The Importance of the Value at Risk Method Using the Historical Simulation Approach in Measuring the Financial Risks of the Organization: An Applied Study on Companies Listed on the Algerian Stock Exchange.

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Abstract:

This study aims to assess and measure the financial risks of the investment portfolio by introducing the value-at-risk approach through the historical simulation approach. The various variables of the study were addressed theoretically and practically by measuring the value at risk (VaR) of a hypothetical investment portfolio in active companies listed on the Algerian Stock Exchange. Through this study, we reached the extent of fluctuation in prices and returns, as well as the size of potential risks and losses that may face the investor in the study sample companies. This may allow the investor to reduce these risks to avoid financial failures that it might incur, as well as to make an appropriate investment decision on time.

Keywords: Financial risks, value at risk, Algerian Stock Exchange.

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1. Introduction

The value-at-risk approach has been commonly used with the beginning of the eighties and nineties of the last century, with the emergence and increase of financial disasters, this measure was adopted by major financial institutions such as JP Morgan withinits Risk Metrics system. In October 1994, relating to market risk management, the use of this value was encouraged by financial and non-financial institutions, small institutions, central banks, as well as various investment institutions, considering it as standard for estimating and measuring potential losses and a tool for confronting financial risks in light of market conditions, and even more so at the time, obligated a group ofinternational institutions, both American and European, to disclose the value at risk to control market risks, using different approaches and methods, including those based on the method of historical simulation.

1.1 Study problem:

Financial risks are an essential element that accompanies the investment operations on which various investment decisions and policies are built in the institution, which requires officials to measure and analyze these risks according to different methods and predict them to limit or reduce their impact. Based on that, the problem of the current study can be formulated in thefollowing question:

Can the historical simulation approach be used as a measure of value at risk in estimating and measuring the financial risks of institutions listed on the Algerian Stock Exchange market?

To reach results that can answer the study's question, we posed the following sub-:questions:

- What is the importance of assessing and measuring financial risks in economic and financial institutions?

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- Can the historical simulation model be used to estimate and measure the value at risk of an investment portfolio in companies listed on the Algerian Stock Exchange?

- To what extent do financial risks affect the assumed returns of the investment portfolio in companies listed on the Algerian Stock Exchange?

1.2   Study hypotheses:

The objective of this study is based on the following basic assumptions:

- Institutions of all types work to evaluate and measure the value at risk to avoid/reduce financial risks in the future, formulate policies, and make the most effective investment decisions

- Can the historical simulation approach be used as an approach to measure and estimate the value at risk of the assumed investment portfolio in companies listed on the Algerian Stock Exchange.

2.1   **Objectives of study:**

The study aims to achieve the following objective:

- More accurate estimate of the amount of maximum loss that the investment portfolio under study can incur in a certain period and with a certain confidence interval in light of the current market risks;

- Discussing the most important measures of value at risk and how it work as a tool for estimating and measuring potential losses to confront financial risks;

- Applying the historical simulation model to measure and evaluate returns exposed to risk in the stock market in Algeria;

- Discussing the importance of estimating the value at risk of the institution's returns and its role in improving the institution's performance and determining the requirements for itscontinuity.

3.1 Study Methodology:

Through this study, we adopted the two descriptive and analytical approaches in conducting the applied study, because it allows a review of the procedural definitions as well as the various literature that dealt with the variables of the study. We also relied on the analytical approach to determine the effectiveness of using the historical simulation method as a measure of value at risk in assessing and measuring financial risks by applying it to companies listed on the Algerian Stock Exchange.

2. The theoretical foundation of the study variables

1.2 The concept of value at risk

The value at risk was defined by several concepts, especially in the 1990s, namely the dollar at risk, capital exposed to risks, and returns exposed to risks **Earnings at Risk ,** and finally, value at risk, and many researchers have addressed it .Academics have introduced the concept of value at risk, as it was defined by **Kevin David**, It is the maximum amount of loss to which the institution's financial " portfolio can be exposed at a certain level ofconfidence[1]".

