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Measuring Operational Risk through Value at Risk Models (VaR) in Albanian Banking System

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Abstract:

The main methodology adopted by financial institutions to calculate the risk associated with a financial asset is those of Value at Risk. Correct application of this methodology allows these institutions to understand financial risk attached to contracts that they sign.

The main methodology adopted by financial institutions to calculate the risk associated with a financial asset is those of Value at Risk. Correct application of this methodology allows these institutions to understand the risk-bearing financial contracts that they sign.

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The objective of this study is assessment of the operational risk of a bank being set in this way the amount that should be set aside to deal with the risk. By combining these two functions can estimate the probability distribution function of accumulated losses and calculate Value at Risk (VaR) with a confidence level of 99.9%.

Key words: Value at Risk, Operational Risk

The purpose of this paper is the benefit of a quantitative instrument that reaches valuation of a bank's operational risk in order to predict correctly that it should be the amount that must keep aside to meet potential risks.

The objective of this paper is to assess the operational risk of a bank being defined in this way the amount that should be set aside to deal with the risk.

(Gallati, 2003) Value at risk is a necessary component for risk calculation because it is a quantitative instrument where his objective is proper risk forecast with a reasonable cost. This reasoning implies a selection between different methods that better suit that has an individual portfolio or financial institution. Value at risk is an instrument which, assuming a portfolio of given financial assets accounts maximum loss in which can incur portfolio, which may be caused by the evolution of market prices, in a bow-limit, under a level certain confidence.

VaR models which uses forecast volatility and correlations between different instruments at returns considered. VaR is useful because it can be applied to market risk, which may belong to different typologies of financial instruments (Cheng ,K. Chih. W, Weiru, K., 2013).

(Hull J. W., 1998) The methods used to calculate the VaR can be classified into parametric and non-parametric models. Methodologies can best be summarized in:

1. *Variance/covariance Approach*
2. *Historical simulation*

3. *Monte Carlo simulation.*

(Yasuhiro Y. and Toshinao Y., 2001) Variance/covariance Approach is preferred and is used in cases where the portfolio considered is composed of instruments that have a connection linear, while simulation Monte Carlo is preferred in cases where the portfolio have components not linear as can be in this case options. Historical simulation placed in an intermediate stage cases that we considered above. Historical simulation and Monte Carlo he enter the so-called non-parametric methods (Pichler S., Selitsch, 1999).

Different approaches to the calculation of VaR can be classified into:

- Parametric Models
  - *AccessVariance/ covariance n h h t h n cil can find models:*
    - *Normal Portfolio*
    - *Asset normal*
    - *Delta normal*
    - *Gamma delta-normal*
- Non parametric Models
  - *The simulation approach*
    - *Monte Carlo*
    - *Historical simulation*

The calculation of VaR

To calculate the VaR of a portfolio considering an appropriate level of confidence and assuming a certain period of time serving certain records:

1. The market value of the portfolio subject to analysis
2. determining the variables of risk factors
3. selection of temporal horizon or holding period *(holding period)*
4. determination of the desired level of confidence
5. Determination of the maximum potential loss using the above information.

VaR for the total distributions

The calculation of VaR can be simplified if we assume that as far as parametric distribution can be considered as normal distribution.

In this case VaR can be derived immediately from the standard deviation of the portfolio using a moltiplikues factor which depends on the level of confidence selected (Jorion, 2001). This approach is called parametric because it implies a valuation parameters such as standard deviation, setting quintile distribution.

This method is simple and convenient to use because it produces a VaR estimate of when the distribution is normal. If we assume that W_0 is the initial investment, where R is the yield provided, then the value of the portfolio after the retention period is: $W_1 = W_0 (1 + R^*)$.

VaR can be defined in terms of relative and absolute ones. Relative VaR can be defined as the loss relative to the mean:

$$VaR\ (average) = E(W) - W^* - W = {}_0 (R^* - \mu)\ 1.1$$

While VaR expressed in absolute terms is the loss relative to 0, but without considering the expected value:

$$VaR\ (zero) = W_0 - W^*\ 1.2$$

In both cases, and the determination of VaR is the same and consists of assessing the value of the minimum returns or $W^* R^*$. VaR can be used using the next distribution of portfolio value $f(w)$.

At a certain level of confidence c, we can estimate the realization W^* in such a way that the probability of not exceeds this value in c:

or the probability that a value smaller than W^*, where $p = P(w \leq W^*)$ to be $1-c$:

W^* is quintile distribution, which is equal to the value which a certain probability will not be exceeded.

This model applies to any distribution and in this case the standard deviation is used. To calculate the value at risk in this case assume day as yields are iid (identical and independent distribution). VaR at a 95% confidence level can be calculated as 5% of the tail of the Histogram.

Historical Simulation Method

Unlike other models of historical simulation requires no assumption about the probability distribution of returns. Inside the historic simulation methods exist 2 different VaR, VaR parametric and non-parametric. Historical simulation uses the historical distribution of the assets of portfolio returns to simulate the VaR of the portfolio, based on the assumption that the portfolio will be maintained beyond the period covered by historical data available.

