CREDIT RISK

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Abstract
Credit risk or default risk involves inability or unwillingness of a customer or counterparty to meet commitments in relation to lending, trading, hedging, settlement and other financial transactions. The Credit Risk is generally made up of transaction risk or default risk and portfolio risk. The portfolio risk in turn comprises intrinsic and concentration risk. The credit risk of a bank's portfolio depends on both external and internal factors. The external factors are the state of the economy, wide swings in commodity/equity prices, foreign exchange rates and interest rates, trade restrictions, economic sanctions, Government policies, etc. The internal factors are deficiencies in loan policies/administration, absence of prudential credit concentration limits, inadequately defined lending limits for Loan Officers/Credit Committees, deficiencies in appraisal of borrowers' financial position, excessive dependence on collaterals and inadequate risk pricing, absence of loan review mechanism and post sanction surveillance, etc. This paper points out the measurement, hedging and monitoring of the credit risk.

Key words: *credit risk, credit risk measurement, credit risk hedging and credit risk monitoring*

INTRODUCTION

Credit risk management is the part of the comprehensive management and also the part of the control system. Credit risk can be considered as one of the major risk because it is associated with every active trade. Banks generally handled risk management strategy that incorporates the principles of risk management processes including risk identification, monitoring and measurement. The aim of the credit risk management is to maintain the efficiency of the business activities and the continuity of the business.

Credit risk is the risk of loss given default that does not meet its obligation under the conditions of the contract and thus causes the holders of creditor's loss. These obligations arise from lending activities, trade and investment activities, payment and settlement of securities trading on its own and foreign account. (Jílek, 2000) There may be cases if a counterparty fails to honour its undertaking and repay fully or partially due principal and interest, have not repaid on time. Credit risk is part of most balance sheet assets and off-balance sheet transections series (bank acceptances or bank guarantee). (Kašparovská, 2006)

Credit risk includes credit risk default, risk of the guarantor or counterparties of the derivatives. This risk is present in all sector of the financial market, but most important is in banks, mainly from credit activities and off-balance sheet activities, such as guarantees. Credit risk also arises by entering into derivative transactions, securities lending, repurchase transactions and negotiation. For derivative transactions conducted an analysis of the creditworthiness of counterparties and watching its changes.

1. CREDIT RISK MEASUREMENT

It is necessary to measure the credit risk. The purpose of the credit risk measurement is the quantification of potential losses from credit operation. The amount of losses is never known with certainty therefore it is necessary to estimate it. There are two basic approaches to define credit losses and thus to quantify the credit risk.

The methods based on the absolute position in Credit risk

This approach is also known as "default-mode". Each borrower may be found at the end of the risk horizon in only two states – default or success. Credit risk then arises from default of the debtor.

Access to credit risk measurement through discrete models is typical for homogenous portfolio (mainly, banks´ exposures to retail small clients with unified credit products). Among the known methods using discrete models can be classified CreditRisk+, KMV model or CreditPortfolioView, (Vlachý, 2006)

These methods show the volume of balance sheet assets, which is exposed to credit risk. When selling the loan to the client, the credit risk or potential loss, represented the entire amount of the loan together with accrued interest and fees, and it is possible to correct if there is the existence of quality collateral. By using this method, bank do not constitute reserves and adjusting entries to the sold loans. The reserves will be started to form only when there is a breach of loan agreement terms by client as an expression of possible loss of credit.

The methods based on the expected rate of default on credit claims

This approach is also known as "market-to-market". The debtor may be located in any from n-located rating grades including the failure in the end of the risk horizon. In this approach, the credit risk arises from the debtor transition to a lower rating grade.

This approach uses the method of continuous models to credit risk measurement. It is characterized by the fact, that unlike the discrete models that operate on a system of only two options for situation of client – failure or success, there are multiple values, which the debtor can acquire. This approach is more suitable for non-homogeneous files such as loans to large companies. Determination of individual risk categories are usually based on external credit ratings. Credit migration is then likely to transition from category to the second category.

The differences between these two approaches for credit risk measurement are more than evident. Methods based on absolute position have positive approach to the credit risk. They assume that the loan will be repaid on time and properly. Reserves and remedies are starting to be created at the moment when the problem comes. In contrast, methods based on the expected rate of default are more realistic. Based on the assessment of the client´s credit, each loan have a risk weight of defaults and the bank begins to form reserves and remedies. Individual risk weights are based on historical data and represent the relationship between the risk of default and its credit rating. In practice, the methods on the expected rate of default are more use because they faithfully served the image of credit risk which the bank exposed.

