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Sustainable Risk Management in the Banking Sector

Abstract: The globalization of financial markets and negative consequences of the financial crisis resulted in negative connotations in the operation of many financial institutions, businesses and citizens and imposed the need to implement appropriate risk management measures in the banking sector. Evolution of the financial sector makes a lot of news in the field of risk management and particularly the modelling of market, credit and operational risk. The main methodology for risk management is the value-at-risk, which is used in practice with other techniques such as the capital-at-risk method in order to minimize business risks and achieve optimal results in the banking and, generally, financial operations. Accordingly, at all levels of governance in the banking sector, there are prudential policies in place governing the management of all types of financial and operational risks. Based on the abovementioned, the focus of the examination was on the above postulate, and prompt recognition, control and proper management of banking risks.

Key words: banking sector, financial risks, risk management mechanisms, supervision, measuring methods.

JEL classification: G21, F65.

1. Introduction

Due to the fact that the basic element in banking business is risk evaluation, the aim of this paper is to introduce the concept of risk management. Most of the attention is devoted to defining the process of banking risk management, primarily the fundamental mechanisms, management of different kinds of risks, as

well establishing a robust institutional control system. Also, specific methods of banking risk measurement are presented.

2. Risk management mechanisms in banking

The emphasis in this chapter will be placed on the Basel agreements, as well as on mechanisms of the key banking risks management. Throughout several subsections, we will see how to manage liquidity, credit, market, operational and foreign exchange risks. There will also be discussions on risk management monitoring and institutions dealing with this monitoring.

a. Basel agreement

International banking has to devote considerable attention to supervisory standards so that banks, depositors and investors can protect themselves from risks, which are an integral part of the banking business. In order to control business operations by applying common standards of supervision, there was a need for the constitution of the body that would be in charge of coordination and determining which standards were to be applied and to what extent. These tasks were assigned to the new supranational bodies: Commission of the European Communities and the Basel Committee.

The Commission of the European Communities had the task to form common standards of supervision, which were to be applied in the EU countries.

The governors of central banks of the member states founded Basel Committee in 1974. The committee meets four times a year, and its members are representatives of Belgium, Germany, Canada, Italy, Luxembourg, Japan, the Netherlands, Spain, Sweden, Swiss, UK and USA (McNeil, Frey, Embrechts, 2005:8).

The function of the Basel Committee is to formulate general supervisory standards and guidelines and provide examples of best banking practices in the expectation that the legislative authorities in individual countries will take measures for their implementation to best suit the specifics of the local system. Following the adoption of national legislation, the Basel Committee recommendations become final and binding for the countries that have decided to implement them. (Barjaktarović, 2009:80)

The Committee reports to the governors of the member countries for the approvals on their plans and initiatives. The committee decision relates to various fields. “One of the most important areas is related to the harmonization of differences that exist in the international supervision framework for the purposes of applying two basic principles: not a single internationally active bank can evade supervision and the monitoring process is to be adequate.” (Barjaktarović, 2009:80)

In the mid-1980s, as a response to the debt crisis and unfair banking competition from the Far East, the world’s leading financial institutions reached for measures of international regulation. The regulation has been exercised in two ways:

- strengthening the equity of commercial banks’ capital reserve base by allocating more capital for insurance against risk assets
- Creating equal rules for all participants by adopting international standards and procedures for banking business. (Đukanović, 2009:193)

b. Basel I accord

In 1987, representatives of leading industrial countries within the framework of the Basel Committee on Banking Supervision announced a preliminary agreement on banking and capital standards - Basel I accord. Basel I officially came into force in 1988 and its effective application began in 1992. Since 1998, this accord has been applied in almost all countries in which active banks operate internationally - over 100 of them. Basel I primarily focuses on credit risk.

The advantages and positive effects of Basel I implementation are:

- increased capital adequacy of internationally active banks,
- relatively simple structures,
- applicable in various countries around the world,
- strengthened competition of banks on the international level,
- increased discipline in the process of capital management, and
- benchmark for bank assessment carried out by participants in the financial market.