While **John and al** indicates risk at value as measurement of portfolio risk and is a statement ofat a certain probability level, the expected losses will not exceed the [2].number resulting from the value at risk

It should be noted that estimating the value at risk is only an estimate of the value of the expected loss in the market value of financial assets within a specific **N** period, and the value at risk can be represented according to several confidence levels through the following figure:

Figure 1-1 Value at risk at different confidence levels
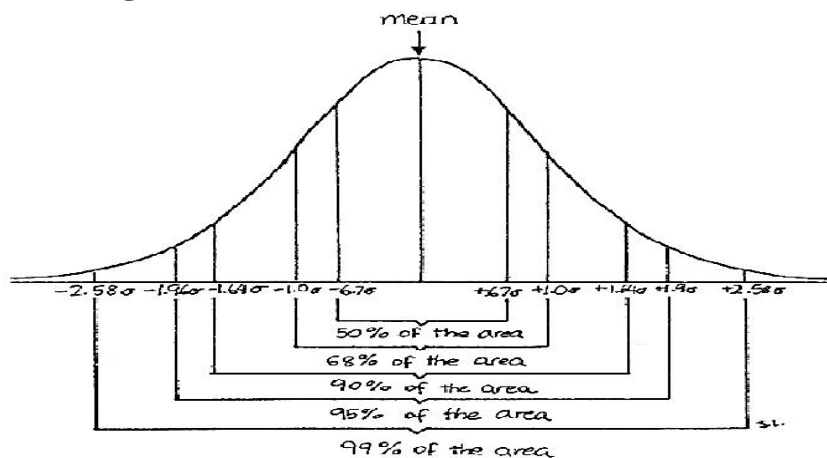
Source: Ayaba, O., H., and Okah, P., O., "Value at Risk: A Standard Tool In Measuring Risk – A Quantitative Study On Stock Portfolio", Thesis, University UMEA, Sweden, 2011, P 11.

Accordingly, the value-at-risk approach can be defined as a mathematical model through which officials in the organization's management aim to measure the maximum value that can be lost in the investment portfolio during a specific period and at a specific level of confidence. It may befor example 95 %, 97 %, or 99 % be as short as days or as long as a year. As an explanation for Figure1-1 above, the statistical value of the risks to which the organization's returns may be exposed is at a range of 99 % confidence for one day within a maximum period of 100 days, while the institution may be exposed to these risks for five days during the same previous period, meaning that these risks occur once every 20 days. Of course, this is subject ‹% to choosing a confidence level estimated at 95

2.2   :Value-at-Risk Methods

The Value-at-Risk (VaR) measure is one of the most important modern models used in measuring and evaluating financial risks. The methods of this measure are numerous and vary depending on its distribution function, so they can be summarized according to the following table:

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Table 1-1 Methods for measuring value at risk

advantages	Concept and mathematical formula	Style
✓ Ease of application of the method; ✓ Speed of making calculations; ✓ There is no need for historical data on returns.	Among the parametric models with analytical technique, it is based on a basic assumption that is <u>the normal distribution of returns</u>. This method is done by forming 3 matrices: ✓ <u>standard deviation matrix;</u> ✓ <u>correlation matrix;</u> ✓ <u>Weights matrix.</u> The formula for this method is as follows: $$VaR\rho = -Za * \sigma\rho * P$$ where: =$VaR\rho$ Value at risk of the investment = Za standard value, which represents the standard deviations on the left side of the mean at a certain confidence level, = $\sigma\rho$ standard deviation of the amount invested. = The value of the invested amount P.	Variance and covariance method
✓ The least time-consuming method; ✓ It makes no assumptions about the probability distributions of financial returns; ✓ There is no requirement for linearity between the data sets.	It is a method that relies mainly on historical data for investment returns, and the basic assumption in this method is that: <u>the past is a better indicator of the future</u>. The formula for this method is as follows: $$VaR_{t+1}^{\rho} = percentile\{(r_{t+1-T})\ _T^m = \mathbf{1, (100.}p\mathbf{)\%}$$	Historical simulation method
✓ Possibility of calculating linear and non-linear risks; ✓ This approach is flexible because it incorporates time variation into volatility;	This method is based on the assumption that the behavior of financial prices converges using computer simulations to generate random price paths (i.e. the assumption that prices and returns follow a random path). The formula for this method is as follows: so that: VaR(c,T)=E(Ft)-Q(Ft,c) E(Ft) = expected values Q(Ft,c)= c The value that was exceeded the number of times During a certain set of repetitions.	Monte Carlo simulation method