These methods estimate the amount of expected losses but also the probability of the loss. Total risk amount (the amount of potential loss) is equal to the probability of default and the amount of loss. Each loan is included to the appropriate risk category and have its risk weighting.

Inherent risk is determined for the balance sheet products and therefore the amount of exposure is relatively easy to determined, for example for loans is the principal, interest or accessories. In off-balance sheet products the measurement is difficult. Normally, only the fraction of the principal is exposure to the risk. When setting credit limits for current and future transactions, the bank must make an estimate of the volume of credit risk that could arise in the future. Among the methods for calculating the future unredeemed debt for off-balance sheet products belong system of weighted credit equivalents and determining of the general reserve. (Waterhouse, 1994)

Risk measurement starts at the level of each individual trade. Each client has his own rating or score when evaluating the creditworthiness. Credible valuation is called a summary of indicators based on economic, financial and legal characteristics of the client. These characteristics draw the ability and possibility of client to meet the commitments arising from the loan. Rating is then called as the process of determining the creditworthy clients and their unification in the context of the scale.

Client gets his rating after a thorough analysis of his creditworthiness. The validity of this credit rating is usually for one year. If in the course of the contractual relation changes in the creditworthiness of

the client, his rating is adjusted according to the current situation. The rating change can take place in both directions, i.e. move to a higher or lower category.

For each rating category, the bank calculates the probability of default. Inclusion of the client to the rating category measures how he is able to repay his debt to the financial institution.

In addition to internal credit rating of the bank, it is possible to use and external credit rating. External credit rating is mainly used in the USA where debt financing is the major source of enterprise funding than in Europe. There are agencies that deal with external credit rating of individual debt instruments. The best-known rating agencies include Standard & Poor´s, Moody´s, Fitch IBCA, and Duff & Phelps.

2. CREDITMETRICS MODEL

CreditMetrics Model belongs to the category of "mark-to-market model". This basically means that the increased credit risk is associated with the reduction in the rating and thus default of the debtor. This model requires that the rating system should include a credit rating for each debtors and the bank set probability of transition from one rating to another (including default). All debtors with the same rating have the same probability of an increase or reduction in the ration as well as the same probability of default. Ratings and transitions to the other rating levels (called a *credit rating migration*) constitute the basis for a full analysis of the credit risk. The analysis is based on an assessment of individual debtors and their subsequent combination into a portfolio using correlation. Key type of uncertainty modelled in this way is just a rating level (or failure), in which the debtor is situated on the year of the reference period.

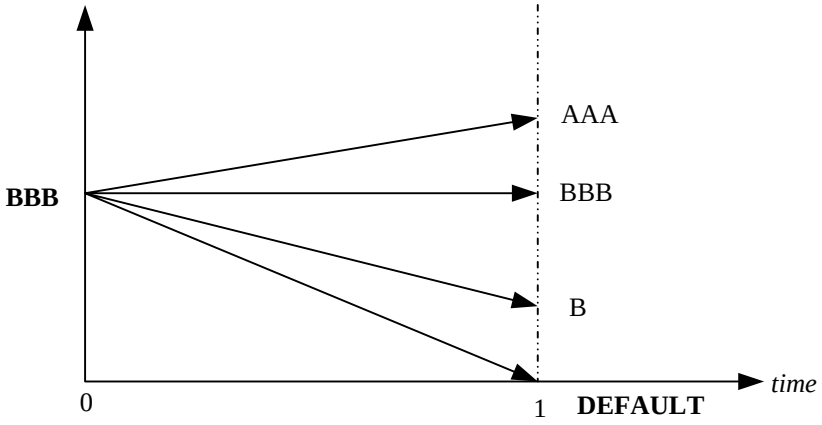

Fig. 2 Credit rating of the debtor at the time of evaluation

Source: own processing

CreditMetrics Model is based on two basic methods:

- *Analytical method*: based on this method is estimated the risk of individual assets, marginal risk contributions of individual assets, and expected value of the portfolio and standard deviations of the portfolio´s value
- *Monte Carlo simulation:* based on this method is derived the distribution of the portfolio value at the end of the risk term (risk horizon generally lasts one year) and based on this distribution, this model estimates the required economic capital using the "Value at Risk".

This model is based on the assumption commonly used in financial theory – *the more is the true value of the assets dissipated, the more is the asset risky*. Standard deviation value of assets is one measure of risk characteristic of the assets. This model uses the distribution of the present value of the asset,

which take into account all possible transitions from a given rating level to another level during the risk horizon. Present value of assets in the rating level is the sum of the discounted values of future cash flows that are expected between the present time and the time of maturity of debt. As the discount factors are used forward rates of zero-coupon bonds which are characteristic of the rating levels.