Despite benefits and positive effects over time, disadvantages of Basel I standards have come to the fore:

- capital adequacy depends on credit risk, whereas other risks (e.g. market and operational) are omitted from the analysis,

- when assessing credit risk, there is no difference between the debtor and different quality ratings,
- emphasis on accounting rather than on market values, and
- inadequate consideration of risk and effects of the use of modern financial instruments, as well as risk mitigation techniques.

In order to determine the necessary active capital risk, this agreement defines five risk categories and corresponding weights. These are the following categories of risk:

- No risk weight 0 % - associated with cash, receivables from central governments and central banks of the OECD countries
- Low risk, weight - 10 % - due from public sector entities, excluding central banks
- Low risk, weight - 20 % - due from banks from the OECD countries, multilateral development banks, the participants in the securities market are subjected to similar rules in terms of capital adequacy, banks and receivables from banks that are not from the OECD member countries with the remaining maturity of less than one year.
- Moderate risk, weight - 50 % - claims: mortgage loans and receivables from counterparts based on products which are normally associated with a weight of 100 %.
- Standard risk - weight 100 % - all other assets, all loans given none banking private sector, claims on OECD banks with a maturity of over one year, and fixed assets.

Basel I capital is defined as the only stable source available to cover losses that may result from assumed risks and makes it is the sum of Tier 1, 2 and 3 capital. In Tier 1 capital, the primary capital, the inputs are common shares, preferred shares of unlimited duration and retained (undistributed) profit. In Tier 2 capital, the secondary capital, the inputs are subordinated bonds, preference shares of limited shelf life, and loan loss provisions. Tier 3 capital that is used to cover market risks consists of short-term subordinated liabilities (up to 2 years) of up to 250% of Tier 1 capital.

The main objectives of the Basel I Accord were ensuring:

- adequate levels of capital in the international banking system and
- fair competition in the market of banking services, no bank can operate without adequate volume of capital anymore

These objectives have been achieved. Therefore, during the 1990s, the Basel Accord has been accepted as the world standard. More than 100 countries have applied the Basel framework to their banking system. Some of the disadvantages of the Basel Accord were removed through amendments in 1993 and 1996. (Stanišić, Stanojević, 2009:8).

c. Basel II Accord

In 1999, the Basel Committee on Banking Supervision raised the issue of harmonization of auditing and supervisory regulations as a function of managing capital adequacy at internationally active banks. The Committee announced additional proposals in 2001 and 2003 that represented improvement in comparison with the original proposal and resulted in the defining of the final framework agreement on capital measurement and standards at the international level, the so-called Basel II. The Member States had the obligation to start parallel assessment of capital adequacy according to Basel I and II as of January 2006, and to implement Basel II as a whole as of 2007.

The main objective of Basel II is to promote stability and security of the banking system and create adequate approach to the assessment of risk taken by a bank, including risks in the assessment of the risk profile of the bank, thereby maintaining the existing minimum capital level of 8 % set out in Basel I Accord. Basel II Accord focuses on internationally active commercial banks and holding companies, banking groups, but its basic principles are to be applied by other banks as well.

Fundamentals of Basel agreements relate to:

- Improved sensitivity to arbitration jobs and innovation in the financial market
- Identifying various risk exposures of different banks, with the application of various methods to assess their unique risk of exposure
- Expanding the types of risks when assessing the level of required capital to cover credit, market and business risk
- A requirement that all banks develop internal models for risk management and stress tests for assessing their own level of exposure to risk (VaR)
- A requirement that each bank determines its own capital requirements based on the calculated risk exposure, with the possibility of revising the budget of the supervisory authority

Promote public participation with the use of higher market risk among banks that are assumed to take greater risks.

