APPLICABILITY OF VALUE AT RISK ON ROMANINAN CAPITAL MARKET

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Abstract: *This paper illustrates the applicability of value at risk in the case of a stock portfolio, from the Romanian Financial Market. The possibility of market risk quantification in higher volatility conditions of the stock market is especially significant for the investment processes in emerging markets. Thus, this paper, investigated the performance of Value at Risk (VaR) methods with the daily returns series of five stocks that are in the portfolio from the Romanian stock market. The originality of this paper is to demonstrate the applicability of the methodology value at risk for a stock market from the perspective of emerging country. The main goal of the research is to test the performance of the historical, variance-covariance and Monte Carlo methods VaR with 95% and 99% confidence level estimates as functions of determining the maximum possible loss from investment activities on Romanian capital market*
Keywords: *Value at Risk, stock portfolio, Monte Carlo method, historical method, variance-covariance method.*

1. INTRODUCTION

Financial markets in general and capital market in particular are characterized by uncertainty manifested through continuous price volatility of stocks, bonds and other financial instruments as well as the rate of return and the exchange rate. Because of the capital market variability, the future incomes generated by the financial assets traded in different time-period are difficult to estimate and are extremely volatile.

The capital market of Romania is a frontier capital market that aims towards an emergent capital market. The difference between a frontier capital market and an emergent capital market is the quality and the volume of the offers of shares and the variety of the investment opportunities.

The frontier capital market is attractive when the initial offerings are made and the emergent capital market offers more opportunities for future incomes.

Value at Risk (VaR) is the representation of the total risk of a portfolio in a single number. Value at Risk (VaR) is the maximum loss not exceeded with a given probability defined as the confidence level, over a given period of time. The applicability of Value at Risk on the frontier and emergent markets has some particularities that are demonstrated in this paper.

This paper analyzes the methodology Value at Risk, the theoretical part, then this paper estimates the Value at Risk for a specific portfolio from the Romanian capital market (Bucharest Stock Exchange) using Microsoft Excel and we conclude with some particularities that the market and the methods used in calculating VaR have.

2. THE METHODOLOGY VALUE AT RISK

Value at Risk is the most used methodology in international banking system and the purpose of VaR is to measure and diminish the negative effects of market risks. The history of Value at Risk is connected to the president of the J.P.Morgan Investment Bank. The success of Value at Risk resides on the importance given to the Group of Thirty in 1993 and the Basel amendment in 1996. In these two documents resides the recommendation made for the Central Banks to use the methodology Value at Risk as a measure to determinate the minimum limit of the capital necessary for a commercial bank to defray the market risk to which it is exposed to.

Value-at-Risk represents the maximum possible loss of holding a portfolio a period of time, for example h days, and this loss cannot be exceeded whit a certain probability p (Jorion P., 2007:17)

Value at Risk indicator measures the risk of all financial instruments that are in the competence of the portfolio it can be options, stocks, currency etc. Value at Risk must respond to the following question: How high can the maximum potential loss of a specific investment be? The loss is calculated with a given probability, x% and a specific period of time, h days. Value at Risk (h,α VaR) measures the maximum potential loss of an financial instruments portfolio for a specific period of time (h days) and with a specific probability (x%) or a specific confidence level (1-α), (Dowd K., 2002: 19).

Value at Risk indicator depends on the period of time selected to determine the maximum potential loss. The P/L of the portfolio during a certain period of time "h" days is calculated as the difference between the value of the portfolio after the "h" days and the initial value of the portfolio. The formula is (Dowd K., 2002: 20):

$$\Delta\Pi h = \Pi h - \Pi 0,$$

Π_0 = The initial value of the portfolio, that is known,

$$P(\Delta\Pi < -VaR) = \alpha$$

Πh= The value of the portfolio after the "h" days (random variable)

$$P(\Delta\Pi > -VaR) = 1 - \alpha$$

$\Delta\Pi$ = P/L (Proft/Loss) for the next "h" days.

Calculating Value at Risk means establishing two parameters: the period of time in which we want to estimate the risk and the percentage of tolerance at risk (1-p) or the probability of confidence for which we want to estimate de risk (Anton S., 2009: 77).

The purpose of Value at Risk is not to describe the most unfavorable scenario, but rather to estimate a range of possible losses or profits. Value at Risk has three main aspects regarding risk management: the distribution of the probability regarding the future value of the portfolio (defined by volatility and mean); the aversion towards risk by the portfolio manager (specified by the level of confidence) and the holding period of the portfolio for the manager (Anton S., 2009: 78).