Source: Prepared by the researcher based onLi, Y., "Evaluation of VaR Calculation Methods in Chinese Stock Market"، thesis, VAASA University, Finland, 2008, p 15.

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It should be noted that despite the diversity of techniques and methods of different models in calculating the value at risk, they involve the following stages

✓ ;Real-time evaluation of the market price of the investment portfolio

✓ ;It is based on the distribution of investment portfolio returns

✓ Measuring and estimating the actual value ofVaR the following figure shows , .the overall structure of the value at risk

Figure 1-2: The overall structure of the value at risk
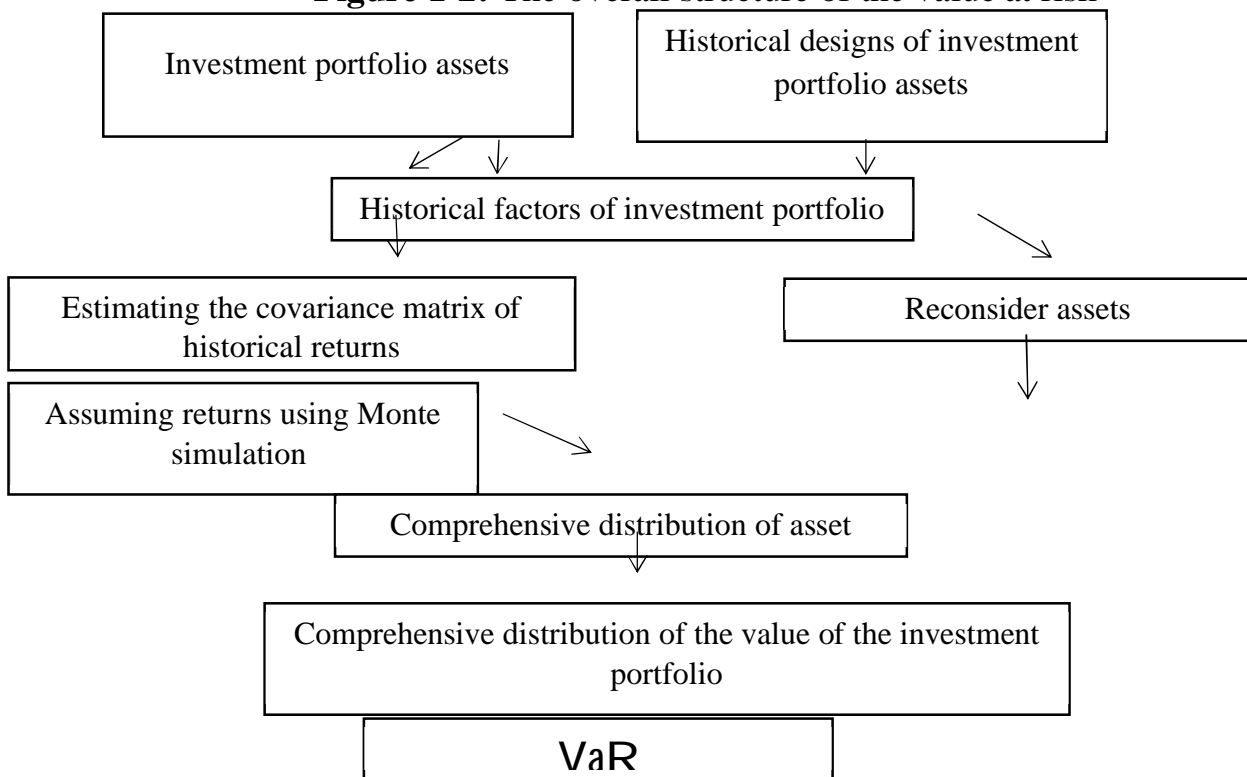
Source: Liu, Guochun, Value At Risk Models For a Nonlinear Hedged Portfolio, M, Sc. Thesis, Faculty of Worcester Polytechnic Institute, p12.

