Credit Risk Rating Migration Analysis

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The Credit Risk Rating System main purpose is to measure credit risk and to rate credits by the risk they pose, providing a well informed decision making process to the management in order to promote safety and soundness of the bank.

This system allows bank management to monitor credit risk and also to forecast trends in risk levels of a bank loan. The rating system should provide information on both the ability and willingness of the borrower to repay the loan. Also the rating system provides dates on the structure and the collateral supporting the loan.

1. Credit Risk Rating System and its importance. Functions

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Basically, the credit scoring models estimate the probability of a loan default and, based on these probabilities correlated with the credit historical evolution, assign a quantitative risk score.

Why is important to a bank to have a credit rating system? Because credit rating system has important functions for the bank management. In this research paper we will try to sum up to most important functions of the ratings, especially those which are influenced by the credit migration process, but this doesn't means that there are no more other functions of the rating systems.

Firstly, the credit rating is useful at the beginning of a loan, starting with the approval and the underwriting process. Ratings provide information for the persons in charge to approve the loans in order to make a decision if the loan will be granted or not by the bank. Also, if the credit is approved, the rating system should be used to settle the structure of the facility granted by the bank in terms of collateral, repayment, etc.

Secondly, the credit rating system is useful to estimate or to settle the loan price. Basically, the rating of a loan guides the risk premium setting. If the loan has a higher risk, then the price should be higher in order to compensate the risk and to provide a balanced risk/return ratio for the bank.

Thirdly, the allowance for loan and lease losses should be directly correlated with the risk level of the credit.

In accordance with the New Basel Capital Accord, the credit rating system is an important tool used to settle the appropriate amount of capital to cover bank's unexpected credit losses.

Similarly, a credit rating system is used to establish a basically relationship with the borrower. If the loan has a higher risk credit, the loan should be reviewed more frequently, in order to contact the borrower more frequently to find out if there are changes in the debtor situation. Some high risk credit may require a special attention from the bank management.

In the same way, the credit rating models adopt by the bank should be used to guide bank's decision to buy, sell and hedge credit facilities.

Finally, the credit rating models choose by the bank are critical tools to credit risk management and strategic decision making.

Even though the rating models are usually made and used for the bank management purposes, regulators use these ratings in order to monitor the overall risk changes and trends. Other users of the credit rating models could be the borrower themselves, the external auditors of the bank, the bank internal audit department, potential investors, public rating agencies, or other users.

In order to provide dynamic information on the credit quality, the credit ratings models should be frequently reviewed and updated whenever relevant information is received.

A Management Information System should be used in order to provide feedback about the credit ratings, generating the following data:

- The volume of the loans whose ratings are changed more than one level – double downgrading;
- The length of time within the loan stays in a rating level;
- The frequency of the credit quality changing or how quickly the credit is changing;
- The ratio of rating upgrades/rating downgrades;
- Loss and default history by each rating category, business, industry, loan officer, etc.

Usually the banks have their own internal rating risk model. Lately, they start to map their ratings to public ratings. Public rating agencies provide credit ratings and updated information about the banks credit conditions and their instruments. There are several credit rating agencies whose business is to rate the credit quality of corporations, governments and also of specific debt issues. The main credit rating agencies are Moody's Investor Service, Standard & Poor's, Fitch IBCA, Duff and Phelps Credit Rating Co.

2. Credit migration matrix – a tool used to measure credit risk

As the ratings express the likelihood that the debtor will be able to service its obligations in accordance with terms, the borrower's financial strength is used as a basic tool in order to forecast the borrower's expected performance. The debtor financial performance is reflected by its historical and projected balance sheet and income

statement, its performance and business projections during the term of the loan (for example cash flow projections).

But during the loan period, the credit quality may change, improving, worsing or staying the same. Therefore, the credit risk analysis is not interesting only for the probability of default, but also for what can happen with a credit on the way to default. In other words, it can occur the probability that a credit moves from a credit level/rating to another due to the fact that the debtor credit quality has improved or deteriorated during the lending period. For instance, the credit default stage can be considered a credit migration process, when the debtor quality falls into default and the credit is "downgraded".

a. Firstly, we have to choose a transition matrix:

A credit migration matrix is a methodology which, based on the estimation of the future changes in the value of a loan portfolio, describes the upwards and downwards of the credit quality of a debtor. This methodology has been used firstly for bonds and loans that are treated both in the same manner. Basically, an improvement in credit quality shows an upgrade in the credit rating matrix, and when a downgrade or default in the debtor credit quality occurs shows us a downgrade in the credit rating matrix. As well as, the credit rating system for a bank should be accurately chosen, as, the more credit levels are used in the rating process, the more credit migration possibilities of moving from one credit quality to another could be. JP Morgan introduced in 1997 a Credit Metrics as an asset value approach, that will discuss it below.

