USE OF THE VAR METHOD FOR MEASURING MARKET RISKS AND CALCULATING CAPITAL ADEQUACY

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Over the past 20 years financial markets around the world have undergone huge changes. Terms such as derivatives and securitisation have gained an iconic status for this period. Balance sheet structure, the sources of revenues and losses have changed so much as to require the establishment of new accounting principles and a completely new way of looking at the mutual relationships between a bank's incomes and the risks that it must undertake. The opinion has taken root that the business of commercial banks has, thanks to these innovations, become more risky and possible losses greater. We are now beginning to see these processes also in Slovakia. It is clear that these are taking a similar course in this country too, the one difference their being much faster, and therefore also more dramatic. It is a generally accepted fact among those who know that, Slovakia shall sooner or later become a member of the eurozone and thus become a part of the most developed financial markets with huge competition, global players and the widest range or financial instruments. It is very probable that significant changes will occur in the balance sheet structure of Slovak banks. The share of tradable assets such as bonds, equities, interest rate or foreign currency derivatives will increase. The development of complex swap operations will enable a greater dynamism and the ability to react to investment opportunities without the need for significant change in the basic portfolio. It may be said with certainty that all these changes will expose banks to much greater market risks than those to which they are accustomed, and I fear, prepared for.

With the change in the status of market risks in banks' business, regulatory bodies have also had to reorganise themselves. Previously applicable rules on capital adequacy for the case of assets (bonds or loans) to the private sector capital set coverage at 8%, regardless of the maturity or volatility of these instruments. The size of the capital requirements for covering market risks was set in a flat rate manner by means of coefficients, without taking account of market characteristics of the given instrument. Moreover, these requirements were of an additive nature, i.e. requirements were calculated for each long position and then totalled. This procedure ignored the very important fact that the risk of a portfolio is not the sum of the risks of the individual instruments contained in it. Well-diversified and secured portfolios therefore appeared to be much riskier than they actually were. It was necessary to specify a completely new procedure for calculating the capital adequacy ratio (CAR). Instead of setting fixed coefficients the BIS and the European Commission decided to draw up standards for internal bank risk models. In the event that a bank meets these standards, it may calculate and set the CAR itself. The regulatory body then simply checks the adequacy of the model, imposing a sanction in the case of any failure.

The NBS, pursuant to the Capital Adequacy Directive (CAD), allows banks to calculate capital requirements for covering market risks using their own models founded on Value-at-Risk (VAR) calculations.

In the following text I will deal with the conditions and procedures that a bank must fulfil in order that it may use its own model in determining risks. Immediately at the introduction it is necessary to say that to create a complex and expensive mechanism for measuring risks simply due to capital adequacy would be unreasonable. In the case of Slovak banks this applies only more so. Banks may still express the level of capital adequacy requirements in the old static form. Banks have had this mechanism implemented for a long time now and it therefore requires minimal additional costs. At present capital adequacy moves at levels considerably above the required 8%. Banks then are not "balancing on the edge" and do not feel capital as a brake on their development. The benefits of a more precise measurement of risk in a situation where a bank cannot grow due to overvalued capital requirements would naturally change the situation.

Measuring risks for capital adequacy therefore needs to be perceived in the wider complex of risk management, serving for the internal needs of portfolio managers and the bank's management. Quality risk management should without problem fulfil all the requirements made by regulatory authorities and calculating the CAR should merely be something of an add-on, with which any modern banking institution should not have any great problems. I see the benefit, which implementing the alternative approach to capital adequacy can bring to a bank operating in Slovakia, as lying mainly in a certain outward formalisation of risk management and in a constant pressure for quality in the procedures used. A bank opting for this approach will, pursuant to the rules of the regulatory authority, have to undergo thorough analysis, ensuring