From the figure above, we notice that the basic inputs to the value-at-risk structure are the investment portfolio and its historical prices. It should be noted that the returns of this portfolio pass in one of two directions: either the assets of this portfolio are reviewed, or the historical returns are estimated by adopting one of the aforementioned methods, arriving at The value-at-risk distribution of the returns on .this investment

3.2 Uses of [3] The two primary uses of the value at risk approach are as follows
Value at Risk

- Reporting risks to the competent supervisory bodies for evaluation using the overall systematic risk assessment of the financial system;

- Internal control o exposure to risks for risk management purposes, as well as disclosure to external parties of the maximum possible exposure to risks.

The value-at-risk method is also used in the following:

- The value at risk can be used to evaluate the risks of various investment opportunities before making decisions. Various decisions can be made based on the value at risk, such as investment guidance, hedging strategies, and trading decisions, as well as making any alternative options for the risks of the portfolio as a whole, [4];

- VaR is used as a tool to monitor and control financial risks.

4.2 The concept of financial risks and their types

Financial risks arise through carrying out operations of a financial nature, such as investments, loans, etc., and are defined as the risks associated with assets or contingent liabilities, which affect the organization's profitability and financial position [5]

Financial risk is also defined as the risk to which ordinary shareholders are exposed, in addition to business risk. This risk arises mainly as a result of the institution's reliance on other sources of financing, for which it pays fixed costs, by which we mean loans and preferred shares [6].

Through the previous definitions, we can formulate the concept of financial risk as follows It is the potential loss that occurs as a result of the fluctuation in future returns associated with a particular asset, or the fluctuation of the returns of ordinary shareholders in the organization. It is also measurable and occurs as a result of several internal and external factors, the most important of which are:

✓ Increased risk of exploitation due to leverage

✓ The inability of current assets to cover liabilities

✓ Using debt to finance the organization's needs

✓ Management, individuals, strategy

The most important classifications of financial risks are shown in the following figure:

Figure 1-1: Financial risk classifications
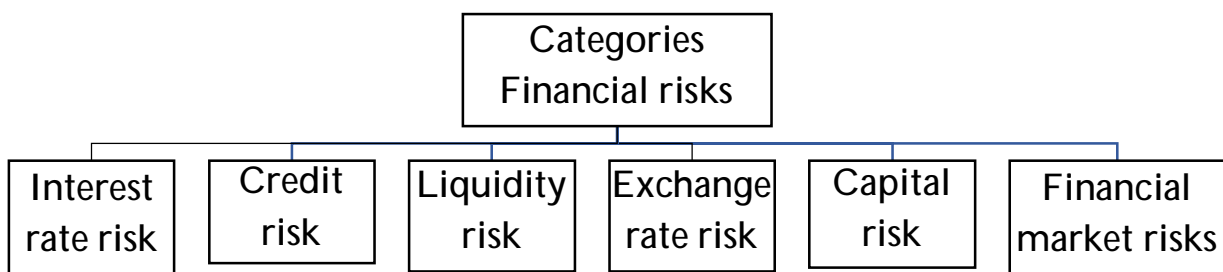
Source: Prepared by Researchers

5.2 The importance of assessing financial risks

The importance of early detection and evaluation of financial risks for the institution is to encourage everyone related to it to make decisions and reactions that will prevent the occurrence of potential losses. At the macroeconomic level, the realization of financial risks could lead to the institution exiting the financial and business sector and becoming bankrupt. This is a strong indicator of poor distribution [7] of resources and their lack of optimal exploitation

Duda and Schmidt believe that VaR provides a consistent and common measure of risk across different situations and risk factors, and as a result, VaR can be applied to all asset classes (stocks, bonds, derivatives, etc.), as well as VaR allowing the measurement of risk in every context. levels of portfolio components, allowing managers to take a detailed measure of portfolio risk

From the above, we conclude that the use of value-at-risk methods is applied to all asset classes, which allows the institution to early detect risks that could lead it to cases of financial failure and bankruptcy, which negatively affects the continuity of its activity, and accordingly, to learn more about what the aforementioned standards add to Financial Risk Management We review the following applied study to reach results on which we base our opinions.