Design of individual risk assets to total portfolio calculation is based largely on the principle of aggregation. In the case, that the total portfolio consists of *n* assets, so it is true that the value of the portfolio will be equal to the sum of the values of individual assets and the variance is derived based on scattering subportfolios which include all combinations of assets pairs and also on the variance of the individual assets.

3. CREDIT RISK HEDGING

The credit risk is not only measures and monitors by bank, but bank also actively seeks to control and reduce it. The risk arising from the investment portfolio is constrained by limits on the amount, distribution of responsibilities, control and separation front- and back- office. Among the hedging techniques belong risk diversification, risk sharing and risk transfer. On each level is applied system of limits. Limits reflect the level of risk that the bank is able to accept. Some of the limits have the character of external regulations and their compliance is monitored by the authorities of banking regulations, other limits the bank may provide as an internal. (Krajíček, 2009) System limits must take into account also other risks to which the bank is exposed and must be proportionate to the size of the bank and also to management method, complexity and capital adequacy.

Limits and hedging at the level of the individual client

Banks provide funding limits for each client based on the creditworthiness of the client. These limits are calculated based on (i) rating of the client, (ii) turnovers on his account, or (iii) assessment of the financial situation of the client. The funding limits an expression of risk exposure to an individual client. These limits are determined by the current situation of the client, market, industry, position in relation to competitors, etc. The overall client limit is usually broken down into individual limits for specific products according to these risky products. Among the forms of limiting risks include: receiving the collateral, guarantee, protection insurance, a lien on the assets or restrictions limits.

Limits for country

In addition to an objective evaluation of the creditworthiness of the client the bank must take into account the fact that some clients are classified into the same risk category. Therefore the banks should not limit their exposure only on an individual basis to individual client, but also on the basis of group of clients who have the same risk characteristics. Limits for country can be defined as the uncertainty that arises in moving funds across borders. It is the risk that the foreign partners are not able to pay their liabilities from macro reason rather than micro reason.

Limits for the sectors

Banks pay much attention to groups of clients operating in the same sector. It is well known that certain sectors are regularly reported above-average profitability in a sufficiently long period, while other sectors fail. Entities operating in the same sector are subject to similar conditions, particularly economic cycle. To establish limits on exposures, the basic factors are analysed such as the current state of the sector, the expected development, sensitivity to the business cycle, competition, sensitivity to changes in technology, cost structure, growth trends, and the barriers to entry into this sector or diversification and regulation of this sector.

Credit limits are specified by the department of the credit risk management, and their draft must be approval by the Bank management. Funding limits are determined by the absolute value or proportion to the equity of the bank. The amounts of the limits are subject to modification depending on macroeconomic development. Among the forms of limiting the risks may be including: netting, transfer of risk, securitization of loans, and hedging through derivatives.

With the development of new sophisticated methods of credit risk measurement through quantitative credit models is now possible to quantify the credit risk accurately. The quantified credit risk can be then easily transferred to a financial instrument, and this instrument can be traded. This approach of transferring the credit risk to the financial and marketable asset brings new possibilities to hedging of credit risk. The simplest method of trading the credit risk is the securitization of bank debt portfolio. (Vlachý, 2006)

Securitization is the joining of financial instrument. Its origin can be dated back to the 70s of the 20th century in the USA, and the cause of origin is the strict banking regulations, especially policy of increasing the equity capital of banks.

The process of securitization is based on the distribution of bank loans by type (e.g. mortgages), and link them into a single unit and the process of making them marketable. This process is usually realized by selling this package to the institution which may be established by bank and do not subject to strict regulation by the baking regulator. Then the bank emit the bankable papers (securities) covered by the future repayment of loans and sell them to the financial investors, especially to other banks or insurance companies. By trading these securities, the bank obtain the cash and the process of securitization is closed. Illiquid assets (mainly loans) are transferred to the securities and liquid. Securitization is not limited to loans, but also to other bank debts, e.g. credit cards.

Another possibility of selling the credit risk on the financial market are the credit derivatives. Each derivatives has specific underlying asset and must have clearly defined contract conditions. The underlying asset, for credit derivatives, is the credit contract, loans or bond. Credit derivatives are usually swap, where one party pays the fee and in the case of failure of the underlying asset will receive the agreed amount. This is the way to sell the credit risk to the investors.

4. CREDIT RISK MONITORING

Ongoing active monitoring and management of credit risk positions is an integral part of credit risk management activities. Monitoring tasks are primarily performed by the divisional credit risk units in close cooperation with the business which acts as first line of defence, dedicated rating analysis teams and portfolio management function.

