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An Empirical Study of Value at Risk on a Financial Portfolio in the Kuwaiti Market 2018

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Abstract: This study aims to show how do the Value at Risk contributes at measuring the risks that face the financial portfolio and its damages using a Financial Portfolio that was formed from five normal stocks of listed companies in the Kuwaiti Financial Market of 2018. The study has adopted confidence levels of 99, 95 and 90% to calculate the value at risk using historical simulations and comparing it to the parametric method to the daily portfolio returns. The study resulted at there are some differences between the two methods and that this qualitative tool is accurate and important in estimating maximum losses that can be achieved within the selected time horizon of one day and a month.

INTRODUCTION

The securities portfolio is a combination of a range of investment alternatives. Where the investor is in the process of forming a mix of diverse securities, a diversification ensures him mitigation of risk and thus to form a portfolio, it must be taken into account several factors on top of them: return, risk and diversification; to the purpose of getting an affordable portfolio. Then, after the training stage comes the administration stage. The latter needs scientific knowledge and great experience in the field of investment in securities and its strategy is hanging with the desired goals.

The management of the financial portfolio is considered as one of the issues that occupied researchers, economists and investors, so that, the risks surrounding investment in the money bills are so, big and that their returns are volatile. It becomes necessary to find a suitable means of identifying these risks to avoid it and to take the suitable investment decision. This led to the emergence many theories and models in order to find a model that allows to the director of a financial portfolio to predict the returns and their expected risks, so, the investment policies, the decisions as well as the achievements must be subjected to a continuous evaluation.

It was found out that the traditional models in predicting the implicated risks from share trading activity, made the related parties rely on traditional results in making investment decisions and their negative impacts. This led to the necessity to find other modern and quantifiable methods from using new statistical tools that allow a statistical identification to risks and monitor it from adding regularity and clarity to the evaluation process.

In this vein, the value at risk is considered from the new applied methods by the financial institutions and dealers in order to avoid the potential losses, especially in the actual financial environment which knows periodical rises and traumatic shocks. So that, we find that the value at risk respond better to the investors requirements in the financial portfolio, from defining to them the extreme possible quantitative losses that can be in a particular time horizon. From here the investors can take appropriate

precautionary measures in the light of the obtained data. The value at risk is one from the most widely used tools to calculate market risks, since, it calculates the quantitative worst loss in a particular horizon time at a certain confidence level in other words it represents the tail of the estimated distribution of profits and losses.

From the previous sayings, we will attempt to address the basic concepts related to the value at risk, its basic methodologies, how to calculate and use them and the decisions to be made before calculating them and to identify the most important advantages and disadvantages. We have also considered applying the value at risk method to a sample portfolio of listed companies in the Kuwaiti Financial market to demonstrate the extent to which this method contributes to the measurement and management of risk using the historical simulation method and comparing it to the informational method for daily portfolio returns.

The value at risk

Historical background: Value at Risk (VaR) is a means of mitigating market risks which emerged in the insurance industry where this technique was applied late exactly in 1980 in the USA markets by Bankers Trust. Then it became more popular in the investment bank JP Morgan in 1994 thanks to its risk system known as Riskmetrics TM. This process is used in a wide range by almost the major banks.

The VaR emerged with its present sense as a result to the vitality in the financial markets, the evolution of derivative products, especially after a series of bankruptcies and collapses in stock markets and financial institutions. This pushed to think of establishing a common composite to risk index, which emerged in April 1995 after Basel II agreements. It has been widely recognised and accepted very quickly by financial institutions as a standard for financial risk assessment, especially by the central banks that use the VAR in order to determine the level of private money that the financial institutions must acquire for dangerous positions (credits positions)[1].

The use of VaR techniques has become widely used as an advanced risk assessment tool by most financial institutions operating in economy. It is also, used to estimate the worst expected losses over a specific period of time and within a certain level of confidence under normal market conditions.

VaR definition: There is a wide range of definitions that are different in texts but they have the same meaning. From which one can mention the followings.

It is the loss to be expected with a certain probability over a specific period in time in which the composition of the components of the investment activity is maintained[2]. It is the decline in value of the investment over a specific time period with the estimated probability of changes in market prices and rates that directly affect the return on investment[3].

It is a quantitative estimate of maximum value that can be lost in an investment portfolio over a specific period of time and with a specific level of confidence. It refers to portfolio risk measurement, which is a statement of the following: at a certain probability level, potential losses will not capture the VaR figure, which is commonly used in financial markets[4].