3. Applied study:

In this part, we identified the variables of the study and the methods used to measure the value at risk, as well as their importance in revealing the financial position of the institution. Some descriptive statistics for the study sample, which are companies listed on the Algerian Stock Exchange, were presented, and the development of prices and returns of their shares was clarified for the period .extending from 01-01-2023 until 05-07-2023

1.3 :Introduction to the Algerian Stock Exchange

It is a company with shares with a capital of 485,200,000 DZD. It was established according to Legislative Decree No.: 93-10 of May 23, 1993, and its completion was achieved on May 25, 1997. The company represents a regulated and controlled framework for serving brokers in stock exchange operations. As professionals to enable them to perform their duties by applicable laws and regulations, the company has begun, since its establishment, to install the necessary executive and technical equipment for transactions on transferable values accepted on [8].the stock exchange

1.1.3 Tasks of the management company of the Algerian Stock Exchange: [9] The tasks of this company are as follows:

- The actual organization of the listing process on the stock exchange
- Physical organization of trading lots on the stock exchange and management of the trading and pricing system

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- Publishing information related to transactions on the stock exchange and issuing the official pricing bulletin

2.1.3   Companies listed on the Algerian Stock Exchange: Companies listed on the Algerian Stock Exchange are divided into twocategories:

- **The official market:** It consists of four major companies represented by Alliance .Insurance Company, M.D. Eurasian T.F., Sidal, BioPharm

- **Small and medium enterprises market:** It includes Investors

Table 3 Companies listed on the Algerian Stock Exchange

The nominal value of the stock B: DJ	Number of Shares	sector	Company Name	Symbol on the stock exchange
200	2,287,217	Insurances	Alliance Insurance	ALL
250	6,000,000	Hotel	Eurasian PLO	AUR
250	10,000,000	Pharmaceutical industry	fishing the	SAI
200	25,521,875	Pharmaceutical industry	Biopharm	BIO
100	4,596,030	tourism	Ohm. invest	AOM

Source: Prepared by Al-Baha based on Algerian Stock Exchange data

It is noteworthy that the activity of the Algerian Stock Exchange witnessed a decline during April 2023, such that the value of transactions reached: 10,222,240 DZD, compared to March 2023, where transactions recorded a value of 21,065,881 DZD, representing an average decrease of 51.47 percente Also, the trading volume for April for the same year decreased to 5,159 shares compared to the volume of 35,179 shares in March, and the following table shows this:

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Table3-2 Algerian Stock Exchange transactions for March and April

Change	Avril	March	data
-	13	13	Number of trading days
8,151%	150492	59938	The volume of orders offered for purchase
95 , 72-%	40120	148330	The volume of orders offered for sale
% -47 , 51	10,222,240 DZD	21,065,881 DZD	Trading value (DZD)
% -34 , 85	5159	35179	Trading volume

Source: Prepared by the researcher based on data from the Algerian Stock Exchange

2.3   Descriptive and statistical study of the development of the returns of the studied sample companies:

By following what was stated in the bulletins of the Algerian Stock Exchange, the development of the returns of the companies listed in it can be presented through the following table

Table 3-3: Stock prices of companies listed on the Algerian Stock Exchange for the period from May 2020 to March 2023

SAI	BIO	AURS	AOM	ALL	month-year
525	1211	560	490	426	**May 2020**
525	1211	560	490	426	**June 2020**
557	1211	560	490	418	**July 2020**
554	1221	552	490	375	**August 2020**
552	1110	550	490	378	**September 2020**
552	1151	550	490	381	**October 2020**
552	1167	552	490	381	**November 2020**
552	1201	554	490	332	**December 2020**
552	1225	550	490	240	**January 2021**