Basel II consists of three Levels (Stanišić, Stanojević, 2009:8):

- **Level I** defines the minimum capital requirements for credit, market and operational risk, with the possibility of using sophisticated models and techniques for their calculation. The basic requirement is that banks have at least 8 percent of capital in relation to their risk weighted assets. Risk weighted assets are calculated by multiplying nominal amounts of the asset positions by risk factors. The minimum capital of banks provides solvency of banks in relation to the risks to which the bank is exposed.
- **Level II** reinforces the connection between capital requirements and the type and degree of risks to which a bank is exposed in its operations and insisting on the process of supervision. Supervisors control the compliance with capital requirements, internal risk assessment methodologies, and determine corrective actions for banks that do not meet the prescribed standards.
- **Level III** complements the relationship between Level I and Level II, stressing the importance of market discipline and the introduction of minimum requirements for disclosure of information by banks. This standard stresses the importance of transparent banking information. Also, the institutions prescribe mandatory submission of a series of cycles of adequate information on the performance of banks, which are usually submitted quarterly or semi-annually.

d. Basel III Accord

The Basel III framework sets out (ICAEW:1-3):

- Higher and better-quality capital:
 - a. an increase in the minimum common equity requirement from 2% to 4.5% and a capital conservation buffer of 2.5%, bringing the total common equity requirement to 7%;
 - b. a longstanding 8.0% Basel minimum ratio increases to 10.5%, including a 2.5% capital conservation buffer;
 - c. a tighter definition of capital (phasing out of non-standard Tier 1 over 10 years beginning from 2013;
 - d. a tighter treatment of deductions, including minority interests, investments in other financial institutions, deferred tax assets; Tier 3 abolished).

- Better risk coverage, especially related to capital market activities:
 - a. trading book exposures will be subject to a stressed value-at-risk requirement;
 - b. higher risk weights for securitisations and re-securitisations in both banking and trading books.
- The introduction of a leverage ratio as a backstop to the risk-based requirement:
 - a. measures to promote the build up of capital that can be drawn down in periods of stress;
 - b. a 3% minimum leverage ratio of Tier 1 capital to total assets will be tested and monitored from 2011, to be formally introduced as of 2013.
- The introduction of two global liquidity standards:
 - a. Liquidity Coverage Ratio (LCR): subject to the observation period as of 2011 and will be formally introduced as of 2015;
 - b. Net Stable Funding Ratio (NSFR): subject to the observation period as of 2013 and will be formally introduced as of 2018.

3. Management of different types of financial risks

a. Management of liquidity risk

The fundamental role of banks in the maturity transformation of short-term deposits into long-term loans makes banks vulnerable to liquidity risk, either looking at an individual bank or the whole banking system. (Ivanović, 2009:383). Liquidity can also be defined as the ability of the bank to provide funds for asset growth and to meet its obligations when they fall due, without incurring an unexpected loss. (Mishkin, 2006:125).

A bank must manage its assets and liabilities so that it can meet its obligations at any given moment and on an ongoing basis.

The most important obligations of a bank which usually reflect on its liquidity are:

- Commitment to timely execute orders from customers who have funds in accounts held with the bank

- Commitment to the agreed terms released in the course of granted loans and advances
- Commitment to specific loan repayment deadlines that were granted to it by its creditors - the central bank or any other bank or institution.

A bank is considered liquid if its available funds in cash are equal to accrued obligations or higher than outstanding liabilities. If not, the bank is considered insolvent. In order to effectively manage liquidity risk, the competent authority is responsible for the creation and implementation of policies for managing liquidity. Privacy liquidity management involves planning the inflow and outflow of funds, liquidity monitoring and the adoption of measures that would help prevent or resolve insolvency of the bank. A bank holds adequate liquidity if it is able to obtain sufficient funds in short term and at an acceptable cost. In this sense, the most important are those funds that can be easily replaced in cash (Tepavac, 2009:116). These are the primary liquidity reserves.

Primary liquidity reserves include:

- Cash-in-hand and treasury
- Balances in accounts with other banks (demand deposits and time deposits)
- Obligatory reserves with the central bank
- Cash in the process of collection - checks, interest coupons and other securities sent for payment which will shortly be converted into cash.“

The objective of managing this risk should be avoiding situations that a bank has negative liquid assets, which is the cause of ALM (Asset Liability Management). The ALM concept is based on cash flow forecasting and strategic planning. If an outflow of liquid funds is expected, then certain changes in the balance sheet must be made to retain equilibrium. A bank may provide liquid funds in two ways: through asset management - sale of existing assets; and through liabilities management - lending money to the market. Big banks opt to manage liabilities, while smaller banks generally decide to sell parts of liquid assets because they cannot rely on it to borrow funds in the market easily and at reasonable terms.

