100.00%	50.00%				
11		SUM	500000000.00			78300000.00						
12					% of placed	15.66						
13												
14			AMOUNT OF RESERVES FOR MORTG							INTEREST MINUS RESER	AMOUNT OF RESERVATION WIT	INTEREST MINUS RESERVE
15			39000000.00		24180000		1950000		26130000			
16			97500000.00		20670000		4875000		25545000			
17			137500000.00		-3850000		6875000		3025000			
18			275000000.00		-176000000		13750000		-3850000			
19			0.00		0.00		0		0			
20		SUM	1820000.00		23400000		27450000		50850000			
21												
22			10.98		4.68		5.49		10.17			
23												
24												
25												
26												

If in the good assets we place 78% of loans, and in bad (no extreme category D) 22%, then we'll have:

- The result that is positive in each variant, except it is 2.2 times higher with the possession of mortgage for V and G category;
- Individual by categories, the result is negative without a mortgage for V and G categories, and with the mortgage for the G category.

As a G category in each case (with or without mortgage) produces a negative result, such a placement can be granted with a maturity longer than quarter only in exceptional cases.

SVA Indicator - additional value of equity

SVA is an indicator that shows the bank's net profit in absolute terms, after deduction of all bank's expenses, and withholding the limit rate of return of capital (in this example is 25% x CAR).

$$SVA = \text{interest margin} - \text{the expected losses (EL)} - 25\% \text{ CAR} \geq 0$$

In other words, SVA indicator shows the net increase of capital over the economic CAR capital, which serves to absorb unexpected losses in some years. According to this methodology, SVA must have a positive absolute value in order for a bank to approve loan. Only in this case, the bank from formed revenues (consisting of net interest and commission) form a contribution to long-term increase of share capital.

RESUME

The meaning of the analytic modeling of bank's performance (adjusted for risk) derived from such operating conditions characterized by the presence of numerous risks. If the overall risks increase in the real sector due to deregulation and globalization, these risks are transferred to banking, so banks have to increase risk premiums that are part of the interest and commission. If the bank would not be protected from increased risk, they would have reduced profitability as a sector, which could cross over into the zone of negative profitability (insolvency). An attitude that increased cost of banking services (due to risk) over the interest and commission are shifted to companies and households as the beneficiaries of these services is no longer realistic. Increased competition on banking and financial markets prevents it. Hence, today a necessary condition for the use of effective methods of risk management that ensure accurate ranking borrowers in different risk classes and pay the appropriate risk premium is imposed to banks, which become much more differentiated. Only those banks that can cover the level of value at risk with its capital will be competitive in today's competitive business environment. In the case they do not achieve that, they will have two options, both equally bad: (1) to be too conservative in estimating the risk (risk aversion), which will result in expensive banking products, keeping the larger collateral in relation to competition, loss of potential customers, or (2) bank will become too liberal in assessing risk, which in definition leads to bad loans and losses. Accumulated losses lead to a reduction of profits and capital, so the bank can get into a state of technical insolvency, and the road out of it is complex and uncertain (debt, recapitalization, merger).

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