ESTIMATING THE RETURN OF THE FINANCIAL TITLES OF THE COMPANIES FROM THE MANUFACTURING INDUSTRY, LISTED ON THE BUCHAREST STOCK EXCHANGE

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Abstract

The paper presents a method of estimating the maximum expected loss of value that can be recorded by holding a portfolio of financial titles for a certain period of time, through the VaR model, using Monte Carlo simulation method. The research was based on the closing prices of 33 companies from the manufacturing industry in Romania, listed on the Bucharest Stock Exchange. The results of the paper showed that, for a portfolio composed of the financial titles of the 33 studied companies, in which it will be invested an amount of 1.000.000 lei, the maximum daily loss, estimated during the studied period of 01.01.2016-31.12.2016, was 2.513,47 lei.

Keywords: financial titles, Value at Risk (VaR), Monte Carlo method, closing price, market risk

JEL classification: G11, G17

1. Introduction

Value at Risk (VaR) model was created on 1994 by J.P. Morgan, being considerated at the moment, one of the most modern possibilities to estimate the risk encountered in banks or, companies. Acest model allows to estimate the risk, by determining the maximum expected loss by holding a portfolio of titkes, for a certain period of time and with a certain probability (Ion Stancu, Florentina Bălu, 2006). VaR model is used in most of the researches regarding the study of the price of the financial titles, but it can be used also in order to forecast the rate of exchange (Mittnik, 2000), the interest

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rates (Ferreira & Lopez, 2005), the credit risk (Allen & Powell, 2009), the market risk (Bank for International Settlements, 2006), etc.

2. Literature review

In the study "VaR: Exchange Rate Risk and Jump Risk", Fen Ying C., (2010) states that Value at Risk represents the most extended method of determining the financial risk. Andersen T., Bollerslev T. (2012), in the paper "Financial Risk Measurement for Financial Risk Management", highlights the need to have an appropriate risk management. He is referring in particular to the risk of financial titles. Jorion P. (2006), classifies the financial risks in 5 categories[3]: the market risk, determinated by the changes in the volatility of the prices of financial assets; the credit risk, determinated by not meeting the payment obligations from the side of one of the parties; the liquidity risk, that appears when the assets can not be converted in cash in an useful period of time; the operational risk, determinated by the human or technological errors; the legal risk, caused by penalties and sanctions, due to the non-compliance of the legal provisions.

In order to determine Value at Risk (VaR), it is necessary the random choice of two elements: the period of holding the financial titles (h) and the level of relevance (α). Risk Metrics department from J.P. Morgan bank, uses a time horizon of 1 day and a 95% confidence level.

There are several methods of determining VaR, the most used being: the method of non-parametric historical simulations, the parametric / analytical method and Monte Carlo simulation method (Ţimurlea Mihai, 2003). In this paper, we used the Monte Carlo simulation method. Applying this method involves going through five steps (Yun Hsing Cheung, Robert J. Powell, 2012).

- In the first step, it is determined the parameters used for calculating the Brownian geometric movement: time increment (Δt), the expected yield (k) and the annualized standard deviation of the historical returns (stndev). Time increment (Δt), is related to a one-year period (The number of trading days in a year is 252, Δt being 0,0040).
- The second step aims to generate a flow of unui flux of pseudo-random numbers, uniformly distributed between 0 and 1. In this

[3] Jorion, P. (2006), " Value at Risk the New Benchmark for Managing Financial Risk", 3rd Edition, The McGraw-Hill Companies, Inc., New York, pp. 22.

research, using Excel soft, there were generated 10.000 de pseudo-random numbers, uniformly distributed between 0 and 1. The seed used in those simulations, was randomly chosen as being 230. The 10.000 simulations were generated with the formula:
7^5 x the previous number (the initial number is the seed-ul 230), divided by 2.147.483.647 (2^{31}-1)

- In the third step, the 10.000 pseudo-random numbers are converted in 10.000 of random numbers normally distributed between 0 and 1. The conversion was done through NORMSINV function (probability) from Excel soft, using the pseudo-random numbers as probabilities.
- The fourth step applies the
random numbers normally distributed, in the Brownian geometric mouvement process, in order to obtain simulated returns of the assets.
- În the last step, it is determinated the daily potential loss 5% VaR, expressed as percentage, as well as 5% VaR expressed in RON.