The framework for liquidity risk management has three aspects:

- Measurement and management needs for net financing, which includes assembling the maturity structure and daily, monthly, or date-agreed obligations, calculating a cumulative net excess or shortage of funds.
- Market access, which includes three key business scenarios in terms of normal operations (i.e. normal market situation), in the conditions of

crisis situation for the bank and general market crisis (the whole sector is threatened). Liquidity risk management is based on the quality of disbursed funds.

- Contingency planning in the future, as well as their impact on a bank (whether a bank can overcome contingencies using its own reserves, or by taking borrowings from its founders or other commercial banks, or the intensity is so strong that its leading the bank to bankruptcy). (Barjaktarović, 2009: 191)

Relevant reports for liquidity risk management are:

- A report on liquidity risk
- Statement of founders
- A report on projected needs and sources.
- A report on the availability of funds
- Reserve funding plan.

The aforementioned reports indicate changes in the leading indicators of the bank's business, or point to a growing or declining liquidity risk.

A bank is required to maintain the liquidity level so that the liquidity ratio (Jović, 2008:215):

- amounts at least 1.0 when calculated as an average of the liquidity indicators for all working days in a month
- does not fall below 0.9 for more than three consecutive working days
- amounts to at least 0.8 when calculated for one working day.

b. Credit risk management

Credit risk is the most common cause of bank failure, and therefore credit risk management is of crucial importance for the survival of bank business. There's a big responsibility of bankers, mainly those employed in credit departments, to monitor the effects of factors that can affect the quality of the loan portfolio of the bank and to promptly respond to adverse developments that may lead to bank bankruptcy.

In order to minimize credit risk, it is essential to devote attention to potential sources of origin of credit risk. The bank management must monitor credit risk, which includes: (Greuning Van H., Bratanovic Brajovic S., 2009:187-188).

- Rigorous selection of credit risk
- Limiting the amount of borrowing to a single client or a group of clients
- Diversifying lending
- Obtaining high-quality security instruments to repay a loan. (Ivaniš, 2012: 4)

Particular attention should be given to the selection of loan applications, which must be carried out carefully in order to adequately assess credit capacity of borrowers. The main objective is to prevent the taking of loans by customers who are unable to repay them.

The Basel Committee has prescribed the principles and strategy for credit risk management which imply:

- Ensuring application environment for measuring and managing credit risk - imply that banks must develop a credit risk strategy or plan in order to determine the objectives and activities of a bank in connection with the granting of loans and policies that will ensure their implementation
- Valid, reliable and consistent loan approval process - implies the existence of clearly defined criteria for granting loans.
- Suitable credit administration process - implies the existence of classes or just a couple of employees who run the affairs of credit documentation, obtaining financial information from clients, sending notices and enforcement of various documents such as credit agreements and the like.
- Actively measure, manage and control credit risk
- An adequate control of risk exposure and active participation and oversight of regulatory institutions.

For easier management of credit risk, bank receivables are classified into the following categories (Hadžić, 2009:409):

- Category A - receivables from debtors who do not expect problems in the collection and that its obligations on time and with exceptional delay of less than 30 days;
- Category B - receivables from borrowers whose cash flows are assessed as adequate in terms of settling obligations, but whose financial situation is not satisfactory due to some problems in business with no indications of any significant deterioration in the future, and receivables from debtors of their obligations are generally settled with a delay of less than 90 days;
- Category V - receivables from borrowers whose cash flows are not adequate in terms of settling obligations and whose maturity match of certain

elements of assets and liabilities does not match its business, trade debtors of their obligations generally settled with a delay of 90 days and no longer than 180 days;

- Category G - receivables from debtors who operate with loss, claims on illiquid or insolvent debtors, amounts due from a debtor subject to enforced collection proceedings, claims from debtors to discharge their liabilities with a delay of 180 days, and exceptionally with a delay not longer than 360 days, provided that it is reasonable to expect that at least some debtors will settle their obligations;
- Category D - receivables with doubtful or disputed legal basis, receivables from debtors in bankruptcy, claims that do not meet the requirements for classification in other categories, trade debtors of their obligations often settled with a delay of more than 360 days and the like. (Hadžić, 2009:409).

c. Interest rate risk management

When managing interest rate risk, bank is obliged to align the scope and structure of assets and liabilities so as to enable an efficient management of this risk, and to establish policies and procedures for identifying and managing these risks.