Credit risk monitoring can be divided into two level, (i) monitoring of credit risk at the level of the client and (ii) monitoring of credit risk at the level of the credit and bank portfolio.

Monitoring of credit risk at the level of the client

At the level of individual trade operations, there is a regular monitoring, when the bank monitors the fulfilment of the contract conditions, financial situation of the client, and also the macroeconomic conditions. To identify changes in the ability to repay the loans, the bank may set many identifiers, such as turnover, repayment discipline, profitability, liquidity. Regular monitoring and identification of the changes in the ability to pay is an important tool for risk management. In the moment of the deterioration of debtor, the bank may initiate steps to maximize the return of their claim, or to minimize the losses, for example the negotiation of the additional conditions, the use of hedging instrument, the restructuring of the debt, etc. The frequency of credit risk monitoring depends on the creditworthiness of the client. Clients with good rating has been monitoring one a year, clients with a worse rating has been monitoring quarterly or monthly.

In this regular monitoring, there is all the information about the client again evaluated, for example his financial situation and also the ability to meet his commitments. The output of the regular annual renewal is either the confirmation or modification of the rating and the revision of rating is updated by new calculation of limits. The information system monitors the exceeded the gross credit exposures compared to the currently valid limits.

Bank follows up the changes of the client and if fund some of the following facts, the extraordinary monitoring is used. The impetus for extraordinary monitoring are:

- Exceeding of the credit exposure with comparison to applicable limits,
- New records in the bank or non-bank registers,
- Changes in financial indicators outside the limits of tolerance,
- Information about the execution or insolvency,
- Changes in the amount of turnovers on account,
- Payment after the due date.

The progress and content of the extraordinary monitoring is almost the same as the proper monitoring, but is caused by external factors, and given the nature of these factors can be expected deterioration in the situation of the client.

Monitoring of credit risk at the level of the credit and bank portfolio

The credit portfolio is divided into four main segments: non-financial corporations, mortgages, consumer credits and the other credits. Structure of the credit portfolio is dependent on the type of the bank, i.e. whether the bank is universal or specialized. One of the basic rules of the credit risk management is the principle of diversification. The degree of diversification of the credit portfolio significantly related to the clients to who the bank is concentrated. If the bank provides a large amount of the credits to retail clients, mainly to households, the degree of diversification is higher than at the bank that provides credits to the large corporations. The quality of the credit portfolio of the bank depends on the economic position of individual credit borrowers. (Šenkýřová, 2007)

Status and basic trends of credit portfolio are expressed in terms of return of the credits, the cause of the subprime loans involve not only the ability but also the willingness of the borrower to repay the loan including interest. One of the methods of credit risk measurement is based on this principle, i.e. the willingness and ability to repay the credit and also on the behaviour of individual components of the credit portfolio and uses the expected default rates. The expected default rates tell us what percentage of the credit will not be repaid whether due to inability or unwillingness of the client.

At the level of the portfolio, the bank assesses the degree of diversification, the pumping limits and accumulation of debtor in the individual rating levels. Next, the bank assesses the developments in individual sectors and adjusts the funding levels for subjects of particular sectors of economy.

The aims of the entire portfolio monitoring are:

- to ensure, that the cumulative amount of credit does not exceed the established credit limits,
- to monitor the trends in individual credit portfolios managed by bank,
- and to ensure, that the limits set by the bank will minimize the risk and maximize the returns.

Monitoring and evaluation of the credit portfolio as a whole often lead to identify trends that are not evident in individual credit monitoring. The most important trends of development that should be monitored are:

- the share of abandoned assets in comparison with the total volume of assets,
- the classification of the risk, according to the number of clients in each class and according to the value of the credits in each class (weighted average risk rating),
- the trend to the concentration – by the sector and geographical distribution,
- credit ratio, credits which were re-negotiated the conditions, to the total volume of loans,
- the technical exceptions,
- the profitability,

- and the marketing information such as number of credits, number of clients, etc.

The trends and limits are assess at the level of credit portfolio. All the exceeded limits and warming trends must to by subjected to analysis and if it is necessary take steps to remedy, such as:

- block the credit limits,
- the rejection of applications for prolongation credits,
- considering of credit limit revision,
- reconsider the cost of credit.

Credit risk management at the level of bank credit portfolio is based on the fact that the risk is present on the active side of the bank and it is included in the following items: receivables from clients and purchased credit securities. Both of these active items include potential borrowers default. If the portfolio of securities is riskier than the credit portfolio is less risky and vice versa.

