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USING THE VALUE AT RISK (VAR) METHOD TO ANALYSE AND ASSESS RISK

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Abstract: *Given today's problems that are emerging in the national economy, knowing and using the techniques of risk analysis and management, becomes compulsory for all managers who are aware that risk is a multidimensional phenomenon. Of the methods and tools that measure market risk, mentioned in the international literature on the same subject, we will focus in this paper mainly on the Value at Risk method, and how it can be applied on loan risk. VaR, standard criteria for assessing risks in financial industry, is based on standard statistic tools, constantly used in other technical domains, as well. This method quantifies the biggest possible loss, after a given timeframe, in common market conditions and having a certain probability.*
Key words: *risk management, loaning portfolio, interest rate*

1. INTRODUCTION

Value at Risk measures the largest loss an institution can expect in an established time interval in normal market conditions with a given level of trust. This risk is estimated with the help of statistic and simulations methods designed with the scope of acquiring the volatility of assets in the company's portfolio. From the specialty literature (Basak & Shapiro, 2000), (Berkowitz & Brien, 2001), (Holton, 2003), (Jorion, 2001), (Penza & Bansal, 2000) 5 methods of calculus arise: the delta-normal method (known under the name of parametric method, due to the work hypothesis of normal distribution or the variance-covariance method), delta-gamma method (Greek method), historical simulation method, testing external conditions method (scenario analysis) and the Monte Carlo simulations method. The necessity to screen loan risk, as main target of the strategy pertaining to banks, also demands that a system of maximum limits be imposed on branches, clients, types of loans, loan period, as well as adopting a standard screening system that monitors loans, so as to make the loaning portfolio a better one. One of the definitions of VaR used quite frequently nowadays is as follows: VaR is a maximum estimation, with a certain probability, of how much a portfolio has lost value, over a certain timeframe. Credit Metrics is a method to measure loan risk using VaR, according to which, if we rely on the available data from the rating of that who is making the loan, the possibility that it changes over a certain period of time (usually a year), the level of provisions in case of bankruptcy and the level of interest rate in the loan market, we can calculate a hypothetical price as well as the standard deviation for any loan or loan portfolio, and the corresponding VaR for any loan of a specific portfolio. (Hull, 2006)

2. VALUE AT RISK (VAR) METHOD

According to the Basel agreement, when calculating the VaR, a bank will use a „trust" frame of 99%, a maximum period of 10 days, while taking into consideration a timeframe of at least 1 year of past data and observations.

Loan category	Probabilities
Standard	0.0819
In observation	0.8272
Sub standard	0.0458
Doubt	0.0202
Loss	0.0249

Tab. 1. The probability in the first month after the loan has been given

At the same time, it will recognize the effects of the correlation between various risk factors (interest rate, foreign exchange rate, price on assets, etc), but it will have to calculate the VaR of different risk categories based on a simple sum. (Greuning & Bratanovic, 2004), (Hoggarth et al., 2004)

So as to see how exactly we put this theory into practice, we will calculate the VaR for a real example. We will take the case of a loan worth 1,000,000 RON, given to a company, for a 6 month period, and yearly interest rate of 15.5%. The loan is considered as "under strict observation" by the bank, and based on past data, we can say that the probability that it remains as such, a month later, is at about 82.72%, while the probability that it then passes to other categories in the first month after the loan has been given is shown in table 1. The effects of the rating increase or decrease are seen in the changes that occur in the hypothetical market values, which we are to calculate hereon. If the category where the loan now sits decreases, then the interest rate increases, as a result of the increased risk the bank is now facing, and, as a conclusion the hypothetical value that the bank could sell the loan to another bank, decreases. The increase of category has the reversed effect. If we look at the loan mentioned earlier, the hypothetical market value of the loan for "i" category of loans can be deduced using the formula:

$$P=D+\frac{D}{1+r_1+s_1}+\frac{D}{(1+r_1+s_1)(1+r_2+s_1)}+\frac{D}{(1+r_1+s_1)(1+r_2+s_1)(1+r_3+s_1)}+\frac{D}{(1+r_1+s_1)(1+r_2+s_1)(1+r_3+s_1)(1+r_4+s_1)}+\frac{D+C}{(1+r_1+s_1)(1+r_2+s_1)(1+r_3+s_1)(1+r_4+s_1)(1+r_5+s_1)} \quad (1)$$

Were:
D- Absolute monthly interest**;**
r_1 – interest rate for bonds, which are anticipated for the future, for every month of the loan;
s_1 – monthly interest rate for every rating;
C- Value of loan.