From the previous definitions, it can be concluded that the concept VaR means the worst loss that can be expected from the acquisition of a financial asset or portfolio within a certain period of time (one day, a week, a month) under normal market conditions and with a confidence level.

VaR is based on the modification of traditional statistics for use in risk measurement. Accordingly, risk is aggregated according to its individual positions. It is assumed that the returns of the asset in the margin are distributed naturally and therefore the expected returns and risks of the dilution are reduced in the arithmetic mean and the standard deviation taking the shape of a curve (the natural curve).

The VaR translates these values into the amount of loss resulting from it. There are many decisions that must be taken before the VaR of a specific asset of risk of exposure. Among them the following[5]:

The risk manager should choose the time horizon for the risk or the period of time in which he is concerned about the possibility of loss. A time horizon of risk of a term means that the user is interested or concerned about potential market risk from a period of up to three month, while a time horizon for one day indicates a very short period.

The risk manager should specify the confidence level. In the context of hypothetical theory, the level of confidence that the VaR represents the worst loss for the next period. For instance, the confidence level 5%will result in the calculated loss being believed by the risk manager to occur in the next period with probability 5%, if the risk manager assumes that probability distributions are stable over time. Interpretation of probability recurrence allows the user to provide a more powerful statement or confidence about the level of confidence selected and to say Y% is that he can say that he will not loss more than X in more than Y in the next 100 days. This status represents the fair value risk.

The risk manager must determine the frequency of the calculation or the regularity of the calculation according to which the VAR is calculated. This is due to the risk manager and depends on the objectives of the institution.

However, it should be noted that the calculation must be done in most cases not less than the risk horizon. Although, the opposite is not necessary true. For example, you may want to calcite VAR every week while the VAR calculation per week may be acceptable at a low level.

MATERIALS AND METHODS

Methods of calculating VaR: There are several methods and approaches that are field used to calculate VaR. Among them these three methods:

The parametric method: The most common and the best known method is the (Riskmetrics) model, also (variance-covariance) method which directly link VaR measurement to the variance of fragmentation of portfolio revenues. Obviously, the greater the variance, the higher the VaR is. This method is mainly based on finding the main parameters of the arithmetic means and the standard deviation of the returns of the asset or investment portfolio, assuming that the distribution of returns is a natural distribution and that the linkages between the components of market risk are stable. Accordingly the VaR is determined based on the returns at the left end of the distribution at a significant level of 5 or 1% (confidence level 95 or 99%) for the specified time period. The most important of these models:

Riskmetrics model: This model is based on the collection observations and data on the changes of the financial instrument whose value is to be calculated at risk over a significant period of time; let it to be for a year. The majority of the VaR calculation depends on the hypothesis of the stability of the data prior to the forecasting of the future.

Calculation of the standard deviation through these observations and then calculate the maximum loss that can be exposed to the financial instrument and equal to the value of the standard deviation.

This method is based on the premise of the distribution of price changes to the natural law, in the sense that there is always a strong probability that the observation is close to the average and probability is weak so that the observation away from the average. Then, there must be a choice of desired level of confidence and the extraction of the number of times the weight deviation to determine the value VaR.

As for a diversification portfolio of assets, the application of this model to the VaR account requires calculating the degree of correlation between the instruments because it allows measuring the degree of correlation of the value of a variable (financial asset) with the value of another variable (other financial asset). Therefore, the distribution of the portfolio would reduce the VaR[6].

Variance-covariance model: It is a model based on the estimated variance and co-variation matrix which allows the processing of hundreds of financial instruments in one, by creating three matrices:

- Matrix of Volatility (V)
- Correlation matrix (C)
- Weighting matrix (W)

In general, VaR can be written as follows:

$$VaR_h = \mu_h + \sigma_h . \varphi^{-1}(1-\alpha)$$

Where:

$\mu h, \sigma h$ = Represent the arithmetic mean and the standard deviation of returns over a given period of time

h and $\varphi^{-1}(1\alpha)$ = That represent the density function of the natural law[7]

Historical simulation: This model is based on the assumption that the past data is consistent with the best forecast for the future. It is therefore a model of estimating the distribution of price changes to the current portfolio of assets, VaR is defined as a non-standard model. The portfolio as a whole is taken into a VaR account and not each asset as stated in the previous model. Therefore, the VaR of the asset portfolio is not the VaR of each financial instrument of financial instrument asset but VaR is the portfolio as a whole.