The essence of managing interest rate risk is that the exposure to interest rate risk is maintained at a certain level. Fluctuations in interest rates affect the income, capital and the cost of banks. (Rose, Hudgins, 2005: 325-326).

The most commonly used models for interest rate risk management include (Cvetinović, 2008:114):

- Gap analysis - This model is intended aims to classify assets and liabilities under maturity groups that are defined by pricing (points at which the interest rate may change) and measuring the gap at every point of maturity. Thus, for example, if the gap is positive, i.e. the level of asset prices is higher than the liability, which would mean more revenues. Bank management has the ability to make a profit so that the resulting gap is zero, which would protect the bank from interest fluctuations.
- Simulation - this model measures the sensitivity of net interest income and capital to certain key variable risks, including changes in interest rates. The model is dynamic and takes a long time until any significant results can be obtained.
- Analysis period - interest rate risk in this model is measured by calculating the present value of assets, liabilities and off-balance sheet positions

of banks to then measured sensitivity of the net value of the interest rate changes. Model looks at things in the long term as opposed to others that focus on current earnings.

The bank management manages interest rate risk using various reports on daily and monthly changes in financial indicators that it regularly receives. A high interest rate risk may be a sign of adverse changes in the following indicators: the ratio of long-term assets to total assets, the ratio of outstanding deposits to long-term assets, the ratio of residential real estate (unsold from special funding or collateral on the basis of non-performing loans) to total assets, the ratio of depreciation (assets) and Tier 1 capital (banks). The following reports are used in a successful management of interest rate risk: an overview of risk - summary report, earnings in terms of risk, audit reports, risk capital and bank net interest margin analysis. The aforementioned reports serve to minimize operational risks, i.e. the maintenance of interest rate risk at an acceptable level for a bank, only if appropriate measures and actions are taken by all parties involved in the process of interest risk management in the bank. (Barjaktarović, 2009:171).

d. Operational risk management

In 2003, the Basel Committee came up with the basic practices for managing this risk. It is believed that it is best to manage operational risks where they appear, and the planning, coordination and monitoring should be carried out centrally by the department for operational risk management. According to the Basel Accord, the management of this risk should be carried out through four steps: identification, assessment, control and monitoring. (Fabris, 2006:67).

Risk assessment is carried out with the help of qualitative and quantitative techniques. Qualitative techniques include:

- Reports of loss incurrence cases?
- Management supervision
- Questionnaires for employees
- Exit interviews for employees
- Management self-evaluation and
- Internal Audit

Quantitative techniques were developed primarily with a view to determining the cost of capital for the bank operational risks. Great job here has been made by the regulatory bodies developing Basel II agreements relating to capital adequacy. (Cvetinović, 2008:115). There are various events that cause loss-this may include

alignment errors, system errors, petty theft, customer complaints, etc. Losses can be direct (e.g. theft) and indirect (e.g. disruption reputation banks).

The goals of managing this risk are:

- Prevention of potential events that manifest as operational risk?
- Mitigation of the effects that have been incurred under operational risks and reduce their impact
- Adequate control of any damage the event of operational events.

There are three modes of treatment of operational risk .These are: risk avoidance, reduction and sharing and risk-taking.

Risk avoidance is practiced as a treatment in cases where the expected profit margins of less activity undertaken in relation to the costs of risk-taking. Such activities should be halted or see to it that that they are not the only ones taken. The decision should be made in the context of several aspects: temporal aspect, available expertise, strategic goals and reputational risk.

Reducing risk - the goal could be to reduce the frequency of occurrence of risk events, as well as reducing the intensity of risk events. Such instruments are typically used by numerous organisational and control mechanisms within the system of internal control.

Sharing and transfer of risks are acceptable only if the risk cannot adequately be reduced through internal controls or if the cost control higher than expected losses. Another case in the context of risk profile of a bank is when the risk is too big that it could be accepted. (Filipovska, 2011:66).

e. Foreign exchange risk management

Foreign exchange or currency risk is the risk that a bank can most easily lead to large losses and therefore it should be treated with special care. The key is to establish specific policies and procedures that will set limits to this kind of risk. It is necessary to regularly monitor the changing situation in the domestic and foreign market.