We suppose that interest rates for bonds are shown in table 2, and the corresponding monthly rates for each loan category are each shown in table 3.

We now have all the necessary data to calculate the hypothetical prices of the loan given to the company.

Month	1	2	3	4	5
Rate (%) r_i	0.5	0.5417	0.5833	0.625	0.6667

Tab. 2. The interest rates for bonds

Loan category	Interest rate (s_i)
Standard	0.008825
In observation	0.012833
Sub standard	0.020308
Doubt	0.029383
Loss	0.038767

Tab. 3. The corresponding monthly rates for each loan category

Loan category	Value (RON)
Standard	1004630.554
In observation	985760.3499
Sub standard	951726.9585
Doubt	912341.1954
Loss	873719.3305

Tab. 4. The market value of the loan

Thus, according to these calculations, the market value of the loan is, as shown in table 4.

As can be seen in fig. 1, the distribution series of hypothetical prices has a negative asymmetry.

Still, according to the Credit Metrics algorithm, we will calculate two measures for VaR: one for the real distribution, which can be seen in the figure, and another one under the hypothesis of distribution symmetry. The first step is to calculate the average and the deviation of the square average, based on the data from table 5.

Med = 981474.2 and σ = 22029.55

It is the bank's best interest to find its potential loss, as a result of any unpleasant event that is likely to occur, and which does occur every 20 months (VaR of 5%) or every 100 months (VaR 1%).

Taking into account the distribution series of hypothetical prices, we are left with the following values for VaR:

(5%) VaR = 1.65 × σ = 1.65 × 22029.55 = 36348.76 RON

(1%) VaR = 2.33 × σ = 2.33 × 22029.55 = 51328.85 RON

For the real distribution, the values are as follows:

(5%) VaR = average – a = 981474.2 – 951726.9585 = 29747.242 RON

(1%) VaR = average - b = 981474.2 – 873719.3305 = 107754.87 RON

Where:

a) stands for the value from the first cumulative sum (upwards) of the probabilities that surpass 5%;
b) stands for the value from the first cumulative sum (upwards) of the probabilities that surpass 1%.

We can calculate the VaR more precisely using a linear interpolation.

Thus, the 5% represents 916554.9561, and using the same principle, 1% means 845230.9251, and so the new values of the VaR will be:

(5%) VaR = average – a = 981474.2 – 916554.9561 = 64919.24584 RON

(1%) VaR = average – b = 981474.2 – 845230.9251 = 136243.2768 RON

Loan category	Probabilities (p)	Value (π)
Standard	0.0819	1004630.554
In observation	0.8272	985760.3499
Sub standard	0.0458	951726.9585
Doubt	0.0202	912341.1954
Loss	0.0249	873719.3305
Loan category	**π- average**	**$P\times(\pi$- average$)^2$**
Standard	23156.35	43916141.04
In observation	4286.148	15196544.39
Sub standard	-29747.2	40528351.08
Doubt	-69133	96543326.32
Loss	-107755	289116696.9

Tab. 5. The average and the deviation of the square average

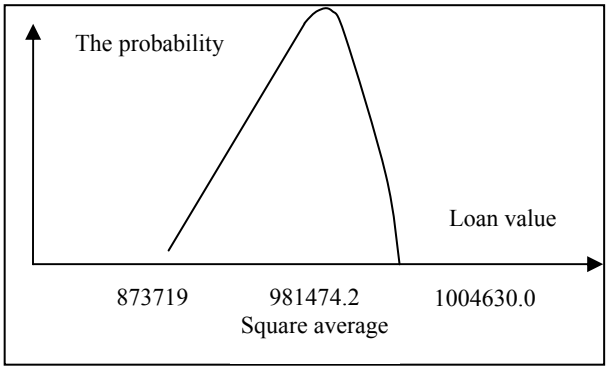

Fig. 1. The distribution series of hypothetical prices

3. CONCLUSION

In other words, there are 5% chances that the bank looses more than 64919.24584 RON after the first month, and 1% chances to lose more than 136243.2768 RON.

What is interesting at this point is comparing the provision made by the bank (5% of the value of the loan, meaning 50000 RON, this being considered as "under strict observation") and VaR. There is a strong contrast between the forecast made by the bank and VaR, since the VaR which is calculated using this method, gives different values for loans belonging to the same category, while the bank has a rigid system of provisioning, using the same percentage for different loans and different maturities.

The VaR methodology is especially important both for banking institutions as well as for the other investors because it allows the identification of maximum loss registered by the value of the portfolio of financial assets, which can appear in the following period with a certain pre-established probability.

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