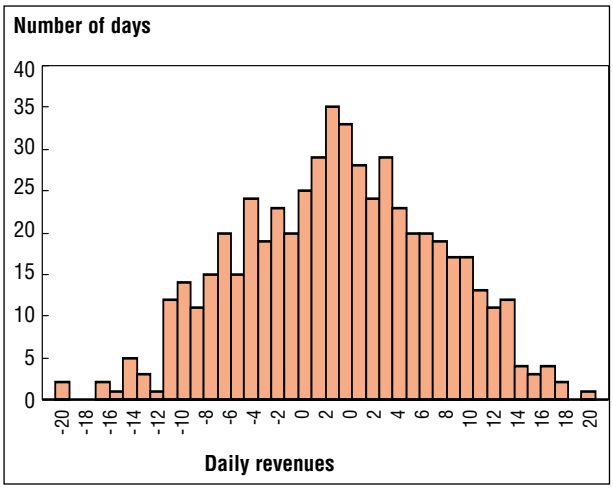
the constant verification of the accuracy of results, testing and audit, and in general will be under greater pressure to comply with quality risk management. I presume that the loss of prestige in the case of a potential inability to fulfil the conditions taken on would be a sufficiently worrying deterrent. In the following text I will focus on the requirements set by the regulatory authority as the condition for using alternative methods of calculating the CAR. Since these conditions essentially define quality risk management, or rather one of its instruments - the calculation of VAR, this text may be seen as a guide to implementing VAR models, even for the case that these are not intended primarily to serve for calculating the CAR.

VAR

One of the definitions of VAR states:

VAR is the value of the negative result (loss) that for a certain period and with a certain probability will not be exceeded.

The method of calculating this value is termed the VAR method. It is already clear from its name that VAR is a risk category. It attempts to determine the degree of risk. With a little simplification it may be said that VAR measures risk. To make things clearer I will state a numerical example of how it is possible to express the risk of a portfolio with the help of VAR. Graph 1 depicts the distribution of daily revenues of an imaginary portfolio of Bank A. The x axis shows the daily revenue and the y axis the respective number of days when the given results occurred. Over the period in question the most frequent daily result was around zero. In two cases a profit of 20 million was made and on another two days the bank fared very badly, recording a loss of 19 million. The average result for the 556 days monitored was 1.5 million, from which it results that the bank for the period reported a profit of 834 million. The variance of revenues was 52.419 and the standard deviation was 7.24 million.



From the graph it can be seen that extreme losses occur irregularly, whereas the average values are much more probable. The next step is to select a distribution function and probability interval. For reasons of simplification let us assume that the profits from the portfolio correspond to a normal distribution and let us select an interval of 95%. Our VAR estimate then covers 95% of possible losses and 5% of losses remain uncovered. Let us assume that the level of a loss which separates the worst 5% of results is 11.94 million, which is, under the assumption of normality, 1.65 times the standard deviation. We can then say that we can expect a loss greater than 11.94 million one day in twenty (5%). The value 11.94 million is our VAR. Alternatively and in accordance with our previous definition we will interpret the VAR as follows: with a 95% probability the loss from the portfolio for the period of the following day will not be greater than 11.94 million.

VAR may also be expressed from the aspect of the rate of return. In this case VAR, which is expressed in a nominal value, will be expressed as:

$$VAR \text{ (in absolute terms)} = -REV^* = -r^* * W \quad (1)$$

Where $-REV^*$ represents the worst revenue (loss) that occurs with the selected probability. This boundary value of loss is then expressed as a product of the boundary revenue and the value of the portfolio. If we designate m as the mean value of the rate of return we can express VAR in relative terms in relation to the mean value as:

$$VAR \text{ (in relative terms)} = -REV^* + REV = -r^* * W + \mu^* W \quad (2)$$

If now we know the distribution function of the portfolio's rate of return, we can write the boundary rate of return r^* as:

$$r^* = \mu + \alpha^* \sigma \quad (3)$$

Where σ expresses the standard deviation and α a is a parameter corresponding to the selected probability interval. In the case of a normal distribution and a 95% interval this is the already mentioned 1.65. By linking equations 1 and 2 we arrive at:

$$VAR \text{ (in relative terms)} = -\alpha^* \sigma^* W \quad (4)$$

The product $-\alpha^* \sigma^*$ expresses the boundary negative change in the rate of return in the case of the selected parameters. Since VAR is expressed as a negative change in the present value of the portfolio, the relative VAR calculated according to (4) is sufficient for us without our knowing the mean value of the revenue.