A useful way to analyze the probability of moving from one rating level to another is through a transition matrix. As an example, Figure 1 contains the historical frequency of annual transitions based on S&P observations from 1981 to 1998. This is a method for modeling credit migration and default probability.

Standard & Poor's has seven rating categories, the highest being AAA and the lowest being CCC.

D is defined as default stage, when the debtor can not make payments related to a loan.

AAA- Highest Quality; Capacity to pay interest and repay principal is extremely strong

AA - High quality
A - Strong payment capacity
BBB – Adequate payment capacity
BB - Likely to fulfill obligations; ongoing uncertainty
B - High risk obligations
CCC - Current vulnerability to default
D - In bankruptcy or default, or other marked shortcomings.

Transition Matrix: Probabilities of credit rating migration from one rating quality to another, within one year

INITIAL RATING	AAA	AA	A	BBB	B	B	CCC	Default
AAA	91.93%	7.46%	0.48%	0.08%	0.04%	0.00%	0.00%	0.00%
AA	0.64%	91.81%	6.76%	0.60%	0.06%	0.12%	0.03%	0.00%
A	0.07%	2.27%	91.68%	5.12%	0.56%	0.25%	0.01%	0.04%
BBB	0.04%	0.27%	5.56%	87,87%	4.83%	1.02%	0.17%	0.24%
BB	0.04%	0.10%	0.61%	7.75%	81.48%	7.90%	1.11%	1.01%
B	0.00%	0.10%	0.28%	0.46%	6.95%	82.80%	3.96%	5.45%
CCC	0.19%	0.00%	37.00%	0.75%	2.43%	12.13%	60.44%	23.69%

Figure 1: S&P's one year transition rates, adjusted for the "not-rated" category

The rows in table show the rates at which the portfolio of loans begins the year, and the columns list the grades at which the portfolio ended the year. The table contains the transition probabilities, reflecting the average experience of loans that began the year with the probability to upgrade, to remain the same or to downgrade, including default.

For example, based upon the matrix, a BBB - rated credit has a 4.83% probability of being downgraded to a BB – rating by the end of one year. A CCC – rated credit is given a 0.19% probability of being upgraded to AAA, but a B – rated credit has a 0.00% probability of such an upgrade.

Supposing that a debtor is currently in AA rating, the AA row in the table shows the probability that the rating agency estimated, that this debtor will migrate over a period of one year to any of the eight possible ratings, including the default stage. The most probable situation for our debtor is that the credit quality will remain the same over a period of one year and the debtor will remain in the same category - AA – 91.81% probability to remain in the same category. The debtor has 0.00% probability to downgrade in default category over one year, while the probability that the debtor will upgrade in AAA category is higher – 0,64%, but still insignificant.

In other words, as expected, the matrix show higher default risk and higher migration volatility for lower quality grades. We can see that default probability increases exponentially with decreasing rates. Also, we can see the second largest probability is usually in direct neighborhood to the diagonal. In general, the further away a probability is from the diagonal, the smaller is the likelihood of such an occurrence. This rule is frequently called monotonicity (JP Morgan - 1977, p.73). But there are some violations of this rule – For A, BBB and B rated debtors, the likelihood of defaulting is larger than the likelihood of ending with CCC rating. Also, the probability of a credit rated in CCC to be in the next future in AAA is higher than the chance of being upgraded to AA.

The probability of a downgrade or an upgrade is significantly higher if the loan was downgraded or upgraded before. The probability of a downgrade this year is higher if the same loan was downgraded last year. Especially loans that were downgraded last year to the C to CC and CCC score are more disposed to default than those that were in these classes already the year before.

Regarding the influence of the business cycle on rating migration, the probability of a downgrade, or a default, is higher in recession than in a boom period. This information can be used to stress test credit portfolio models. Then, it could be determined the probability to enter a recession or an expansion period.

If we want three year default probabilities matrix, we simply multiply the matrix by itself three times. In other words, the n year matrix can be obtained multiplying the one-year transition matrix n times.

b. Secondly, we have to specify the credit risk horizon.

Usually, the credit risk horizon is considered to be one year, depending how often can be updated the information regarding the credit quality. This implies the availability of information from the financial statements in accordance with the frequent changes in debtor credit quality. This horizon of time can be extended or narrowed if data can be provided daily. Practically, the shorter the measurement interval, the fewer rating changes are omitted.