CONCLUSION

Credit risk management for banking is a robust and flexible solution for measuring and monitoring regulatory credit risk measures of a bank portfolio. Credit risk is most simply defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms. The aim of credit risk management is to maximise a bank´s risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters. Banks need to manage the credit risk inherent in the entire portfolio as well as the risk in individual credits or transactions. Banks should also consider the relationships between credit risk and other risks. The effective management of credit risk is a critical component of a comprehensive approach to risk management and essential to the long-term success of any banking organisation.

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REFERENCES

1. Buc, D., Klieštik, T. *Aspects of statistics in terms of financial modelling and risk*. In: Proceedings of the 7th international days of statistics and economics, Prague, pp.215-224., 2013
2. Cisko, Š., Klieštik, T. *Finančný manažment podniku II*. Žilina: EDIS Publishers, University of Žilina, 774 p., 2013

3. Crouhy, M., D. Galai, R. Mark. *A comparative Analysis of Current Credit Risk Models*. 2000. In: Journal of Banking and Finance, Vol. 24, pp.59-117.
4. Duffie, D., Singleton, K. J.. *Credit Risk: Pricing, Measurement, and Management*. 2003. Princeton University Press.
5. Gregová, E. *Malé a stredné stredné podniky v podmienkach transformujúcich sa ekonomík SR a RF* . Žilina: EDIS Publishers, University of Žilina, 160 p., 2007
6. Jílek, J. *Finanční rizika.* 1. vyd. Prague: GRADA Publishing, 2000. 635 s. ISBN 80-7169-579-3.
7. Kašparovská, V. a kol. Ř*ízení obchodní bank, vybrané kapitoly*, Nakladatelství C. H. Beck, 2006, ISBN: 80-7179-381-7
8. Kincl J., Dickson A.: *Jak se české banky připravují na Basel III*, dostupné k 1.4.2012 na http://grantthornton.cz/uploads/media_items/biii-bankovnictvi.original.pdf
9. Klieštik, T.: *Risk models based on capital structure of a company* In: Scientific Journal Forum statisticum Slovacum : ISSN 1336-7420. - Roč. 9, č. 6 (2013), s. 78-83
10. Kočišová, K. Mišankov, M. *Assessment model used for determination of default*. In: Proceedings of ICMEBIS 2014 International Conference on Management, Education, Business, and Information Science, Shanghai, China, EDUGait Press, Canada, pp. 39-42, ISBN 978-0-9917647-3-0
11. Krajíček, J.: *Ekonomika a řízení bank*, studijní materiál, Masarykova univerzita, Ekonomicko-správní fakulta, Brno, Listopad 2009, 1. aktualizace únor 2011
12. Lehutová, K. *Application of Corporate Metrics method to measure risk in logistics* In: Proceedings of the International Scientific Conference Computer systems aided science industry and transport - TRANSCOMP 2011, Zakopane, Poland, ISSN 1231-5478. S. 2209-2213
13. Šaárová M.: *Řízení úvěrového rizika podle Nové kapitálové dohody*, bakalářská práce, Masarykova univerzita, Ekonomicko-správní fakulta, Brno, červen 2010
14. Šenkýřová, A.: *Úvěrová rizika bank a možnosti jejich řízení*, diplomová práce, Masarykova univerzita, Ekonomicko-správní fakulta, Brno, květen 2007
15. Valášková. K., Klieštik. T. *Assessing Credit Risk by Merton Model*. In: Proceedings of ICMEBIS 2014 International Conference on Management, Education, Business, and Information Science, Shanghai, China, EDUGait Press, Canada, pp. 27-30, ISBN 978-0-9917647-3-0
16. Vlachý, J. Ř*ízení finančních rizik.* 1. vyd. Praha: Vysoká škola finanční a správní, o. p. s., 2006. 215 s. ISBN 80-86754-56-1.
17. Waterhouse, P.; Navrátil, V. *Úvod do řízení úvěrového rizika*. 1. vyd. Praha: Management Press, 1994.
18. Zvaríková K. *Operational risks* In: Proceedings of the International Scientific Conference Globalizácia a jej sociálno-ekonomické dôsledky recenzovaný zborník z medzinárodnej vedeckej konferencie, Rajecké Teplice 2012. ISSN 1336-5878. 1010-1017.
19. Zvaríková, K., Majerová, J. *Financial literacy in the Slovak Republic*. In: Journal Procedia - Social and Behavioral Sciences, ISSN 1877-0428, 2014. Vol. 110, pp. 1106-1115.