The methods used in this paper to calculate Value at Risk are (Mutu S., 2012: 96):

a) Historical Simulation Method;
b) Variance-Covariance Method;
c) Monte Carlo Method.

The historical simulation method represents the theoretical value of the current portfolio modified by the historical risk variation. The advantage of the method is that there is no hypothesis about the return distribution. This method uses the empirical distribution generated by the historical spreadsheet; it's relatively simple to calculate VaR using this method. The disadvantage is that it needs a high quantity of historical data and is based only on the historical data, thus, if the past doesn`t repeat itself the estimation is imprecise.

The variance-covariance method has the hypothesis that the return distribution of the financial instruments in the portfolio is a normal distribution. This method considers that the returns are independent and uninfluenced by each other. The main disadvantage of variance-covariance method is that has the hypothesis that the return distribution of the financial instruments in the portfolio is a normal distribution and most of the financial instruments don`t have a normal distribution (Anton S., 2009: 77).

The Monte Carlo method is based on generating different scenarios based on the historical data to determine the nature of the return distribution. This method is very flexible; it can be used for all types of portfolios. When Monte Carlo simulation is used, there are ways of extending the model building approach so that market variables are no longer assumed to be normal. The drawback of the Monte Carlo simulation is that it tends to be computationally slow because a company's complete portfolio (which might consist of hundreds of thousands of different instruments) has to be revalued many times (Hull, J., White A., 1998: 9-19).

Choosing the method for calculating Value at Risk depends on the financial instruments that are in the portfolio, the accurate measurements of risk, the hypothesis of the methods, the understanding of the methods and the results generated by the methods etc (Codirlasu A., Chidesciuc N., 2007: 105).

3. CALCULATING VALUE AT RISK FOR A STOCK PORTFOLIO FROM THE ROMANIAN CAPITAL MARKET

Value at Risk has become a standard market risk measurement instrument in the financial-banking system. There are many international research papers regarding the applicability of Value at Risk on developed capital markets but the emergent capital markets have been studied less from this point of view.

On a national level there is little research on the subject of our paper, one example being that of Codirlasu (2007), who tested Value at Risk for three portfolios – stocks, currency and options using EWMA and GARCH. (Pele&Armeanu 2008) have tested the applicability of Markowitz model on the Romanian capital market.

Emergent capital markets have low dealing values; the liquidity risk, the currency risk, the interest rate risk and the regularity risk are the basis of the excessive volatility on the emergent capital market (Gençay R., Selçuk F., 2003: 2).

The emergent capital markets have short historical data and the standard deviation of Value at Risk rises with the confidence level. (Su&Knowles, 2006) demonstrated that at a 99% confidence level the standard deviation of VaR is higher using Monte Carlo and variance-covariance than at the 95% confidence level.

In this paper we estimate VaR for a portfolio of 5 stocks from the Romanian capital market. The stocks that are in the portfolio are selected from companies in different economic sectors, having the same historical data and presenting a higher liquidity than other companies listed on the Bucharest Stock Exchange.

Table no.1: The data regarding the portfolio for calculating Value at Risk

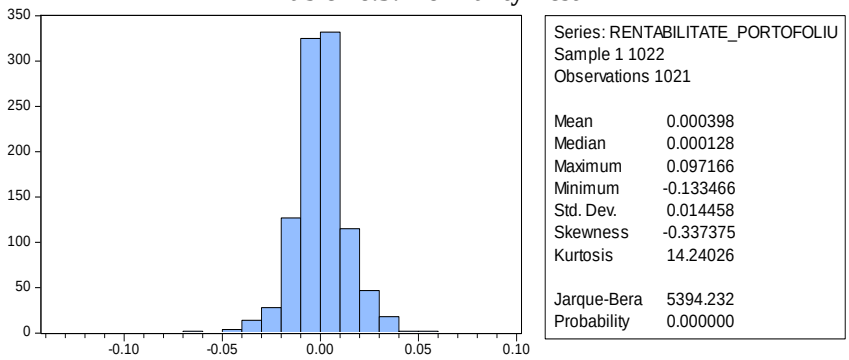
Number of stocks	5
Companies	TLV (Banca Transilvania), SIF 2 Moldova, ATB (Antibiotice), TEL (TransElectrica) și SNP (Petrom).
Historical data	2011-2015
Number of observations	1022 days
Period of time	1 day
Level of confidence	95%, 99%
Nature of observation	Daily prices
The investment	100.000 RON