3. Research methodology

VaR model is applied on a set of data with daily frequency (260 observations from the period 01.01.2016-31.12.2016), based on the closing prices of 33 companies from the manufacturing industry in România, listed on the Bucharest Stock Exchange, at the standard and premium categories: ALRO S.A. (ALR), ALTUR S.A. (ALT), AEROSTAR S.A. (ARS), ARTEGO S.A. (ARTE), ANTIBIOTICE S.A. (ATB), BIOFARM S.A. (BIO), CEMACON S.A. (CEON), COMELF S.A. (CMF), COMPA S.A. (CMP), CONTED S.A. (CNTE), ELECTROARGES S.A. (ELGS), ELECTROMAGNETICA S.A (ELMA), ELECTROPUTERE S.A. (EPT), ROMCARBON S.A. (ROCE), ROMPETROL RAFINARE S.A. (RRC), ZENTIVA S.A. (SCD), BOROMIR PROD S.A. (SPCU), TURBOMECANICA S.A. (TBM), TERAPLAST S.A. (TRP), VNC (VRANCART S.A.), TMK - ARTROM S.A. (ART), BERMAS S.A. (BRM), CARBOCHIM S.A. (CBC), GRUPUL INDUSTRIAL ELECTROCONTACT S.A.(ECT), MECANICA CEAHLAU (MECF), PRODPLAST S.A. (PPL), PREFAB S.A. (PREH), SANTIERUL NAVAL ORSOVA S.A. (SNO), STIROM S.A. (STIB), SINTEZA S.A. (STZ), UAMT S.A. (UAM), UZTEL S.A. (UZT), VESY (VES S.A.).

- The result obtained within a portfolio of titles, in a certain period of *"h"* days, is determined as difference between the portfolio value after

the *"h"* days and it's initial value, according to the model (Ion Stancu, Florentina Bălu, 2006):

$$\Delta\Pi_h = \Pi_h - \Pi_0 \quad (1)$$

where,

Π_0 = the portfolio's initial value;
Π_h = the portfolio's initial value after *"h"* zile (random variable)
$\Delta\Pi_h$ = the profit/loss for the next *"h"* days

4. Case study regarding VaR estimation through Monte Carlo simulation method

The research was carried out both for the company with the highest closing price at the end of the studied period of time (31.12.2016) - Conted Dorohoi S.A. (CNTE), and for the portofolio of titles belonging to the 33 companies from the manufacturing industry from Romania, listed on the Bucharest Stock Exchange, at the first and second categories.

4.1 EstimatingVaR for Conted Dorohoi S.A. company (CNTE)

In the table no. 4.1., there were highlighted the parameters needed in order to determine the Brownian geometric mouvement, including the three indispensable parameters: time increment (Δt), expected return (k) and the annualized standard deviation of historical returns (stndev).

Table no. 4.1. The needed parameters in order to determine the Brownian geometric mouvement

Observations	260
Daily minimum return /Daily minimum loss	-11.11%
Daily maximum return	8.08%
The last closing value	45.2
The number of trading days	249
Time increment (Δt) for 1 day	0.004016064
The return/Daily average loss	-0.07%
Daily standard deviation	1.75%
The return/The average annualized loss for 1 year	-18.37%
Annualized standard deviation (σ)	27.57%
The expected return (k)	-22.17%
The number of simulations	10.000

Seed	230
Modulus (m)	2.147.483.647

Source: Authors own processing, based on the data taken from the companies annual financial statements, available on www.bvb.ro

Then, 10.000 pseudo-random numbers, evenly distributed between 0 and 1, were generated.

In the table no. 4.2., it can be observed the results of 5% VaR, respectively the maximum expected loss expressed as percentage, and also VaR value, based on the investment expressed in RON.