Monte carlo simulation: This method is usually used in the case of sudden and unexpected discontinuities, which is the selection of a specific distribution of the variables of the risk factors are simulated through mathematical modeling after the adoption of options using appropriate statistical tests and through the chosen model is simulated a large number of future computer scenarios. The results of this simulation are used to estimate the distribution of portfolio revenues and then to calculate the value at risk.

Limits on the use of VaR: The choice of VaR methodology has implications for the values obtained. It is important to recognize that the three models of measuring VaR are limited by a basic assumption that future risks are predictable from historical dividend distributions. The methodology for calculating VaR assumes that yields are naturally distributed, implying that the VAR is intended only to describe the losses on a normal day. The rest of the days such as crisis times (i.e., events where the tail of the distribution is fat) occur rarely. These have a serious impact that does not exist under normal circumstances. While the Monte Carlo simulation model presents a model for addressing the

Table 1: Shares of the companies under study

Companys	Sectors	Market values (milion $)
Kuwait Finance House (KFH)	Banking and financial services	12.36
Mobile Telecommunications Company (Zain)	Wired and wireless communication	6.83
Agility Public Warehousing Company (AGLTY)	Transport	4.42
Mabanee Company	Real estates	2.16
Boubyan Petrochemical Company (BPCC)	Basic materials	1.92

Table 2: The relative Weight to each stock

Company	Relative weight
Kuwait Finance House (KFH)	0.2
Mobile Telecommunications Company (Zain)	0.1
Agility Public Warehousing Company (AGLTY)	0.2
Mabanee Company	0.1
Boubyan Petrochemical Company (BPCC)	0.4

toxic tail problem by allowing a variety of distribution assumptions and forecasts of vitality and correlation to be based on the statistical structure of the following returns. In contrast, the historical simulation does not complete or achieve any statistical structure. It implicitly assumes that the exact distribution of past returns predicts the distribution of future returns. This indicates that each of the three models is subject to structural or sudden changes in market behavior.

The sample study: In order to drop the theoretical literature of the study on the applied field and to know the extent of the contribution of VAR in measuring the risk of portfolio, the Kuwaiti market was chosen as a corpus of the study. It is a portfolio composed of five shares for different sectors and activities listed in the Kuwaiti financial market. We have chosen the best five Kuwait companies for the year 2018 as a sample, according to the market value of the companies according to each of Kuwait Stock Exchange and Thomson Reuters Eikon. Where, we have collected the demanded data representing daily and monthly returns for the portfolio shares for the period 2018.

When the portfolio is formed, it is not enough to measure the return and risk of the portfolio stocks, the results are described in the study appendix. We formed a financial portfolio with 1000.000 Dinar Koweitien (KWD) as an initial financial value, then distributed the amount to be invested by the relative weights shown in the following Table 1 and 2 then calculate the return and the standard deviation of the portfolio.

RESULTS AND DISCUSSION

Calculating var using historical simulation: As mentioned previously, the historical simulation model for determining the VaR is considered simple; it does not need complex calculation and it allows the valuation the present portfolio based on historical data. It is therefore a model of estimating the distribution of price changes from past data. The VaR model can be summarized as follows: Record the observations (data) on the assets of the portfolio within a certain period of time (series of time) daily and monthly. Calculate the relative changes of the mean for each period according to the following formula:

Table 3: Results of calculating daily VaR using historical simulation

Historical simulation (%)	Values
Value at risk 99	-19910.12190
Value at risk 95	-11403.65750
Value at risk 90	-8466.05037

Table 4: Results of calculating monthly VaR using historical simulation

Historical simulation (%)	Values
Value at risk 99	-26540.6754
Value at risk 95	-23743.8109
Value at risk 90	-20247.7303

$$Ri = (Pt-Pt-1)/P\ t-1$$

Where:

Ri = Rate of return between periods
Pt = The closing price of the stock in time
Pt-1 = The closing price of the stock in time

Then we multiply the value of the rate of return in the amount to be invested. Calculate the total value of the portfolio for each period. We calculate VaR which is determined on two basic parameters: the first time range and the second the confidence area. For the first parameter, we chose the daily and monthly periods. As for the confidence levels, we chose 90, 95 and 99%.