Table no.2: Descriptive statistics

Discriptive Statistics Portfolio

	ATB	SIF_2	TEL	TLV	SNP	PORTOFOLIU
Mean	0.487518	1.306239	17.71538	1.416829	0.407377	21.33334
Median	0.470000	1.302500	16.86000	1.411500	0.415000	19.89600
Maximum	0.637000	1.741000	32.47000	2.219000	0.490000	37.38360
Minimum	0.340000	0.718000	10.84000	0.831000	0.275000	14.17080
Std. Dev.	0.085786	0.197068	5.078835	0.288894	0.051086	5.377755
Probability	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000
Sum	498.2434	1334.976	18105.12	1447.999	416.3393	21802.68
Sum Sq. Dev.	7.513777	39.65136	26336.25	85.21239	2.664575	29527.57
Observations	1022	1022	1022	1022	1022	1022

Table no.3: Normality Test



The descriptive statistic table illustrates the minimum value of the portfolio as 14.17 RON and the maximum value of the portfolio as 37.38 RON that can be achieved a day. After the normality test our data-set is not modeled by a normal distribution, is modeled but rather a leptokurtic distribution which the majority of financial instruments have.

In a leptokurtic distribution the probability that an extreme event can take place is higher than in a normal distribution.

4. RESULTS AND CONCLUSIONS

Table no. 4: The variation of P/L of the portfolio historical data

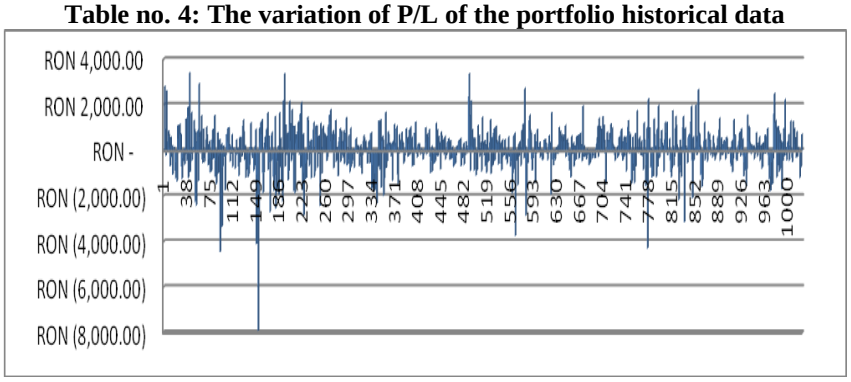


Table no. 5: Value at Risk results

Confidence level	Historical simulation	Monte Carlo	Variance-covariance
95%	1 381.60 RON	4 253.87 RON	2 527.67 RON
99%	2 666.60 RON	3 713.13 RON	3 574.93 RON

Value at Risk in this paper responds to one question: What is the maximum loss of a portfolio investment on the capital market for a specific period of time with a specific probability?

For a 95% confidence level the historical simulation has a result of 1 381.60 RON, Monte Carlo 4 253.87 RON and variance-covariance method 2 527.67 RON. There

are different results for each method. However, the ideal result must be obtained following the establishment of a basic methodology/method. According to the specialty literature the basic method considered for the calculation of VAR is the Monte Carlo method, but this must be combined with the other two methods of the value at risk, as well as other methods such as the extreme values theories (which calculates the market risk of the tail behavior), the stress conditions tests (which estimate the potential losses in the abnormal market conditions) and the historical testing. The Value of Risk measures the potential loss in the normal market conditions, determined by the change in the assets' price.

The maximum possible loss in one day for a portfolio investment of 100 000 RON analyzed at a 95% confidence level is 4 253.87 RON.

The maximum possible loss in one day for a portfolio investment of 100 000 RON analyzed at a 99% confidence level is 3 713.13 RON.

(Andjeli G*. et al,* 2010) analyzed VaR for an emerging capital market and concluded that a 99% confidence level is characteristic to a volatile market. The Romanian capital market is volatile market thus as a result of VaR in this paper we conclude that the maximum possible loss for portfolio investment of 100 000 RON in the portfolio analyzed for a 99% confidence level in one day is 3 713.13 RON.

We conclude with some limitations regarding the Romanian capital market such as:

- low liquidity on the market;
- limited access to historical data;
- limited historical data;
- limited financial instruments;
- limited number of listed companies.

Given the high volatility that exists on the international and national capital markets the accurate quantification of the market risk represents an indispensable condition for the risk management. Value at Risk is the most used methodology to measure and quantify the financial risks on developed capital markets.

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