Table no. 4.2. Estimating VaR for Conted Dorohoi S.A.company

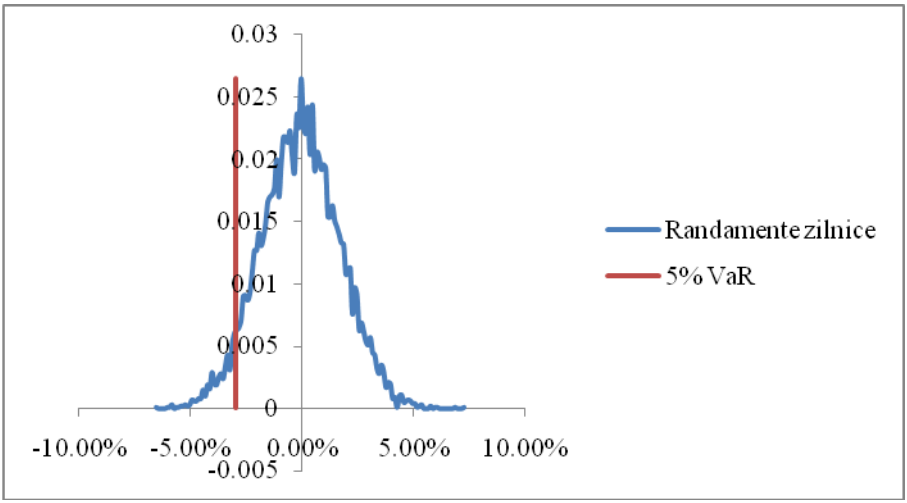
Confidence level	95%
The smallest 5% observations	500
5% VaR	-2.97%
The investment amount	1.000.000
Daily potential loss (5% VaR)	(29.679) lei
The selected range	0.10%

Source: Authors own processing, based on the data taken from the companies annual financial statements, available on www.bvb.ro

At a 95% confidence level, 5% significance level, and an investment of 1.000.000 lei, there would have been a potential maximum daily loss of 2.97%, respectively of 29.679 lei.

The returns distribution for Conted Dorohoi S.A. company, through the Monte Carlo simulation is presented in the figure no. 4.1.

Figure no.4.1. The returns distribution for Conted Dorohoi S.A. company



Source: Authors own processing, based on the data taken from the companies annual financial statements, available on www.bvb.ro

The returns between -3% and 3% have the highest frequency, representing around 91% from the total number of observations.

4.2. Estimating VaR for the 33 companies portfolio

For the portfolio composed of 33 financial titles, it was applied the same research methodology as teh one used for Conted Dorohoi S.A.company.

Table no. 4.3. The parameters needed in order to determine the Brownian geometric mouvement – the first 5 titles with the highest return, during 01.01.2016-31.12.2016

Companies / Calculation Items	TBM	SPCU	STIB	ELGS	VESY
The number of observations	260	260	260	260	260
The minimum daily loss	-13.28%	-11.43%	-10.48%	-4.98%	-14.65%
The maximum daily return	14.83%	14.78%	14.96%	14.83%	14.72%
The last closing price	0.0968	0.306	17	0.97	0.078
The number of trading days	249	249	249	249	249
Time increment (t) for 1 day	0.00401	0.00401	0.00401	0.00401	0.00401

Daily average return	0.44%	0.37%	0.34%	0.28%	0.27%
Daily standard deviation	2.85%	3.37%	3.06%	2.09%	2.9315%
Annual average return for/year	109.21%	91.54%	83.54%	68.82%	66.3094%
The annualized std dev (σ)	45.03%	53.33%	48.29%	33.03%	46.2590%
The expected return	99.07%	77.32%	71.87%	63.36%	55.6099%
The number of simulations	10000	10000	10000	10000	10000

Source: Authors own processing, based on the data taken from the companies annual financial statements, available on www.bvb.ro

In the table no. 4.3., it can be observed the fact that the financial titles with the highest expected return during the studied period of time, belong to: Turbomecanica S.A. (TBM), Boromir Prod S.A. Buzau (SPCU), Stirom S.A. Bucuresti (STIB), Electroarges S.A. (ELGS) and Ves S.A.(VESY).