To apply this model before take as identify different instruments to portfolio and historical data are taken from the returns on a given observation period. Also it assumed as historical distribution of returns is a good predictor of the distribution of returns during the next period of retention.

Each observation t gives us a unique portfolio yield R_t^p and each of them will be produced corresponding gain or loss. The latter will be organized in order of ascending and desired percentile is considered to calculate VaR.

The advantages are many historical simulations. The main one is the simplicity of this model, since the data can be found in a simple and does not depend on assumptions about the distribution of returns.

In fact it should not be assumed that the distribution of returns is normal, *t-student* or any other distribution. It should not be assumed as the yields are independent in time. This allows us to overcome the problem of modeling leptokurtosis which is one of the main problems of the normal approaches to calculating VaR (Dowd, 1999).

Nature non parametric historical simulation allows us to overcome the problem of evaluating the variance, correlation and covariance or calculating the variance-covariance matrix.

In historical simulation correlation it is reflected in the historical record and the only thing we have calculated are current yields. Evaluation of VaR that will benefit will be independent of the risk model is a problem that normal approaches.

Also it can be applied to any types of market risk. However the application of this model, it appears a significant limits which is the total dependence on a set of historical data. Another problem regarding this method is that it needs a long period of observations.

To capture the risks that are not represented in the database community that is based on analysis of historical simulation, the models can be used *stress tests or scenario analysis.*

Monte Carlo Simulation

VaR calculation through Monte Carlo allows capturing the nonlinear effects of the risk variables. The simulation model consists of a number of high values of a single asset which constitutes portfolio and allows us to use different distribution of empirical probability.

This method generates some variables, transforms these numbers in multiple market scenarios and applies through the revaluation of the portfolio to generate a distribution of profit / losses.

Suppose you want to determine the VaR of a position of a certain action. The first step to be taken is to create a model that crosses us share price behavior over time.

Monte Carlo simulation represents several advantages because it is a very powerful method very flexible and can handle more positions.

No problems with nonlinearity, and is ideal for exotic options which are very complex. This model can be simplified to increase the speed and efficiency calculations. One of the biggest limitations of this model is totally dependent on the results obtained from the model and the stochastic process. This model requires big financial investments and method turns out to be a non-intuitive and difficult to explain.

Risk tipology in Albanian Banking System

Credit Risk

Credit risk is defined as the risk that counter-party does not fulfill its contractual obligation or the quality of an issuer deteriorates (BCBS, 2010).

Counterparty risk: The risk that a counterparty does not fulfill its contractual obligation including:

- **Sovereign risk:** Counterparty risk in respect of a sovereign entity, irrespective of the currency involved.
- **Settlement risk:** The risk that the counterparty defaults on transactions in the process of being settled, where value has been delivered to the counterparty but not yet received in return.

Issuer credit risk: The risk that the value of a security decreases because of deterioration in the quality of the issuer (change in the issuer's credit rating).

Concentration risk: The risk of correlated risks being insufficiently spread on a portfolio basis (industry, regional or products basis) or in respect of a specific counterparty

Cross-border (Transfer) risk: The risk that foreign currency funds cannot be transferred out of a given country as a result of

action(s) on the part of that country's authorities or as a result of other events.

- **Macro Economic risk**: The risk of a macro economic downturn negatively impacting the quality of our assets or the profitability of our business (collective debtor risk).

Legal Risk

Legal risk is defined as the risk of non-compliance with applicable laws, rules, regulations and prescribed practices. Legal risk can also include risks arising because a contract cannot be enforced or because its content does not accurately reflect the bank's intentions (BIS, 2006).

Liquidity Risk

Liquidity risk is defined as the current or prospective risk to earnings and capital arising from a bank's inability to meet its liabilities when they become due without incurring unacceptable losses.

Liquidity risk arises from the:

- inability to manage unplanned decreases or changes in funding sources
- failure to address changes in market conditions that affect the ability to liquidate assets quickly and with minimal loss in value

This risk is associated with changes in the:

- Liquidity prices
- Liquidity price volatility
- Correlation between different liquidity price determinants.

Market Risk

Market risk is defined as the risk that movements in financial market prices will change the value of the bank's trading portfolios. Market risk is further defined as the current or

prospective risk to earnings and capital arising from adverse movements in bond prices, security and commodity prices and foreign exchange rates in the trading book. This risk arises from market making, dealing, and position taking in bonds, securities, currencies, commodities, and derivatives (bonds, securities, currencies, and commodities) (CEBS, 2006).
Market risk is categorized into:

- General market risk
- Specific market risk

Operational Risk

Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, human behavior and systems or from external events (Tarrant, W, Guegan, D, 2012). Operational risk means unexpected losses arising from phenomena which are divided into 4 main categories:

- Human error,
- Incorrect procedure
- Ineffective checks,
- Information structures not suitable.