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530	2278	495	267	403	**January 2023**
530	2409	495	269	413	**February 2023**
530	2539	495	271	420	**March 2023**
530	2573	475	273	426	**April 2023**

Source: Prepared by the researcher based on data from the Algerian Stock Exchange From the table above, we note that there is a relative fluctuation in the share.

prices of the companies: Saidal, Al-Aurasi, and Om Invest, which witnessed a relative decline in their prices in the middle of 2022, unlike the case with Biopharm, whose share prices wereincreasing.

3.3 Measuring the value at risk of an invested portfolio (Hypothetical) in the Algerian Stock Exchange companies by adopting the historical simulation approach:

Suppose that there is an investor who has an amount of 2,000,000 DZD and wants to invest it in companies listed on the Algerian Stock Exchange by forming an investment portfolio consisting of shares distributed in varying shares among these companies Alliance Insurance, Al-Aurassi Hotels Corporation, Biopharm Company, Saidal Company, and Om Invest Company. As shown in the following table:

The total value of the investment portfolio= 2,000,000 DZD				
SAI	**BIO**	**AURS**	**AOM**	**ALL**
300,000 DZD	700,000 DZD	500,000 DZD	300,000 DZD	200,000 DZD

However, this investor fears loss, so they ask a question: What is the maximum value he could lose on the worst trading day ?To estimate the size of the financial risks of this portfolio, which may lead to financial failure, we calculated the value at risk using the historical simulation approach, as it is not based on any restrictive

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assumption, and therefore data for companies listed on the stock market was collected from the Algerian Stock Exchange regarding the development of... The stock prices of the assumed investment portfolio, starting from June 2020 until April with approximately 500 daily views, and the value at risk was calculated ,2023 according to the following steps:

   ✓ Find the monthly rate of return

   ✓ Determine the value of the monthly return

   ✓ Construct the portfolio's monthly profit and loss distribution

   ✓ Percentile metric, which is a statistical measure, to determine the value at risk, i.e. the maximum possible loss for the portfolio

Based on the historical data of the average monthly prices of shares of companies listed on the Algerian Stock Exchange mentioned above, their monthly financial return rates were as follows:

Table 3-4 Rates of returns on shares of companies listed on the Algerian Stock Exchange for the period from May 2020 to March 2023

Returns in: DZD

SAI	BIO	AURS	AOM	ALL	Company the month
-	-0.738%	-	-	-0.142%	Avril 2023
-	-0.007%	-	-	-0.3%	March2023
-	-0.628%	-	-	-	February 2023
-1%	2.33%	-	-	-1%	January 2023
-1,333%	0.218%	-	-	-10,5%	December 2022
-	11,428%	-	-1%	-1,333%	November 2022
-1%	-1.04%	-	-0.19%	-0.7%	October 2022
-0.888%	-3,966%	-	-1,221%	-2,176%	September 2022
....	....	....	....	....	....
....	....	....	....	....	....

:Until

-	-0.294%	-3%	-	-0.877%	January 2021
-	1,125%	0	-	-	December 2020
-	-0.609%	-	-	-1%	November 2020
-1%	-1,369%	-1%	-	-	October 2020
-0.333%	-12.1%	-0.75%	-	-1,069%	September 2020
-1,093%	-	-	-	4,375%	August 2020
-	-	-	-	-	July2020
-	-	-	-	-	June2020

Source: Prepared by the researcher based on the stock prices of companies listed on the Algerian Stock Exchange

From the table above, we note that Biopharm had the highest increase in its returns, as it recorded a maximum value of 353 DZD at the beginning of the year 2023, at a rate of 2.33%, in contrast to the two companies, Alliance Insurance and Ohm Invest, whose shares witnessed a noticeable gradual decline, reaching a maximum in the first company. The amount of 92 DZD at the beginning of the year 2021, at a rate of - while the maximum negative value of the second company Ohm Invest was ,%0.877 at the amount of -166 DZD in the middle of the year 2022.