It should be noted that another time range can be tested, depending on the investor's needs and needs. Generally, VaR takes the time to calculate returns. The results obtained are summarized in the following Table 3 and 4.

The amounts 19910.12; 11403.65 and 8466.05 represent the VAR at 99, 95 and 90% confidence intervals respectively, the worst loss to be expected from the portfolio's holding in the next day and under normal market conditions.

Estimating var using the parametric method: If the random variable X represents the value of the portfolio, with $X \sim N(\mu, \sigma^2)$, then X can be rewritten according to the standard natural variable ε. Where, $\varepsilon \sim N(0, 1)$. If a represents the critical value associated with the target probability, we can rewrite:

$$X = \mu+\alpha\sigma$$

The value at risk is calculated as follows:

Table 5: The results of daily VAR using the parametric method

Parametric method (%)	Values
Value at risk 99	-19078.81748
Value at risk 95	-13242.27807
Value at risk 90	-10130.84050

$$VaR = E(X)-Q(X, c) = \mu-(\mu+\alpha\sigma) = -\alpha\sigma$$

where, Q is the quantile associated with a probability c. In the statistical study to evaluate the basic characteristics of the distribution of the returns of the daily portfolio, it was found that the deviation is slightly positive since the torsion scale Skewness (to explain the distribution status of the whole series) is 0.810 and the Kurtosis oblate distribution scale (to complete the torsion scale) is = 2.24.

This led us to study VAR by using the model of comparing the results. In this method, the value at risk is calculated by a relatively simple analytical account in practice and the most common model is the Variance-Covariance method. As portfolio returns and risk factors follow normal distribution as this method assumes that returns are distributed to risk factors. The results of VAR calculation using the method are shown in Table 5:

The amounts 19078.81, 13242.27 and 10130.84 represent the VAR at 99, 95 and 90% confidence levels respectively, the worst loss to be expected from the portfolio's holding in the next days and under normal market conditions.

By comparing the previous VAR results with the historical simulation method and their results in a parametric method, there is some slight difference in results. The worst expected loss of portfolio holdings in the next day and under normal market conditions when calculated in the historical way is 19910.12, 11403.65 and 8644 KWD and when calculated in a parametric method, it was found to be equivalent to 19078.81, 13242.27 and 10130.84 KD for the areas of confidence 99, 95 and 90%, respectively, due to the difference in the use of distributions. While the historical method uses the empirical distribution, the parametric method uses the theoretical distribution.

CONCLUSION

The development in the global economy and the increase in capital movement within the markets financial markets has led to increased interest of investors to invest in securities within the financial portfolios. The latter may achieve high returns under acceptable levels of risk and emerged as a result of the change in the global financial environment a set of theories that the concept of financial portfolio theory has been developed.

Many studies have sought to develop models to measure the risk of the portfolio and allow proper assessment of them to develop appropriate strategies to address them and make better investment decisions. There is no doubt that the VAR is one of the most important statistical tools to be applied to assess the portfolio risk quantitatively. On the basis that it is able to summarize the maximum loss that can occur within a certain time horizon in the form of a single number that reflects the position of the portfolio which allows the portfolio manager to take appropriate precautionary measures.

In this study, we tried to use a financial portfolio composed of five ordinary shares of listed companies in the Kuwaiti financial market for 2018, calculating VAR by using historical simulation. The results indicated the accuracy and importance of this qualitative tool in estimating the maximum losses that can be achieved within the selected time horizon One day and a month.

The graphical representation of the daily returns of the portfolio was found to be distributed naturally which gave us a motive to conduct the normal distribution tests and represented by charts showing the nature of observations and the adoption of a scale (Skewness) and (Kurtosis) to show it, which directly reflected in estimating the value at risk by the parametric method. The results showed that the maximum loss of the portfolio at the same time horizons and the specific confidence level differ slightly from the previous results obtained when calculating the VAR of the historical simulation method.

Although it is important to measure the risk of the financial portfolio, it has some shortcomings such as unpredictability in the long term horizon. Dividends and losses are not necessarily subject to normal distribution under extreme financial conditions such as shocks and exceptional market conditions in which the tail of the distribution is fat. Therefore, a range of other alternative methodologies have been developed for this measure, such as the conditional value, stress tests, sensitivity analysis, scenario analysis and simulation analysis.

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