Reputational Risk

Is defined reputational risk as a risk arising from negative public opinion, irrespective of whether this opinion is based on facts or merely on public perception.
Such risk can result from:

- Actions and behaviour of the organisation or its staff, for example selling products, providing services or interacting with stakeholders, which constitutes direct risk products sold, services provided, or interactions with stakeholders, which constitutes direct risk.
- Actions and behaviour of external parties, which constitutes indirect risk.

RESULTS

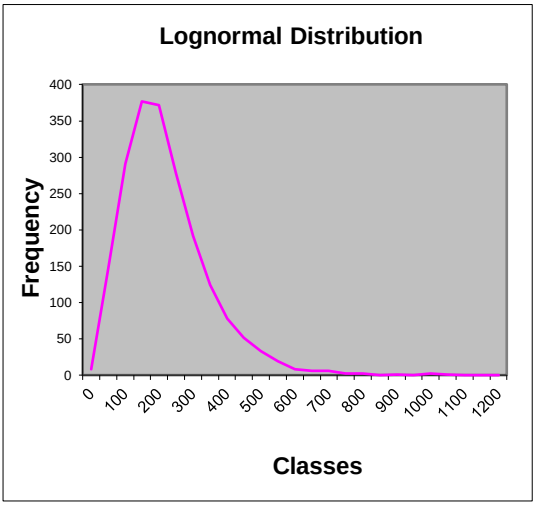
The data bank VaR applying our theory by 2 methods. Simulated losses confidences applies the desired level and thus will benefit a potential risk calculation by which the bank will use to forecast amounts should dispose of in order to bear the risk.

VaR			Poisson	**Severity**										
95.0%	**99.9%**	**Prg**	**Frequency**	1	2	3	4	5	6	7	8	9	10	**Loss**
430.0	1224.6	1	7	6.5	14.4	30.7	4.4	4.9	56.9	75.5	0.0	0.0	0.0	193.3
435.5	1158.3	2	4	6.4	8.1	15.5	29.3	0.0	0.0	0.0	0.0	0.0	0.0	59.3
432.0	1298.0	3	7	19.8	9.1	96.5	14.8	29.6	32.9	26.9	0.0	0.0	0.0	229.6
465.1	891.3	4	3	7.5	6.3	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.8
453.5	1034.2	5	5	39.5	78.9	20.2	55.0	22.7	0.0	0.0	0.0	0.0	0.0	216.2
622.4	880.1	6	6	7.6	11.3	42.3	9.4	22.0	6.1	0.0	0.0	0.0	0.0	98.6
672.2	844.3	7	2	19.8	88.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108.4
659.1	869.7	8	5	20.3	25.4	11.1	18.2	2.1	0.0	0.0	0.0	0.0	0.0	77.1
657.7	1159.1	9	1	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0
575.1	995.4	10	4	52.3	5.0	36.0	84.3	0.0	0.0	0.0	0.0	0.0	0.0	177.7
		1995	3	14.3	46.3	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.8
		1996	6	26.9	4.2	24.0	11.7	10.7	16.3	0.0	0.0	0.0	0.0	93.9
		1997	11	12.5	38.9	13.3	86.3	62.3	40.9	68.5	31.0	34.4	1.3	411.0
		1998	5	21.9	5.3	84.4	33.6	11.9	0.0	0.0	0.0	0.0	0.0	157.2
		1999	10	152.1	9.4	8.7	3.0	19.1	11.9	14.3	8.7	34.6	132.6	394.3
		2000	5	22.4	43.0	47.6	9.5	16.4	0.0	0.0	0.0	0.0	0.0	138.8

Value at Risk		
VaR		
Int. confidence.(α)	Monte Carlo	Historical Approach
95%	*450.8454307*	*450.515972*
99.9%	*914.6184113*	*1089.9902*

Value at Risk		
	95%	**99.9%**
VaR	597.0	1044.7
c(VaR)	82.5957996	123.12515

	Lognormal	Gamma
Classes	Frequency	Frequency
0	4	6
50	142	1969
100	329	25
150	400	0
200	326	0
250	260	0
300	168	0
350	152	0
400	78	0
450	56	0
500	23	0
550	16	0
600	19	0
650	11	0
700	2	0
750	5	0
800	1	0
850	2	0
900	1	0
950	1	0
1000	2	0
1050	1	0
1100	0	0
1150	1	0
1200	0	0



CONCLUSION

In all contracts analyzed by the method of simulation Monte Carlo reached to determine in detail the risk of loss, confirming the contracts as a tool for risk cover against operational risk.

This paper concludes that the bank selection method that Value at Risk depends on the instruments that are in the portfolio. Only if the portfolio does not contain optional components, then you can apply the method to the cost of smaller and easy to understand as VaR variance-covariance.

Albanian legislation allows trading of any instrument without differentiation on exotic instruments that are identified as speculative instruments.

Value at Risk analysis show that specific banks could evaluate the potencial loss and dynamically act to provide capital in capital markets.

Analysis of different models used to calculate the value at risk, understood as the loss of value in a portfolio of fixed, they can occur as a result of changes unfavorable to one or more risk factors, a horizon given.

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