The following chart shows these fluctuations in stock return rates.

Figure 3-1 Curve of changes in stock returns of companies listed on the Algerian Stock Exchange For the period extending from June 2020 to April 2023
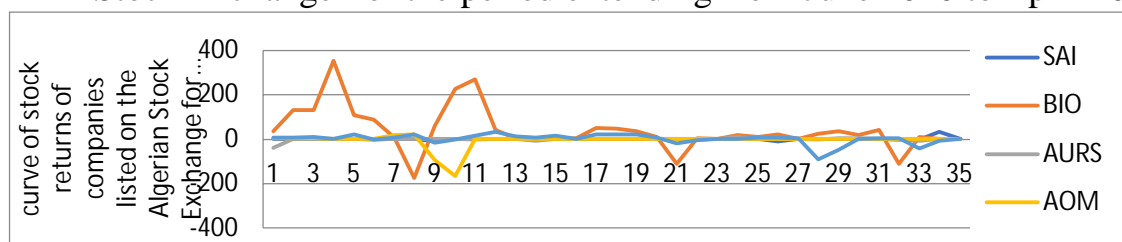
Source: Prepared by the researcher based on the outputs of theExcel program The previous data can be explained statistically

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Table 3-5 Results of descriptive statistics of monthly returns for shares of companies listed on the Algerian Stock Exchange For the period extending from June to April 2023 2020

Torsion coefficient COEF-ASSYMYTRIQUE	Coefficient of variation CO-VARIANCE	standard deviation ECART-TYPE	Average MOYEN	Highest value returns	Minimum returns	Company
0,13-	22 , 0	22,70	2	20	-92	ALL
0,19-	-5,24	32,52	6,2-	21	-166	AOM
0,21	-4,74	6,91	1,457	9	-38	AURS
0,23	2,48	96,97	39	353	-113	BIO
0,03	29	5,98	0,2	32	-9	SAI

Source: Prepared by researchers based on the outputs of Excel

By analyzing the table above and choosing Biopharm as the most traded company in the stock market, we find that the highest value of its returns amounted to DZD, which was recorded in January 2023, while the lowest was a negative 353 value of -113 DZD, which was recorded in August 2021. Its average monthly returns for the period studied amounted to 39 DZD.

A high standard deviation of 96.97 indicates the presence of fluctuation in the value of returns during the period studied and thus fluctuation in the value of portfolio returns, and this means a high degree of risk.

The value of the skewness coefficient was positive, amounting to 0.23, which is small compared to zero, which indicates the presence of a very slight skewness towards the right. This means that the large and small values of returns are almost symmetrical concerning the average.

The coefficient of variation expresses the degree of risk per unit of return, and therefore a high coefficient of variation value of 2.48 indicates a high percentage of risk.

By multiplying the rates of returns calculated in **Table 3-4** for each company by the value of its investment portfolios, we obtain the following table:

Table 3-6 Value of investment portfolio profits/losses for each stock market company

Amounts in: DZD

Total portfolio gains/losses for each company	SAI	BIO	AURS	AOM	ALL
5 .454 -	0	5 .169 -	0	0	285 -
653 -	0	53 -	0	0	600 -
4 .402 -	0	4 .402 -	0	0	0
11 .311	3 .000 -	16 .311	0	0	2 .0 00 -
23 .471 -	4 .000 -	1 .528	0	0	21 .000 -
74 .333	0	80 .000	0	3 .000 -	2 .666 -
12 .251 -	3 .000 -	7 .280 -	0	571 -	1 .400 -
38 .445 -	2 .666 -	27 .762 -	0	3 .663 -	4 .352 -
5 3	0	5 .164 -	0	1 .283 -	6:500
11 .678 -	3 .000 -	1 .144 -	DZD5 . 000 -	0	2 .533 -
....	....	....	....	....	....
....	....	....	......	....	....
17 .585 -	3 .000 -	9 .585 -	5 .000 -	0	0
91 .589 -	1 .000 -	84 .700 -	3 .750 -	0	2 .139 -
5 .468	3 .281 -	0	0	0	8 .75 0
0	0	0	0	0	0
0	0	0	0	0	0
The total amount of portfolio losses **DZD380. 701 -**					