In using the VAR method it is necessary to select parameters best corresponding to the type of risk and the risks with which we are working. We will focus on the correct selection of parameters in the following text.

Selecting parameters

The question we must answer first of all is what risk, from a very wide spectrum, we want the VAR method to express. The VAR method was originally developed to cover a widespread family of market risks, such as currency, interest rate, commodity and equity risks. In this field the VAR methods are most sophisticated, and most used in practice, having become the standard for measuring market risks[1]. In the text below I shall therefore concentrate on this field. In the conditions in which Slovak banks operate this concerns primarily interest rate and currency risks.

Such a use is assumed also by the CAR, as it allows internal VAR models to be used for calculating capital requirements ensuing to the bank merely from market risks. Moreover, market risks are, according to the standard approach, expressed only for a commercial portfolio.

Despite this, I am convinced that the risk management of a bank should, at least for internal needs, monitor market risks for the whole banking book. Every open position generates risks regardless of the portfolio it occurs in. This measuring of risks must go hand in hand with a market-to-market (M-t-M) revaluation of also the banking book. The VAR method in fact relates to the loss which is expressed as the difference between the net present value of a portfolio at the beginning and end of a set period, which is merely a different name for the M-t-M revaluation of the portfolio. Despite the fact that such a procedure goes beyond what is required by international accounting standards, I consider it necessary. If we want to apply VAR to the whole banking book we will need to express also its market value. M-t-M provides a relatively objective and reliable estimate of a portfolio-'s value, and on top of this it provides managers with useful information on the performance of their strategies, makes it more difficult to conceal losses, and assists in their early disclosure, in addition, revaluation is essential at least for the reverse testing of the VAR method.

Selecting a time period

The next point will be the selection of a time period (or holding period). The most common periods are 1 day, 2 weeks (10 working days) or 1 month. At present the shortest period is one day, even if it is likely that over time some global institutions trading 24 hours daily in various times zones will consider using even shorter time periods. Four reasons exist that can influence decision-making on the length of the period used. The first is the liquidity of the market in which the bank operates[2]. According to this criterion this period should ideally equal the shortest period for which the bank in a given market is able in an ordinary manner to close its whole position. The problem is that the markets for individual instruments in a portfolio need not be equally liquid. Moreover, the liquidity of a market may fluctuate over time. It is therefore unlikely that a single value will always correspond to these conditions in all markets. We should therefore choose a time horizon which is appropriate for the largest part of the portfolio. Investment banks trading in a very liquid market, let's say the stock market in the USA, will probably use 1 day, whereas for example commercial banks which must close their positions on the none-too-liquid OTC market should select a longer period of 10 days or one month.

The three remaining reasons will argue in favour of a shorter holding period. The first is the possibility to use a normal distribution. A good example is a portfolio with a significant share of non-linear positions. The revenues of such a portfolio are in fact not governed by a normal distribution. If however we select a sufficiently short period, let's say 1 day, we can make the assumption of a normal distribution of revenues.

The second reason comprises changes in the composition of the portfolio. In calculating VAR we assume that the composition of the portfolio does not change over the selected time period. This assumption however can be made only with some difficulty in the case of longer periods. Portfolio managers will probably modulate a portfolio so that it develops in line with market conditions. An exception could be portfolios that are less actively administered.

The last aspect influencing the selection of the holding period is the need for testing the VAR method. (Will a greater loss than the VAR value occur only in x% of cases?). The fact is that sufficiently precise testing requires a large volume of data. If, for example a good test requires 1 000 (non-overlapping) observations, we will in using a one-day period need data for the last 4 years. In the case of using a 10-day holding period we will need data for the past 40 years, etc.

To be continued in issue 3/2005

[1] In recent years the measuring of credit, liquidity and operating risks have been made by modified VAR methods, more precisely termed also Credit-at-Risk or CashFlow-at-Risk. These procedures were developed from the classic VAR measurement of market risks and allow market as well as non-market risks to be combined, making risk measurement much more complex and integrated. A bank can with one number express what are, in their essence, very different risks.

[2] More precisely said, the liquidity of the market in the instruments forming the portfolio whose risk we wish to measure.