A bank is obliged to maintain the relationship between assets and liabilities in a way that its total daily open position at the end of the working day does not exceed 20 % of its capital.

The two basic types of transactions in bank operations are: transactions arising from the operations of exchange activity and traditional banking transactions: Therefore, the bank applied two methods to manage currency risk (Cvetinović, 2008:115):

- Daily liquidity management for business brokerage and commercial transactions
- Monthly liquidity management for traditional banking operations.

The key limitations to risk exposure that should be applied in the management of credit risk are:

- Limit the net open position - this limit is the maximum loss due to foreign exchange risk. Expressed as a percentage share of the bank's capital, it represents the total limit of bank exposure to currency risk.
- Limit currency positions - each bank should maintain limits on exposure to individual currencies or to keep the net open position limits for each currency individually.
- Limitations of other positions - these limitations are related to the payment certificate when currencies are traded or in the case of derivatives, etc. Restrictions are usually expressed as the maximum value of all contracts on individual maturity dates.
- Provisions on maximum loss - these limitations are common in the foreign exchange markets where predetermined limit exposure to losses on various positions are applied.
- Restrictions on settlement risk - it is important to determine the limits of settlement risk (collaterals etc).
- Restrictions on the risk of contracting parties - these limitations are especially important for those contractors from countries where the generation of foreign exchange shortages.
- Permanent revaluation (or conversion) – i.e. the reduction in market value is important in risk management. The assessment of realistic exchange rates particularly for countries whose currency is not conversional is important. (Cvetinović, 2008: 115).

When we summarize these types of banking risks, it should be noted that increasing the riskiness of banks is unequally dispersed. Namely, traditional risks such as credit and liquidity risks are largely under control due to the development of technology and operational procedures. On the contrary, influence of the new banking operations risks should be mitigated by efficient use of information

technology and economics portfolio. But, banks cannot avoid risk-taking as an essential aspect of the business (Vasiljević, 2009:83).

4. Overall Banking Risks Measurement Methods

This section deals with the methods of measurement of banking risks – standard methods and method that measures risks based on specific features

Standard methods of measuring risk are Value-at-Risk - VaR and Capital-at-Risk - CaR.

a. VaR method of risk measurement

One of the greatest successes in the field of risk management in recent decades is the development and a wider use of all methods of VaR risk measurement. Today this method is commonly accepted in finances and banking, as well as by companies that calculate their own versions of VaR. “A significant popularity VaR methods achieved due to their conceptual simplicity, and the fact that the VaR synthesized in one value potential losses that might occur with a defined probability, that determines the maximum expected loss over a given period of observation under normal market conditions, with a defined level of reliability.” (Čičković R.,2011:373).

The VaR is the maximum loss that can appear at a given level of tolerance. Tolerance level of possibility implies that losses exceed the mathematically projected limit. VaR is the value of all risks that a bank undertakes, i.e. the maximum potential loss that a bank may incur in its business and that can be exceeded only to a small and precisely defined percentage in all possible cases, and this percentage of probability that is not covered by the accepted VaR is called the tolerance level. The VaR value can be calculated at all levels of commercial banks (at the level of each business unit and entire bank) as well as by groups of business transactions.

In practice, the VaR gives investors answers to the questions: “How much money could I lose if the month in which I invest is unfavourable?” Or “What is the worst-case scenario that may occur?” And it contains three components: the time period in which it is calculated, the level of confidence - the degree of accuracy to which an investor can count the amount of funds that he could lose, as expressed in monetary units or percentages.

b. CaR method of risk measuring

The purpose of quantitative determination of VaR is to provide an adequate level of quantitative economic capital of a bank or capital-at-risk (capital at risk – CaR). Accordingly, the management of banking risks is reduced to calculating the amount of VaR in order to determine the level of CaR. In doing so, CaR is treated as the ultimate guardian of bank solvency. CaR is the amount of capital required for a bank to cover in advance potential losses in the coming period, and unlike VaR, it can only be calculated at the bank level.