Source: Prepared by researchers

Percentile function to the returns calculated in the above table No. 3-5, we obtain the calculated values **of the value at risk(VaR) for** the chosen confidence intervals of 90 % , 95 % , and 99 % according to the following table:

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Table 3-6 Amounts of values at risk for the investment portfolios of the studied companies

Monetary value at risk	The value of the investment to be invested	Various confidence intervals	Company
2,613		VaR 90%	Alliance Insurance Company ALL
-3,221	200,000 DZD	VaR 95%	
-15,341		VaR 99%	
-342		VaR 90%	Om Invest Company AOM
-1,798	300,000 DZD	VaR 95%	
-3,437		VaR 99%	
-5		VaR 90%	Al-Aurasi Hotel Corporation AURS
-5	500,000 DZD	VaR 95%	
-11		VaR 99%	
-8,749		VaR 90%	Biopharm Company BIO
-44,834	700,000 DZD	VaR 95%	
-294,448		VaR 99%	
-3,168		VaR 90%	Saidal Company SAI
-4 ,150	300,000 DZD	VaR 95%	
-4,150		VaR 99%	

Source: Prepared by the researchers.

Applying to the total investment portfolio, we obtain the following table:

Table 3-7 Amounts of values at risk for the assumed total investment portfolio

Monetary Value at Risk	The value of the assumed investment portfolio	Various confidence intervals
_ DZD 1.116 2-	DZD 2000.000	VaR 90%
DZD 388 . 54-		VaR 95%
DZD 064 . 296-		VaR 99%

Source: Prepared byresearchers

The table above shows the value at risk of the assumed investment portfolio, which was calculated using the historical simulation method at different confidence levels: 90 % , 95 % , 99 % , for the period extending from June 2020 until April 2023, :and the following was reached

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- The maximum loss incurred by the assumed investment portfolio during the period studied at the 90 % confidence level is 21,116 DZD . This means that the portfolio's return will not decrease in 90 days below the risk value calculated within 100 days, meaning that the investor will be 90 % sure that his loss per day will not exceed this amount.

- The maximum loss incurred by the assumed investment portfolio during the :period studied at the 95 % confidence level is 54.388DZD , which means that the portfolio's return will not decrease in 95 days from the risk value calculated in days, meaning that the investor will be 95 % sure that his loss per day will not 100 exceed this amount.

The maximum loss incurred by the assumed investment portfolio during the period studied at a confidence level of 9.9 % is 296.064DZD, which means that the portfolio's return will not decrease in 9.9 days below the risk value calculated within days, meaning that the investor will be 9.9 % sure that his loss per day will not 100 exceed this amount.

4. :Conclusion

In conclusion, what was previously presented in the theoretical and applied aspects of the study, as well as addressing the calculation of the value at risk using the method of historical simulation of the investment portfolio in companies listed on :the Algerian Stock Exchange, we reached the following results

• The historical simulation method in measuring the value at risk is the most effective and accurate approach in estimating the future risks and returns to which the investor may be exposed, which allows him to make the right investment strategies, decisions, and decisions at the appropriate time, and this is what **proves the validity .of the first hypothesis**

• Relying on the prices and returns of the companies in the study sample that are active on the Algerian Stock Exchange, we found that the investment portfolios

formed and assumed in them include fluctuating risks because risk and return are the indicators that investors rely on in their selection of these stocks to form an investment portfolio that achieves the highest returns and the lowest risks.

- We were able to use the historical simulation approach as an approach to measuring and estimating the value at risk of the assumed investment portfolio in companies listed on the Algerian Stock Exchange, as it became clear to us, the extent of the fluctuation of prices and returns, as well as the size of the potential risks and losses that the investor may face in the companies sampled in the study, **which proves the validity of the second hypothesis.**

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