Also, the horizon of time chosen depends on the application purpose. In order to determine credit risk exposure, one year transition horizon is enough. If the matrix purpose is to determine the pricing of credit derivatives, a shorter horizon is needed.

c. Thirdly, we have to do the revaluation.

CreditMetrics uses credit ratings and historic migration rates incorporated with asset values to generate a distribution of expected asset value based on the migration rates. Practically, the model try to forecast next year asset value.

Basically, if a loan is downgraded, the risk credit premium should rise and the present value of the loan will fall. If a loan upgrades, the loan present value is higher. For example, if we have $ 100 million, 5 percent loan for 5 years, at the end of the first year, after a change in credit quality has occurred, the current value is:

$$P=5+\frac{5}{(1+r_1+s_1)^1}+\frac{5}{(1+r_2+s_2)^2}+\frac{5}{(1+r_3+s_3)^3}+\frac{105}{(1+r_4+s_4)^4}$$

where the ri the risk free bonds on T-bonds expected to exist one year, two years, and so on, into the future and si are annual credit spreads for loans of a particular rating class of one year, two years, three years, four years to maturity.

Speaking about spread risk, we refer to spreads fluctuating because the conditions on the capital market have been changed, affecting credit spreads for all credit ratings, or maybe the credit quality of the debtor changed, improving or deteriorating. That is way,

"downgrade risk" is considered to be a "pure credit spread risk" (Risk Management – Michael Crouhy, Dan Galai, and Robert Mark).

Credit risk is highly correlated with market risk. Social and economic factors such as: changes in interest rate, changes in foreign exchange, unemployment rate, etc. affect the profitability of a company. That is why, the probability that a loan moves from one credit quality to another, including default, is strongly correlated to market risk. These factors should be taken into consideration when a credit rating is made.

3. Usefulness of the credit migration matrix and difficulties in applying credit migration matrix in practice

Referring to New Basel Capital Accord requirements, the credit migration analyze is important mostly due to credit migration process effects, such as: capital planning, risk-based pricing, loss forecasting and provisioning, or collections and recovery workflow planning and scheduling. The credit migration analysis functions described previously, can apply only if the matrix is accurately and frequently updated when risk changes, because historical analysis of credit risk sometimes do not reflect the current credit environment. Like other models, the portfolio credit scoring system should be carefully evaluated and periodically validated.

For example, these models are difficult to be used in emerging countries due to the lack of experience of the banks management, lack of data and impossibility to periodically update the credit rating matrix since the market changes are unpredictable and frequent. Until banks gain more experience with them regarding the market conditions, they should use such methodology simultaneously and supplementary with traditional tools of credit risk management, such as: credit analysis, risk selection at origination and individual loan review.

As well as, the credit rating system for a bank should be accurately chosen, as, the more credit levels are used in the rating process, the more credit migration possibilities of moving from one credit quality to another could be.

In many cases, banks need to model borrower credit risk changes separately for each account. Therefore is generally difficult to establish an overall borrower rating probability for retail credits.

The primary impact of rating migration is on the expected return, especially on fixed income security value. As we explained above, changes in price and asset values are functions of credit rating process. Unexpected gains or/and losses due to credit risk migration are information that may be used to estimate losses when the credit portfolio is subject to mark-to- market disclosure and investor strategy. In other words, the bank can consider a buy or hold strategy considering expected default loss estimates.

Another implication of rating migration refers to the financial institution's policy on tolerance for credit quality changes. In other words, banks have internal policies regarding their credit rating system that allows the bank to have a certain portion of low quality credits. For example, bank's management may approve that 5% of loan portfolio can be below a BB rating. Consequently, if the initial portfolio comprised of newly granted loans of 50% A and 50% BBB loans and for example, 8% of the portfolio

fall below credit risk limitation, than 3% of the credit downgraded should be "sold" or carefully managed.

Ratings migration models have some shortcomings. First, credit rating reflects the overall credit quality. That means that the credit quality depends on both probabilities of default as well as recovery. In this case, if two credits have the same credit rating, but one credit is senior and the other one is subordinated, the senior one is most probably to have a higher default probability and the other one has a highly recovery rate. Second, credit rating migration matrix is not dynamic and consequently they are not sensitive to business cycle or other fluctuations in business environment.

Loans are not market traded and current and future values are difficult to estimate. In the same time, the distribution of credit returns or credit losses can not be easily defined, unlike the market risk where is common to use normal distribution.