The VaR and CaR values have to be constantly adjusted in the dynamic functioning of the bank. CaR must be adopted provided if the risk data are available. If VaR is increasing, then the CaR must increase as well. If the CaR is determined, then the corrections are made on the risks side of VaR.

VaR and CaR differ in the following:

- CaR is used at the global level by integrating all risks. It is understood the necessary capital in relation to the collection of all the risks that arise while VaR is mainly used on individual level, for customers, products, or organizational units;
- The level of tolerance in the CaR should be higher because it is linked to bank solvency.

In order for CaR to be calculated in the right way, it should be calculated for the entire portfolio of the bank and to reflect all risks to which the bank faces.

c. Credit metrics

The portfolio model for measuring credit risk had not been developed for a long time because credit risk had been analyzed using financial statements. Credit Metrics occurred due to altered conceptions of risk after the debt crisis in the United States (1990-1991) and in response to the proposal by the Basel Committee to apply the VaR technique in determining required capital. The development of quantitative models has fundamentally changed the perception of quality measurement, analysis and control of risks. According to Helvig, the debt crises of the 1980s and 1990s were created precisely as a result of misunderstood risks and due to the lack of quantitative models. The Credit Metrics system was developed in 1997 by J. P. Morgan based on the VaR methodology. It serves for measurement of credit risk within the portfolios of financial institutions.

Compared to traditional credit risk analysis, the Credit Metrics method provides a quantitative framework for credit risk. The question asked here is: “If next year is a bad year, how much will I lose on my credit and my credit portfolio? The Credit Metrics aim is to provide a process for the estimation of distribution or individual values due to changes in credit quality. (Subotić) Credit Metrics first looks at the position of portfolio credit profile and determines the exposure of each position. Then, account for the variability of each position due to fluctuations in the credit rating of a company, as changes in credit ratings affect the change in market value of a loan. For example, if the credit rating of a company drops, the company pays the price of risk at a higher interest rate. The Credit Metrics method is used for loans with verified credit ratings. Otherwise, it can use a bank’s internal rating assessment.

d. Interest rate risk measuring-models

The basic measure of interest rate risk is the ratio between assets sensitive to interest rate changes and liability items sensitive to interest rate changes. This ratio essentially reflects a bank’s willingness to accept the risk in terms of predicting future movements in market interest rates, particularly in the period of large fluctuations in these rates. If there is a decline in interest rates, and the bank has this ratio at the level higher than the unit, its revenues will decrease, whereas in case of a rise in interest rates, it will also rise. In order to minimize the exposure to interest rate risk and due to difficulties in predicting future movements in interest rates, some banks have resorted to the restructuring of balance sheet assets and liabilities sensitive to interest rates, so that the coefficient of sensitivity to interest rate strives towards the unit, which is not easily achieved in some cases.

There are three models of assessment of interest rate risk:

Revaluation model is based on the maturity mismatch of bank assets and liabilities, bearing in mind that their sizes may be revalued in the upcoming period due to changes in interest rates. Within each maturity segment, the amount of bank assets and liabilities and the amount of imbalance with positive and negative signs are calculate, and the results for each segment serve the bank to calculate the effect of changes in interest rates on the interest margin.

Maturity model is a better model for understanding the effects of interest rate changes on the balance sheet position of banks. It is based on the change in market value of assets and liabilities of the bank (especially bonds) that occur due to changes in interest rates. Assets and liabilities are not valorised at carrying value,

but at market prices. This model has built-in approach where an increase in interest rates reduces the market value of bank assets and liabilities, while a decline in interest rates increases the respective market values.

Duration model (durability) measures the weighted average time of maturity of assets and liabilities through the use of relative present values of cash flows as weights. This model emphasizes the timing of cash terms of loans and deposits.

5. Conclusion

Based on the above, we can conclude that there are no banking transactions without risk, so it is necessary to ensure adequate risk management process in a bank in order to avoid any negative consequences for a bank and its assets and liabilities. The risk should be first identified and then effectively measured, regulated and managed. All this should be done under the supervision of the competent authority.

Banks cannot eliminate risks entirely, but the mission and the main task of each bank should be to minimize them to the extent possible.

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