Table no. 4.4. The parameters needed in order to determine the Brownian geometric mouvement – the first 5 titles with the highest return, during 01.01.2016-31.12.2016

Companies / Calculation Items	**TRP**	**ART**	**CMF**	**PREH**	**ECT**
The number of observations	260	260	260	260	260
The minimum daily loss	-35.62%	-14.83%	-13.98%	-12.50%	-14.53%
The maximum daily return	6.83%	14.89%	15%	14.35%	14%
The last closing price	0.5	2.61	2.21	1.1	0.0186
The number of trading days	249	249	249	249	249
Time increment (t) for 1 day	0.00401	0.00401	0.00401	0.00401	0.00401
Daily average return	-0.10%	-0.07%	-0.06%	-0.04%	-0.04%
Daily standard deviation	3.02%	3.38%	3.30%	3.32%	3.05%
Annual average return /year	-23.85%	-17.34%	-15.85%	-9.01%	-11.12%
The annualized std dev (σ)	47.76%	53.37%	52.08%	52.53%	48.21%
The expected return	-35.26%	-31.58%	-29.41%	-22.81%	-22.75%

The number of simulations	10000	10000	10000	10000	10000

Source: Authors own processing, based on the data taken from the companies annual financial statements, available on www.bvb.ro

In the table no. 4.4. it can be noticed the fact that there were generated 10.000 pseudo-random numbers evenly distributed between 0 and 1. The financial titles with the lowest expected return during the studied period of time, belong to: Teraplast S.A. (TRP), TMK Artrom S.A. (ART), Comelf S.A. (CMF), Prefab S.A. (PREH) and Grupul Industrial Electrocontact S.A. (ECT).

In the table no. 4.5. there can be noticed the results of 5% VaR, respectively the maximum expected loss expressed as percentage, and also VaR value, based on the investment expressed in RON, for the portfolio composed of the 33 titles.

Table no. 4.5. Estimating VaR for the portofolio of 33 titles

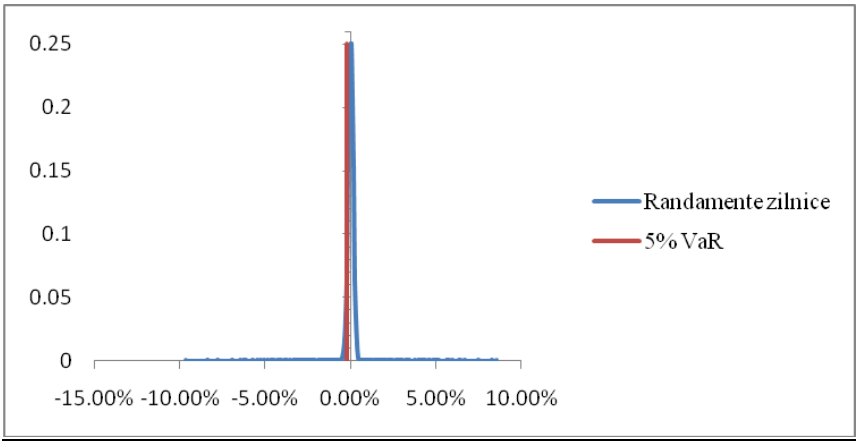
The confidence level	95%
The smallest 5% observations	500.00
5% VaR	-0.25%
The investment amount	1.000.000
Daily potential loss (5% VaR)	(2.513,47)

Source: Authors own processing, based on the data taken from the companies annual financial statements, available on www.bvb.ro

At a 95% confidence level, 5% significance level, and an investment of 1.000.000 lei, there would have been a potential maximum daily loss of 0.25%, respectively of 2.513,47 lei.

The returns distribution for the portfolio of 33 titles, through the Monte Carlo simulation is presented in the figure no. 4.2.

Figure nr.4.2. The portfolio's returns distribution



Source: Authors own processing, based on the data taken from the companies annual financial statements, available on www.bvb.ro

The returns between -0,3% and 0,3%, have the highest frequency, representing around 94% from the total number of observations.

5. Conclusions

The results obtained after applying Monte Carlo simulation method of VaR estimation, demonstrated that the financial titles of Conted Dorohoi S.A. company, recorded a maximum daily potential loss of 2.97% during the period 01.01.2016-31.12.2016, and that the portfolio composed of the 33 titles, recorded during the same period of time, a maximum daily potential loss of only 0,25%. Therefore, by diversifying the investment, the expected maximum loss can be considerably reduced.

In our opinion, this study can be useful to investors in order to choose the most efficient investment option and to minimize the risk. In future research we aim to extend the use of the VaR model, through parametric and nonparametric methods, as well as through the family of GARCH models.

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